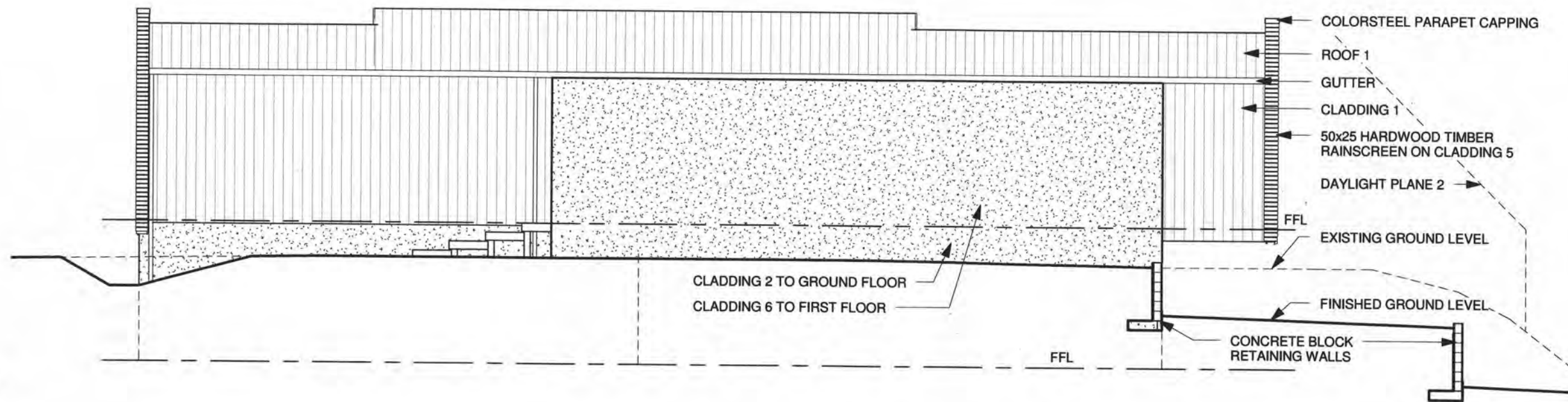
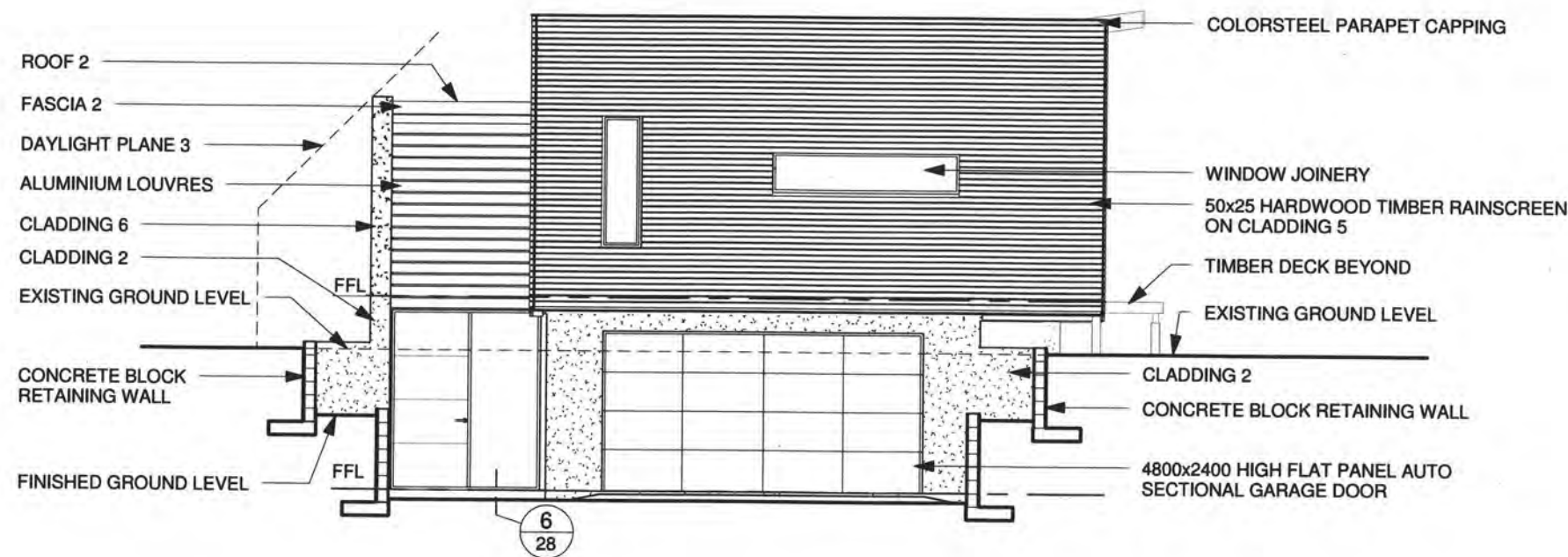




ELEVATION 1

1 : 100



ELEVATION 2

1 : 100

SELECTED PRODUCTS

- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
- CLADDING 1 - 0.55 GAUGE COLORSTEEL ENDURA BB900 REVERSE RUN CLADDING ON HARDIES HOMERAB LINING ON FRAMING
- CLADDING 2 - APPROVED MODIFIED ACRYLIC PLASTER FINISH ON 250mm AND 300mm AMBIONSE POLYSTYRENE BLOCK WALLS
- CLADDING 3 - PAINT FINISH 180mm HARDIES LINEA BEVELBACK WEATHERBOARD CLADDING ON 50x25 H3.1 CAVITY BATTENS ON HARDIES HOMERAB LINING ON FRAMING
- CLADDING 4 - PAINT FINISH HARDIES TITAN PANEL WITH NEGATIVE JOINTS ON HARDIES CLD CAVITY BATTENS ON HARDIES HOMERAB LINING ON FRAMING
- CLADDING 5 - PAINT FINISH 6mm HARDIFLEX CLADDING ON 50x25 H3.1 CAVITY BATTENS ON HARDIES HOMERAB LINING ON FRAMING
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- ROOF 2 - 1mm ARDEX BUTYNOL MEMBRANE ROOF ON 17mm H3 CCA PLY LAID TO 1.5° FALL ON FRAMING
- SOFFITS - 4.5mm HARDIFLEX
- FASCIA 1 - PRE-PRIMED EX 250x40 TIMBER
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- GUTTERS - DIMOND COLORSTEEL 125 BOX GUTTER
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- WINDOW FLASHING TAPE - THERMAKRAFT ALUBAND SYSTEM



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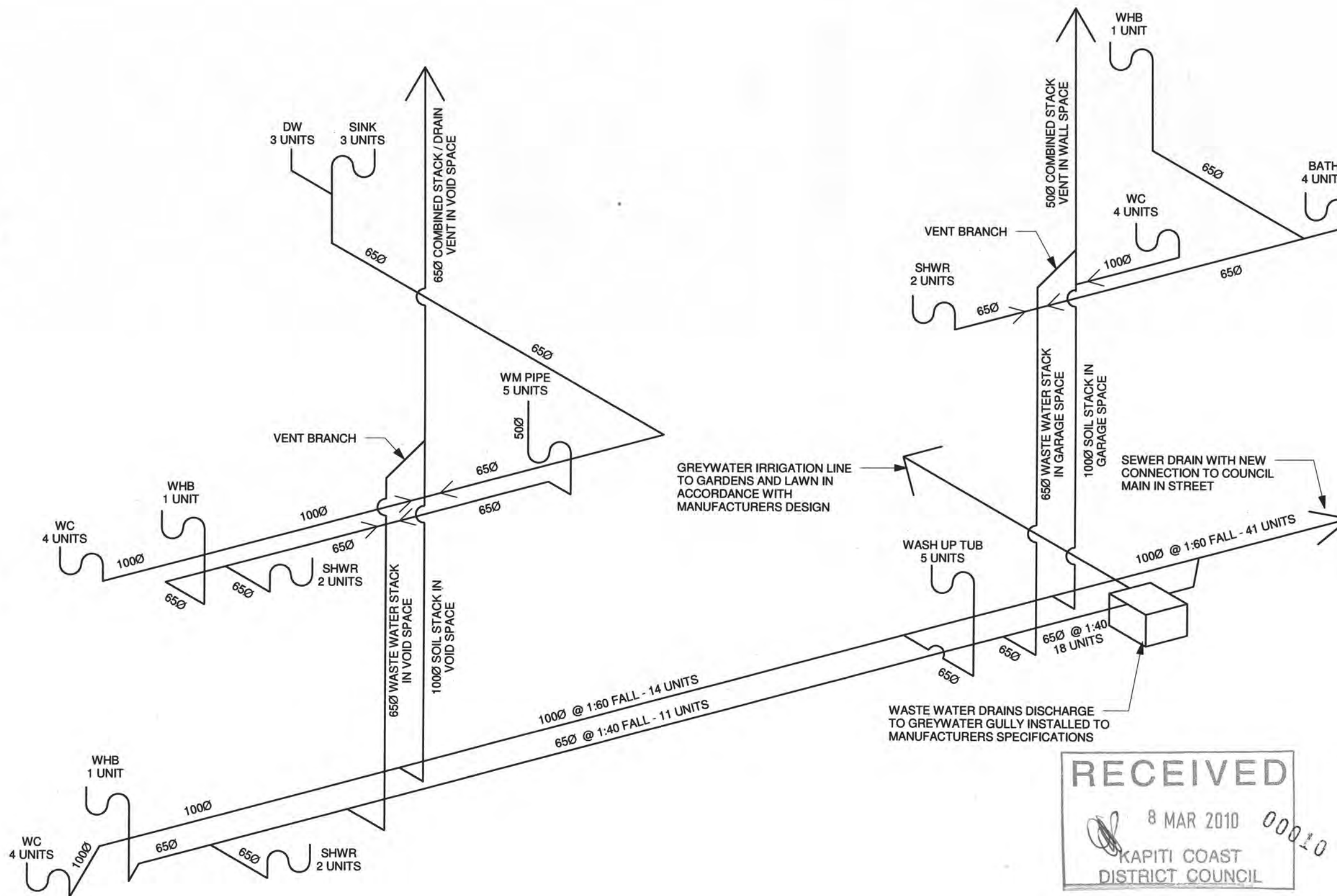
ELEVATIONS

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PLUMBING SCHEMATIC
N.T.S.

PLUMBING KEY

BATH	= BATH	= 4FU
BG	= BATHROOM GROUP	= 6FU
DW	= DISHWASHER	= 3FU
SHWR	= SHOWER	= 2FU
SINK	= SINK	= 3FU
TUB	= LAUNDRY TUB	= 5FU
WC	= TOILET	= 4FU
WHB	= WASH HAND BASIN	= 1FU

DP	= DOWNPIPE
DV	= DRAIN VENT
HT	= HOSE TAP
HWC	= HOT WATER CYLINDER
IP	= INSPECTION POINT
ORG	= OVERFLOW RELIEF GULLY

MAXIMUM NUMBER FIXTURE UNITS FOR
VENTED 1000 DRAIN LAID 1 IN 60 = 165 =
REFER TO TABLE 4.3 AS/NZS 3500.5:2000 FOR
OTHER GRADIENTS.

PIPE GRADIENTS

MINIMUM GRADES FOR DRAINS & DISCHARGE
PIPES:

650 & LESS	= 1 IN 40
800 & 1000	= 1 IN 60

PLUMBING & DRAINAGE NOTES:

- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
- THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH BRANZ PLUMBING AND DRAINAGE GUIDE SECTION D AS/NZS 3500 PART 2 FOR GROUND FLOOR SYSTEMS AND SECTION F DRAINAGE REQUIREMENTS
- REFER ALSO TO PLUMBING SCHEMATIC
- ALLOW TO INSTALL NEW LATERAL FROM COUNCIL STREET MAIN
- PROVIDE 10000 L WATER STORAGE TANK WITH PUMP SUPPLY TO WC CISTERNS AND EXTERIOR HOSE TAPS - LOCATION TO BE CONFIRMED BY CLIENT
- INSTALL WATER SUPPLY TOP UP TO WATER TANK FROM TOWN WATER MAIN
- ALL PIPES FROM WATER TANK SUPPLYING WC AND EXTERIOR TAPS TO BE CLEARLY LABELED AS SUCH
- INSTALL SIGNS AT EXTERIOR TAPS TO SHOW WATER NOT FIT FOR DRINKING
- ALL FIRST FLOOR WASTE PIPES TO BE WRAPPED IN ACOUSTIC INSULATION
- PROVIDE SEISMIC RESTRAINTS TO HOT WATER CYLINDERS

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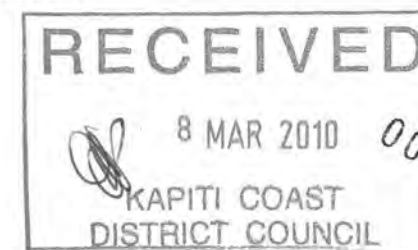
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PLUMBING SCHEMATIC

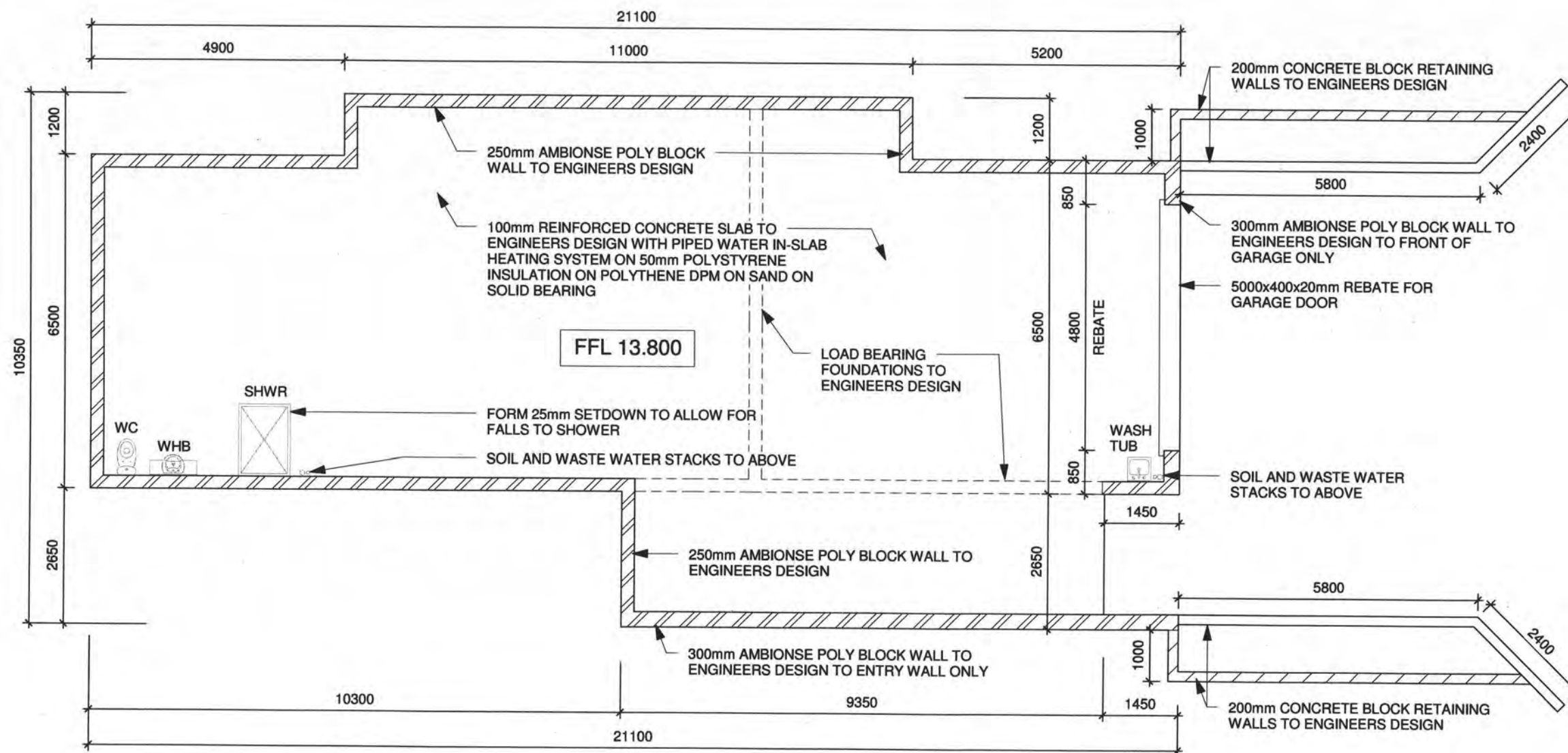
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- FOUNDATION NOTES**
- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
 - ALL CONCRETE SLAB AND FOUNDATION DETAILS TO ENGINEERS DESIGN
 - REFER TO ENGINEERS DWGS FOR SLAB SAWCUT LOCATIONS
 - PIPED WATER IN-SLAB FLOOR HEATING SYSTEM TO BE INSTALLED TO MANUFACTURERS DESIGN AND SPECIFICATION
 - ALL DECK PILES TO HAVE 6KN JOIST / BEARER / PILE CONNECTIONS



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GROUND FLOOR
FOUNDATION PLAN

BUILDING CONSENT

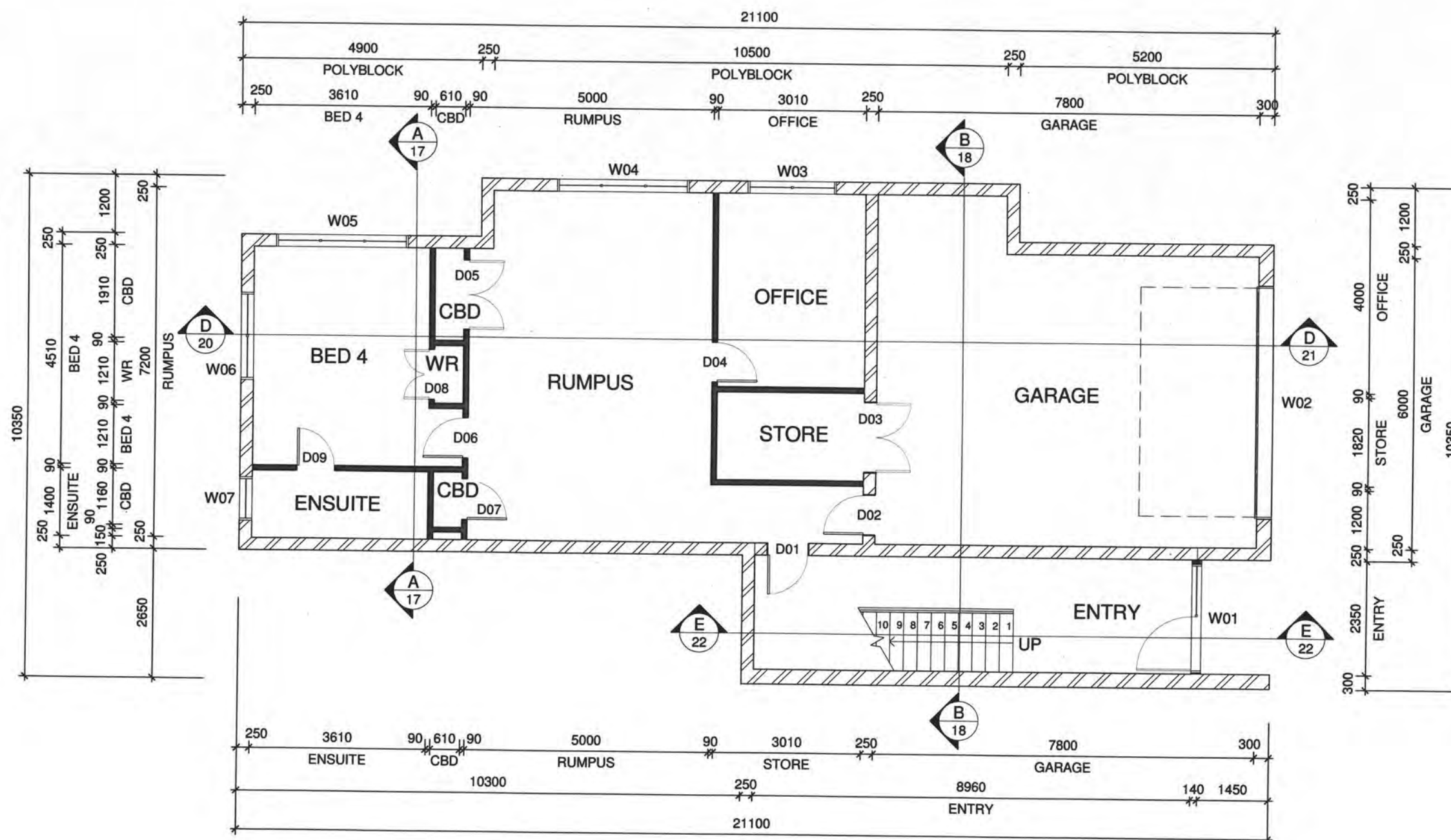
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GROUND FLOOR FOUNDATION PLAN

1 : 100

- WALL FRAMING NOTES**
- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
 - EXTERIOR WALL FRAMING TO BE KILN DRIED 140x45 UNLESS NOTED OTHERWISE
 - EXTERIOR WALL FRAMING TO BE AT 400 CRS UP TO 3600 STUD HEIGHT
 - EXTERIOR WALL FRAMING TO BE DOUBLE STUDS AT 450 CRS UP TO 4200 STUD HEIGHT
 - INTERIOR WALL FRAMING TO BE KILN DRIED 90x45 AT 600 CRS UP TO 3000 STUD HEIGHT
 - INTERIOR WALL FRAMING TO BE KILN DRIED 90x45 DOUBLE STUDS AT 600 CRS UP TO 3600 STUD HEIGHT
 - ALL FIXINGS TO BE GALVANISED TO PREVENT DETERIORATION DUE TO TEMPORARY EXPOSURE
 - ALL WINDOW AND DOOR LINTELS ARE TO PRENAIL MANUFACTURERS DESIGN UNLESS NOTED OTHERWISE
 - WINDOW OPENINGS TO BE 20mm LARGER THAN WINDOW SIZES (10mm TOLERANCE EACH SIDE)
 - ALL BRACING TO ENGINEERS DESIGN



GROUND FLOOR FRAMING PLAN
1 : 100



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GROUND FLOOR FRAMING PLAN		
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- ELECTRICAL NOTES:**
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 - ALL SOCKET AND SWITCH GEAR TO BE SELECTED BY OWNER
 - TV AERIAL WIRING TO BE SUITABLE FOR SKY DIGITAL, TELSTRA CLEAR CABLE TV AND FREEVIEW HD
 - PHONE LINE WIRING TO BE SUITABLE FOR INTERNET HIGH SPEED CONNECTIONS
 - ALL POWER CIRCUITS TO HAVE RCD AT SWITCHBOARD
 - ALL LIGHT FITTINGS TO BE FITTED WITH LONG LIFE BULBS
 - ALLOW FOR SECURITY SYSTEM TO BE INSTALLED TO MANUF DESIGN AND SPEC.
 - ALLOW FOR ELECTRICAL REQUIREMENTS TO DSHH IN-SLAB HEATING SYSTEM IN ACCORDANCE WITH ENERGY EFFICIENT HOMES INSTALLATION SPECIFICATION
 - ALLOW FOR ELECTRICAL REQUIREMENTS FOR SOLAR WATER HEATING SYSTEM IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
 - ALLOW FOR ELECTRICAL REQUIREMENTS TO PUMP AT WATER STORAGE TANK



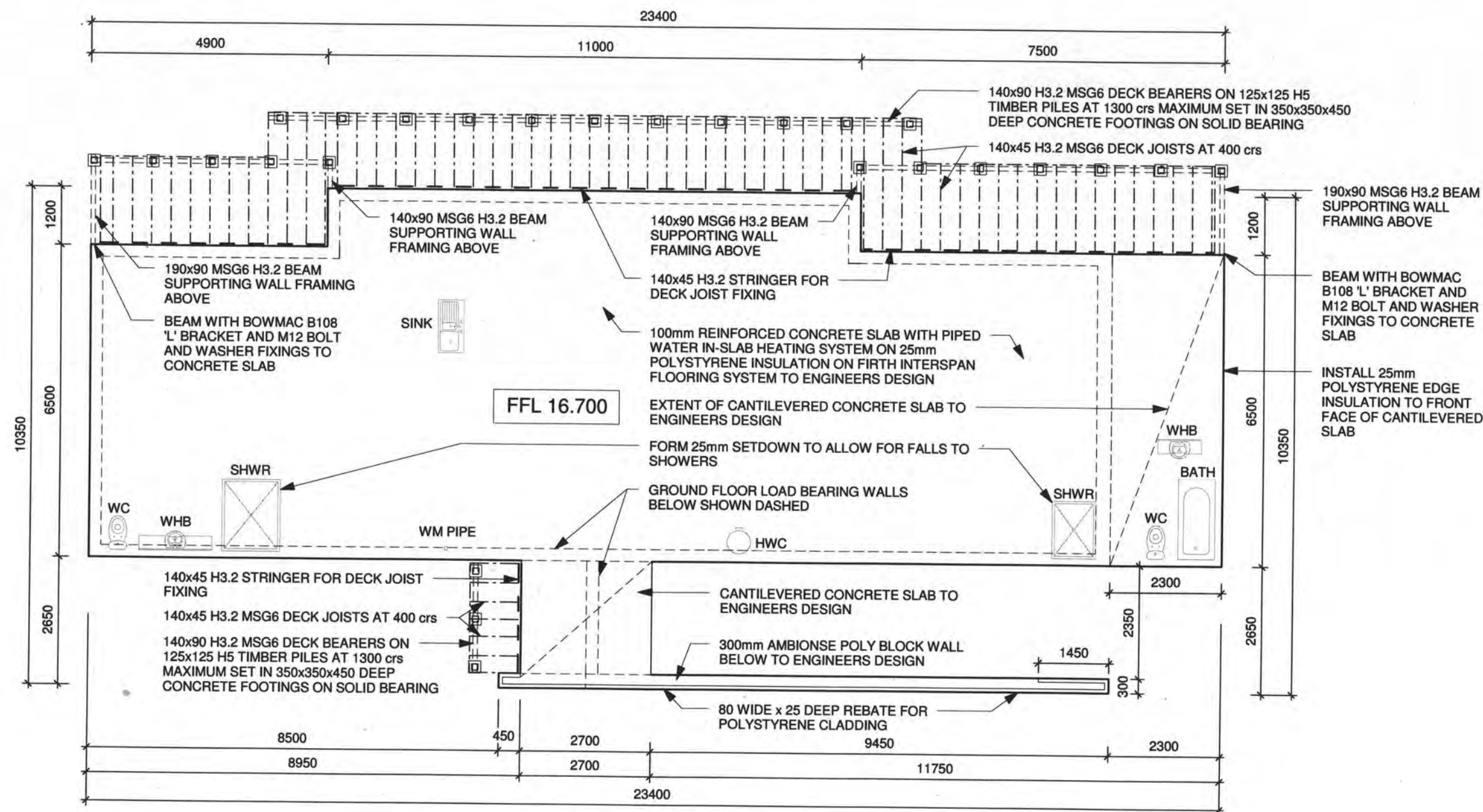
ELECTRICAL LEGEND	
(A)	CEILING MOUNTED LIGHT
(B)	SUSPENDED HALOGEN DOWNLIGHT
(C)	SUSPENDED FEATURE LIGHT
(D)	INTERIOR WALL MOUNTED LIGHT
(E)	EXTERIOR WALL MOUNTED LIGHT
(F)	OVER MIRROR LIGHT
(G)	BATTEN HOLDER
(H)	DOOR SWITCH OPERATED PANTRY LIGHT
(I)	EXTRACT VAN - VENTED TO EXTERIOR
(P)	PIR SENSOR
(S)	HARD WIRED SMOKE DETECTOR
—	FLUORESCENT STRIP LIGHT
⏏	ONE WAY LIGHT SWITCH
⏏	MULTIPLE LIGHT SWITCH
⏏	DIMMER SWITCH
2	POWER POINT (2 = DOUBLE)
AD	AUTO GARAGE DOOR OPENER
HTR	HEATED TOWEL RAIL
DW	DISHWASHER
RH	RANGEHOOD
OV	OVEN
MW	MICROWAVE
H	HOB
CH	CUPBOARD HEATER
PH	PHONE OUTLET
TV	TV AERIAL OUTLET
IT	INTERNET OUTLET ON SEP. LINE
⏏	HARD WIRED DOOR BELL WITH PUSH BUTTON AT FRONT DOOR
■	MAIN SWITCHBOARD
■	METER PANEL

GROUND FLOOR ELECTRICAL PLAN

1 : 100

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GROUND FLOOR ELECTRICAL PLAN		
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FIRST FLOOR FOUNDATION
PLAN

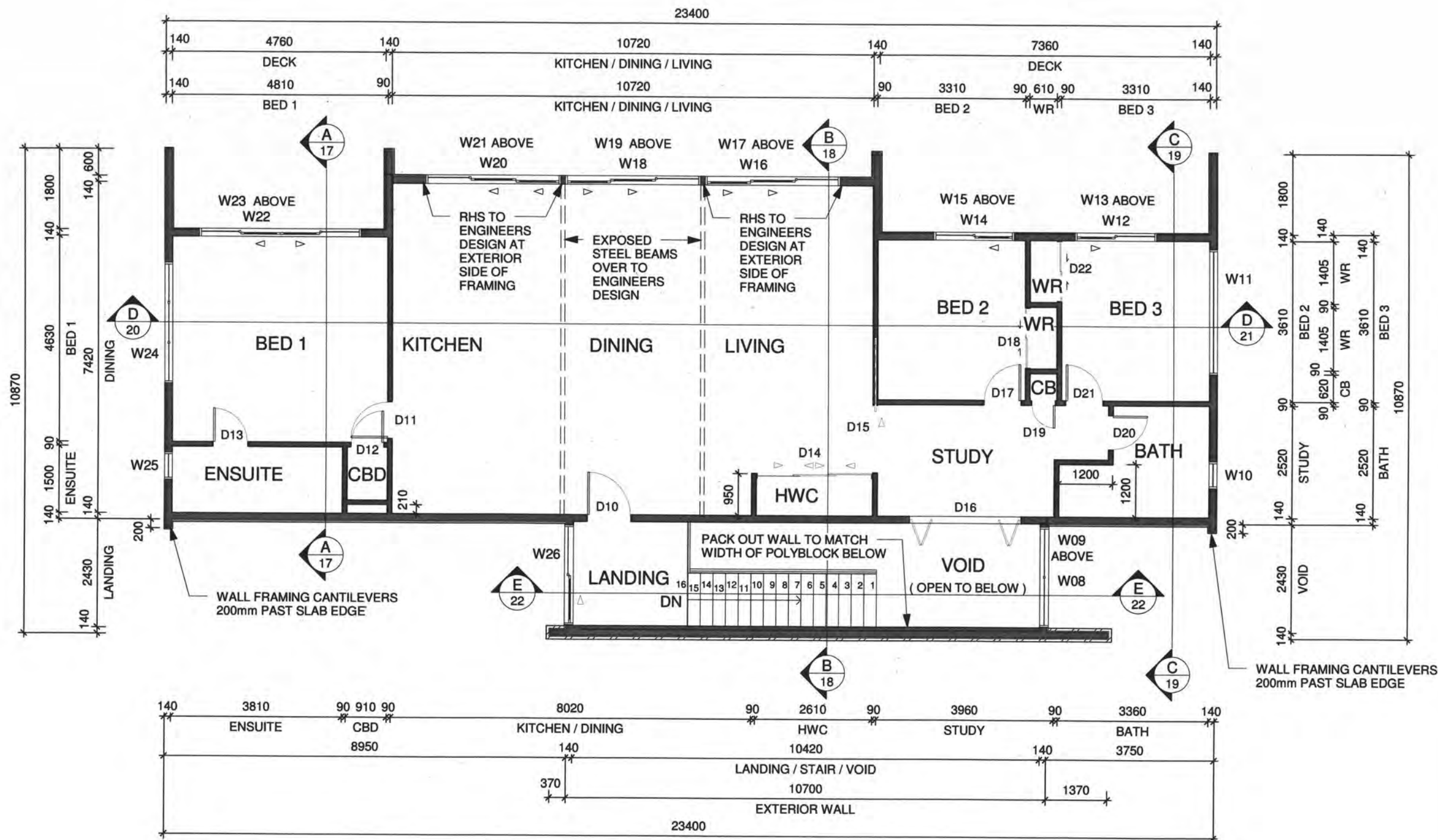
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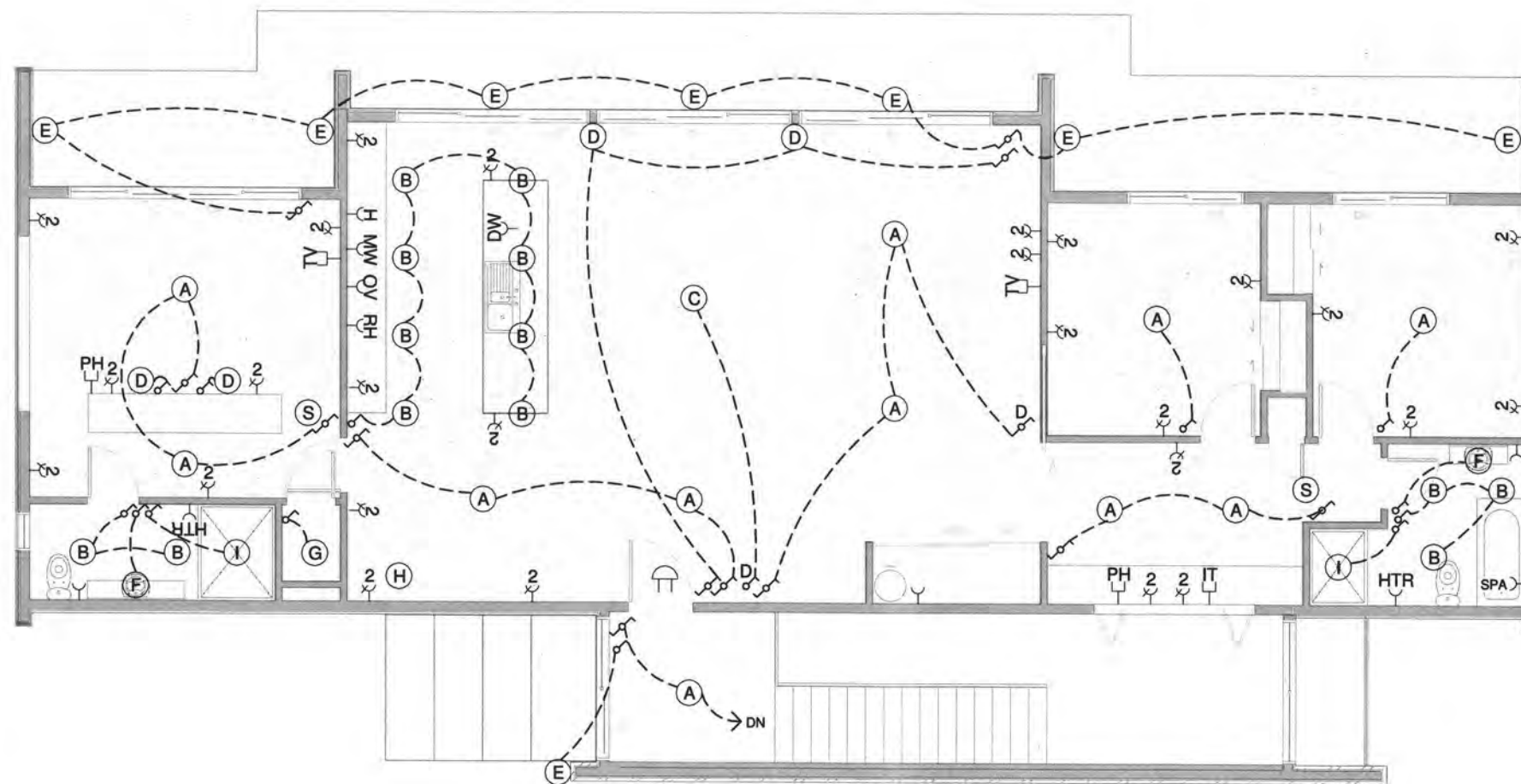
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FIRST FLOOR FOUNDATION PLAN

1 : 100



FIRST FLOOR FRAMING PLAN
1 : 100



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ELECTRICAL LEGEND	
(A) CEILING MOUNTED LIGHT	ONE WAY LIGHT SWITCH
(B) SUSPENDED HALOGEN DOWNLIGHT	MULTIPLE LIGHT SWITCH
(C) SUSPENDED FEATURE LIGHT	DIMMER SWITCH
(D) INTERIOR WALL MOUNTED LIGHT	POWER POINT (2 = DOUBLE)
(E) EXTERIOR WALL MOUNTED LIGHT	AD AUTO GARAGE DOOR OPENER
(F) OVER MIRROR LIGHT	HTR HEATED TOWEL RAIL
(G) BATTEN HOLDER	DW DISHWASHER
(H) DOOR SWITCH OPERATED PANTRY LIGHT	RH RANGEHOOD
(I) EXTRACT VAN - VENTED TO EXTERIOR	OV OVEN
(P) PIR SENSOR	MW MICROWAVE
(S) HARD WIRED SMOKE DETECTOR	H HOB
FLUORESCENT STRIP LIGHT	CH CUPBOARD HEATER
MAIN SWITCHBOARD	PH PHONE OUTLET
METER PANEL	TV TV AERIAL OUTLET
	IT INTERNET OUTLET ON SEP. LINE
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FIRST FLOOR ELECTRICAL PLAN

1 : 100

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DOWNPIPE AND GUTTER CALCULATIONS
 ROOF PITCH = 8°
 ALL DOWNPIPES 80mmØ
 FROM NZBC E1/AS1 TABLE 5:
 80mmØ DOWNPIPE SERVES 85 m² ROOF AREA

125 BOX GUTTER CROSS SECTIONAL AREA = 7500mm²
 FROM NZBC E1, FIGURE 15:
 EXT. GUTTER WITH CROSS SECTIONAL AREA OF 7500mm²
 CAN SERVE ROOF AREA OF 68m² WHERE ROOF PITCH IS
 BETWEEN 0 & 25°

ROOF A CATCHMENT AREA = 178m²
 No. OF DOWNPIPES REQUIRED = 3
 No. OF DOWNPIPES PROVIDED = 3

ROOF B CATCHMENT AREA = 8m²
 No. OF DOWNPIPES REQUIRED = 1
 No. OF DOWNPIPES PROVIDED = 1

ROOF C CATCHMENT AREA = 12m²
 No. OF DOWNPIPES REQUIRED = 1
 No. OF DOWNPIPES PROVIDED = 1

ROOF D CATCHMENT AREA = 61m² (INCLUDES PART
 ROOF A)
 No. OF DOWNPIPES REQUIRED = 1
 No. OF DOWNPIPES PROVIDED = 1

SELECTED PRODUCTS

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- WINDOW FLASHING TAPE - THERMAKRAFT ALUBAND SYSTEM

ROOF NOTES

- INSTALL EAVES FLASHING TO ALL EAVE DETAILS
- REFER ALSO TO DETAILS FOR FLASHING DIMENSIONS
- RAFTERS TO BE HYJOIST HJ360 90 H3 TREATED WITH 2 No. SKEW NAILS + 2 No. WIRE DOGS OR OTHER APPROVED 4.7 KN CONNECTION TO TOP PLATE

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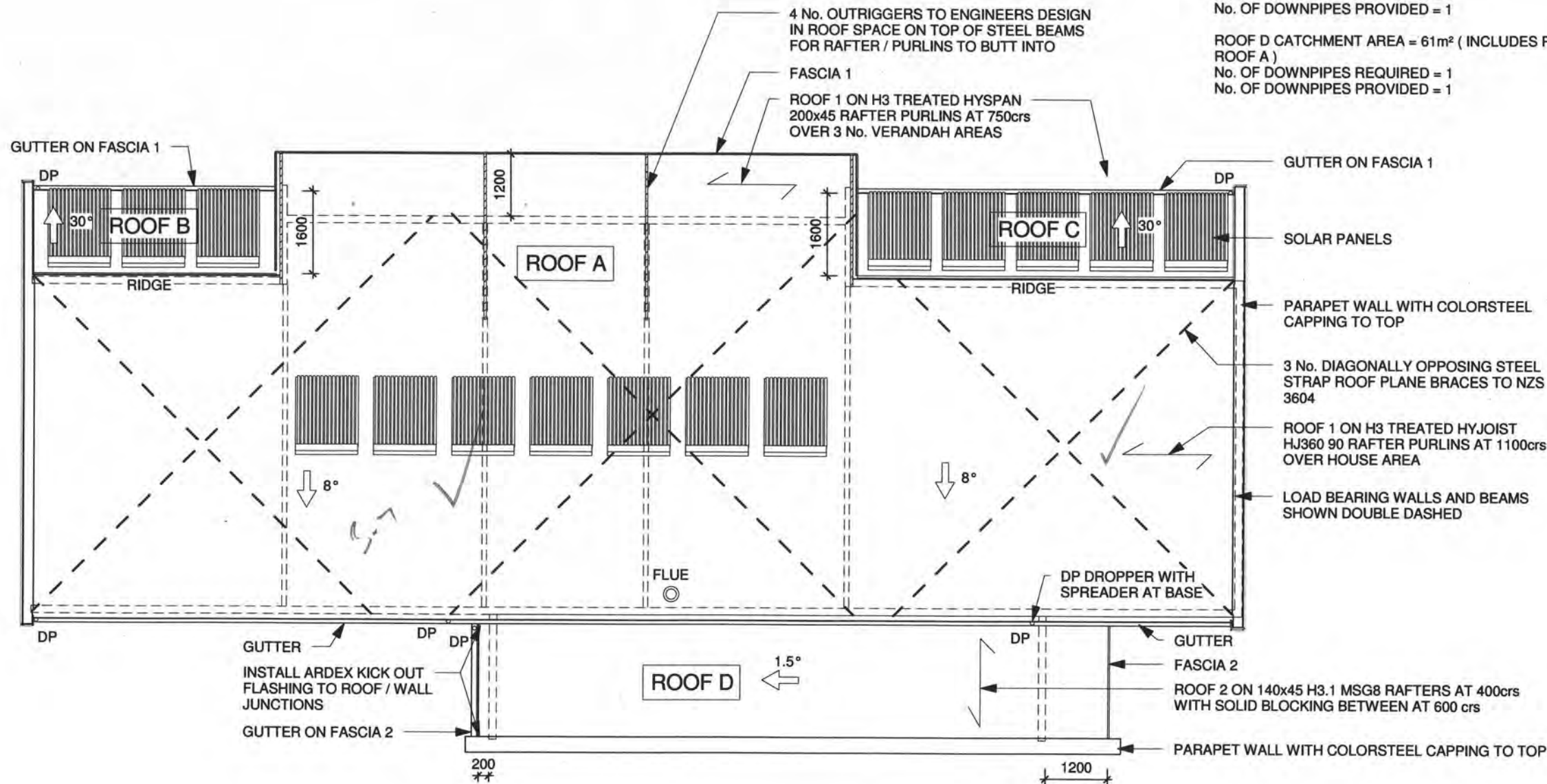
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ROOF PLAN

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ROOF PLAN
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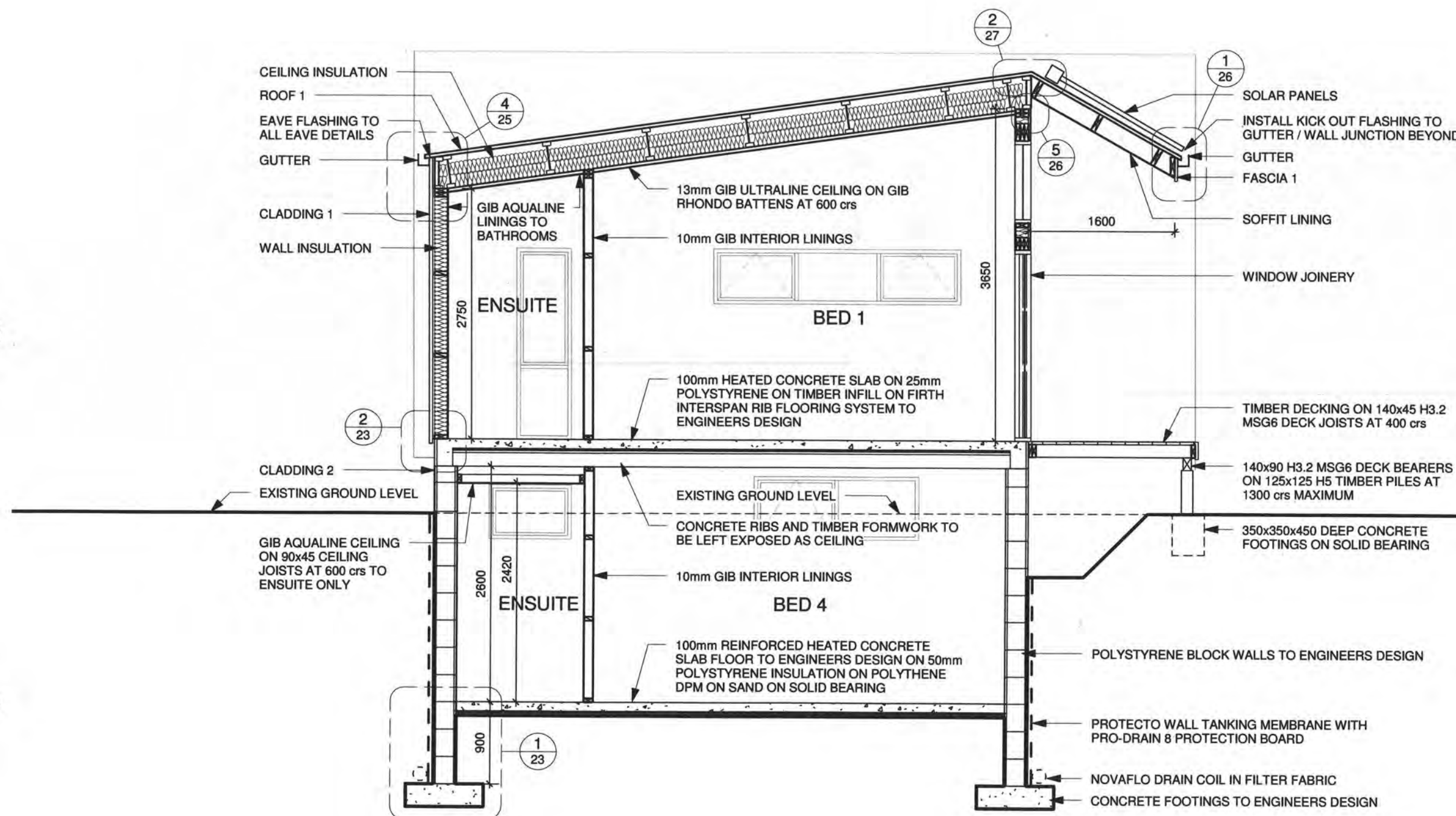
INSULATION "R" VALUES

- COMPLY WITH NZBC H1 AS1 & NZS 4218
- REFER TO SPEC FOR INSULATION TYPES
- REFER TO H1 CALCULATION SHEET

EXTERIOR WALLS = 2 No. LAYERS R1.8 BATTS
GARAGE INTERIOR WALLS = R2.8 ULTRA BATT
CEILINGS = 2 No. LAYERS R2.6 BATTS

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SECTION A
1 : 50



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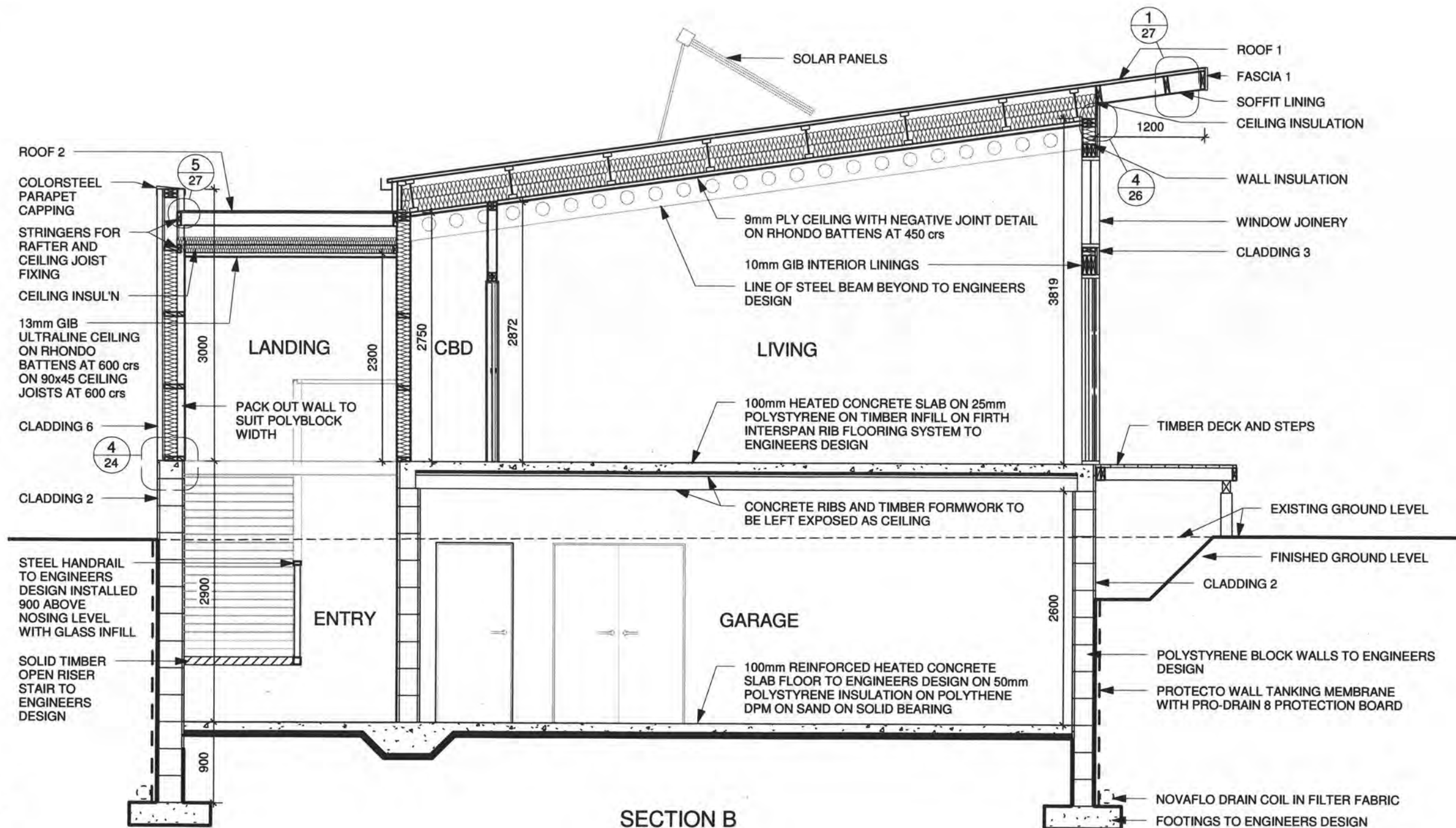
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BUILDING SECTION

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SECTION B
1:50

INSULATION "R" VALUES

- COMPLY WITH NZBC H1 AS1 & NZS 4218
- REFER TO SPEC FOR INSULATION TYPES
- REFER TO H1 CALCULATION SHEET

EXTERIOR WALLS = 2 No. LAYERS R1.8 BATTS
GARAGE INTERIOR WALLS = R2.8 ULTRA BATT
CEILINGS = 2 No. LAYERS R2.6 BATTS

SELECTED PRODUCTS

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- ROOF 1 - 0.55 GAUGE COLORSTEEL ENDURA BB900 ROOFING ON THERMAKRAFT 215 ROOFING U/LAY ON WIRE MESH ON FRAMING
- ROOF 2 - 1mm ARDEX BUTYNOL MEMBRANE ROOF ON 17mm H3 CCA PLY LAID TO 1.5° FALL ON FRAMING
- SOFFITS - 4.5mm HARDIFLEX
- FASCIA 1 - PRE-PRIMED EX 250x40 TIMBER
- FASCIA 2 - PRE-PRIMED EX 200x40 TIMBER
- GUTTERS - DIMOND COLORSTEEL 125 BOX GUTTER
- DOWNPIPES - 80Ø DIMOND COLORFLO
- WINDOW JOINERY - uPVC DOUBLE GLAZED WINDOWS WITH LOW 'E' COATING AND ARGON INFILL
- WINDOW FLASHING TAPE - THERMAKRAFT ALUBAND SYSTEM

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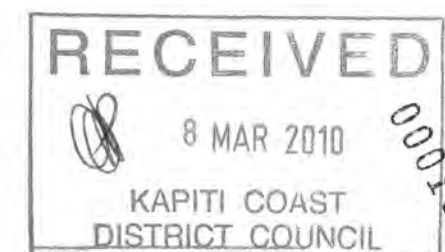
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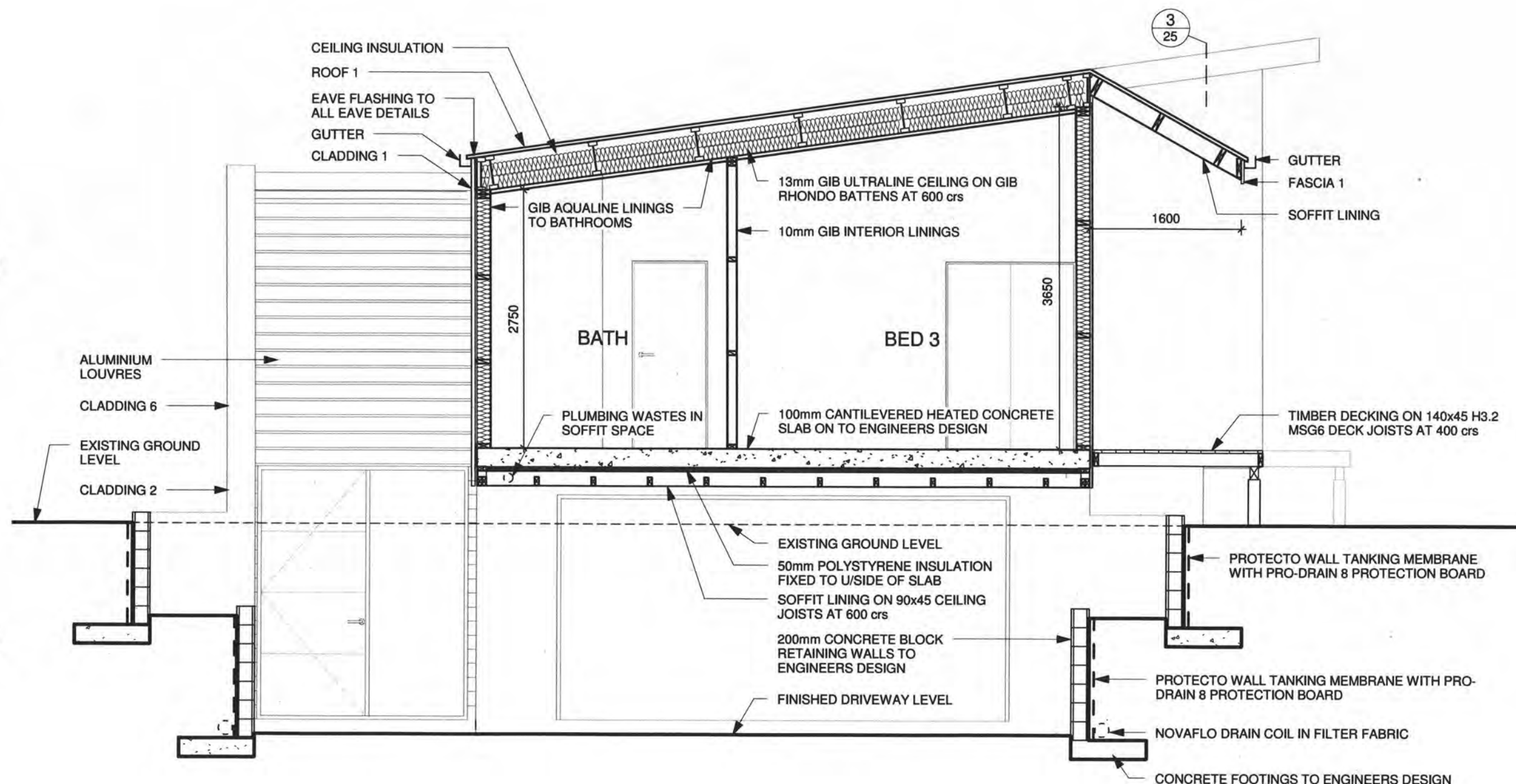


- INSULATION "R" VALUES**
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 - REFER TO H1 CALCULATION SHEET

EXTERIOR WALLS = 2 No. LAYERS R1.8 BATTS
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CEILINGS = 2 No. LAYERS R2.6 BATTS

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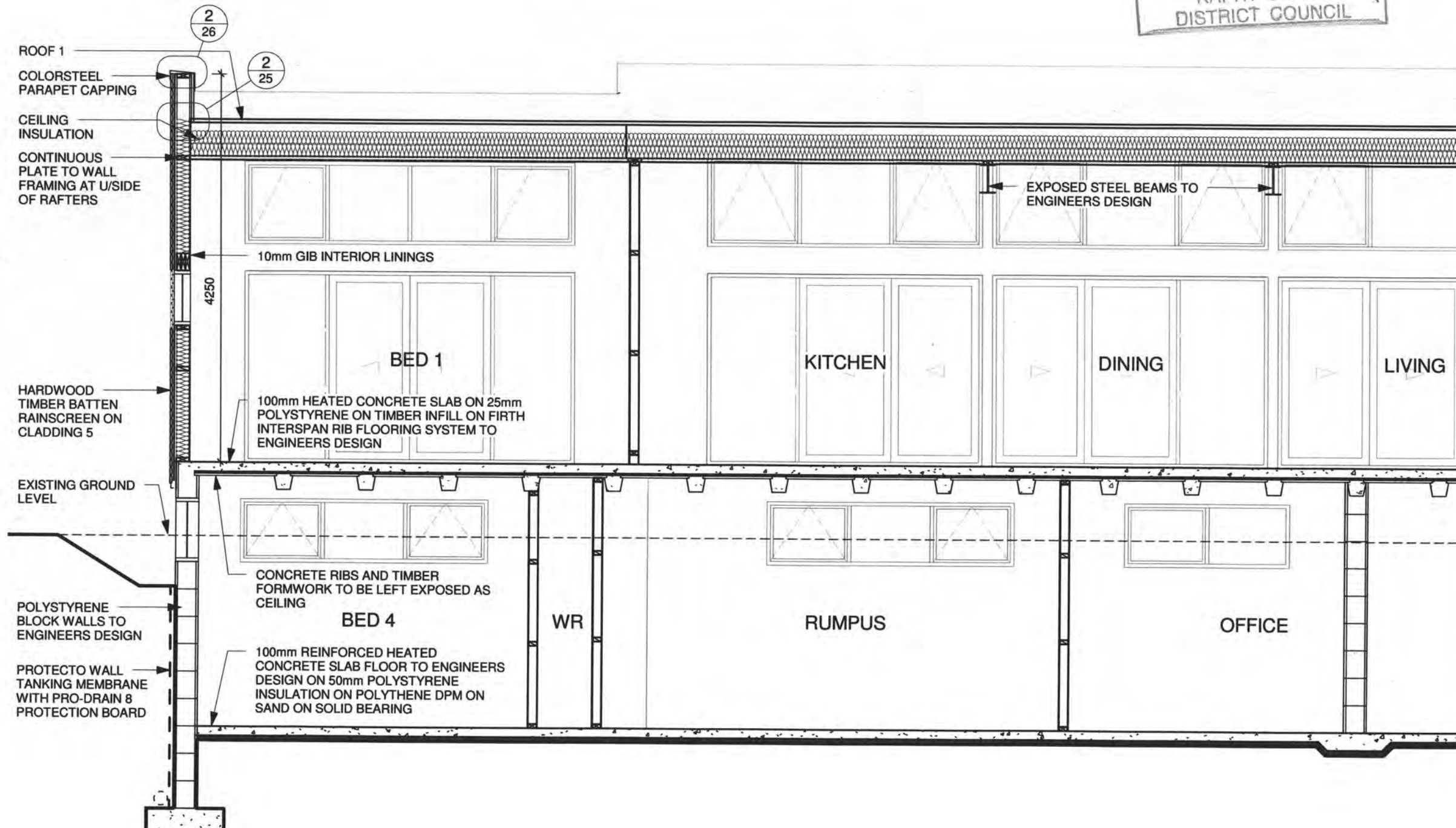
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PART SECTION D
1 : 50

INSULATION "R" VALUES

- COMPLY WITH NZBC H1 AS1 & NZS 4218
- REFER TO SPEC FOR INSULATION TYPES
- REFER TO H1 CALCULATION SHEET

EXTERIOR WALLS = 2 No. LAYERS R1.8 BATTS
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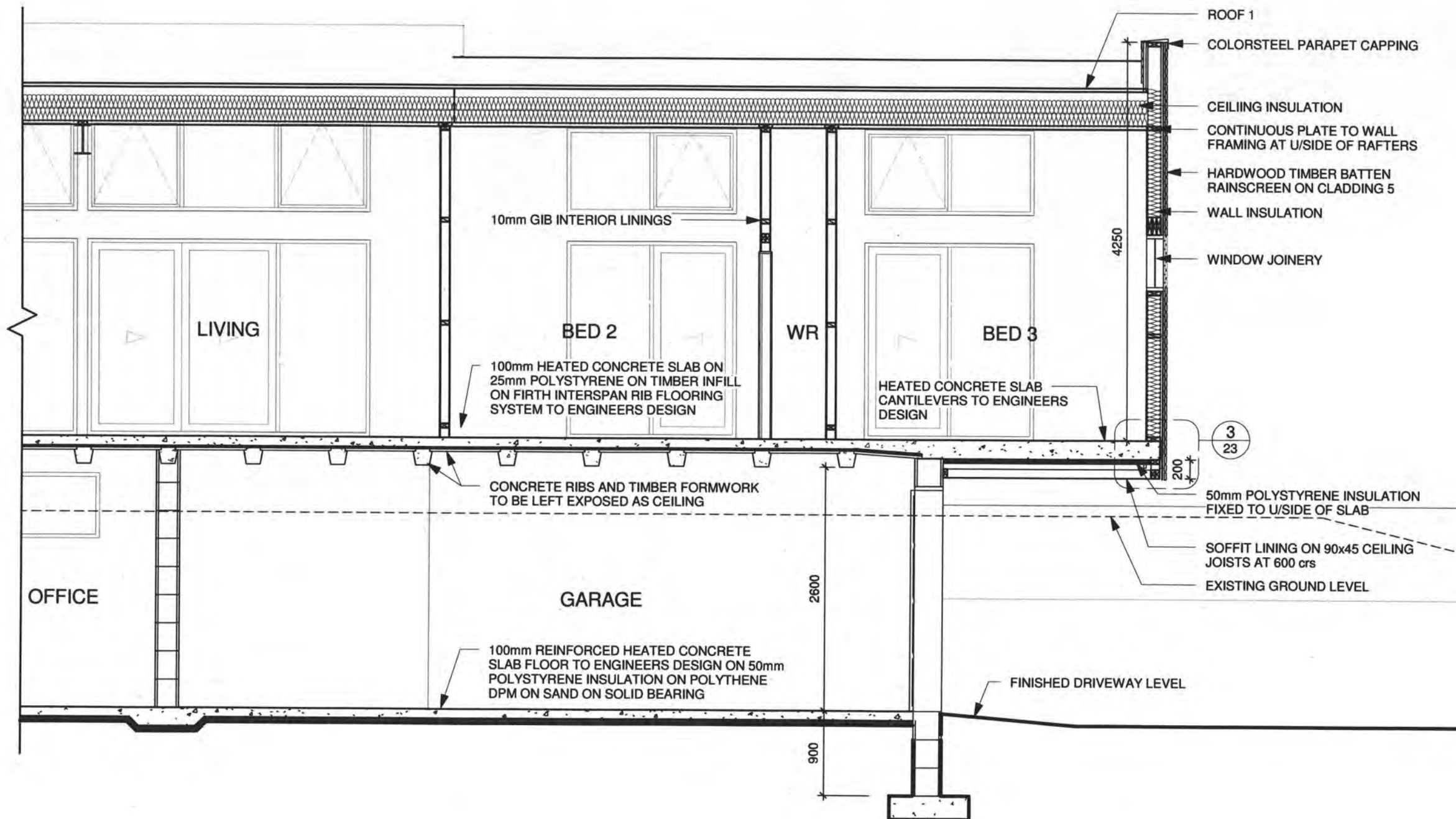
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PART SECTION D
1 : 50

INSULATION "R" VALUES

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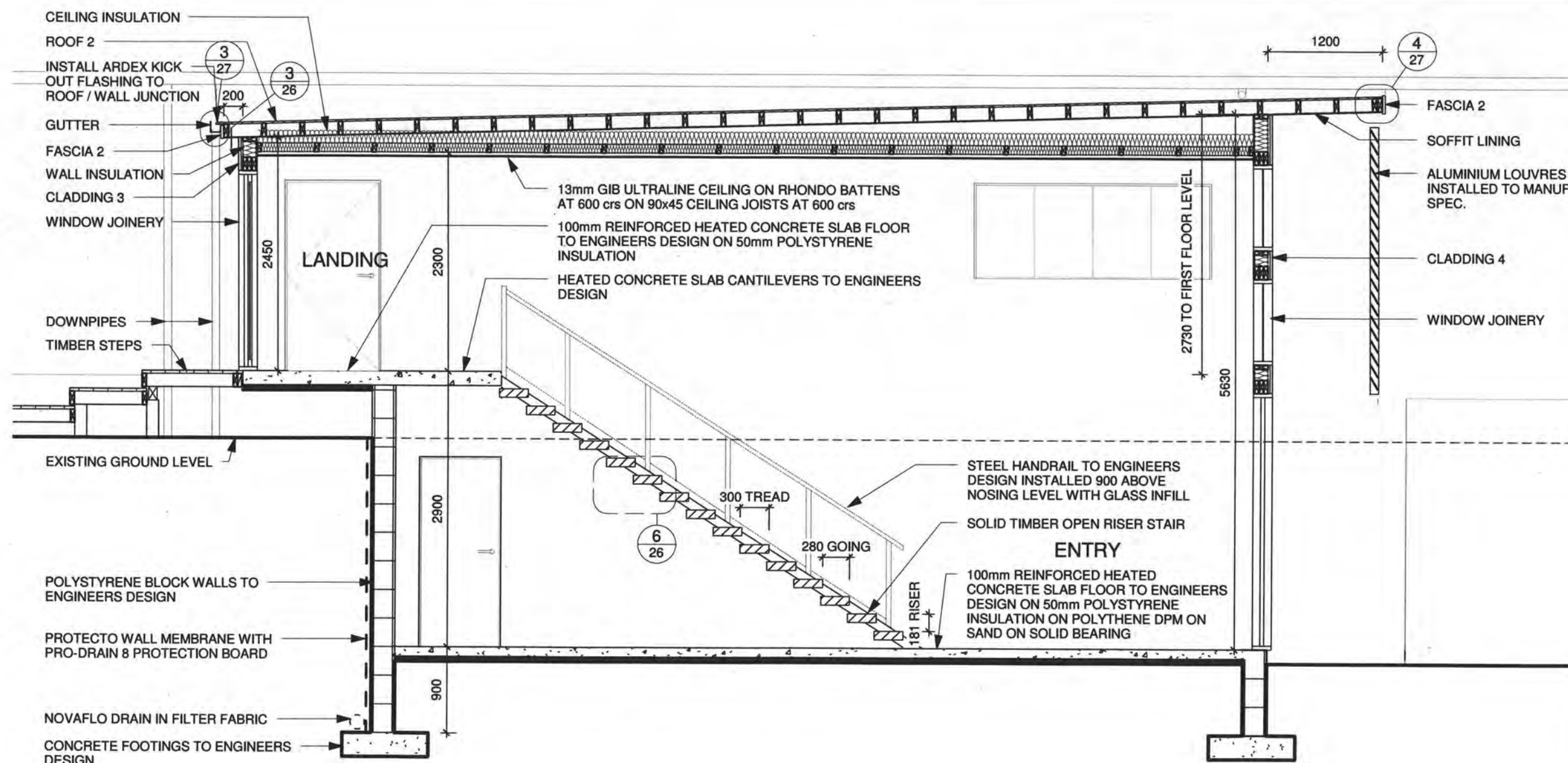
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SECTION E
 1 : 50

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BUILDING SECTION

BUILDING CONSENT

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PLASTER FINISH ON
POLYSTYRENE BLOCK WALL

PROTECTO TAPE TO POLY
BLOCK WALL AND OVER
PRO-DRAIN PROTECTION
BOARD

INSTALL 3 COAT PLASTER
SYSTEM OVER PROTECTO
TAPE STRIP

FINISHED GROUND LEVEL

METAL CLADDING ON HOMERAB LINING
ON FRAMING

BOTTOM PLATE ON DPC WITH RAMSET
H.D. BOLTS INSTALLED TO MANUF. SPEC.

HOMERAB HORIZONTAL FLASHING
INSTALLED BEHIND HOMERAB LINING
AND OVER PLASTER FINISH

COLORSTEEL VERMIN FLASHING WITH
100mm UPSTAND BEHIND METAL
CLADDING AND 5° SLOPE TO COVER
WIDTH OF CLADDING PROFILE

PLASTER FINISH ON POLYSTYRENE
BLOCK WALL TO ENGINEERS DESIGN

INTERIOR LINING

100mm REINFORCED HEATED
CONCRETE SLAB FLOOR ON 25mm
POLYSTYRENE INSULATION ON
TIMBER FORMWORK ON
INTERSPAN RIB FLOORING
SYSTEM TO ENGINEERS DESIGN

GENERAL NOTES

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2 METAL CLADDING BASE
1:5

GIB LINING ON POLYSTYRENE BLOCK
RETAINING WALL TO ENGINEERS DESIGN

100mm REINFORCED HEATED CONCRETE
SLAB FLOOR TO ENGINEERS DESIGN ON 50mm
POLYSTYRENE INSULATION ON POLYTHENE
DPM ON SAND ON SOLID BEARING

INTERIOR LINING

HEATED CONCRETE
SLAB CANTILEVERS TO
ENGINEERS DESIGN

BOTTOM PLATE ON DPC WITH
RAMSET H.D. BOLTS INSTALLED
TO MANUF. SPEC.

HOMERAB HORIZONTAL
FLASHING TO HORIZONTAL
SHEET JOINT

HARDIFLEX CLADDING ON
CAVITY BATTENS ON HOMERAB
LINING ON FRAMING

50x25 HARDWOOD RAINSCREEN
BATTENS SCREW FIXED TO
75x25 H3.2 WEATHERGROOVED
BATTENS AT 600 CRS VERTICAL

25mm POLYSTYRENE
EDGE INSULATION TO
CANTILEVERED SLAB

50mm POLYSTYRENE
INSULATION FIXED TO
U/SIDE OF SLAB

uPVC VENTED CAVITY
CLOSER STRIP

SOFFIT LINING ON 90x45
CEILING JOISTS AT 600 CRS

3 CANTILEVERED SLAB
1:5

PROTECTO WALL
TANKING MEMBRANE
INSTALLED TO MANUF.
SPEC.

PRO-DRAIN 8
PROTECTION BOARD

FREE DRAINING
BACKFILL MATERIAL

NOVAFLO DRAIN IN
FILTER FABRIC

POLYSTYRENE BLOCK FOUNDATION
WALL TO ENGINEERS DESIGN
CONCRETE FOOTING TO ENGINEERS
DESIGN ON SOLID BEARING

1 POLYBLOCK FOUNDATION
1:5

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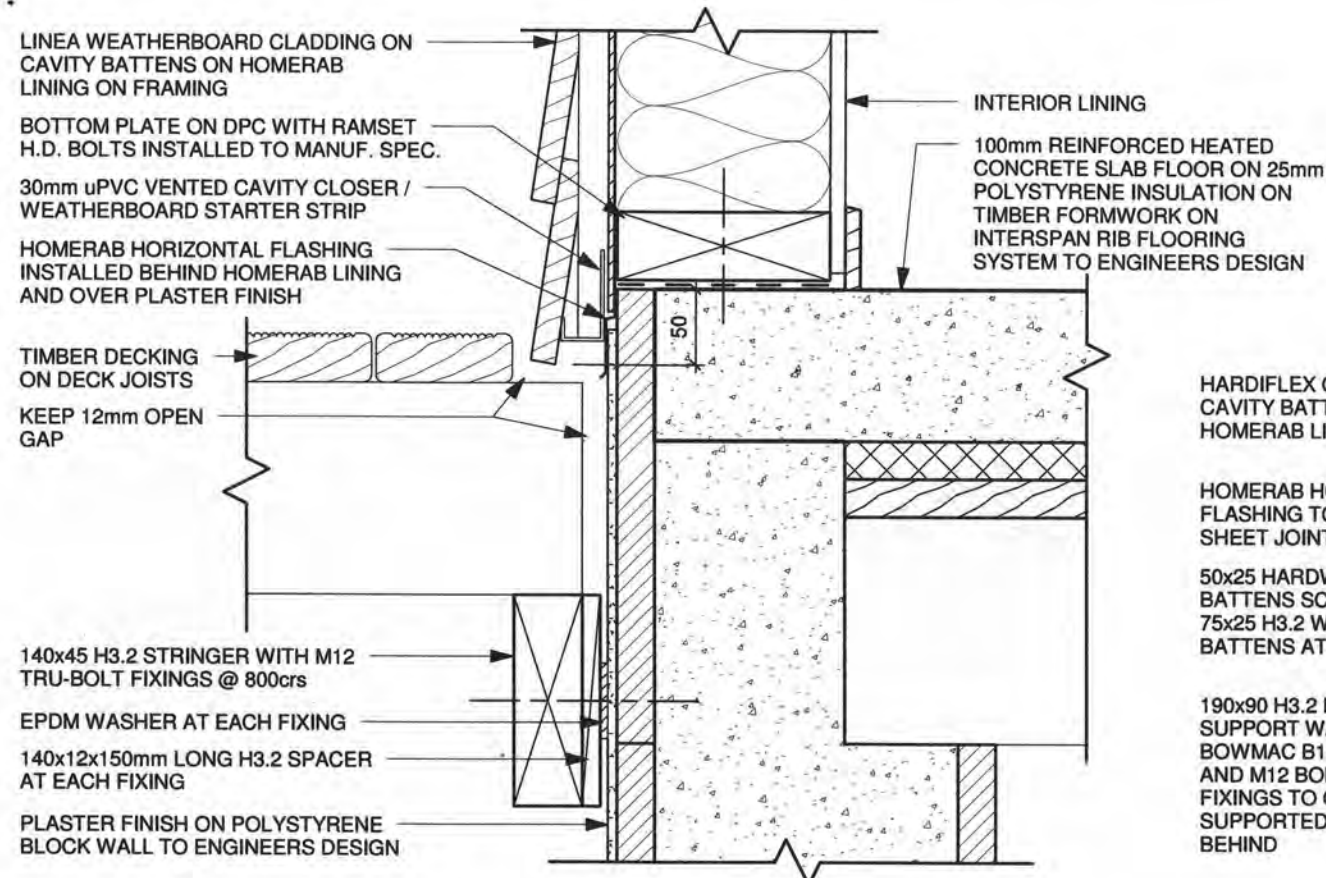
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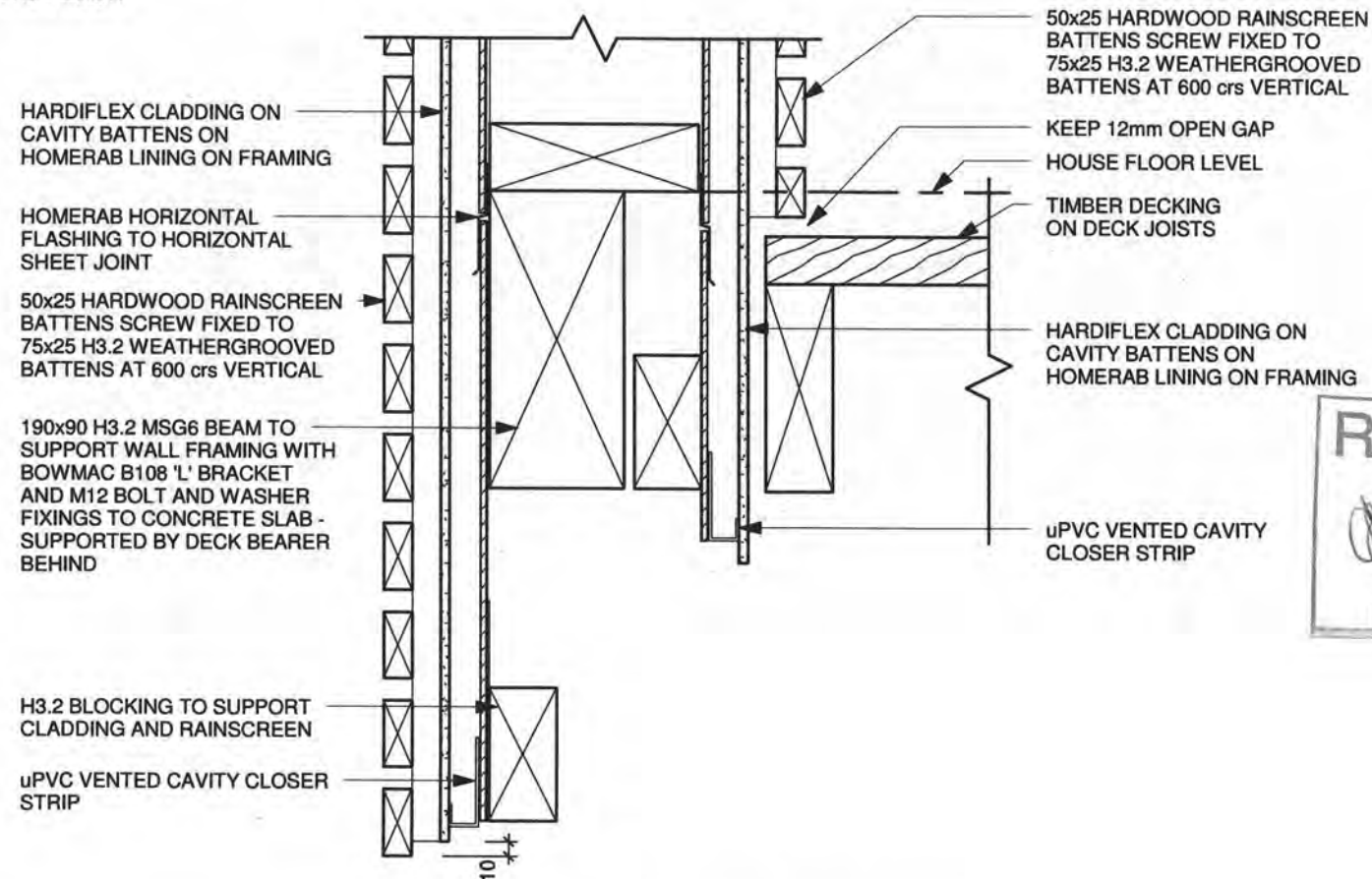
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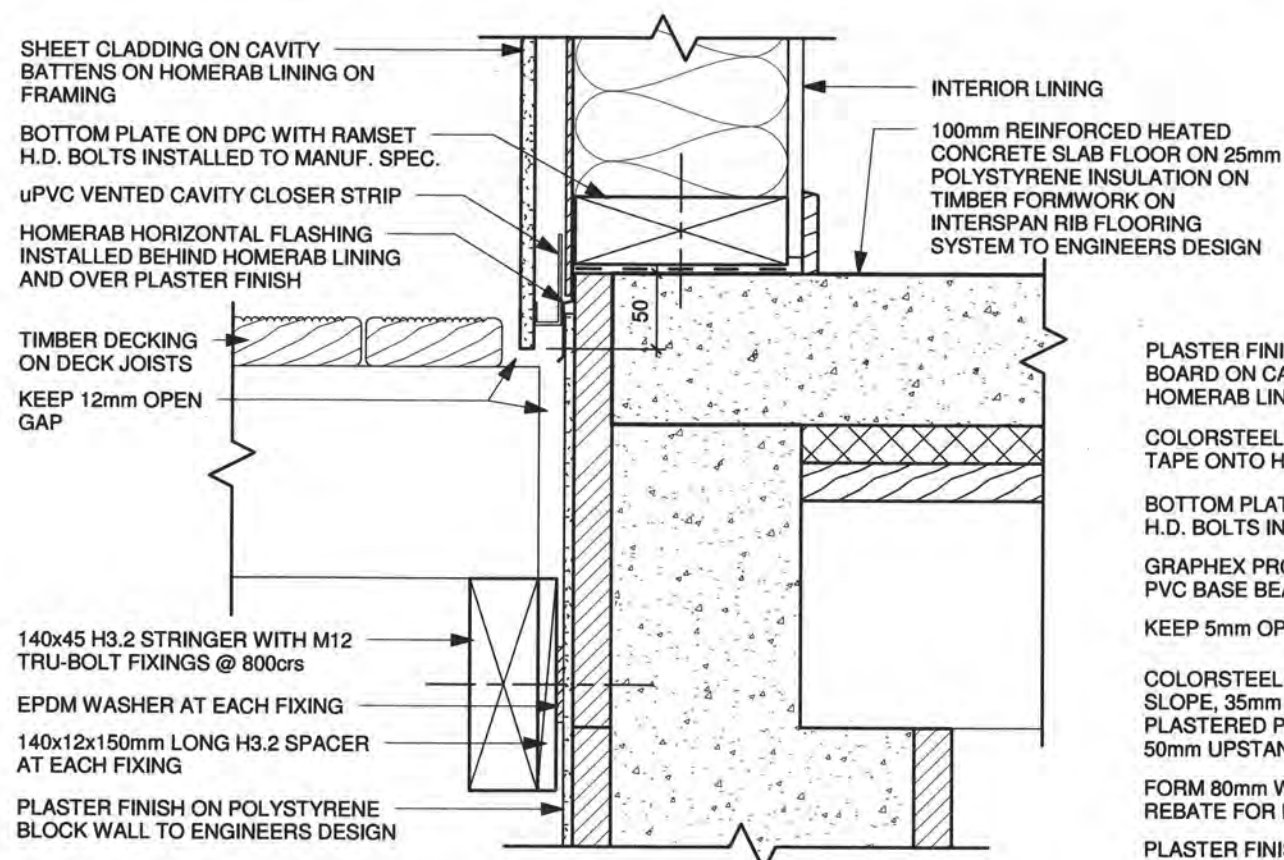
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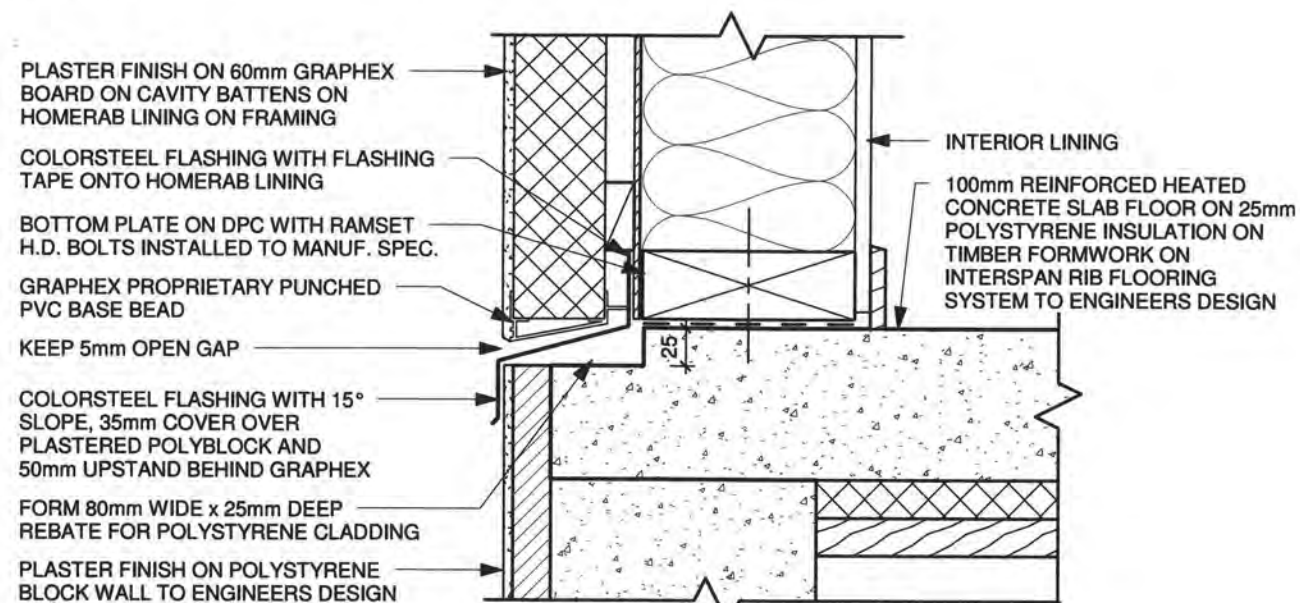
1 DECK / WBD WALL JUNCTION
1:5



3 EXT. WALL AT CANTILEVERED SLAB
1:5



2 DECK / SHEET CLADDING WALL JUNCTION
1:5



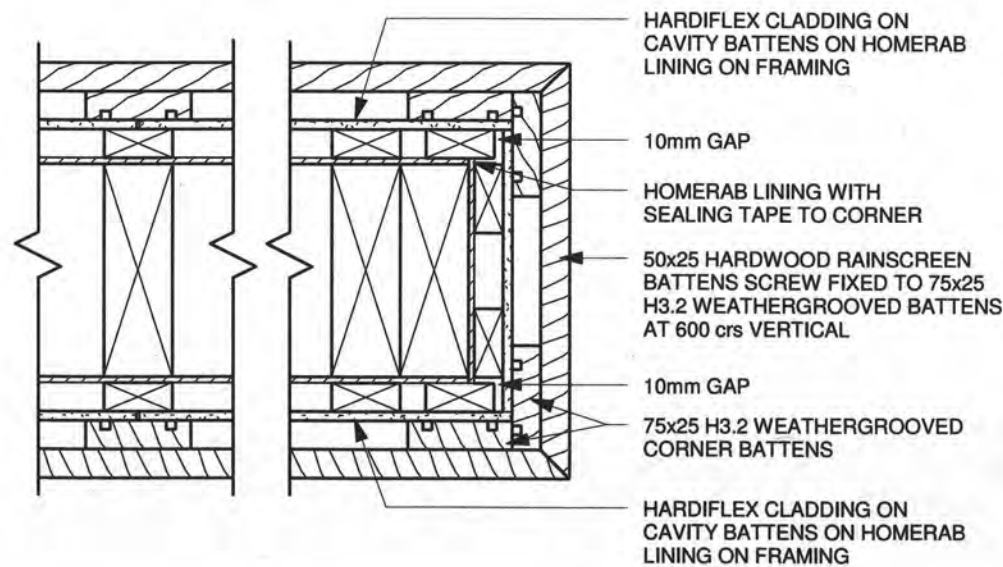
4 GRAPHX - BASE
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GENERAL NOTES

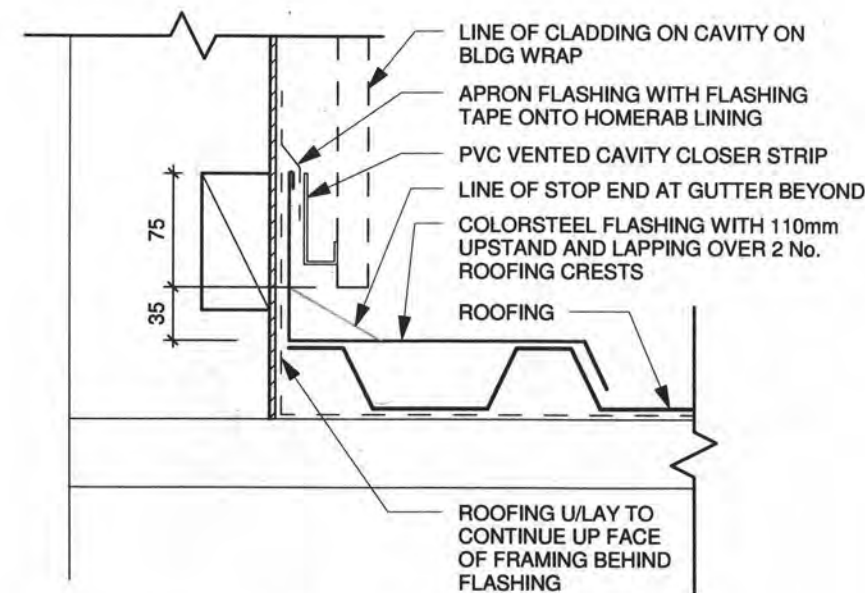
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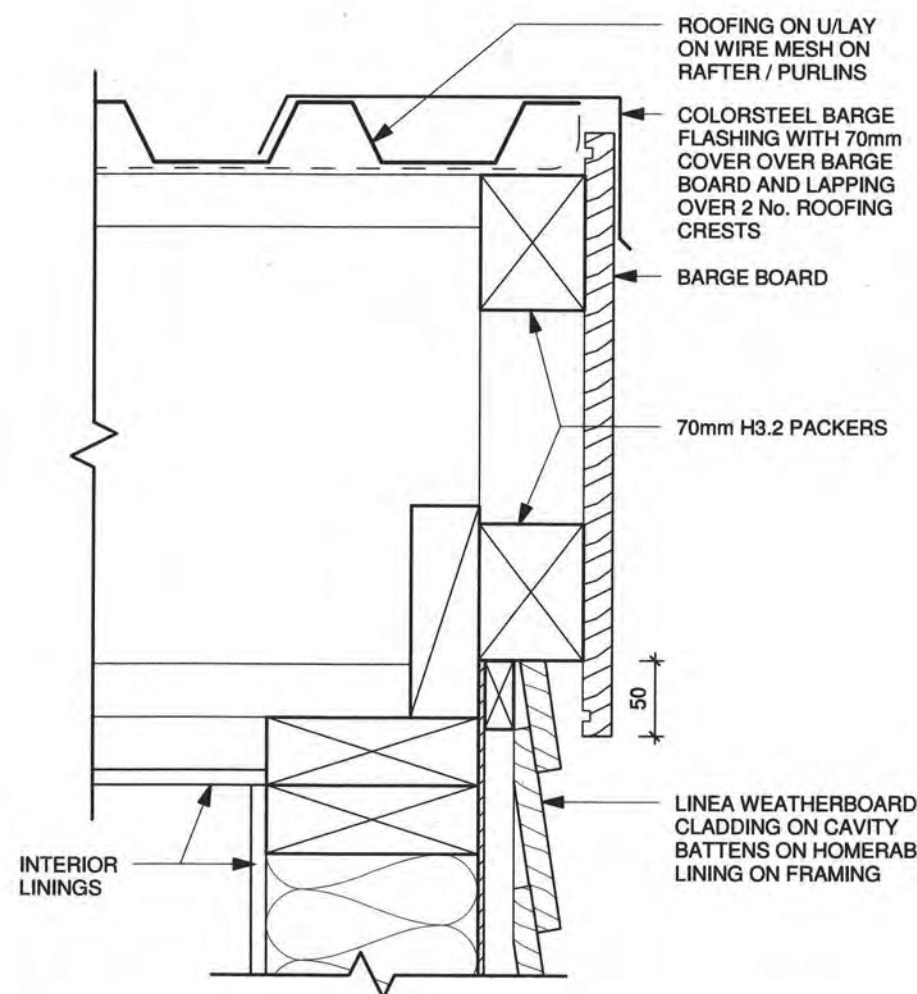
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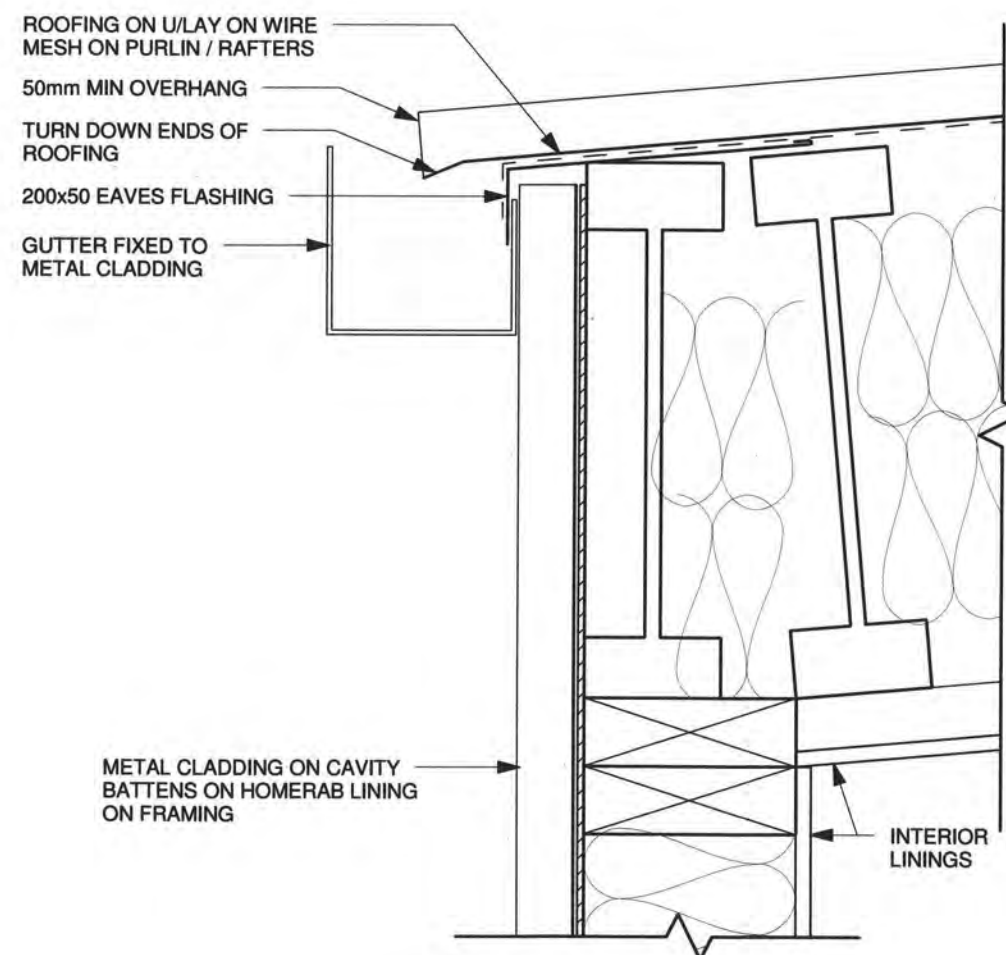
1 RAINSCREEN DETAIL
1:5



2 PARALLEL APRON FLASHING
1:5



3 METAL ROOFING BARGE
1:5



4 METAL ROOF EAVE
1:5

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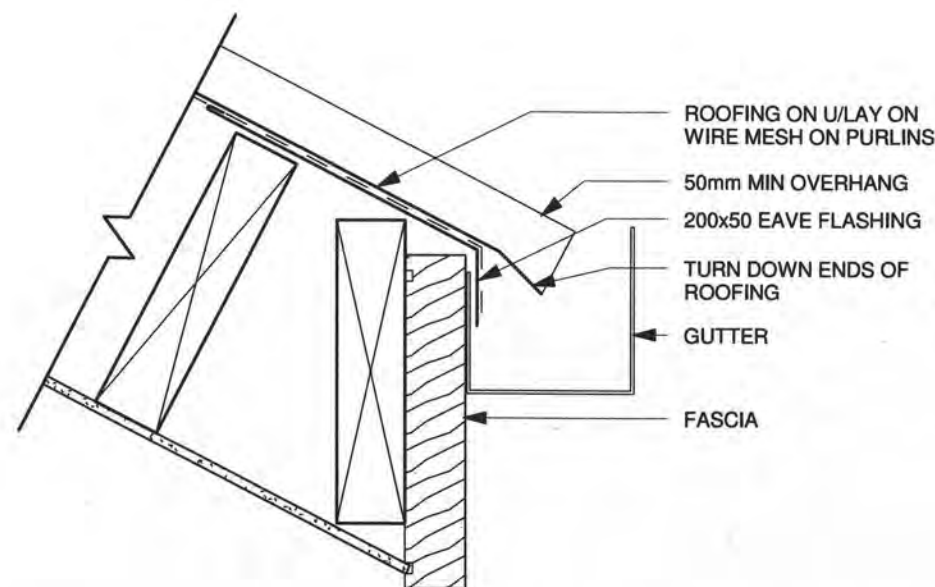
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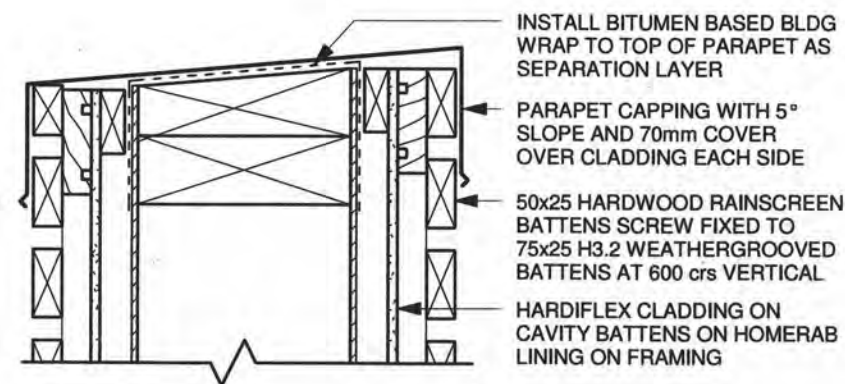
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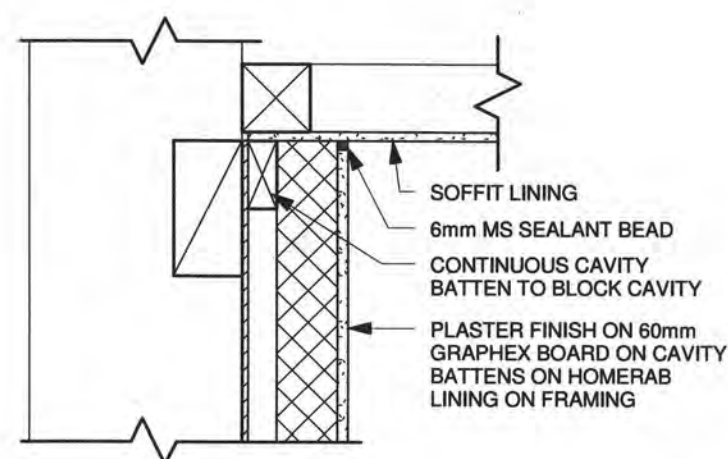
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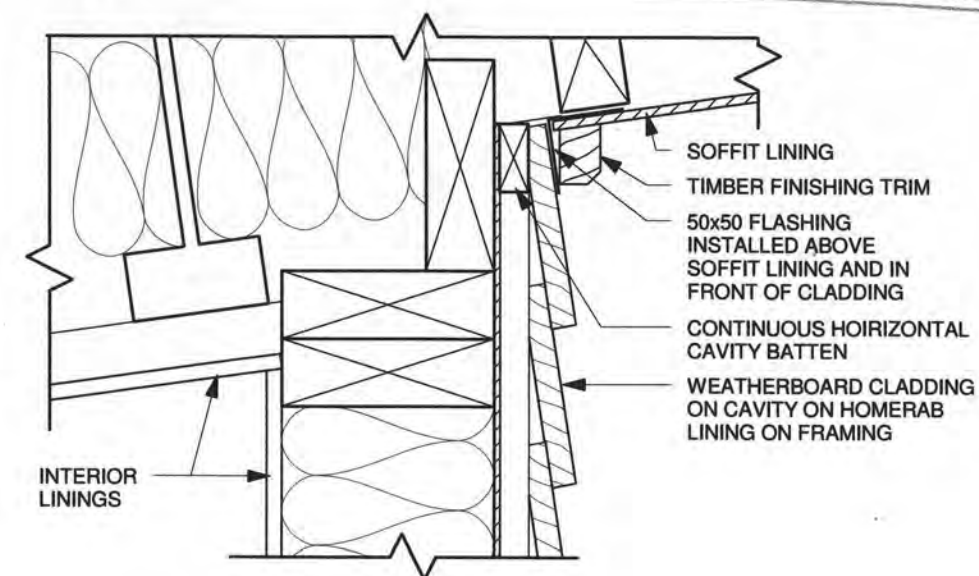
1 METAL ROOF EAVE
1:5



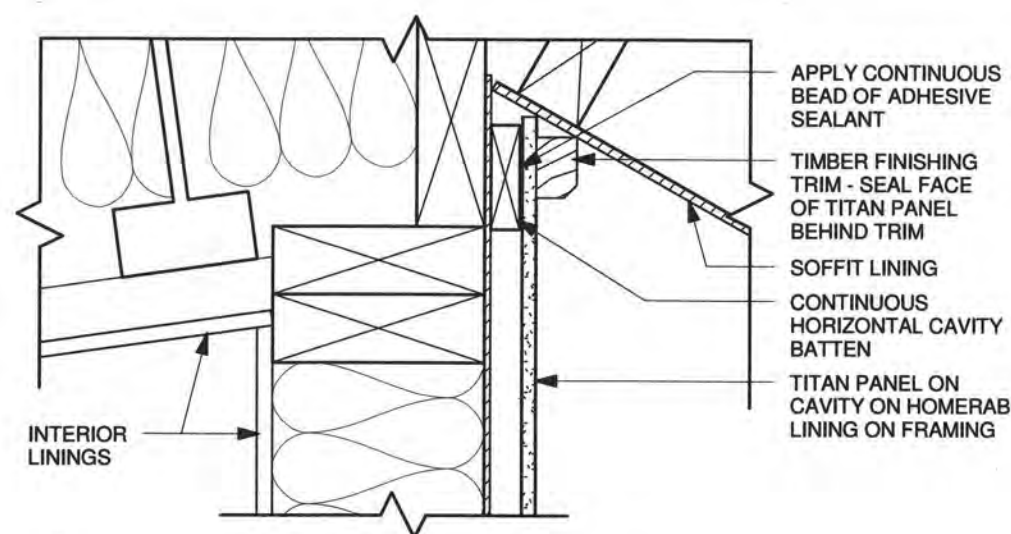
2 PARAPET CAPPING
1:5



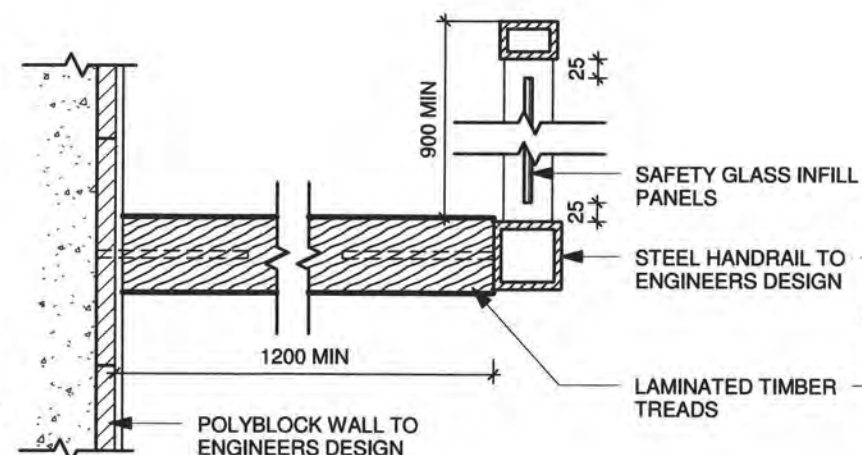
3 GRAPHEX SOFFIT JUNCTION
1:5



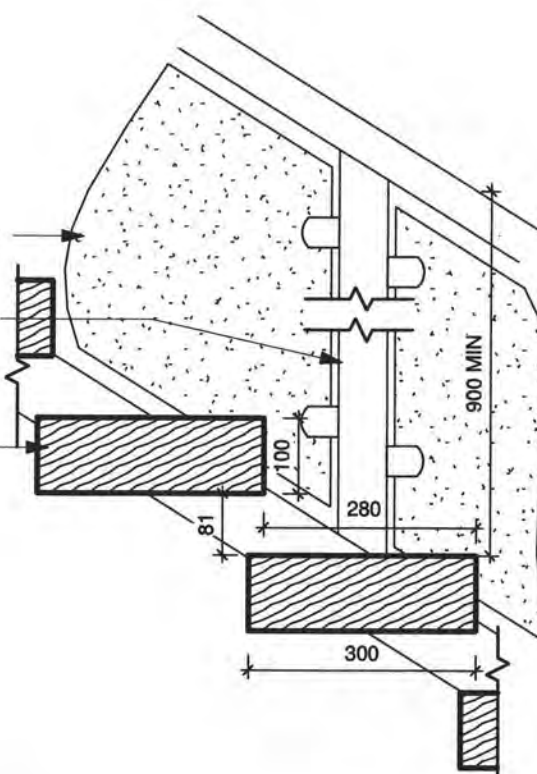
4 WBD / SOFFIT JUNCTION
1:5



5 HARDIES SOFFIT JUNCTION
1:5



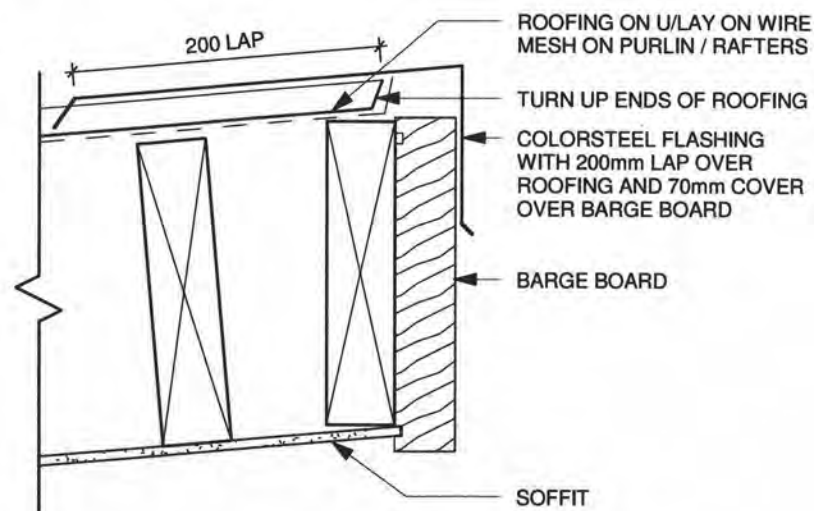
6 STAIR
1:10



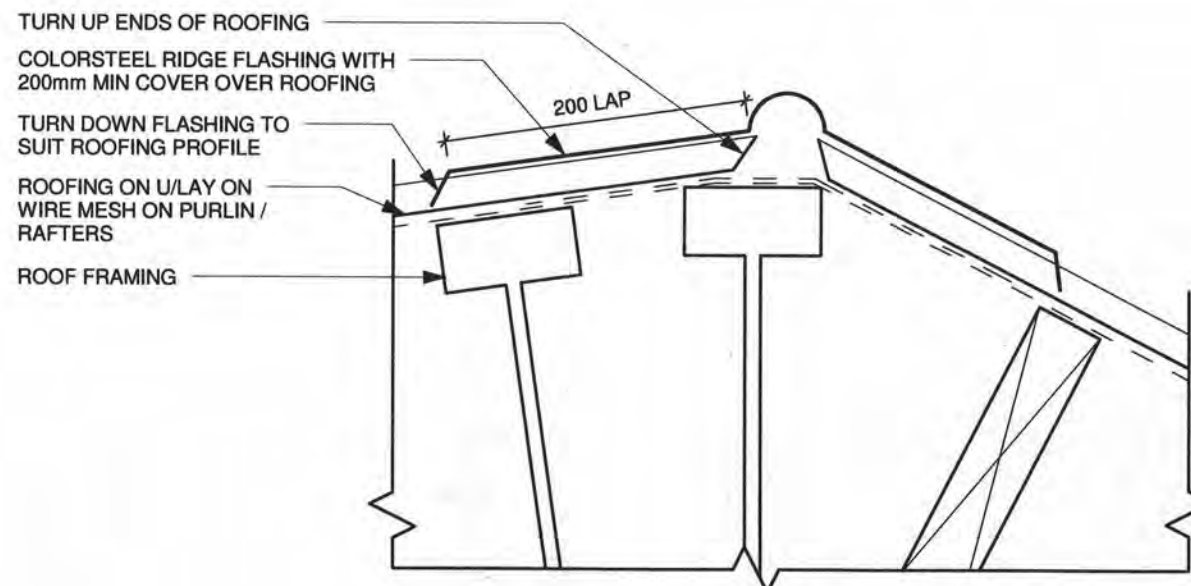
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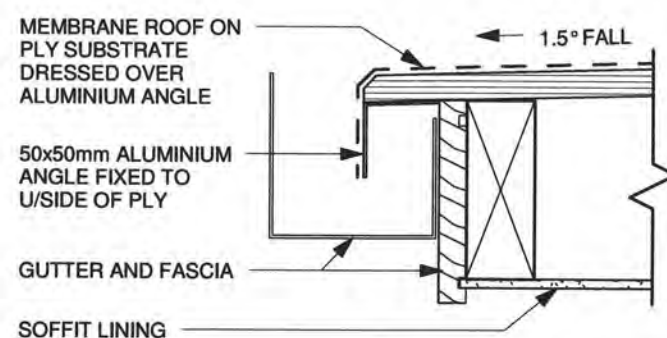
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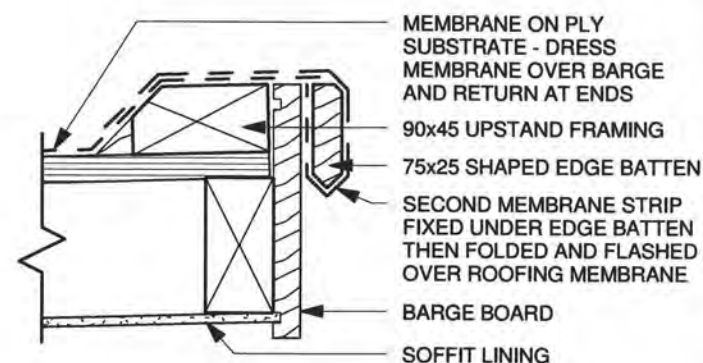
1 METAL ROOFING RIDGE
1:5



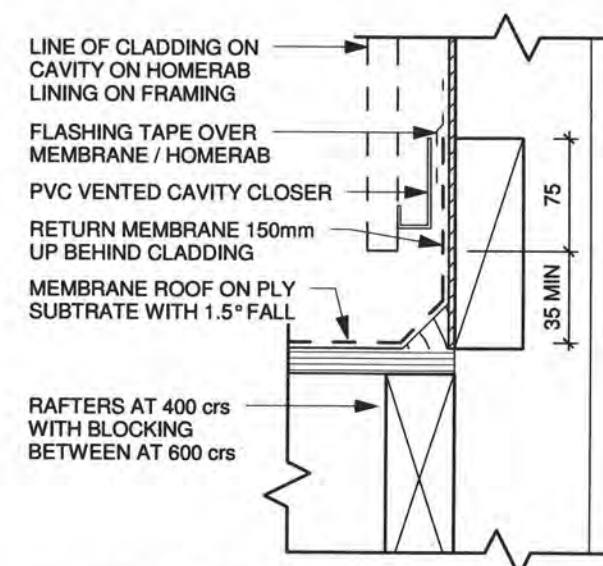
2 METAL ROOFING RIDGE
1:5



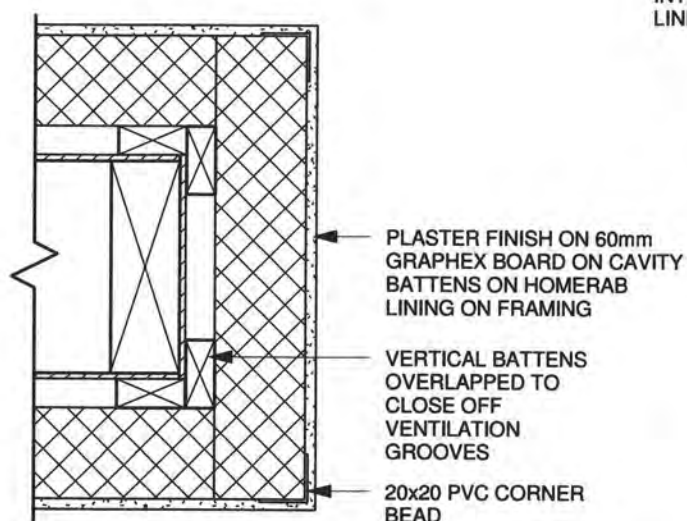
3 MEMBRANE EAVE
1:5



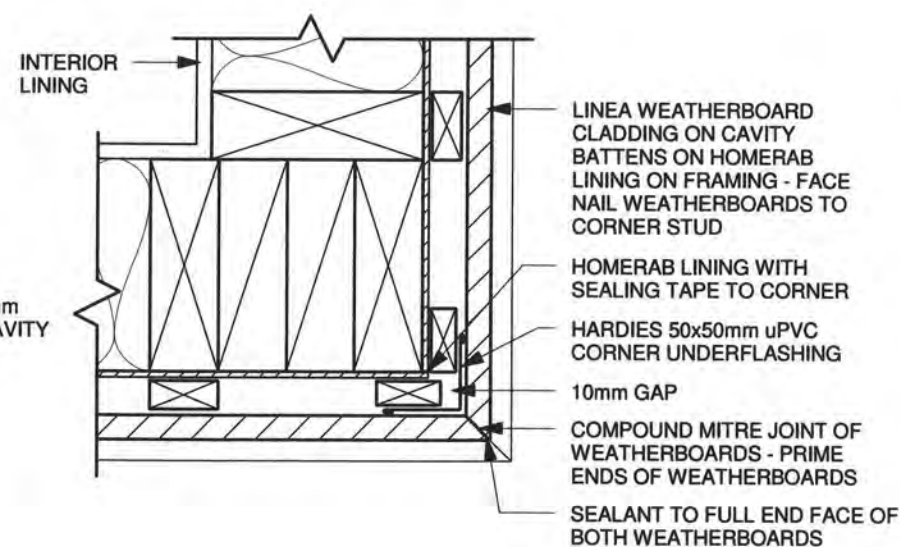
4 MEMBRANE BARGE
1:5



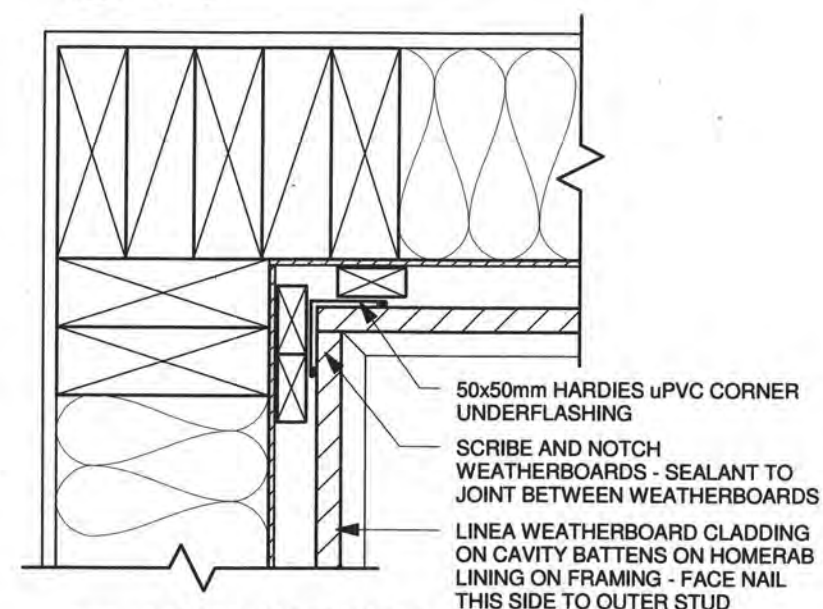
5 MEMBRANE ROOF / WALL JUNCTION
1:5



6 GRAPHEX EXTERNAL CORNER
1:5



7 LINEA EXTERIOR CORNER
1:5



8 LINEA INTERIOR CORNER
1:5

GENERAL NOTES
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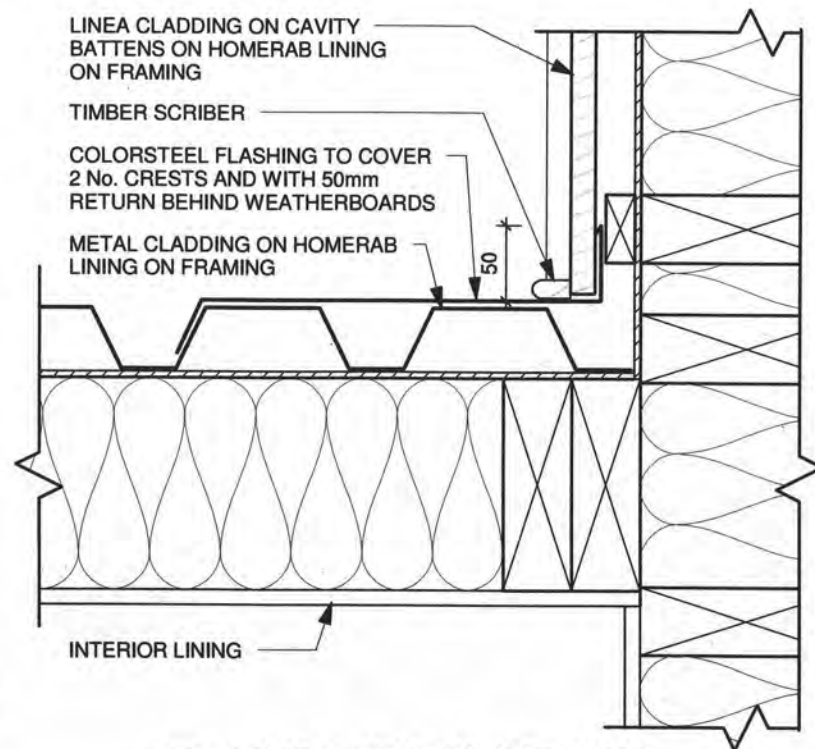
Proposed House
Leonie & Chris Beggs
8 Ngarara Road, Waikanae
Lot 9 DP 13765

A.D
architecture LTD
Ph: 04 298 5662 Fax: 04 298 5663
Info@adarchitecture.co.nz www.adarchitecture.co.nz
PO Box 1585, Paraparaumu Beach

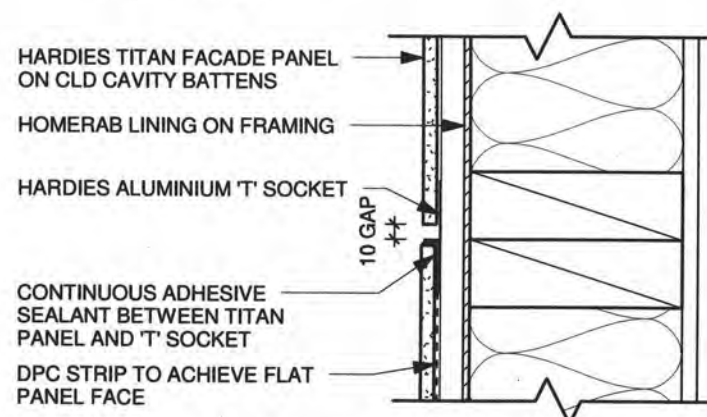
DETAILS

BUILDING CONSENT
DO NOT SCALE DRAWING

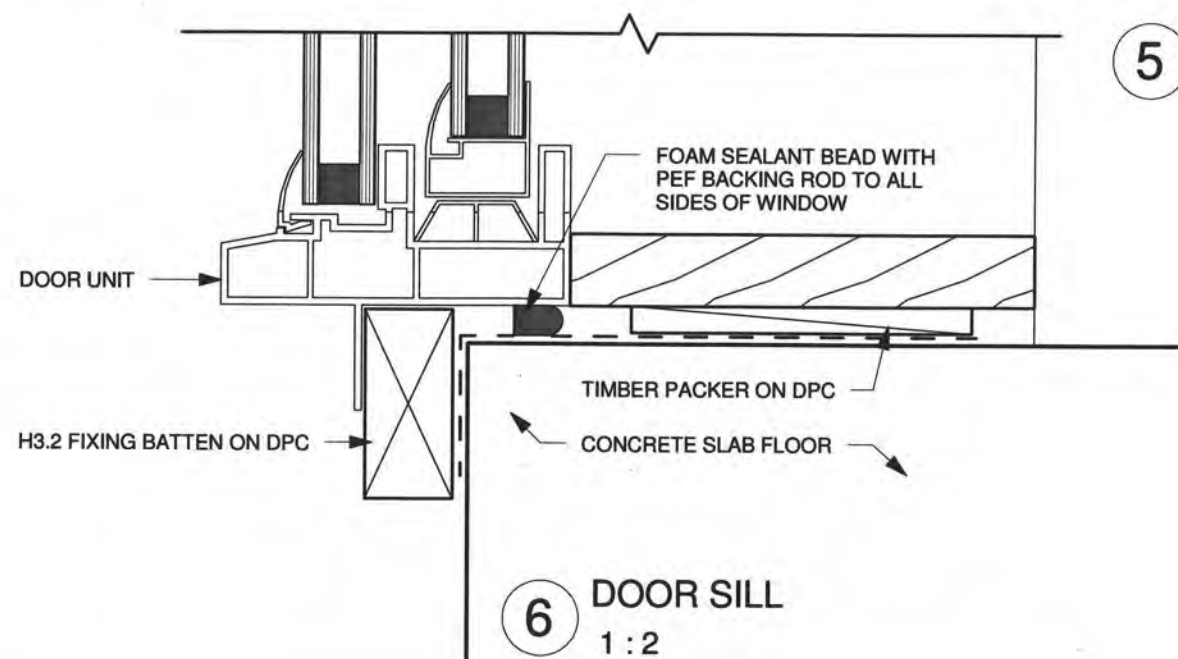
Job	Date	Rev	Sheet
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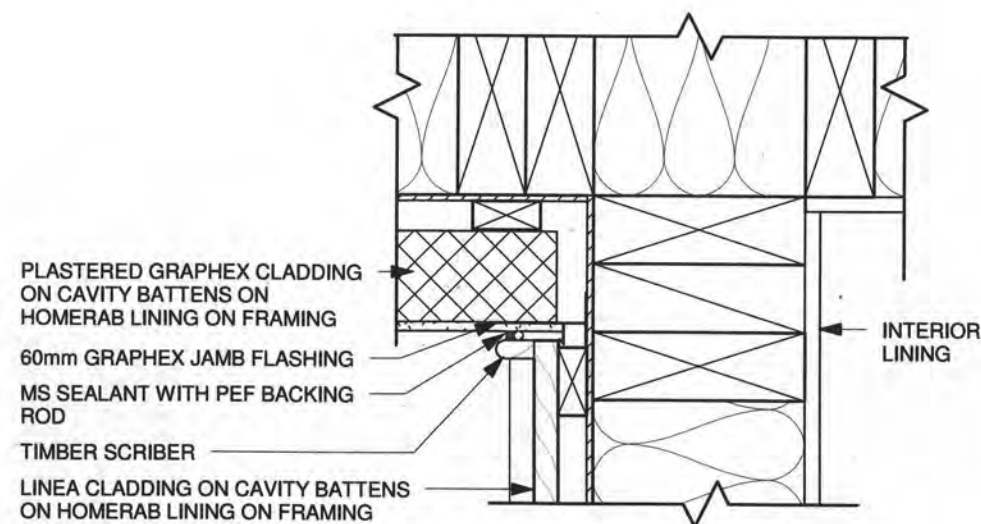
1 LINEA / METAL INT. CNR
1:5



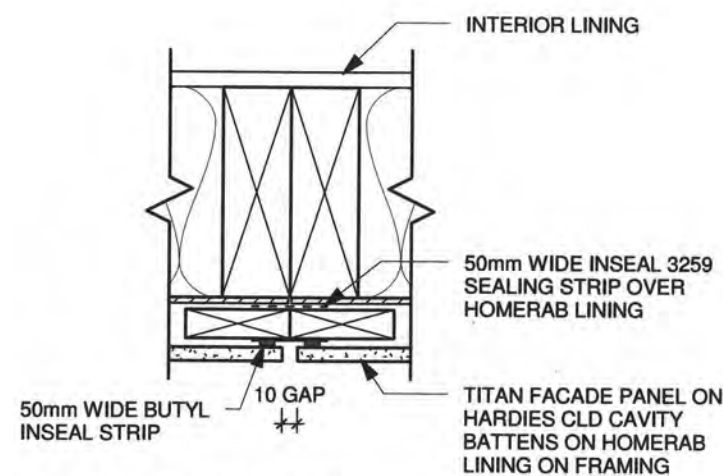
4 TITAN HORIZONTAL JOINT
1:5



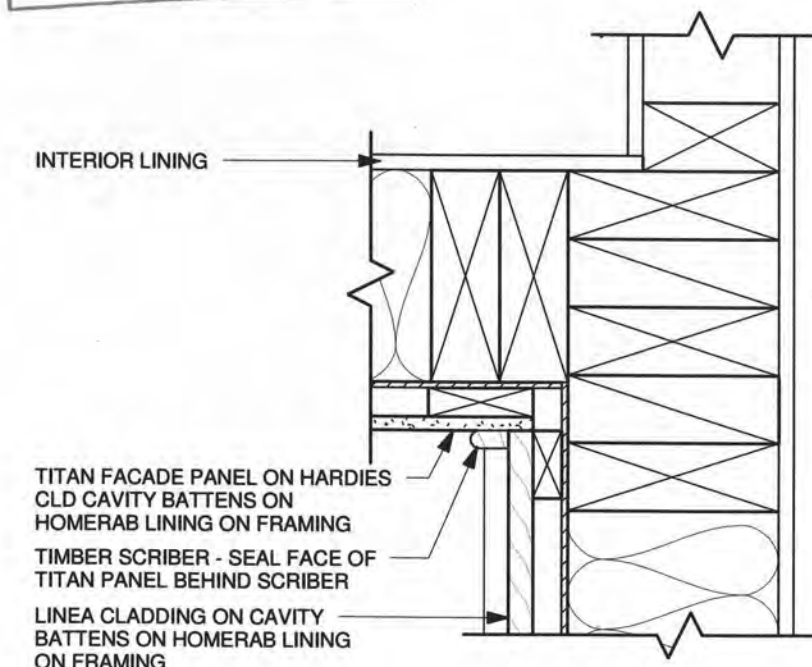
6 DOOR SILL
1:2



2 LINEA / POLY INT. CNR
1:5



5 TITAN VERTICAL JOINT
1:5

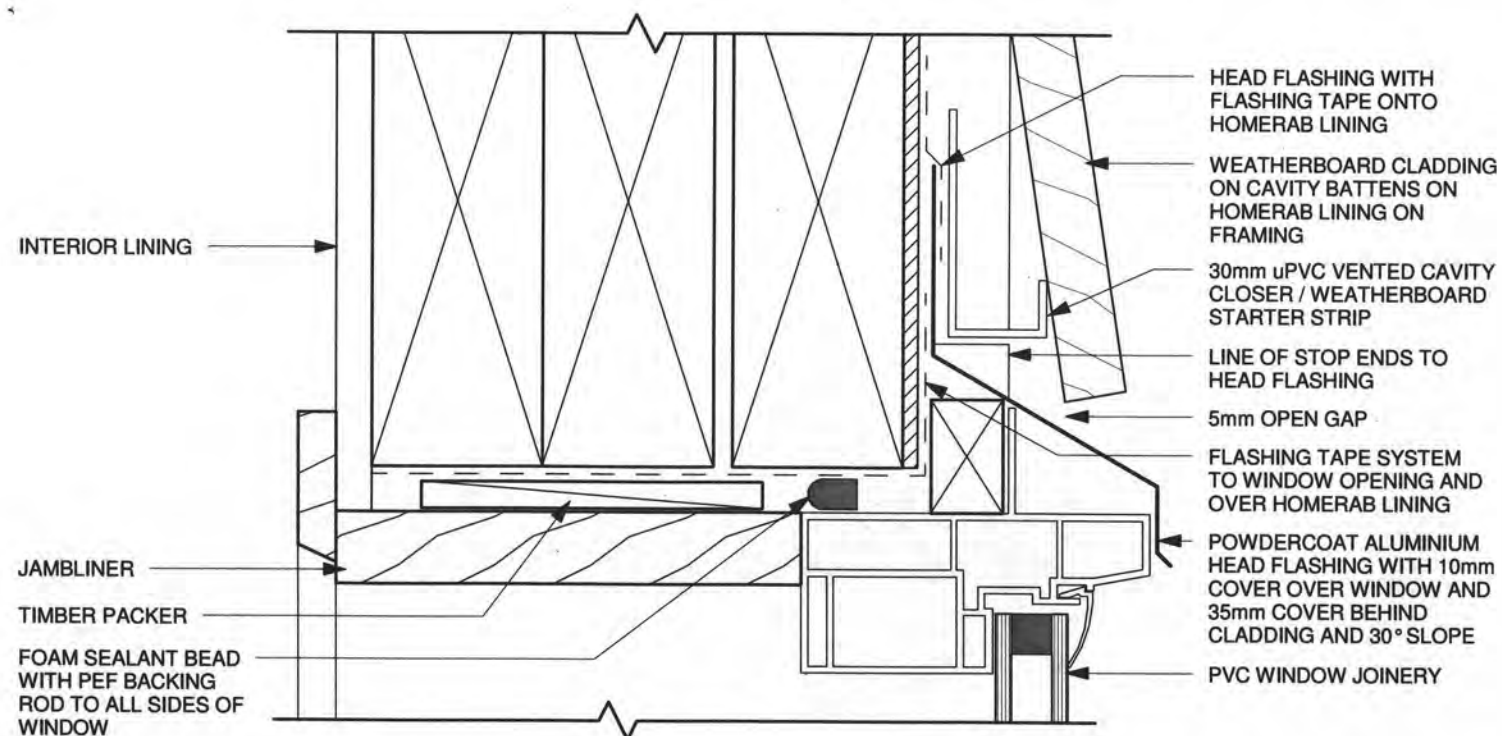


3 TITAN / LINEA INT. CNR
1:5

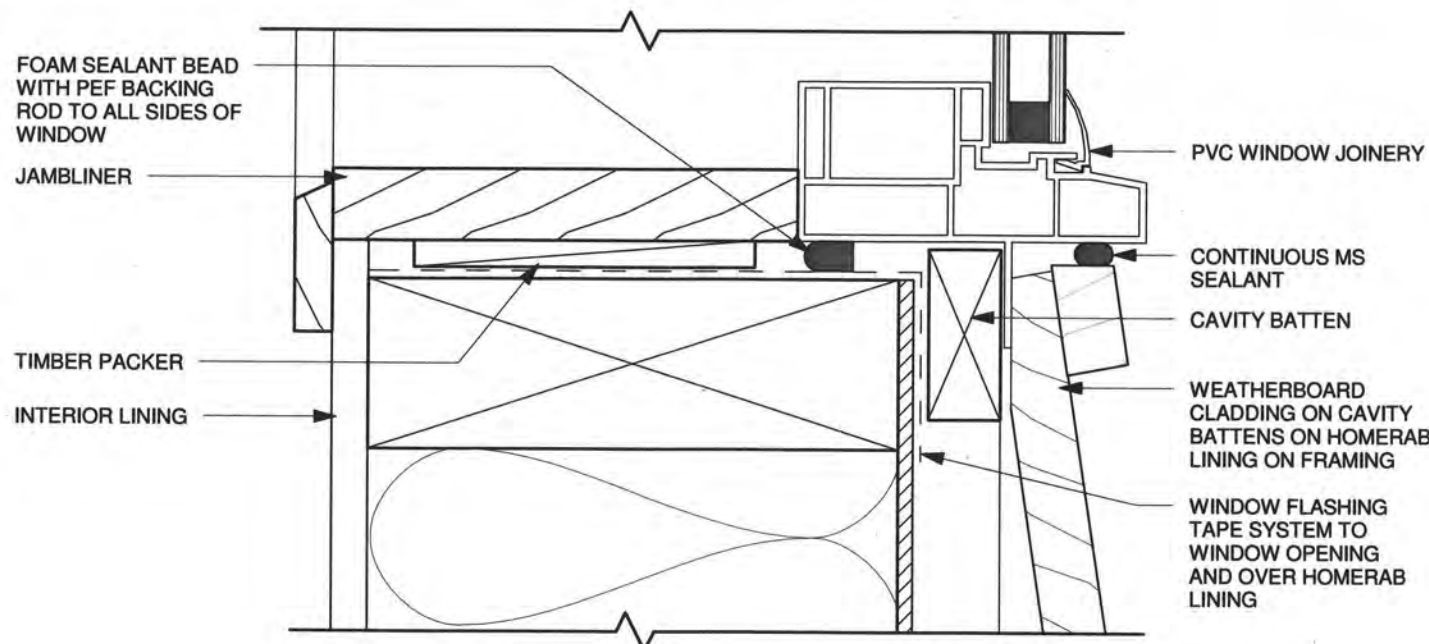
GENERAL NOTES

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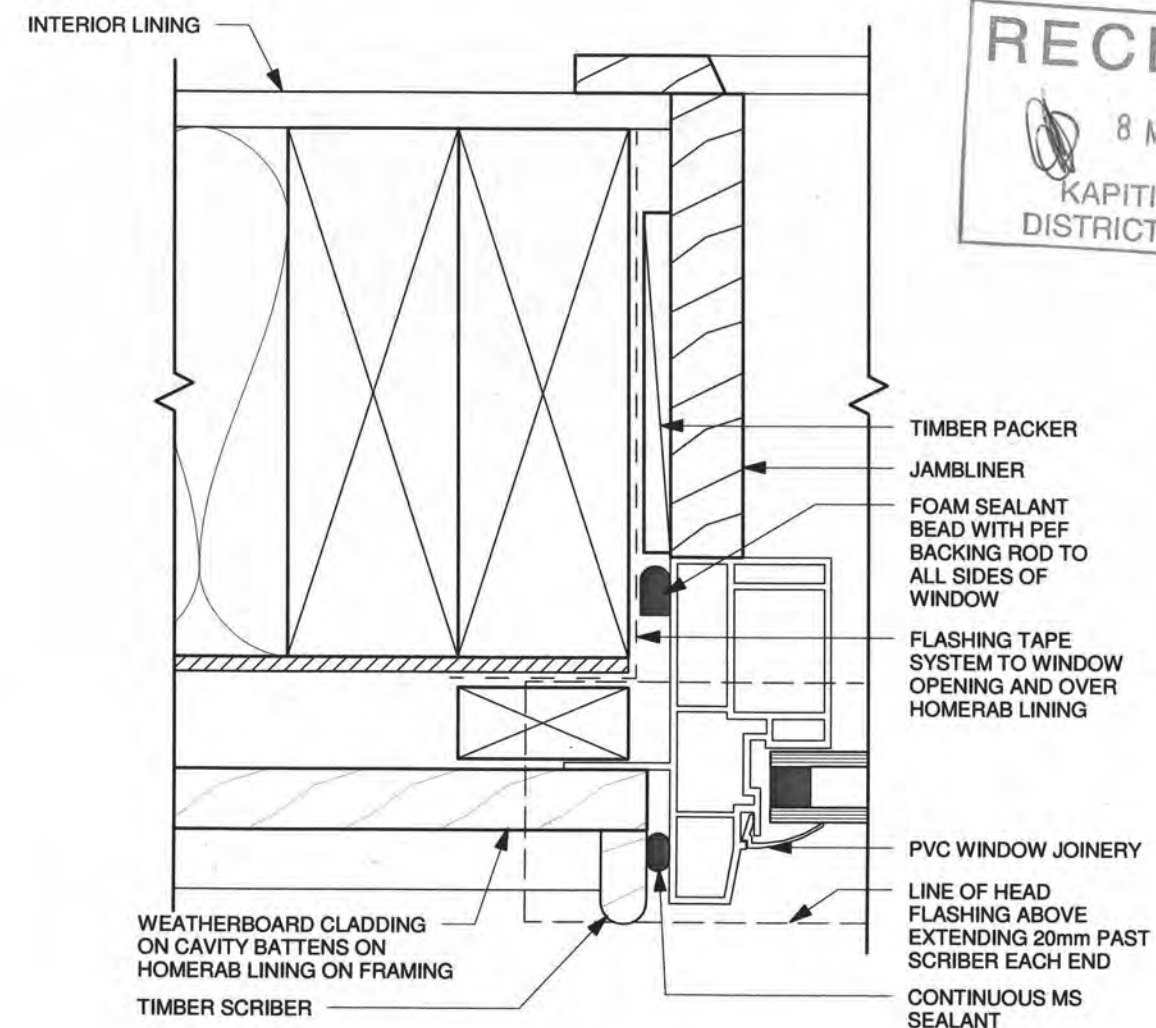
Rev	Date	Description	
Design Certified by			
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[SN: 091109] www.eehnz.com			
Proposed House			
Leonie & Chris Beggs			
8 Ngarara Road, Waikanae			
Lot 9 DP 13765			
A.D architecture			
L T D			
Ph: 04 298 5662 Fax: 04 298 5663 www.adarchitecture.co.nz			
info@adarchitecture.co.nz PO Box 1585, Paraparaumu Beach			
DETAILS			
BUILDING CONSENT			
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1 WBD WINDOW HEAD
1:2



2 WBD WINDOW SILL
1:2



3 WBD WINDOW JAMB
1:2

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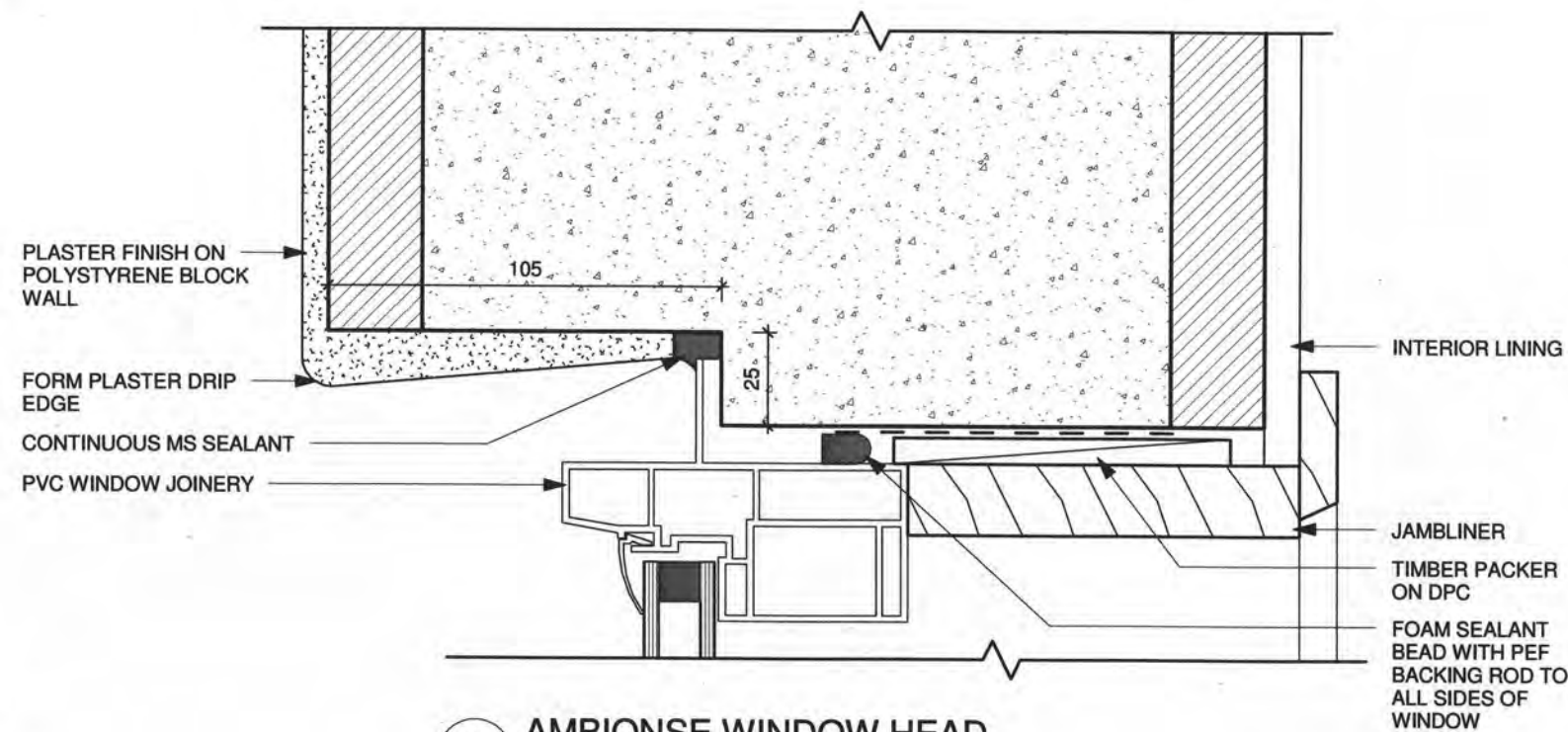
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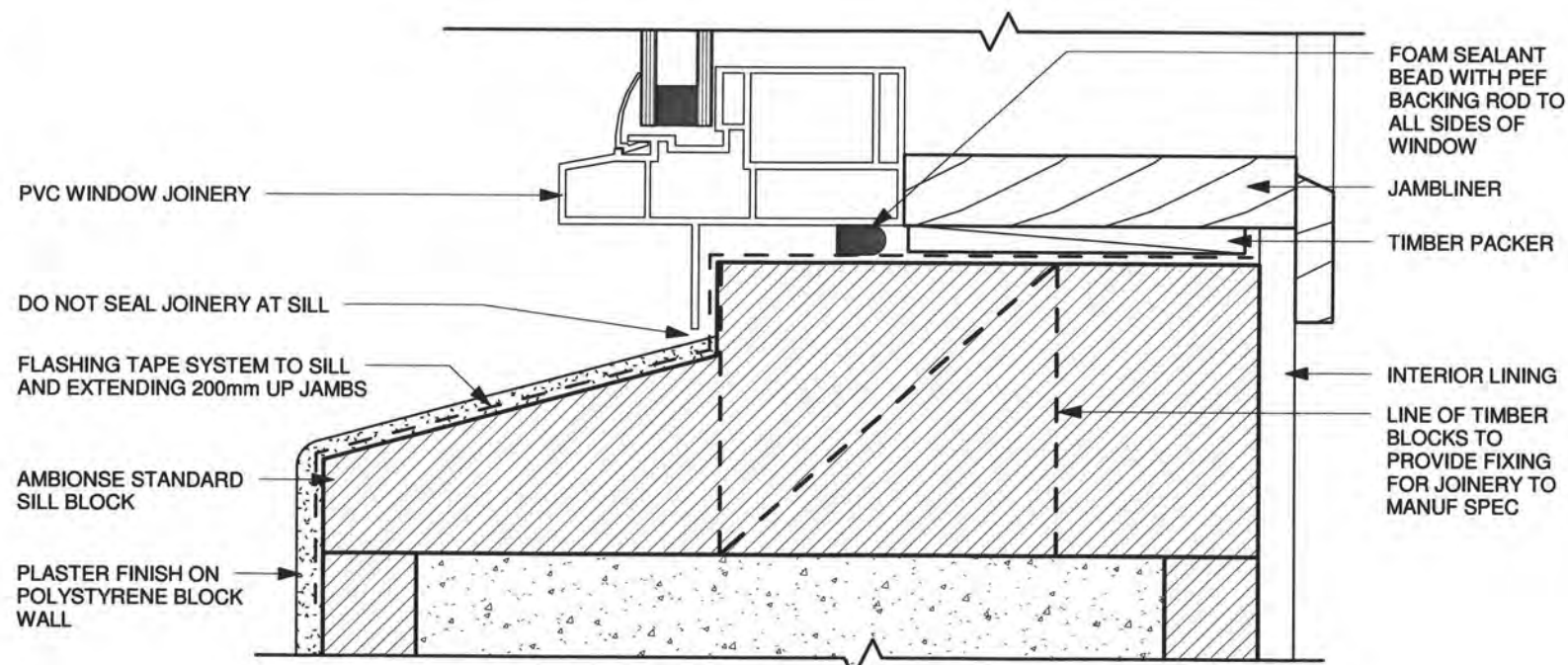
DETAILS

BUILDING CONSENT
 DO NOT SCALE DRAWING

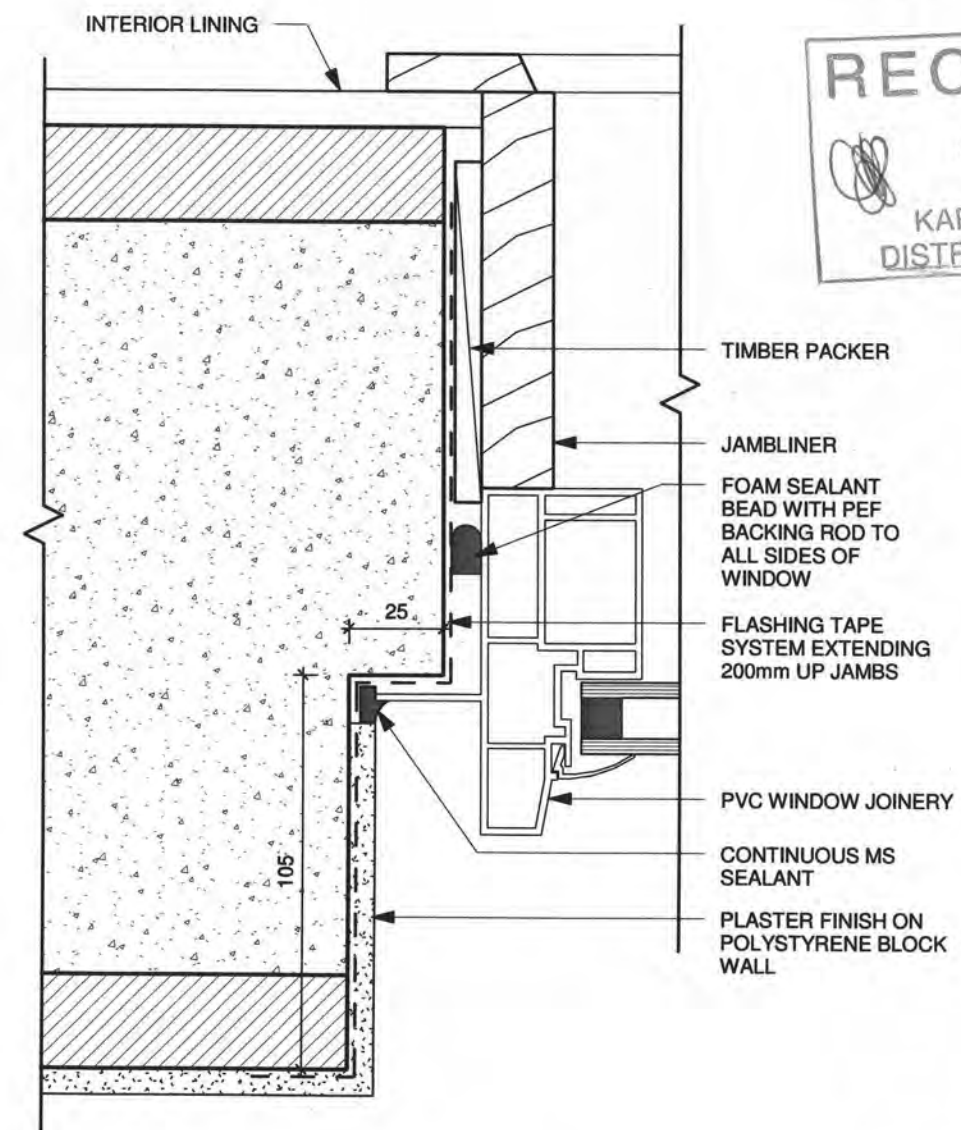
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1 AMBIONSE WINDOW HEAD
1:2



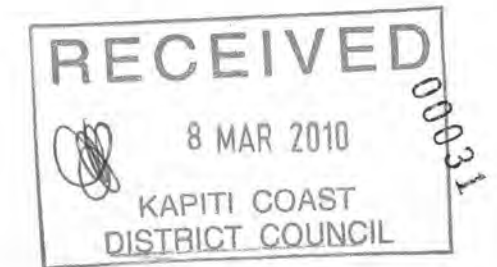
2 AMBIONSE WINDOW SILL
1:2



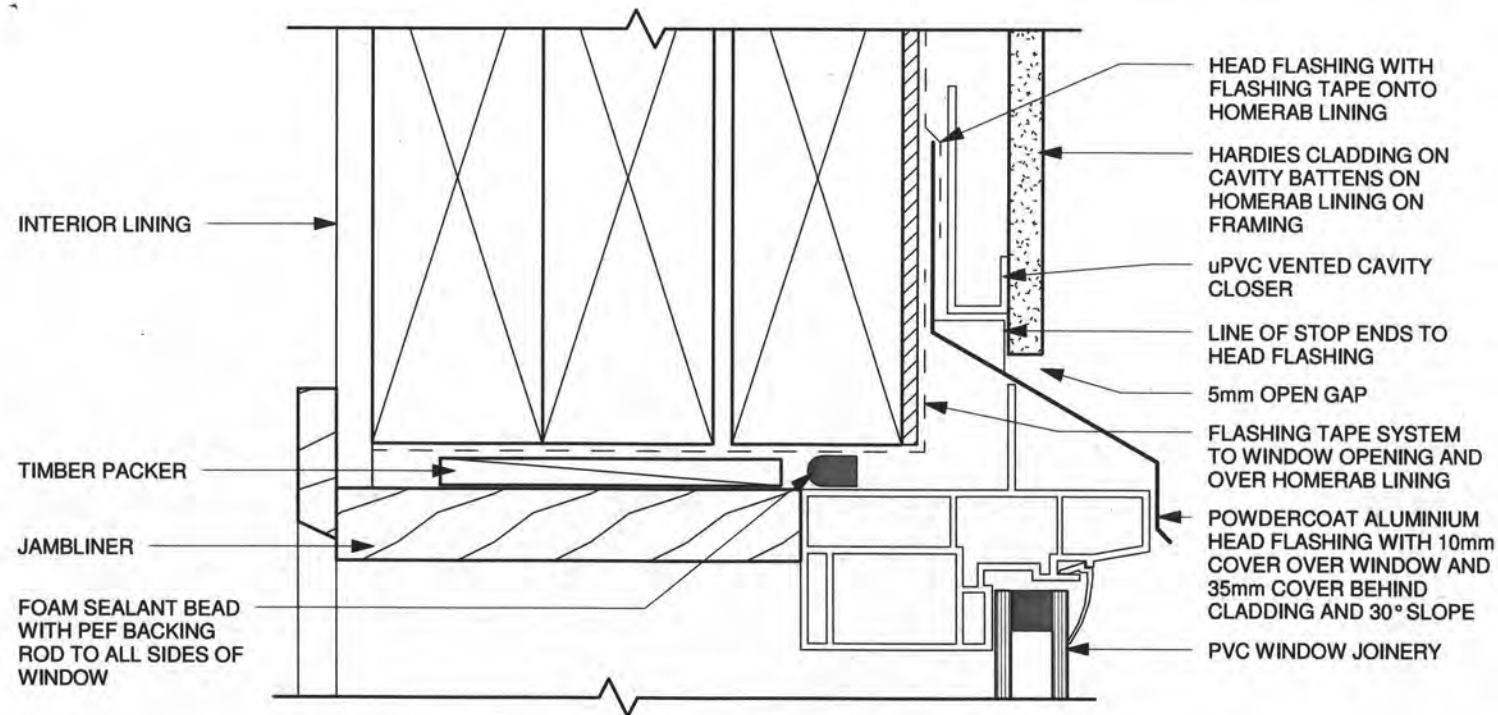
3 AMBIONSE WINDOW JAMB
1:2

GENERAL NOTES

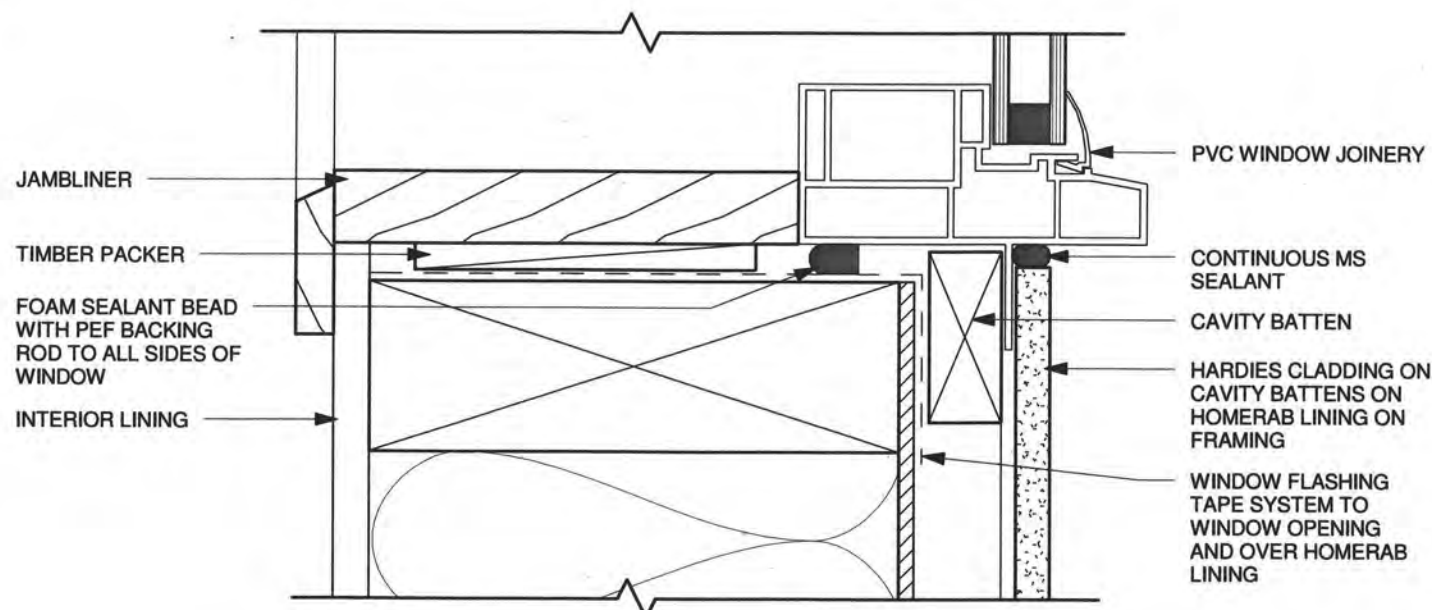
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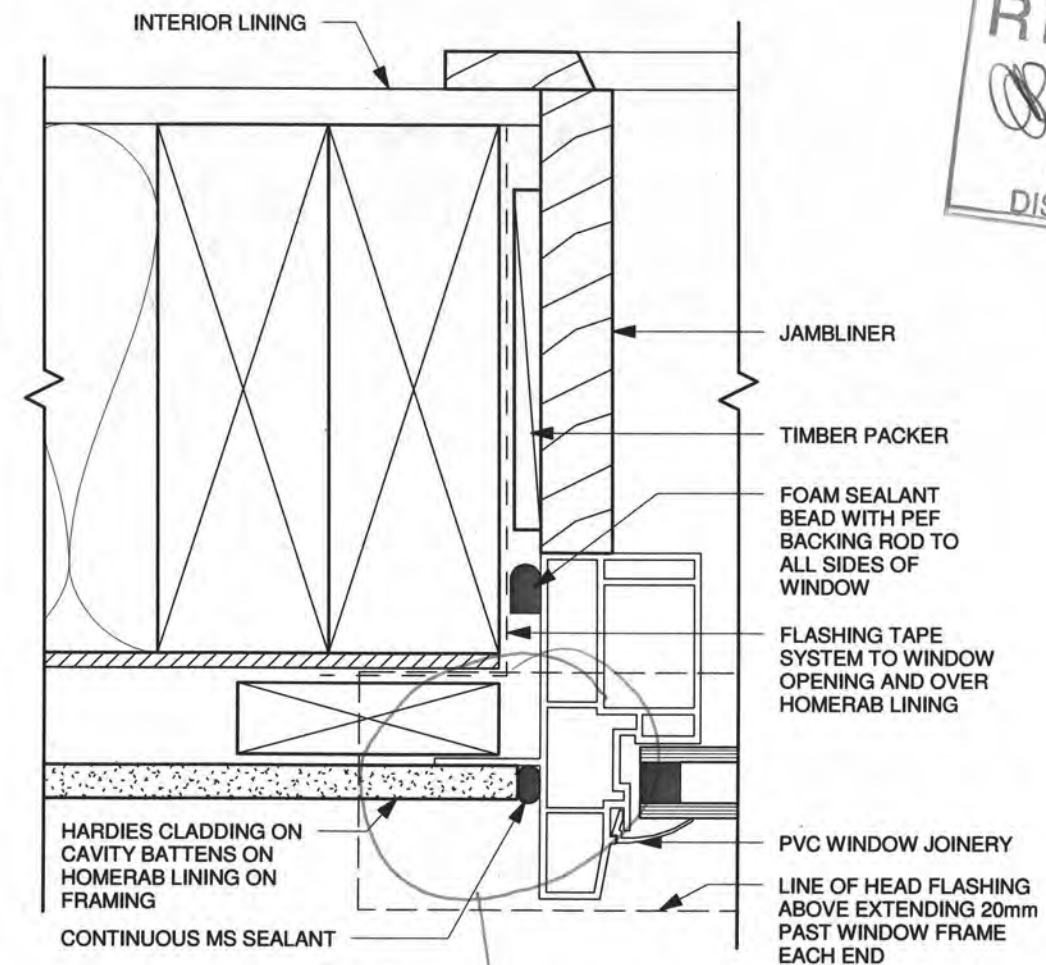
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1 HARDIES WINDOW HEAD
1:2



2 HARDIES WINDOW SILL
1:2



3 HARDIES WINDOW JAMB
1:2

Seal around.

GENERAL NOTES
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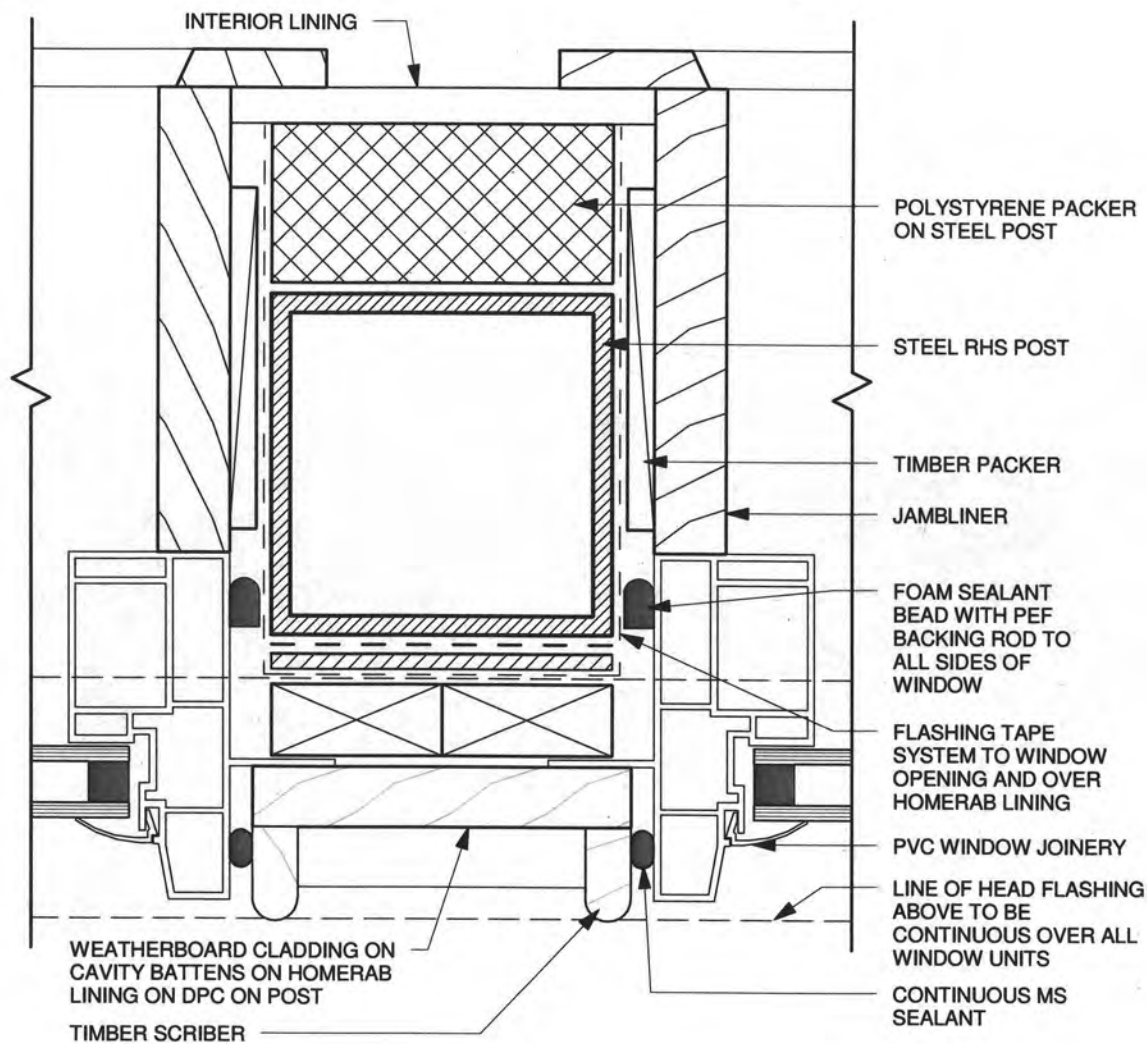
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DETAILS

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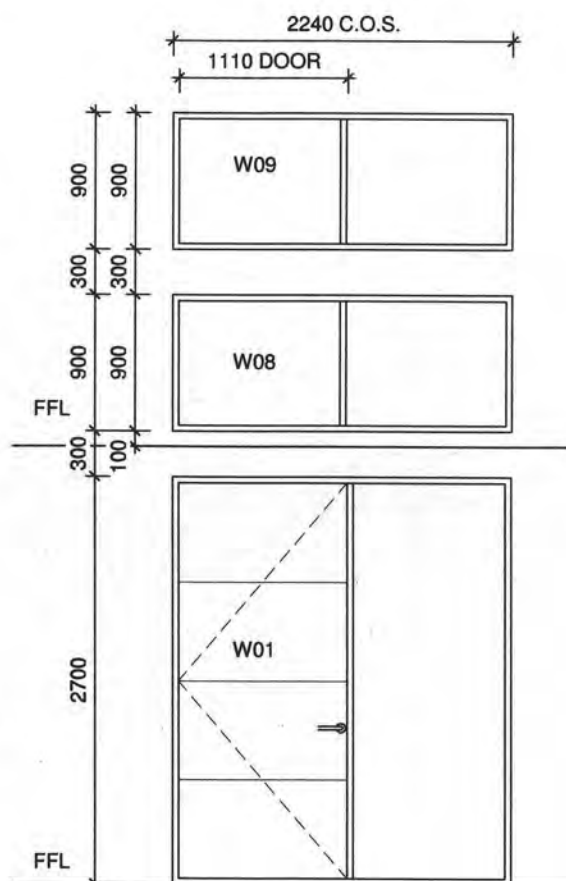
1 DOUBLE WINDOW JAMB
1:2

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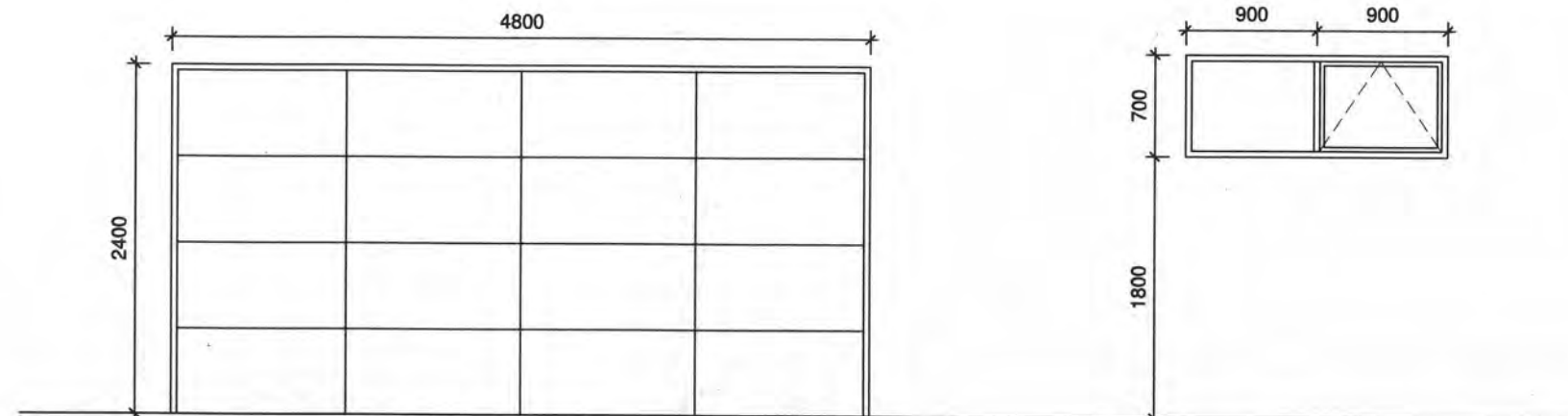


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Proposed House Leonie & Chris Beggs 8 Ngarara Road, Waikanae Lot 9 DP 13765		
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DETAILS		
BUILDING CONSENT		
DO NOT SCALE DRAWING		
Job 09059	Date JAN 2010	Rev Sheet (A3) 32



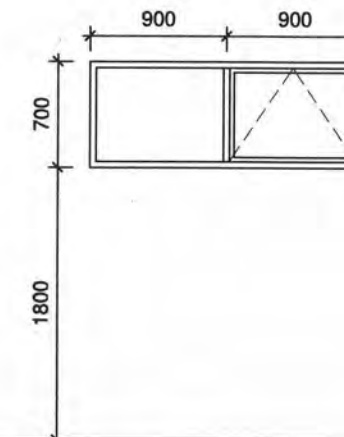
SOLID PANEL ENTRY DOOR WITH SAFETY GLASS SIDELIGHT
FIXED PANES ABOVE

W01, 08, 09

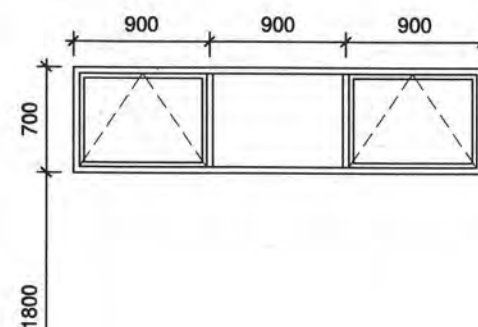


FLAT PANEL AUTO SECTIONAL GARAGE DOOR

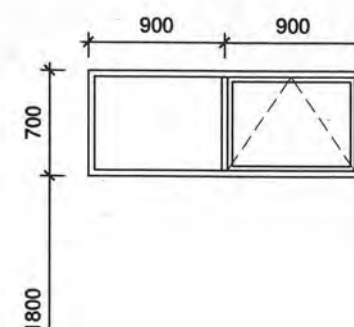
W02



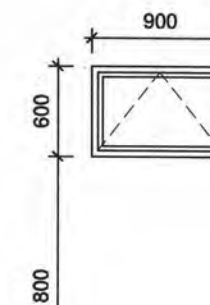
W03



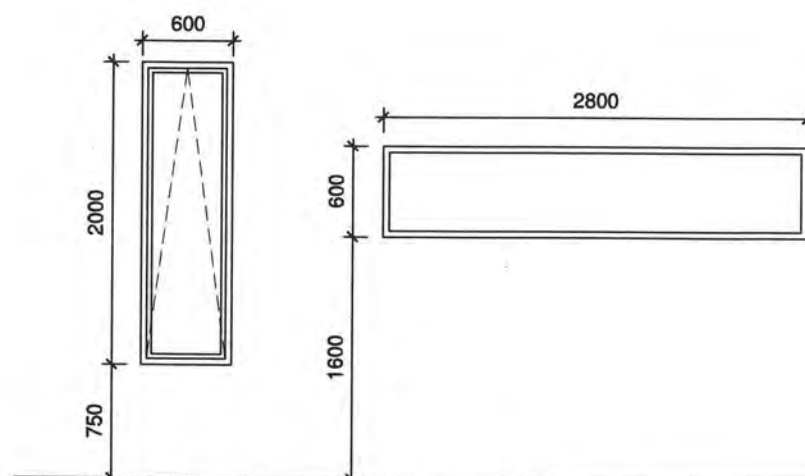
W04, 05



W06



W07

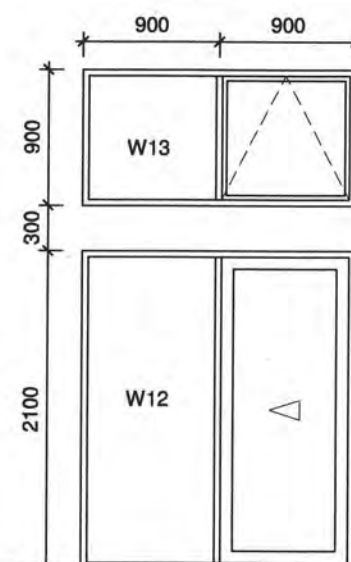


SAFETY GLASS
RESTRICTOR STAYS

W10

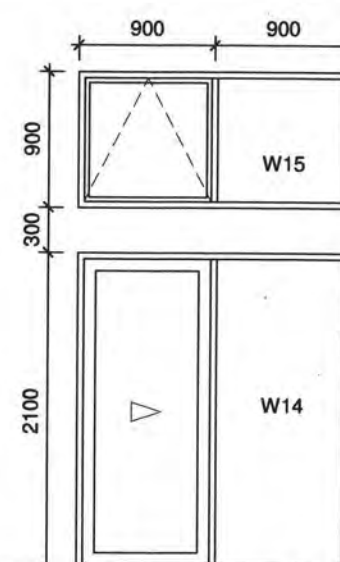
FIXED PANE

W11



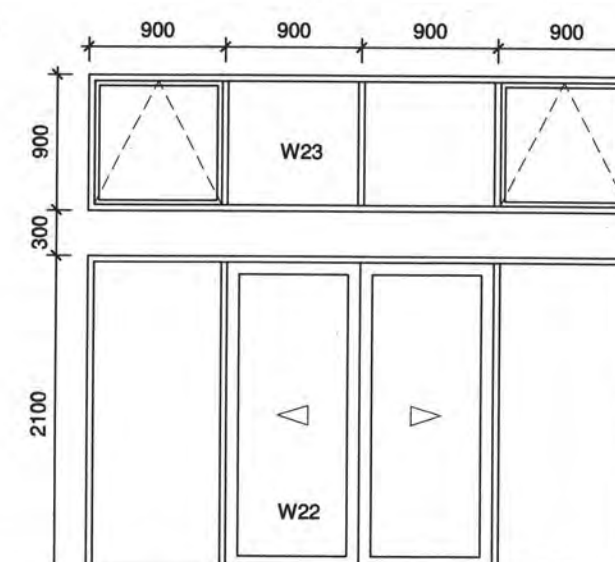
SLIDING DOOR UNIT AND
SEPARATE TOP LIGHT ABOVE
SAFETY GLASS TO SLIDING DOOR
OPENING TOP LIGHT TO BE
ELECTRICAL OR WINDER OPENING

W12, 13



SLIDING DOOR UNIT AND
SEPARATE TOP LIGHT ABOVE
SAFETY GLASS TO SLIDING DOOR
OPENING TOP LIGHT TO BE
ELECTRICAL OR WINDER OPENING

W14, 15



SLIDING DOOR UNIT AND
SEPARATE TOP LIGHT ABOVE
SAFETY GLASS TO SLIDING DOOR
OPENING TOP LIGHTS TO BE
ELECTRICAL OR WINDER OPENING

W22, 23

EXTERIOR JOINERY SCHEDULE

1:50

WINDOW AND DOOR JOINERY:

- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
- SHOWN AS VIEWED FROM EXTERIOR
- ALL WINDOWS TO BE uPVC DOUBLE GLAZED WITH LOW 'E' COATING AND ARGON INFILL
- GLAZING TO NZS 4223 (PART 3 IN PARTICULAR) AND MANUFACTURER TO CONFIRM WINDOWS REQUIRED TO BE SAFETY GLASS
- WINDOW JOINER TO CHECK OPENING SIZES ON SITE BEFORE MANUFACTURE
- WINDOW MANUFACTURER TO SUPPLY ALL FLASHINGS AND WANS WIS COMPONENTS
- REFER ALSO TO WINDOW DETAILS
- ALL WINDOWS HAVE ARCHITRAVES
- ALL OPENING SASHES TO HAVE COLOUR MATCHED DOUBLE TONGUE CATCHES
- ALL JAMB LINERS TO BE 19mm
- FINGERJOINTED PINE, PAINT FINISH
- INSTALL WINDOW FLASHING TAPE SYSTEM TO ALL WINDOW & DOOR OPENINGS IN EXTERIOR WALLS
- ALLOW FOR 390w x 190h (TO BE CONFIRMED) VIEWING PANEL FOR ELECTRICAL METER PANEL



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Proposed House
Leonie & Chris Beggs
8 Ngarara Road, Waikanae
Lot 9 DP 13765

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architecture

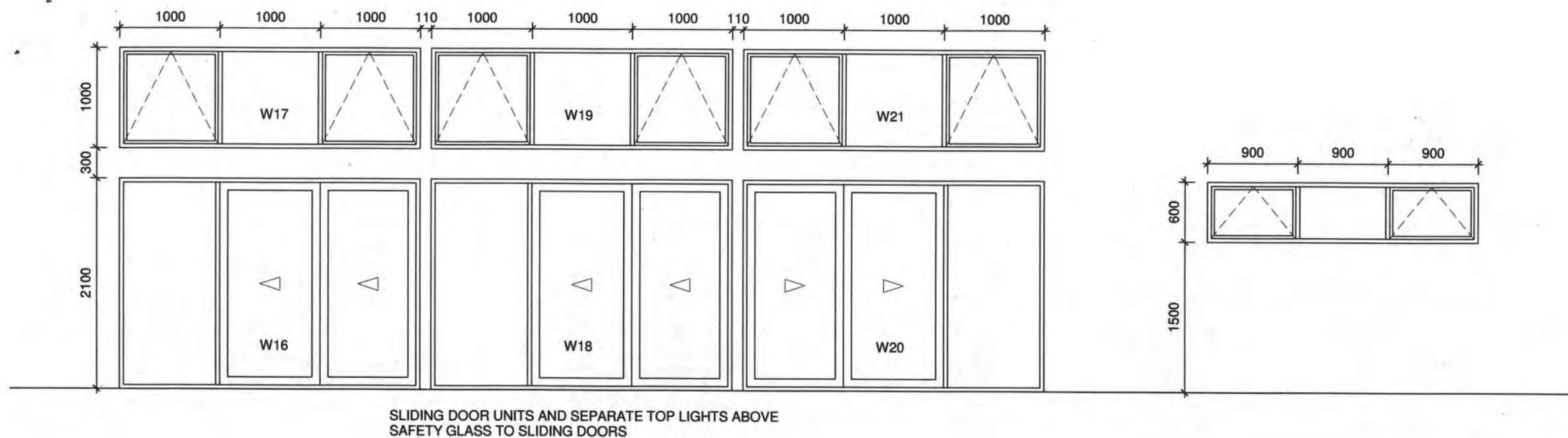
Ph: 04 298 5662 Fax: 04 298 5663
Info@adarchitecture.co.nz www.adarchitecture.co.nz
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EXTERIOR JOINERY
SCHEDULE

BUILDING CONSENT

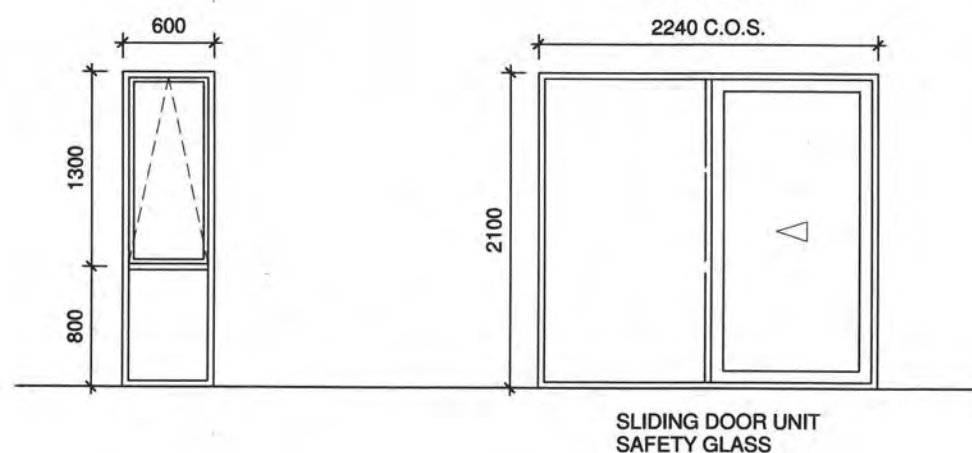
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W16, 17, 18, 19, 20, 21

W24



W25

W26

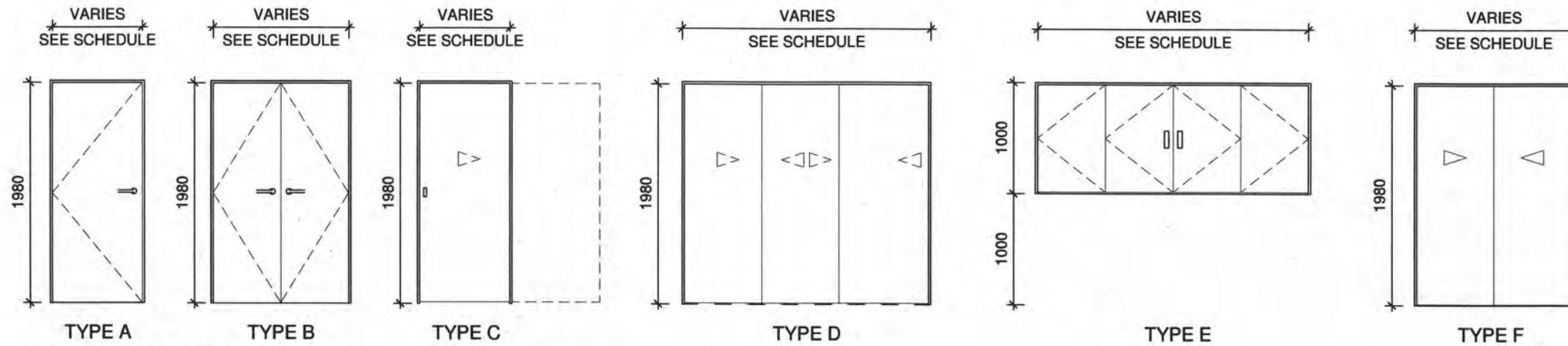
- WINDOW AND DOOR JOINERY:**
- THIS PAGE IS TO BE READ IN CONJUNCTION WITH SHEET 02 - CONSTRUCTION NOTES FOR ADDITIONAL INFORMATION
 - SHOWN AS VIEWED FROM EXTERIOR
 - ALL WINDOWS TO BE uPVC DOUBLE GLAZED WITH LOW 'E' COATING AND ARGON INFILL
 - GLAZING TO NZS 4223 (PART 3 IN PARTICULAR) AND MANUFACTURER TO CONFIRM WINDOWS REQUIRED TO BE SAFETY GLASS
 - WINDOW JOINER TO CHECK OPENING SIZES ON SITE BEFORE MANUFACTURE
 - WINDOW MANUFACTURER TO SUPPLY ALL FLASHINGS AND WANS WIS COMPONENTS
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 - ALL WINDOWS HAVE ARCHITRAVES
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 - INSTALL WINDOW FLASHING TAPE SYSTEM TO ALL WINDOW & DOOR OPENINGS IN EXTERIOR WALLS
 - ALLOW FOR 390w x 190h (TO BE CONFIRMED) VIEWING PANEL FOR ELECTRICAL METER PANEL



EXTERIOR JOINERY SCHEDULE

1:50

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8 Ngarara Road, Waikanae		
Lot 9 DP 13765		
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EXTERIOR JOINERY SCHEDULE		
BUILDING CONSENT		
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Job	Date	Rev
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(A3) 34		



INTERIOR DOOR NOTES

- INTERIOR DOORS TO BE PLYCO MANHATTEN (CONFIRM WITH OWNER)
- REFER TO FLOOR PLANS FOR DOOR SWING DIRECTION
- INSTALL AIR SEALS TO ALL SIDES OF DOOR D02

Interior Door Schedule				
Mark	Type	Size	Operation	Materials
D01	A	810x1980	Hinged Swinging	Solid Core Panel
D02	A	810x1980	Hinged Swinging	Solid Core Panel
D03	B	2/710 x 1980	Hinged Swinging	Hollow Core Panel
D04	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D05	B	2/710 x 1980	Hinged Swinging	Hollow Core Panel
D06	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D07	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D08	B	2/510 x 1980	Hinged Swinging	Hollow Core Panel
D09	A	760 x 1980	Hinged Swinging	Hollow Core Panel
D10	A	960 x 1980	Hinged Swinging	Solid Core Panel
D11	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D12	A	710 x 1980	Hinged Swinging	Hollow Core Panel
D13	A	760 x 1980	Hinged Swinging	Hollow Core Panel
D14	D	2580 x 1980	3 Panel Sliding	Homeplus WR Sliders
D15	C	1500 x 1980	Cavity Sliding	Solid Core Panel
D16	E	4/610w x 980h	Bifold 4 Panels	Hollow Core Panel
D17	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D18	F	1380 x 1980	2 Panel Sliding	Homeplus WR Sliders
D19	A	510 x 1980	Hinged Swinging	Hollow Core Panel
D20	A	760 x 1980	Hinged Swinging	Hollow Core Panel
D21	A	810 x 1980	Hinged Swinging	Hollow Core Panel
D22	F	1380 x 1980	2 Panel Sliding	Homeplus WR Sliders

INTERIOR OPENING SCHEDULE



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INTERIOR OPENING SCHEDULE		
BUILDING CONSENT		
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Job 09059	Date JAN 2010	Rev Sheet (A3) 35

Date: 24/02/2010Fabricator: Placemakers ParaparaumuJob Name: Beggs
8 Ngarara Ave
WaikanaeBuilding Consent No: _____
(to be provided by the City / District Council)Attn: City / District Council

We have been engaged to provide the trusses for the above project and have enclosed the truss layout and Producer Statement to allow completion of the consent application. On advice from the building project owner, the structure will be designed under the following parameters:

Wind Zone Very HighSnow Load N/AEarthquake Zone ARoof Material Light

Treatment Definition	External walls	<u>H1.2</u>	Trusses	<u>N/A</u>
	Internal walls	<u>H1.2</u>		

We can advise that the following will be provided at the time of truss manufacture to both the building owner and your office:

1. A full as-built truss layout and Producer Statement
2. Specific truss / truss and truss / top plate fixing details indicated on the truss layout.
3. All lintel sizes outside NZS3604: 1999 will be indicated on the truss layout.
(all timbers to be MSG8 unless otherwise stated on layouts)
4. Top plate to stud connections will be indicated on the truss layout.

Acknowledgement of this letter, along with the Building Consent number, by fax to our office, would be appreciated.

Placemakers Paraparaumu
A Member of Frame and Truss Manufacturers Association NZ

**PRODUCER STATEMENT
FRAMING COMPONENT DESIGN**

This producer statement is issued by Placemakers Paraparaumu Ltd to

Name of Builder : Nothface Construction

Mitek : Components Frames to be built at

Job Address : 8 Ngarara Ave, Waikanae

On Our Drawings ;

Building Consent No:

Job Reference No. : 43708 (Beggs)

As a Mitek Component Fabricator Accredited By Mitek NZ Ltd:

our design is based on standard designs selected from
the Gang-Nail System Manual or MiTek 20/20 V4.5

Computer-Aided Design Program produced and certified by Mitek NZ Ltd
which have been prepared in accordance with NZS3603 and
AS/NZS1170:2002

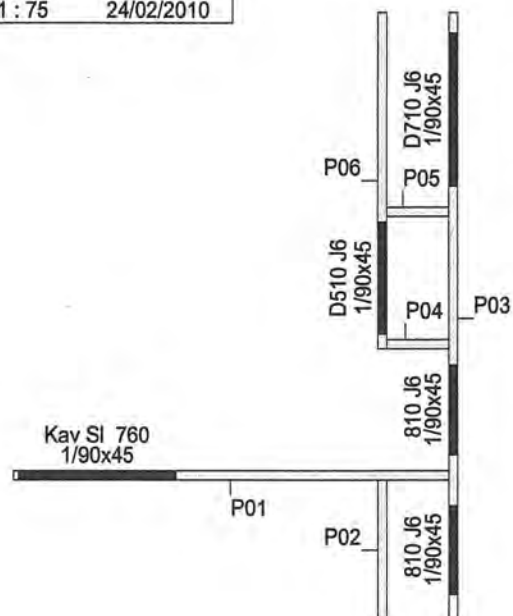
Of the approved documents issued by the Building Industry Authority

In compliance with Clauses B1 and B2 of the New Zealand Building
Code.

Designers Name : M Taylor Date: 24/02/2010

For and behalf of Placemakers Paraparaumu

Company		
Placemakers Manufacturing		
Customer		
Placemakers Paraparaumu		
Customer Address		
Site		
NORTHFACE CONSTRUCTION		
Site Address		
8 NGARARA AVE, WAIKANAE		
Lin Type		
Std		
Stud Height		
2700		
Level		
Ground Floor		
Job	Scale	Date
43708	1:75	24/02/2010



W01
2/190x45
W09 & W08 ABOVE
F01

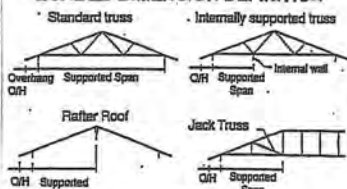
LUMBERLOK® WALL FIXING CHART 01/10

STUD TO TOP PLATE FIXING SCHEDULE (ALTERNATIVE TO NZS 3604:1999 TABLE 8.18)

NOTE:

- All fixings are designed for vertical loads only. Dead loads include the roof weight and standard ceiling weight of 0.20kPa. Refer to table 8.16, NZS3604:1999 for nailing schedule to resist horizontal loads.
- These fixings assume the correct choice of rafter/truss to top plate connections have been made. Refer to the LUMBERLOK® Truss Fixing Chart.
- Gable end wall top plate/stud connections require only 2x90x3.33 nails driven vertically into stud through top plate.
- All fixings assume top plate thickness of 45mm maximum.
- Wall framing arrangements under girder trusses are not covered in this schedule.

LOADED DIMENSION DEFINITION



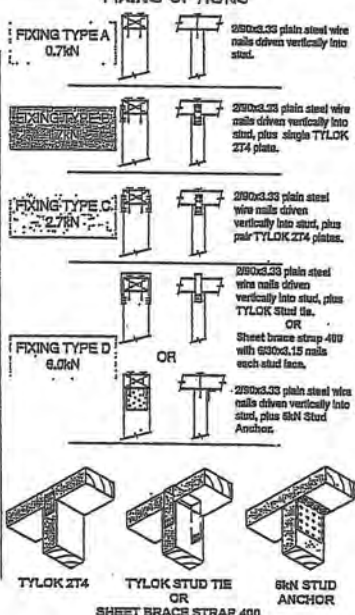
$$\text{LOADED DIMENSION} = \frac{\text{SUPPORTED SPAN} + \text{OVERHANG}}{2}$$

SELECTION CHART FOR FIXING LOADS - TOP PLATE TO STUD

Loaded Dimension	Light Roof Wind Zone				Heavy Roof Wind Zone			
	L	M	H	VH	L	M	H	VH
1.5	A	A	A	A	A	A	A	A
2.0	A	A	A	A	A	A	A	A
2.5	A	A	A	A	A	A	A	A
3.0	A	A	A	A	A	A	A	A
3.5	A	A	A	A	A	A	A	A
4.0	A	A	A	A	A	A	A	A
4.5	A	A	A	A	A	A	A	A
5.0	A	A	A	A	A	A	A	A
5.5	A	A	A	A	A	A	A	A
6.0	A	A	A	A	A	A	A	A

- All studs at 600 mm.
- For studs at 400 mm decrease loaded dimension by 33%.
- All trusses at 300 mm.
- For trusses at 1200 mm increase loaded dimension by 33%.

FIXING OPTIONS



LUMBERLOK® WALL FIXING CHART 01/10

LINTEL FIXING SCHEDULE (ALTERNATIVE TO NZS 3604:1999 TABLE 8.14 & FIGURE 8.12)

DEFINITIONS
Lintel span dimension point

LINTEL FIXING TYPES

TYPE A 1.6kN
Two rows of 290x3.33 nails.
Three sets of 290x3.33 nails. Timber stud to underside.

TYPE B 1.6kN
Three rows of 290x3.33 nails. Timber stud to underside.

TYPE C 7.5kN
Three rows of 290x3.33 nails. Timber stud to underside.

TYPE D 13.5kN
Four rows of 290x3.33 nails. Timber stud to underside.

SELECTION CHART FOR LINTEL FIXING

Lintel Span	Loaded Dimension	Light Roof Wind Zone				Heavy Roof Wind Zone			
		L	M	H	VH	L	M	H	VH
1.5	2.0	A	A	A	A	A	A	A	A
1.5	3.0	A	A	A	A	A	A	A	A
1.5	4.0	A	A	A	A	A	A	A	A
1.5	5.0	A	A	A	A	A	A	A	A
1.5	6.0	A	A	A	A	A	A	A	A
2.0	2.0	A	A	A	A	A	A	A	A
2.0	3.0	A	A	A	A	A	A	A	A
2.0	4.0	A	A	A	A	A	A	A	A
2.0	5.0	A	A	A	A	A	A	A	A
2.0	6.0	A	A	A	A	A	A	A	A
2.4	2.0	A	A	A	A	A	A	A	A
2.4	3.0	A	A	A	A	A	A	A	A
2.4	4.0	A	A	A	A	A	A	A	A
2.4	5.0	A	A	A	A	A	A	A	A
2.4	6.0	A	A	A	A	A	A	A	A
3.0	2.0	A	A	A	A	A	A	A	A
3.0	3.0	A	A	A	A	A	A	A	A
3.0	4.0	A	A	A	A	A	A	A	A
3.0	5.0	A	A	A	A	A	A	A	A
3.0	6.0	A	A	A	A	A	A	A	A
3.5	2.0	A	A	A	A	A	A	A	A
3.5	3.0	A	A	A	A	A	A	A	A
3.5	4.0	A	A	A	A	A	A	A	A
3.5	5.0	A	A	A	A	A	A	A	A
3.5	6.0	A	A	A	A	A	A	A	A
4.2	2.0	A	A	A	A	A	A	A	A
4.2	3.0	A	A	A	A	A	A	A	A
4.2	4.0	A	A	A	A	A	A	A	A
4.2	5.0	A	A	A	A	A	A	A	A
4.2	6.0	A	A	A	A	A	A	A	A
4.8	2.0	A	A	A	A	A	A	A	A
4.8	3.0	A	A	A	A	A	A	A	A
4.8	4.0	A	A	A	A	A	A	A	A
4.8	5.0	A	A	A	A	A	A	A	A
4.8	6.0	A	A	A	A	A	A	A	A

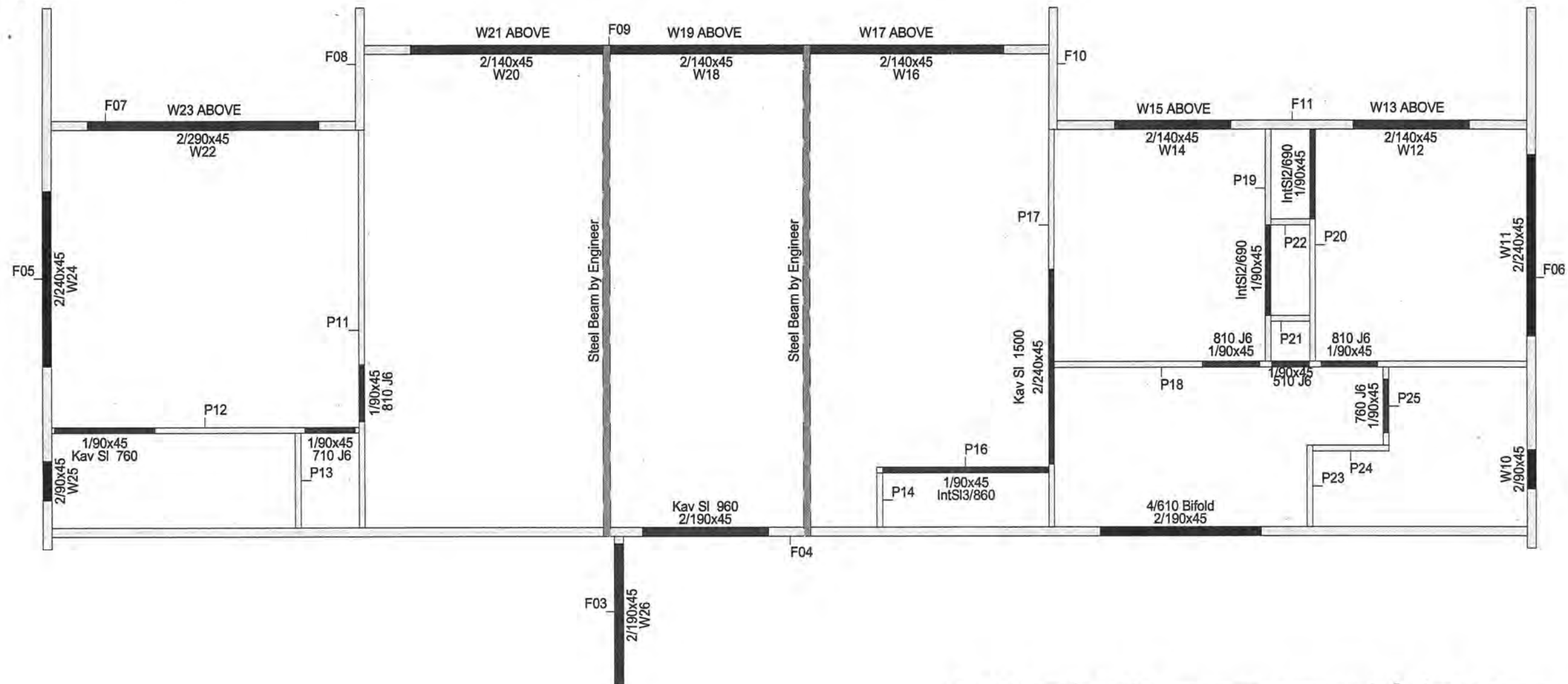
NOTES:

- Lintel spanning girder trusses for ALL load cases use: Fixing type C where contributory area = 10m². Fixing type D where contributory area = 20m².
- All cases outside this require specific design.

For timber floors run the strap down one face of joist or blocking.

Min. M12 bolt with 80x200 washer to concrete floor.

Min. M12 bolt with 80x200 washer to concrete floor.



Company	Placemakers Manufacturing
Customer	Placemakers Paraparaumu
Customer Address	
Site	NORTHFACE CONSTRUCTION
Site Address	8 NGARARA AVE, WAIKANA E
Lin Type	Std
Stud Height	Varies
Level	First Floor
Job	43708
Scale	1 : 75
Date	24/02/2010

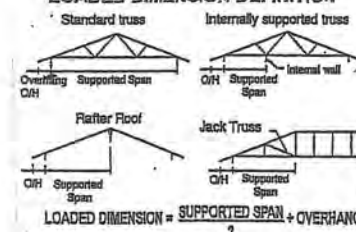
LUMBERLOK® WALL FIXING CHART

STUD TO TOP PLATE FIXING SCHEDULE (ALTERNATIVE TO NZS 3604:1999 TABLE 8.18)

NOTE:

- * All fixings are designed for vertical loads only. Dead loads include the roof weight and standard ceiling weight of 0.20kPa. Refer to table 8.19, NZS3604:1999 for nailing schedule to resist horizontal loads.
- * These fixings assume the correct choice of rafter/truss to top plate connections have been made. Refer to the LUMBERLOK® Truss Fixing Chart.
- * Gable end wall top plate/stud connections require only 2x90x45 nails driven vertically into stud through top plate.
- * All fixings assume top plate thickness of 45mm maximum.
- * Wall framing arrangements under girder trusses are not covered in this schedule.

LOADED DIMENSION DEFINITION

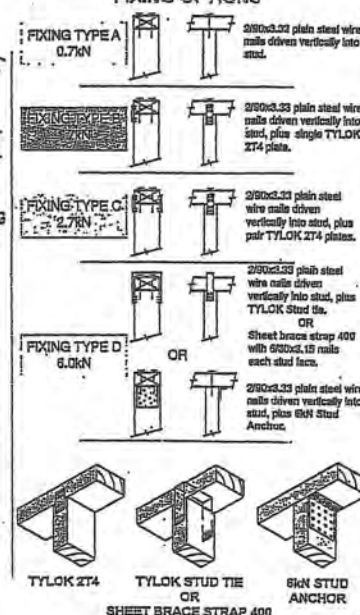


SELECTION CHART FOR FIXING LOADS - TOP PLATE TO STUD

Loaded Dimension	Light Roof Wind Zone				Heavy Roof Wind Zone			
	L	M	H	VH	L	M	H	VH
1.5	A	A	A	A	A	A	A	A
2.0	A	A	A	A	A	A	A	A
2.5	A	A	A	A	A	A	A	A
3.0	A	A	A	A	A	A	A	A
3.5	A	A	A	A	A	A	A	A
4.0	A	A	A	A	A	A	A	A
4.5	A	A	A	A	A	A	A	A
5.0	A	A	A	A	A	A	A	A
5.5	A	A	A	A	A	A	A	A
6.0	A	A	A	A	A	A	A	A

- * All studs at 600 c/s.
- * For studs at 400 c/s decrease loaded dimension by 33%.
- * All trusses at 900 c/s.
- * For trusses at 1200 c/s increase loaded dimension by 33%.

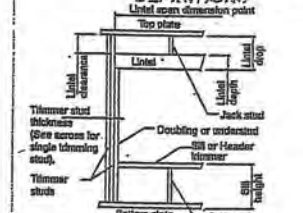
FIXING OPTIONS



LUMBERLOK® WALL FIXING CHART

LINTEL FIXING SCHEDULE (ALTERNATIVE TO NZS 3604:1999 TABLE 8.14 & FIGURE 8.12)

DEFINITIONS Lintel span dimension point

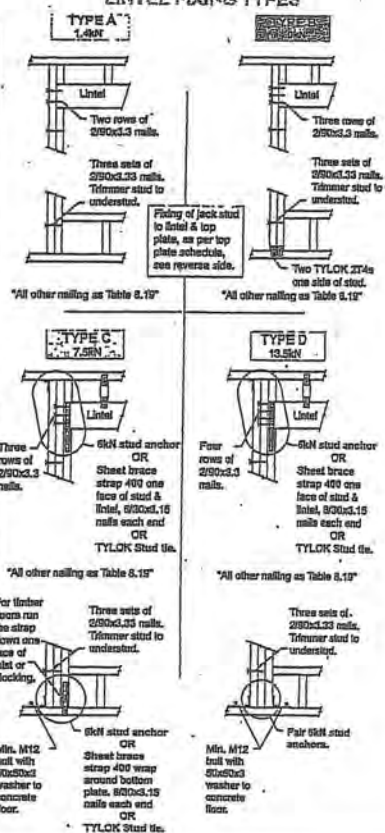


SELECTION CHART FOR LINTEL FIXING

Lintel Span	Loaded Dimension	Light Roof Wind Zone				Heavy Roof Wind Zone			
		L	M	H	VH	L	M	H	VH
1.5	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A
2.0	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A
2.5	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A
3.0	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A
3.5	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A
4.0	2.0	A	A	A	A	A	A	A	A
	3.0	A	A	A	A	A	A	A	A
	4.0	A	A	A	A	A	A	A	A
	5.0	A	A	A	A	A	A	A	A

NOTES:

- * Lintels supporting girder trusses for ALL load cases use Fixing type C where contributory area = 10m².
- * Fixing type D where contributory area = 20m².
- * All cases outside this require specific design.



H1 Energy Analysis Calculation Method

for
NEW HOUSE
Leone & Chris Beggs
8 Ngarara Road, Waikanae

prepared by

A.D
architecture

L T D

Ph: 04 298 5662 Fax: 04 298 5663
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www.adarchitecture.co.nz
PO Box 1585, Paraparaumu Beach

Reference Building - Non-Solid

Component	Description	Area (m ²)	R value	Heat Loss (Area/R-value)
Roof		196.70	2.9	67.8
Wall		290.00	1.9	152.6
Floor		194.40	1.3	149.5
Glazing (30%)		124.28	0.26	478.0
Glazing (>30%)		0.00	0.31	0.0
Skylights		0.00	0.31	0.0
			Total	848.0

NOTES:

Set wall area as either 70% of total wall area or actual wall area, whichever is lower.

Set glazing area as either 30% of total wall area or actual window area, whichever is higher.

Total area of glazing (including skylights) must be ≤50% of the total wall area.

An R-value of 0.26 may be used for traditional leadlight glass if the total area is ≤2.6 m².

Non-glazed areas of door openings greater than 3 m² are treated as wall.

Proposed Design

Component	Description	Area (m ²)	R value	Heat Loss (Area/R-value)
Roof Type 1	Profiled steel, 360mm frame, 1100crs, 2 No. R2.6 batts	168.60	4.81	35.1
Roof Type 2	Membrane, 140mm frame, 400crs, 2 No. R2.6 batts	28.10	5.37	5.2
Roof Type 3	NOT USED	0.00		
Wall Type 1	250mm Ambionse polyblock	109.00	3.00	36.3
Wall Type 2	300mm Ambionse polyblock	35.50	3.00	11.8
Wall Type 3	B/b Wbd, cavity, 140mm frame, 400crs, 2 x R1.8 batts, Gib	28.20	3.00	9.4
Wall Type 4	Metal clad, cavity, 140mm frame, 400crs, 2 x R1.8 batts, Gib	39.80	2.90	13.7
Wall Type 5	9mm Titan, cavity, 140mm frame, 400crs, 2 x R1.8 batts, Gib	28.40	2.90	9.8
Wall Type 6	6mm Hardie, cavity, 140mm frame, 400crs, 2 x R1.8 batts, Gib	41.00	2.90	14.1
Wall Type 7	60mm Poly, cavity, 140mm frame, 400crs, 2 x R1.8 batts, Gib	25.70	3.86	6.7
Wall Type 8	250mm Ambionse polyblock (interior wall)	28.70	3.00	9.6
Wall Type 9	Gib, 90mm frame, R2.8 Ultra batts, Gib (interior wall)	3.90	2.21	1.8
Floor Type 1	Ground floor insulated slab	120.20	2.97	40.5
Floor Type 2	First floor interspan system	55.00	0.91	60.4
Floor Type 3	First floor cantilevered slab	19.20	1.72	11.2
Glazing Type 1	uPVC double glazed, Low 'E' glass, Argon filled	74.08	0.53	139.8
Glazing Type 2	NOT USED	0.00		
Glazing Type 3	NOT USED	0.00		
			Total	405.3

NOTES:

R-values must be no less than 60% of the R-value of the corresponding Schedule values

Total area of glazing (including skylights) must be ≤50% of the total wall area

Non-glazed areas of door openings greater than 3 m² are treated as wall.

An R-value of 0.26 may be used for traditional leadlight glass if the total area is ≤2.6 m²

FLOORS									
REVIT					MANUAL				
Type Mark	Type	Rvalue	Area (m)	Perim (mm)	Type Mark	Type	Length (mm)	Width (mm)	Area (m)
					1	Ground floor slab			120.20
					2	First floor interspan ribs			55.00
					3	First floor cantilever slab			19.20
									0.00
									0.00
									0.00
									0.00
revit sub-totals			0.00	0.00	manual sub-totals			0.00	194.40
			Area	Perim				Perim	Area
TOTALS			194.40	0.00					
REVIT	Floor Type 1		0.00	0.00	MAN'L	Floor Type 1	60.30		120.20
	Floor Type 2		0.00	0.00		Floor Type 2	31.90		55.00
	Floor Type 3		0.00	0.00		Floor Type 3	13.10		19.20
			Area	Perim			Perim		Area

TOTAL	Floor Type 1		120.20	60.30
	Floor Type 2		55.00	31.90
	Floor Type 3		19.20	13.10
			Area	Perim

area/perim ratio - type 1	1.99
area/perim ratio - type 2	1.72
area/perim ratio - type 3	1.47

2

WALLS									
REVIT					MANUAL				
	actual walls (- opg) revit			340.20		manual walls (+ opg)			0.00
	ACTUAL WALLS			340.20		actual walls (- opg) manual			0.00
	TOTAL WALLS			414.28		30% of total walls			124.28
	70% of TOTAL WALLS			290.00		higher of 30% ttl wall \ actual wdw			124.28
	lower of 70% \ actual			290.00					
REVIT	wall type	1		109.00	MANUAL	wall type	1		0.00
	wall type	2		35.50		wall type	2		0.00
	wall type	3		28.20		wall type	3		0.00
	wall type	4		39.80		wall type	4		0.00
	wall type	5		28.40		wall type	5		0.00
	wall type	6		41.00		wall type	6		0.00
	wall type	7		25.70		wall type	7		0.00
	wall type	8		28.70		wall type	8		0.00
	wall type	9		3.90		wall type	9		0.00
	wall type	10		0.00		wall type	10		0.00
TOTAL	wall type	1		109.00					
	wall type	2		35.50					
	wall type	3		28.20					
	wall type	4		39.80					
	wall type	5		28.40					
	wall type	6		41.00					
	wall type	7		25.70					
	wall type	8		28.70					
	wall type	9		3.90					
	wall type	10		0.00					

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WINDOWS											
REVIT					MANUAL						
revit wdws				74.08	manual wdws				0.00		
ACTUAL WINDOWS (rev+manl)					74.08						
wdw area over 30%					0						
actual wdws minus 30% walls					-50.20						
REVIT	glazing type 1				74.08	MAN"L	glazing type 1				0.00
	glazing type 2				0.00		glazing type 2				0.00
	glazing type 3				0.00		glazing type 3				0.00
TOTAL	glazing type 1				74.08	manual wdws per wall type	wall type 1	0			
	glazing type 2				0.00		wall type 2	0			
	glazing type 3				0.00		wall type 3	0			
					wall type 4		0				
					wall type 5		0				
					wall type 6		0				
					wall type 7		0				
					wall type 8	0					
					wall type 9	0					
					wall type 10	0					

1



Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-values. It uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based claddings directly fixed on timber framing. Please make sure to select only appropriate material combinations.

If your construction is not listed, please send an e-mail to designnavigator@gmail.com with a description and a detail drawing (pdf) of it or use the new [Design Navigator message board](#) [\[i\]](#).

Please select the element type. Then choose the construction details and enter the R-value of the insulation either directly in the text box or by choosing a product from the right panel [\[i\]](#).

Floors ☒

Walls ☐

Roofs ☐

Floor: Slab Floor - GROUND FLOOR SLAB

internal surface 0.09			
Insulation value of the slabfloor			
[i]			
Slab floor area [m²]:	120.2		
Perimeter length [m]:	60.3		
External wall thickness [mm]:	250 [i]		
Soil conductivity [W/m °C]:	1.2 [i]		
Underslab insulation:	Total slab		Insulation: 1.3
Slab edge insulation:	External		Insulation: 0.5
R-value: 2.88			

Resulting R-value: 2.97 m²K/W.

[Print Page](#)

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [\[i\]](#):

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31





Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-values. It uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

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Please select the element type. Then choose the construction details and enter the R-value of the insulation either directly in the text box or by choosing a product from the right panel [\[i\]](#).

Floors ☒

Walls ☐

Roofs ☐

Floor: Suspended Floor with concrete joists — FIRST FLOOR INTERSPAN

internal surface 0.09	
Flooring 100m suspended concrete	
R-value: 0.06	
Concrete Joists & Cavity no exposed joists, i.e. complete layer of insulation	
Frame Area: 0%	Cavity Area: 100%
Concrete Joists R-value: 0	Insulation 0.69
Insulation value of the subfloor space	
Suspended floor area [m²]: 55.0	
Perimeter length [m]: 31.9	
Perimeter height [m]: 2.6	
Perimeter type: Continuous perimeter wall (sheltered)	
R-value: 0.07	

Resulting R-value: **0.91** m²K/W.

[Print Page](#)

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [\[i\]](#):

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31





Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-values. It uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based claddings directly fixed on timber framing. Please make sure to select only appropriate material combinations.

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Please select the element type. Then choose the construction details and enter the R-value of the insulation either directly in the text box or by choosing a product from the right panel [i].

Floors ☒

Walls ☐

Roofs ☐

Floor: Suspended Floor with lining under the joists & gap between insulation and lining - FIRST FLOOR CANTILEVER SLAB

internal surface 0.09	
Flooring 100m suspended concrete R-value: 0.06	
Timber Frame & Cavity 190+ mm joists @ 600mm	
Frame Area: 7.8%	Cavity Area: 92.2%
Timber Frame R-value: 1.56	Insulation 1.3
air gap 0.2	
Wall Lining Hardboard 6mm R-value: 0.04	
surface 0.03	
Insulation value of the subfloor space	
Suspended floor area [m²]:	19.2
Perimeter length [m]:	13.1
Perimeter height [m]:	2.7
Perimeter type:	Exposed floor (pole house)
R-value: 0	

Resulting R-value: **1.72** m²K/W.

[Print Page](#)

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [i]:

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26



Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-value uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based cladd directly fixed on timber framing. Please make sure to select only appropriate material combinations.

If your construction is not listed, please send an e-mail to designnavigator@gmail.com with a description and a drawing (pdf) of it or use the new [Design Navigator message board](#) [i].

Please select the element type. Then choose the construction details and enter the R-value of the insulation e directly in the text box or by choosing a product from the right panel [i].

Floors ☐

Walls ☐

Roofs ☒

Roof: Timber framed skillion roof - METAL

external surface 0.03	
Roofing Corrugate iron with building paper	
R-value: 0.01	
Timber Frame & Cavity 250mm rafters or joists @ 480mm, battens (covered with insulation)	
Frame Area: 9.8%	Cavity Area: 90.2%
Rafters	still Airgap 40-90mm airgap (non-reflective)
R-value: 2.07	R-value: 0.14
Thermal Break none	Insulation 5.2
R-value: 0	
Ceiling Lining Gypsum plasterboard 13mm	
R-value: 0.06	
internal surface 0.09	

Resulting R-value: 4.81 m²K/W.

Print Page

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [i]:

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31





Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-value uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based cladding directly fixed on timber framing. Please make sure to select only appropriate material combinations.

If your construction is not listed, please send an e-mail to designnavigator@gmail.com with a description and drawing (pdf) of it or use the new [Design Navigator message board](#) [i].

Please select the element type. Then choose the construction details and enter the R-value of the insulation directly in the text box or by choosing a product from the right panel [i].

Floors ☐

Walls ☐

Roofs ☒

Roof: Timber framed roof, flat ceiling - MEMBRANE

external surface 0.03	
Roofing Butyl membrane on 18mm construction plywood R-value: 0.15	
Roof space (still air) 0.11	
Insulation [i] 2.6	
Timber Frame & Cavity 144mm rafters or joists @ 480mm, battens (covered with insulation)	
Frame Area: 9.8%	Cavity Area: 90.2%
Trusses and dwangs R-value: 1.19	Insulation 2.6
Ceiling Lining Gypsum plasterboard 13mm R-value: 0.06	
internal surface 0.09	

Resulting R-value: 5.37 m²K/W.

Print Page

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [i]:

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31

Moisture

The nature of concrete allows the creation of a virtually weathertight wall. Because Ambionse is simply formwork for reinforced concrete, the same benefits should be expected for a completed Ambionse wall. As with any concrete wall, full information on flashing and sealing of joinery should be sourced from the manufacturers of the cladding and windows used to complete the home to meet the requirements under the Building Code.

Hazardous Building Materials

No components of the Ambionse wall are hazardous to either the builder constructing the wall or the inhabitants of the Ambionse home. The concrete and the Ambionse block are both inert and produce no off-gassing.

Impact & Airborne Sound

There are no requirements for sound attenuation under the Building Code for unattached housing, but you will notice a significant improvement in the quietness with an Ambionse home, compared with a conventional timber framed house.

An intertenancy wall solution that complies with the NZBC has been developed with Ambionse. A field test was carried out to confirm a Field STC of FSTC 53 using the 250 Series Ambionse block. (The NZBC requires a Field STC minimum value of FSTC 50). Full specifications for this wall are available from Styrobeck Plastics on 0800 262 466 or www.ambionse.co.nz.

Energy Efficiency

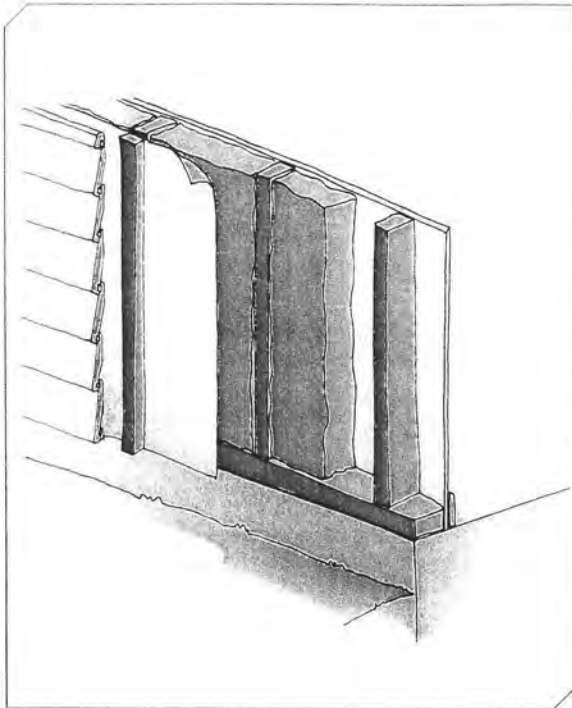
NZS 4214:1977 sets out the procedure for determining the R-Value of building materials. The completed Ambionse wall has an R-value of at least R3.0. This is well in excess of the NZBC requirements of R0.6 for solid construction (concrete) and R1.5 for non-solid (timber framed) construction.



ELEMENT

CLADDING

CONSTRUCTION

Wall**Bevel-back
Weatherboard****Timber framed – cavity**
140 mm frame

Framing timber spacing

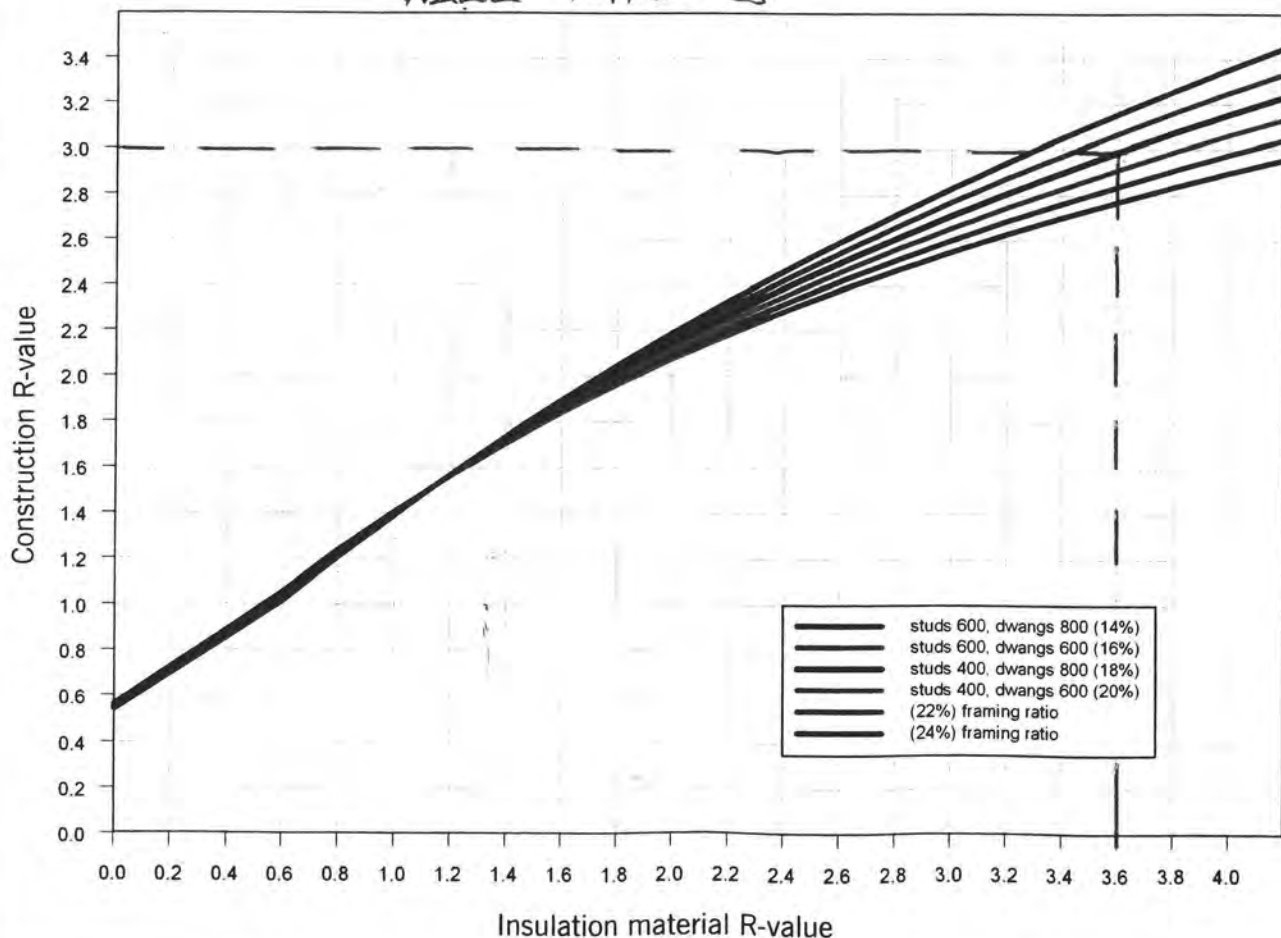
Insulation material R-value

	1.8	2.0	2.2	2.4	2.6	2.8	3.0
Total construction R-value							
studs 600, dwangs 800 (14%)	2.0	2.1	2.3	2.4	2.5	2.7	2.8
studs 600, dwangs 600 (16%)	2.0	2.1	2.2	2.4	2.5	2.6	2.7
studs 400, dwangs 800 (18%)	2.0	2.1	2.2	2.3	2.5	2.6	2.7
studs 400, dwangs 600 (20%)	1.9	2.1	2.2	2.3	2.4	2.5	2.6
(22%) framing ratio	1.9	2.1	2.2	2.3	2.4	2.5	2.6
(24%) framing ratio	1.9	2.0	2.1	2.2	2.3	2.4	2.5

1. All insulants should be placed against wall underlay

Bevel-back weatherboard with cavity 140 mm frame

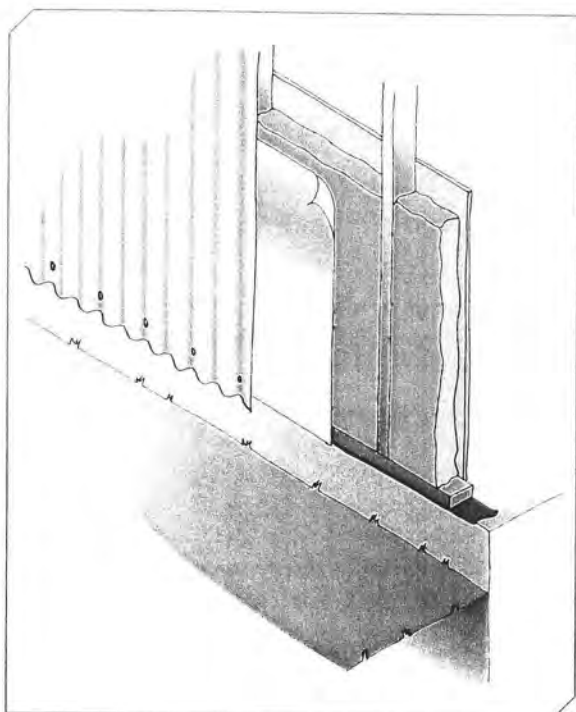
WALL TYPE 3



ELEMENT

CLADDING

CONSTRUCTION

Wall**Metal**
Vertical profile**Timber framed – direct-fixed**
140 mm frame

Framing timber spacing

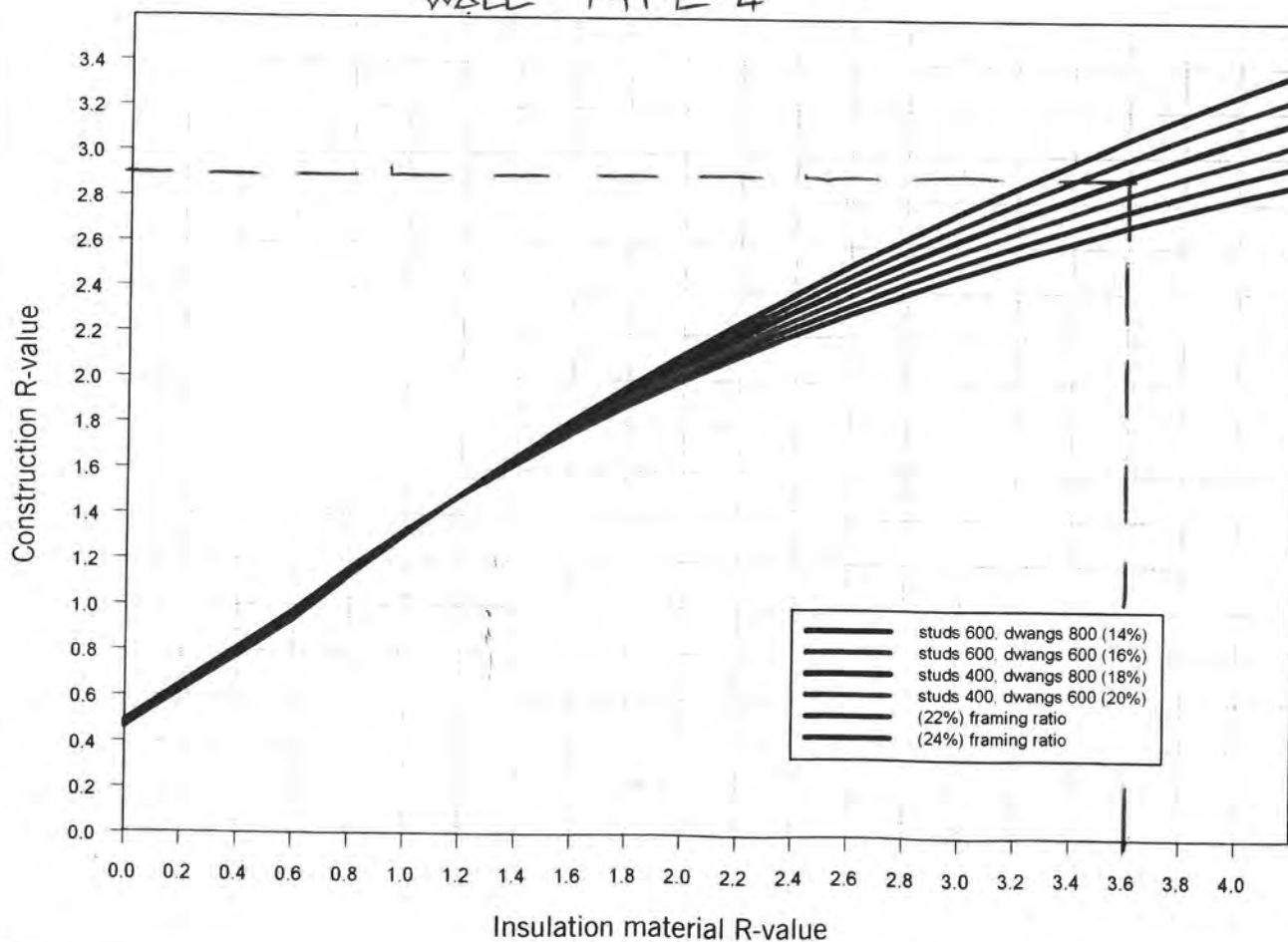
Insulation material R-value

	1.8	2.0	2.2	2.4	2.6	2.8	3.0
Total construction R-value							
studs 600, dwangs 800 (14%)	1.9	2.1	2.2	2.3	2.5	2.6	2.7
studs 600, dwangs 600 (16%)	1.9	2.0	2.2	2.3	2.4	2.5	2.6
studs 400, dwangs 800 (18%)	1.9	2.0	2.1	2.3	2.4	2.5	2.6
studs 400, dwangs 600 (20%)	1.9	2.0	2.1	2.2	2.3	2.4	2.5
(22%) framing ratio	1.9	2.0	2.1	2.2	2.3	2.4	2.5
(24%) framing ratio	1.8	2.0	2.1	2.2	2.3	2.3	2.4

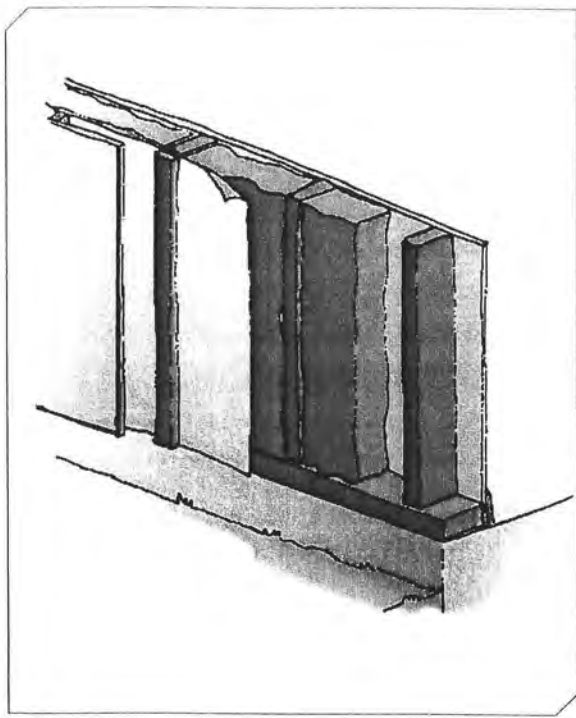
1. All insulants should be placed against wall underlay
2. Under E2/AS1 vertical profiled steel cladding can be used without a cavity up to a risk score of 20

Vertical profile metal direct-fixed 140 mm frame

WALL TYPE 4

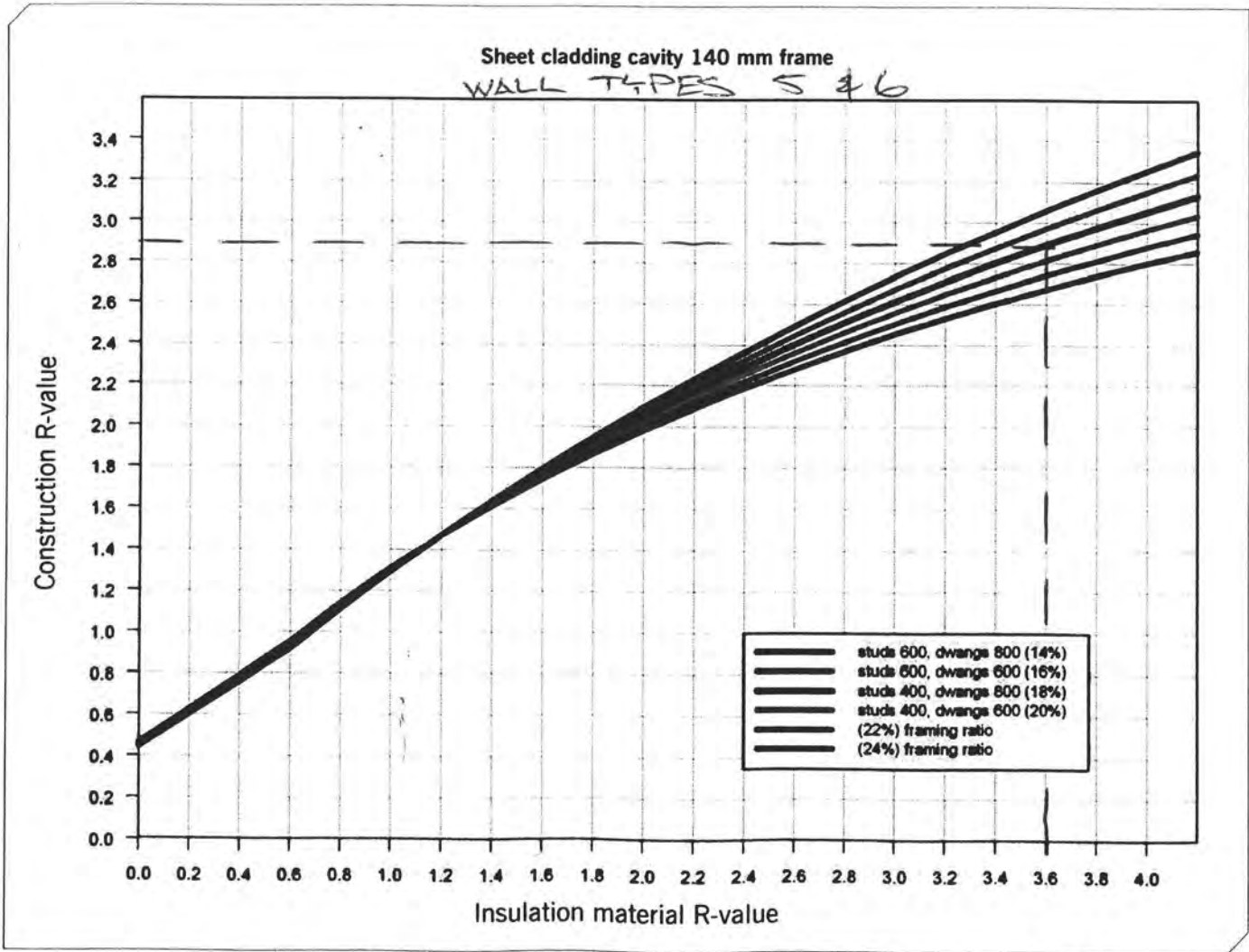
**Wall****Metal**
Vertical profile**Timber framed – direct-fixed**
140 mm frame

ELEMENT	CLADDING	CONSTRUCTION
Wall	Sheet cladding	Timber framed – cavity 140 mm frame



Framing timber spacing	Insulation material R-value						
	1.8	2.0	2.2	2.4	2.6	2.8	3.0
	Total construction R-value						
studs 600, dwangs 800 (14%)	1.9	2.0	2.2	2.3	2.4	2.6	2.7
studs 600, dwangs 600 (16%)	1.9	2.0	2.2	2.3	2.4	2.5	2.6
studs 400, dwangs 800 (18%)	1.9	2.0	2.1	2.2	2.4	2.5	2.6
studs 400, dwangs 600 (20%)	1.8	2.0	2.1	2.2	2.3	2.4	2.5
(22%) framing ratio	1.8	2.0	2.1	2.2	2.3	2.4	2.5
(24%) framing ratio	1.8	1.9	2.0	2.1	2.2	2.3	2.4

1. All insulants should be placed against wall underlay



2008 SUPPLEMENT

Wall	Sheet cladding	Timber framed – cavity 140 mm frame
Wall	Sheet cladding	Timber framed – direct-fixed 140 mm frame



Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-values. It uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based claddings directly fixed on timber framing. Please make sure to select only appropriate material combinations.

If your construction is not listed, please send an e-mail to designnavigator@gmail.com with a description and a detail drawing (pdf) of it or use the new [Design Navigator message board](#) [\[i\]](#).

Please select the element type. Then choose the construction details and enter the R-value of the insulation either directly in the text box or by choosing a product from the right panel [\[i\]](#).

Floors ☐

Walls ☒

Roofs ☐

Wall: Timber frame with vented cavity - WALL TYPE 7

external surface 0.03	
Cladding Graphex 60mm Overlay (R1.97) with plaster finish R-value: 1.97	
15-90mm vented cavity (all R-values on ext. side of cavity will be halved), R: 0.17	
Timber Frame & Cavity 144mm, studs @ 400mm, dwangs @ 800mm	
Frame Area: 20%	Cavity Area: 80%
Timber Frame R-value: 1.19	Insulation 3.6
still Airgap none R-value: 0	
Wall Lining Gypsum plasterboard 10mm R-value: 0.04	
internal surface 0.09	

Resulting R-value: 3.86 m²K/W.

Print Page

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [\[i\]](#):

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31



Construction R-value Calculator

H1 compliance calculator,
now with BPI calculation.

This webpage calculates the R-value of walls, roofs and suspended floors for most insulation material R-values. It uses the "iso-thermal planes" method, the same method as used in NZS4214:2002.

Some of the possible material combinations may not be suitable for actual constructions, i.e. EPS based claddings directly fixed on timber framing. Please make sure to select only appropriate material combinations.

If your construction is not listed, please send an e-mail to designnavigator@gmail.com with a description and a detail drawing (pdf) of it or use the new [Design Navigator message board](#) [\[i\]](#).

Please select the element type. Then choose the construction details and enter the R-value of the insulation either directly in the text box or by choosing a product from the right panel [\[i\]](#).

Floors ☐

Walls ☒

Roofs ☐

Wall: Timber frame (direct fixed cladding) - WALL TYPE 9

external surface 0.03	
Cladding Gypsum plasterboard 10mm into still air (garage, etc.) R-value: 0.1	
Timber Frame & Cavity 90mm, studs @ 600mm, dwangs @ 800mm	
Frame Area: 16%	Cavity Area: 84%
Timber Frame R-value: 0.75	Insulation 2.8
still Airgap none R-value: 0	
Wall Lining Gypsum plasterboard 10mm R-value: 0.04	
internal surface 0.09	

Resulting R-value: 2.21 m²K/W.

[Print Page](#)

Current NZS4218/H1 Schedule minimum R-value Targets (non-solid construction) [\[i\]](#):

	Zone 1	Zone 2	Zone 3
Roof	R-2.9	R-2.9	R-3.3
Wall	R-1.9	R-1.9	R-2.0
Floor	R-1.3	R-1.3	R-1.3
Glazing (vertical)	R-0.26	R-0.26	R-0.26
Glazing (skylights)	R-0.26	R-0.26	R-0.31



SUITABLE CLADDINGS			
FACE	SCORE	CAVITY	CLADDING
1	13	Y	Vertical profile metal / polystyrene block
2	13	N	Polystyrene block
3	4	Y	Bevelback Weatherboard
4	1	N	Polystyrene block
5	9	Y	Rainscreen over Hardiflex
6, 7, 8	5	Y	Titan panel / Bevelback weatherboard / polystyrene block
9	11	Y	Rainscreen over Hardiflex / polystyrene block
10	3	Y	Bevelback Weatherboard

Table 3: Suitable wall claddings
Paragraphs 3.1.2, 3.4.1.1, 3.4.2.1, 3.4.2.2, 3.4.3.2, 9.1.1, 9.4.1.2, 9.4.1.3, 9.6, Figure 1

Risk Score	Suitable wall claddings ⁽¹⁾	
	Direct fixed to framing	Over nominal 20 mm drained cavity
0 – 6	a) Timber weatherboards – all types b) Fibre cement weatherboards c) Vertical profiled metal ⁽³⁾ – corrugated and symmetrical d) Fibre cement sheet ⁽⁴⁾ e) Plywood sheet f) <i>EIFS</i>	a) <i>Masonry veneer</i> ⁽²⁾ b) <i>Stucco</i> c) Horizontal profiled metal ⁽³⁾ – corrugated and <i>trapezoidal</i> only
7 – 12	a) Bevel-back timber weatherboards b) Vertical timber board and batten c) Vertical profiled metal ⁽³⁾ – corrugated only	a) <i>Masonry veneer</i> ⁽²⁾ b) <i>Stucco</i> c) Horizontal profiled metal – corrugated and <i>trapezoidal</i> only d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet g) Plywood sheet h) <i>EIFS</i>
13 – 20	a) Vertical profiled metal ⁽³⁾ – corrugated only	a) <i>Masonry veneer</i> ⁽²⁾ b) <i>Stucco</i> c) Horizontal profiled metal – corrugated and <i>trapezoidal</i> only d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet g) Plywood sheet h) <i>EIFS</i> i) Bevel-back weatherboards
Over 20	a) Redesign the <i>building</i> to achieve a lower score, or b) Specific design – The design may need changing to reduce the risk – The <i>building consent authority</i> may require more comprehensive details and documentation providing evidence of <i>weathertightness</i> – The <i>building consent authority</i>, designer or <i>owner</i> may require more inspections – A third party audit of the design may be required.	

NOTES: (1) The wall claddings in this table are limited to those covered in this Acceptable Solution.
 (2) Traditional *masonry veneer* as per SNZ HB 4236, with minimum 40 mm cavity.
 (3) Refer Figure 38 for profiles.
 (4) Except *stucco* over a fibre cement backing.

Risk Matrix Calculation

to E2 / AS1 Building Envelope Risk Matrix

Leone & Chris Beggs
8 Ngarara Road
Lot 9
DP 13765

Wind Zone
HIGH

Face of Building	1	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	MEDIUM	1
Roof/wall intersection design	V.HIGH	5
Eaves width	V.HIGH	5
Envelope complexity	MEDIUM	1
Deck design	LOW	0
Total risk score	1	13

Face of Building	2	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	MEDIUM	1
Roof/wall intersection design	V.HIGH	5
Eaves width	V.HIGH	5
Envelope complexity	MEDIUM	1
Deck design	LOW	0
Total risk score	2	13

Face of Building	3	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	HIGH	2
Roof/wall intersection design	LOW	0
Eaves width	MEDIUM	1
Envelope complexity	LOW	0
Deck design	LOW	0
Total risk score	3	4

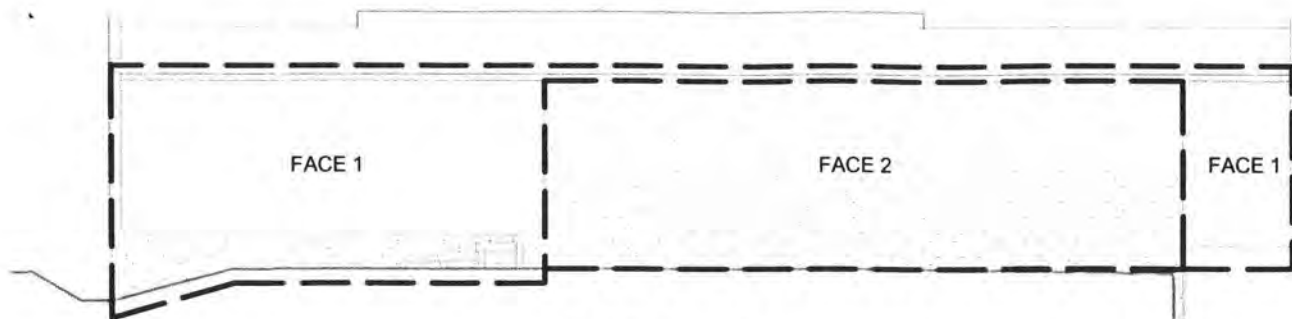
Face of Building	4	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	HIGH	0
Roof/wall intersection design	LOW	0
Eaves width	MEDIUM	0
Envelope complexity	LOW	0
Deck design	LOW	0
Total risk score	4	1

Face of Building	5	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	LOW	0
Roof/wall intersection design	HIGH	3
Eaves width	V.HIGH	5
Envelope complexity	LOW	0
Deck design	LOW	0
Total risk score	5	9

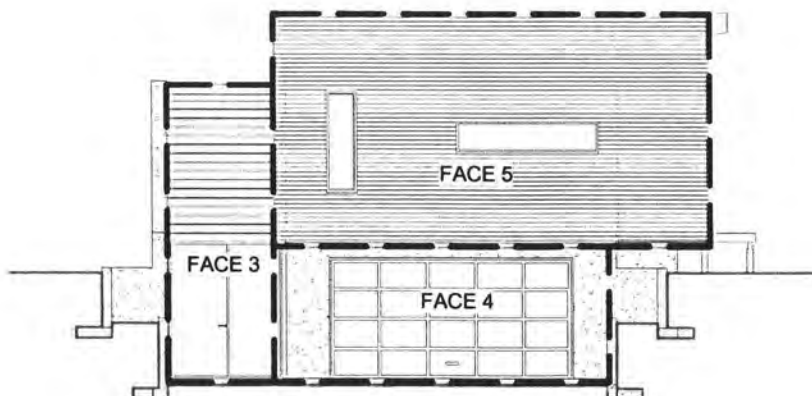
Face of Building	6, 7, 8	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	LOW	1
Roof/wall intersection design	HIGH	0
Eaves width	V.HIGH	0
Envelope complexity	LOW	1
Deck design	LOW	2
Total risk score	6, 7, 8	5

Face of Building	9	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	LOW	1
Roof/wall intersection design	HIGH	3
Eaves width	V.HIGH	5
Envelope complexity	LOW	1
Deck design	LOW	0
Total risk score	9	11

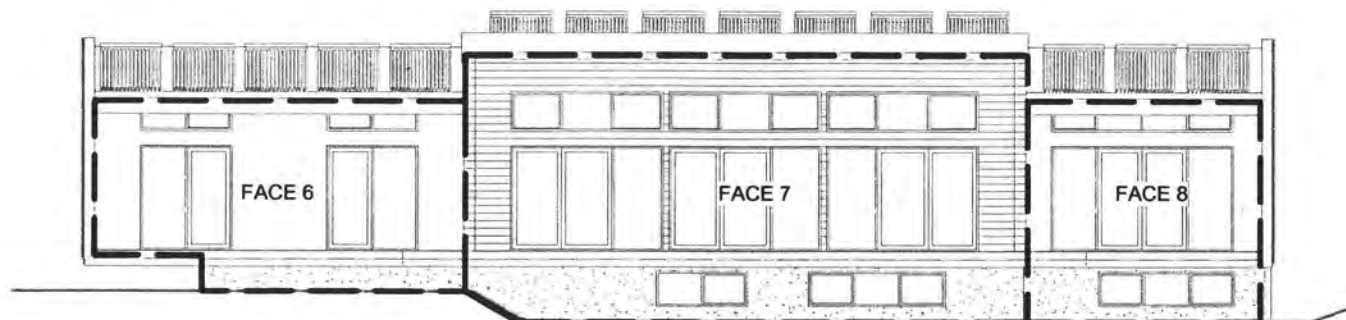
Face of Building	10	
Risk Factor	Severity	Score
Wind Zone	HIGH	1
Number of storeys	LOW	0
Roof/wall intersection design	HIGH	0
Eaves width	V.HIGH	2
Envelope complexity	LOW	0
Deck design	LOW	0
Total risk score	10	3



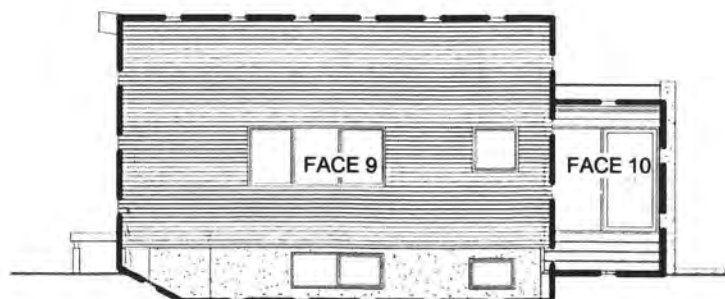
ELEVATION 1



ELEVATION 2



ELEVATION 3



ELEVATION 4

Table 1: Definitions of risk
Paragraph 3.1.1, Figure 1[back to
Risk Matrix](#)

A: Wind zone	Low risk	Low <i>wind zone</i> as described by NZS 3604
	Medium risk	Medium <i>wind zone</i> as described by NZS 3604
	High risk	High <i>wind zone</i> as described by NZS 3604
	Very high risk	Very high <i>wind zone</i> as described by NZS 3604
B: Number of storeys	Low risk	One <i>storey</i>
	Medium risk	Two <i>storeys</i> in part
	High risk	Two <i>storeys</i>
	Very high risk	More than two <i>storeys</i>
C: Roof/wall intersection design	Low risk	Roof-to-wall intersection fully protected (e.g. hip and gable roof with <i>eaves</i>)
	Medium risk	Roof-to-wall intersection partly exposed (e.g. hip and gable roof with no <i>eaves</i>)
	High risk	Roof-to-wall intersection fully exposed (e.g. <i>parapets</i> , <i>enclosed balustrades</i> or <i>eaves</i> at greater than 90° to vertical with soffit <i>lining</i>)
	Very high risk	Roof elements finishing within the boundaries formed by the exterior walls (e.g. lower ends of aprons, <i>chimneys</i> , <i>dormers</i> etc)
D: Eaves width ⁽¹⁾⁽²⁾	Low risk	Greater than 600 mm for single storey
	Medium risk	451 – 600 mm for single storey, or over 600 mm for two storey
	High risk	101 – 450 mm for single storey, or 451 – 600 mm for two storey, or greater than 600 mm above two storey
	Very high risk	0 – 100 mm for single storey, or 0 – 450 mm for two storey, or less than 600 mm above two storey
E: Envelope complexity	Low risk	Simple rectangular, L, T or boomerang shape, with single <i>cladding</i> type
	Medium risk	Moderately complex, angular or curved shapes (e.g. Y or arrowhead) with no more than two <i>cladding</i> types
	High risk	Complex, angular or curved shapes (e.g. Y or arrowhead) with multiple <i>cladding</i> types
	Very high risk	As for High risk, but with junctions not covered in C or F of this table (e.g. box windows, pergolas, multi-storey re-entrant shapes etc)
F: Deck design ⁽³⁾	Low risk	None, timber slat <i>deck</i> or porch at ground floor level
	Medium risk	Fully covered in plan by roof, or timber slat <i>deck</i> attached at first or second floor level
	High risk	<i>Enclosed deck</i> exposed in plan or cantilevered at first floor level
	Very high risk	<i>Enclosed deck</i> exposed in plan or cantilevered at second floor level or above

NOTES:

(1) *Eaves* width measured horizontally from external face of wall *cladding* to outer edge of overhang, including gutters and fascias.

(2) Balustrades and *parapets* count as 0 mm *eaves*.

(3) The term *deck* includes balconies, as described in the Definitions.

Design Certificate – Technical basis for structural design methodology contained in designIT for houses - New Zealand.

designIT for houses, New Zealand has been developed by experienced timber engineers to assist designers in selecting appropriate sizes of structural laminated veneer lumber products manufactured by Carter Holt Harvey (including hySPAN, hy90, hyONE and hyJOIST) and other generic stress grades of timber, to be used as structural elements for the construction of buildings that fall within the scope and limitations of NZS 3604.

The design methodology used for the software complies with the loading and general design requirements contained within AS/NZS 1170:2002 and with timber structural design in accordance with NZS 3603:1993 including Amendment 4 (Verification method B1/VM1, 6.1).

The methodology for designIT uses the most up to date information available from joint Australian/New Zealand standards to ensure designIT solutions correspond with performance levels of design solutions given in NZS 3604:1999.

designIT relies on the accurate input of span and loading information by the user. Where accurate inputs are submitted the product and/or stress grade and the size given will comply with the structural requirements of the New Zealand Building Code, provided the installation is in accordance with the installation requirements provided by designIT and/or in product literature and/or NZS 3604, as appropriate.

References:

NZS 3603:1993 Timber Structures Standard.

NZS 3604:1999 Timber Framed Buildings.

AS 1720.1 – 1997 Timber structures. Part 1: Design methods.

AS/NZS 1170:2002 Structural design actions, Parts 0, 1 and 2.

AS/NZS 1170:2003 Structural design actions, Part 3: Snow and ice actions.

AS 1684.1 – 1999 Residential timber framed construction Part 1: Design criteria.

7 July 2009

For further information or advice please contact:

Carter Holt Harvey Woodproducts New Zealand
173 Captain Springs Road, Onehunga, Auckland
Telephone 0800 808 131
Facsimile 0800 808 132
Email: designit@chhwoodproducts.co.nz

Specifier details:

Specifier:	AD Architecture		
Business name:	AD Architecture		
Address:	Paraparaumu Beach		
Phone: 2985662	Mobile:	Facsimile: 2985663	

Project & Site details:

Project:	New house	Ref. no.: 09059
At (address):	8 Ngarara Road, Waikanae	
For (owner/s):	Leone & Chris Beggs	
Wind Zone:	High	
Snow loading	Snow region: N0, snow loading not applicable	

MEMBER DESIGN DETAILS

Member 1

1) Member code and description	MAIN - Common rafters
2) Date prepared	14/12/2009
3) Design inputs	Span 7.4 m - single Maximum rafter spacing 1100 mm Roof mass 40 kg/m² Lateral restraint condition Bottom edge restrained by ceiling / ceiling battens at 600 c/s max. Serviceability criteria AS 1684.1-1999
Member specification	Use HJ360 90 hyJOIST
5) Installation requirements	Support and tie-down - Details R10, R11, R15 (3/35 x 3.15 FH nails per end) & R14 (4/35x3.15 FH nails/multigrip tab), supporting member J5 or better

Member 2

1) Member code and description	VERANDAH - Common rafters
2) Date prepared	15/01/2010
3) Design inputs	Span 4.8 m - single Maximum rafter spacing 750 mm Roof mass 40 kg/m² Lateral restraint condition Bottom edge restrained by ceiling / ceiling battens at 600 c/s max. Serviceability criteria AS 1684.1-1999
4) Member specification	Use 200 x 45 hySPAN Structural Laminated Veneer Lumber to AS/NZS 4357
5) Installation requirements	Minimum bearing - end supports, 30 mm.

Structural Calculations

For

8 Ngarara Road

Waikanae

These calculations are in accordance with:

AS/NZS1170:2004 Structural Design Actions
NZS3101:2006 Design of Concrete Structures
NZS3404:1998 Design of Steel Structures
NZS3603:1993 Design of Timber Structures
NZS3604:1999 Timber Framed Buildings
NZS4229:1989 Design of Masonry Structures Not Requiring Specific Design
NZS4230:2004 Design of Reinforced Concrete Masonry Structures

Engineer:
John O'Hagan
Hugh Falkner

Initials:
JOH
HAF



Preamble:

Specific structural design for new dwelling including:
Specific roof beams, living room window support framing
Design of suspended concrete floor, including cantilever slab and lintel beams
Design of poly block retaining / bracing walls
Design of masonry and timber pole garden walls

Date:
11 January 2010

Job No.
23448

PRODUCER STATEMENT - PS1 - DESIGN
(Guidance notes on the use of this form are printed on the reverse side*)**ISSUED:** ISP Consulting Engineers Ltd**TO:** **Chris & Leone Beggs**
(Owner / Developer)**TO BE SUPPLIED TO:** Kapiti Coast District Council
(Building Consent Authority)**IN RESPECT OF:** **New Dwelling**
(Description of Building Work)**AT:** **8 Ngarara Road, Waikanae**
(Address)
LOT 9 DP 13765

We have been engaged by the owner/developer referred to above to provide **structural design services and construction monitoring of specifically design elements** in respect of the requirements of Clause B1 (B2 of specifically designed elements) of the building code for

☐ All**Part only as specified of building work:**

- Foundations, poly block and timber retaining walls, suspend concrete floor, Steel roof beams, steel wind posts, and bracing.

The design carried out by us has been prepared in accordance with Compliance Documents issued by Department of Building & Housing B1, VM1 & VM4

The proposed Building work covered by this producer statement is described on the drawings titled: **8 Ngarara Road, Waikanae** and numbered **23448/S1 to S3**

On behalf of the Design Firm, and subject to:

- (i) Site verification of the following design assumptions: Bearing capacity of excavated foundations to be confirmed on site by ENGINEER.
- (ii) All proprietary products meeting their performance specifications requirements;

I Believe on reasonable grounds the building, if constructed in accordance with the drawings, specifications, and other documents provided will comply with the relevant provisions of the building code.

I, John O'Hagan am CPEng #179947

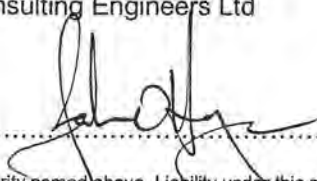
I am a member of: IPENZ and hold the following qualifications: BE(Hons), NZCE(Civil), MIPENZ, CPEng

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 John O'Hagan ON BEHALF OF ISP Consulting Engineers Ltd

Date: 11 January 2010

(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 provide 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.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1992. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional Engineers New Zealand, Association of Consulting Engineers New Zealand in consultation with the Building Officials Institute of New Zealand. The original suite of producer statements has been revised as at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

PS1 Design

Intended for the use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

PS2 Design Review

Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

PS3 Construction

Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:20031 ; or Schedules E1/E2 of NZIA's SCC 2007 2

PS 4 Construction Review

Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.
This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACENZ, IPENZ and NZIA to interpret the Producer Statement.

Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence-based register, either as a Chartered Professional Engineer (CPEng) or a Registered Architect.

Membership of a professional body, such as the Institution of Professional Engineers New Zealand (IPENZ) or the New Zealand Institute of Architects (NZIA) provides additional assurance of the designer's standing within the profession. If the design firm is a member of the Association of Consulting Engineers New Zealand (ACENZ), this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

Professional Indemnity Insurance

As part of membership requirements, ACENZ requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to \$500,000.

Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-5)3 (OL1-OL4)2. The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

Refer Also:

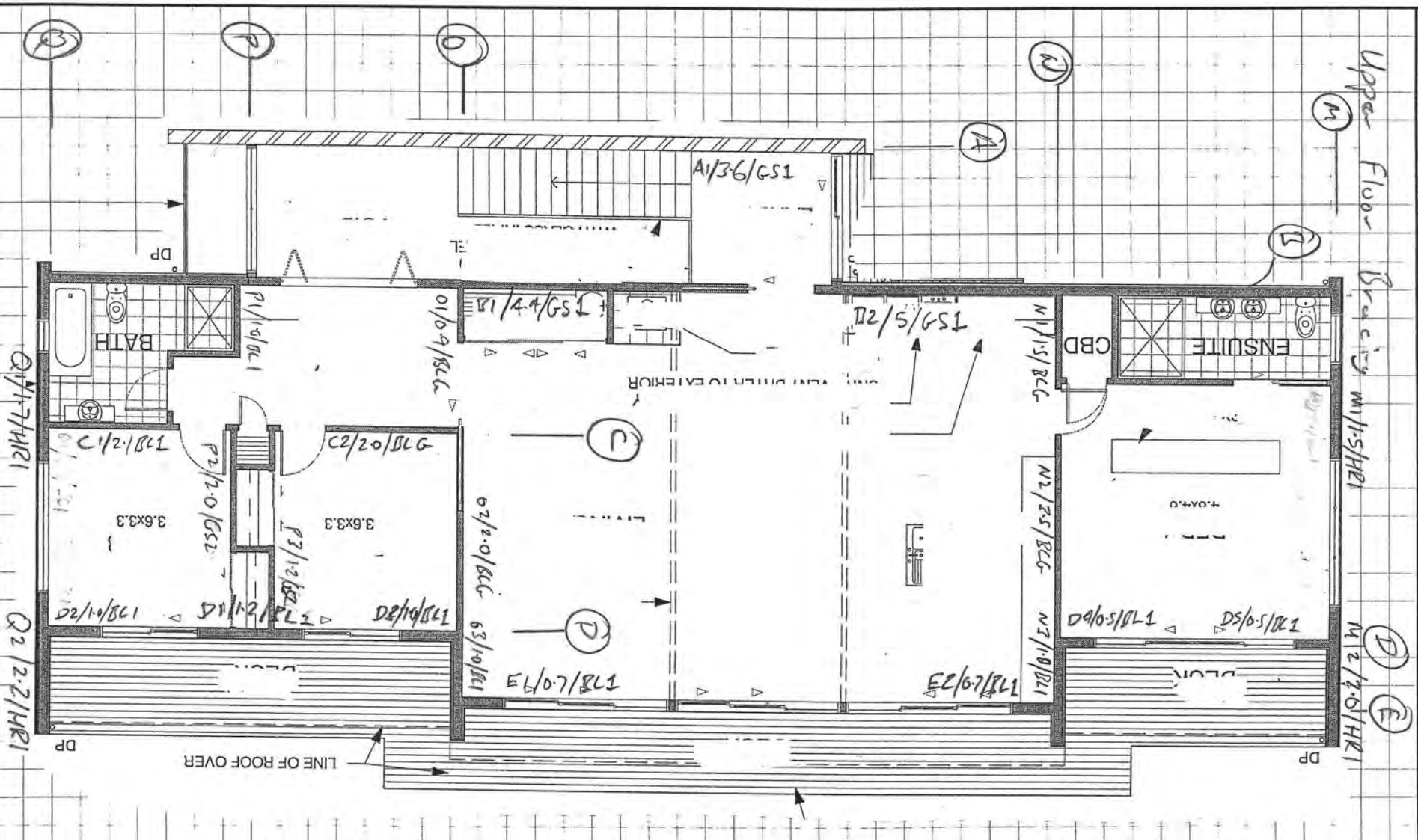
1 Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2003

2 NZIA Standard Conditions of Contract SCC 2007 (1st edition)

3 Guideline on the Briefing & Engagement for Consulting Engineering Services (ACENZ/IPENZ 2004)

www.acenz.org.nz
www.ipenz.org.nz
www.nzia.co.nz

8 Ngara Rd



CALCULATIONS

Date: 1-Dec-09
Project:

Eng: HAF

Job Number: 23448 Sheet No:

4

8 Ngarara Road
Waikanae



Site Wind Speed

$$V_{(z)} = V_r \times M_d \times (M_{(zcat)} \times M_s \times M_t)$$

$$V_{r500} = 51 \text{ m/s}$$

$$M_d = 1$$

$$M_s = 0.85$$

Terrain Factor = 3. Obstructions 3-5m

Building Height = 10m

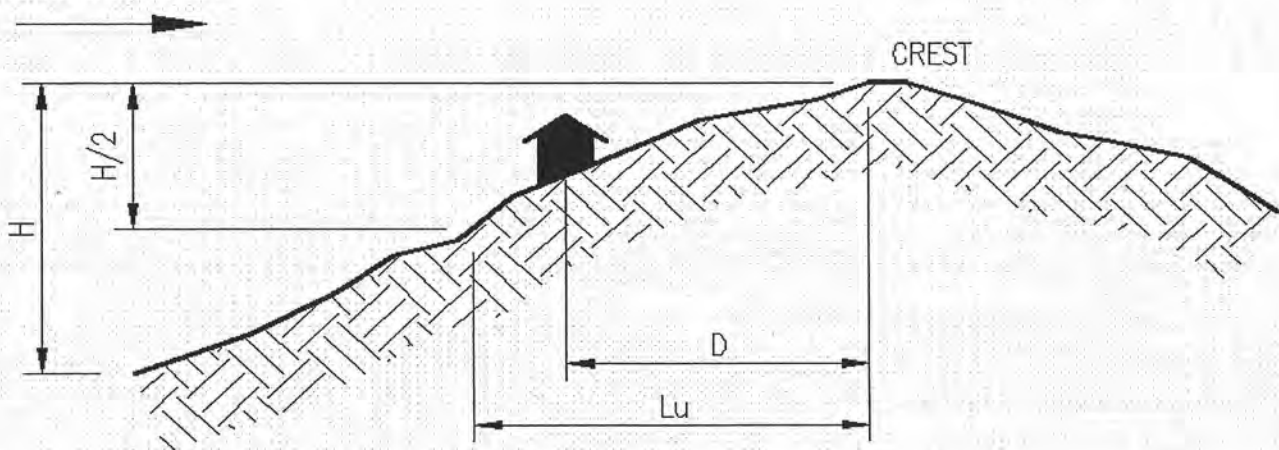
Gives $M_{(zcat)} = 0.83$

$M_s = 0.85$ for buildings in normal built-up areas.

Refer to AS1170.2 Clause 4.3.1

Hill Shape Multiplier M_h

WIND DIRECTION



$$\begin{aligned} \text{If } (H/2)/L_u < 0.05 & \quad M_h = 1 \\ \text{If } 0.05 < (H/2)/L_u < 0.45 & \quad M_h = 1 + (H / (3.5(z + L_1) \times (1 - D/L_2))) \\ \text{If } (H/2)/L_u > 0.45 & \quad M_h = 1 + 0.71(1 - D/L_2) \end{aligned}$$

H = 10 m (Rise height)

L_u = 500 m (distance from mid rise to crest)

D = 1 m (building distance from crest)

z = 10 m (building height)

$M_{lee} = 1$

Elevation = 10 m

Slope $[(H/2)/L_u] = 0.01$

$L_1 = 180 \text{ m}$

$L_2 = 720 \text{ m}$

$M_h = 1.00$

$M_{lee} = 1.00$

$M_e = \text{greater of 1 or } (Elevation - 500) \times 0.00015 = 1.00$

$M_t = M_h \times M_{lee} \times M_e = 1.00$

$$V_{(z)} = 51.00 \times 1.00 \times 0.83 \times 1.00 \times 0.85 = 35.98 \text{ m/s}$$

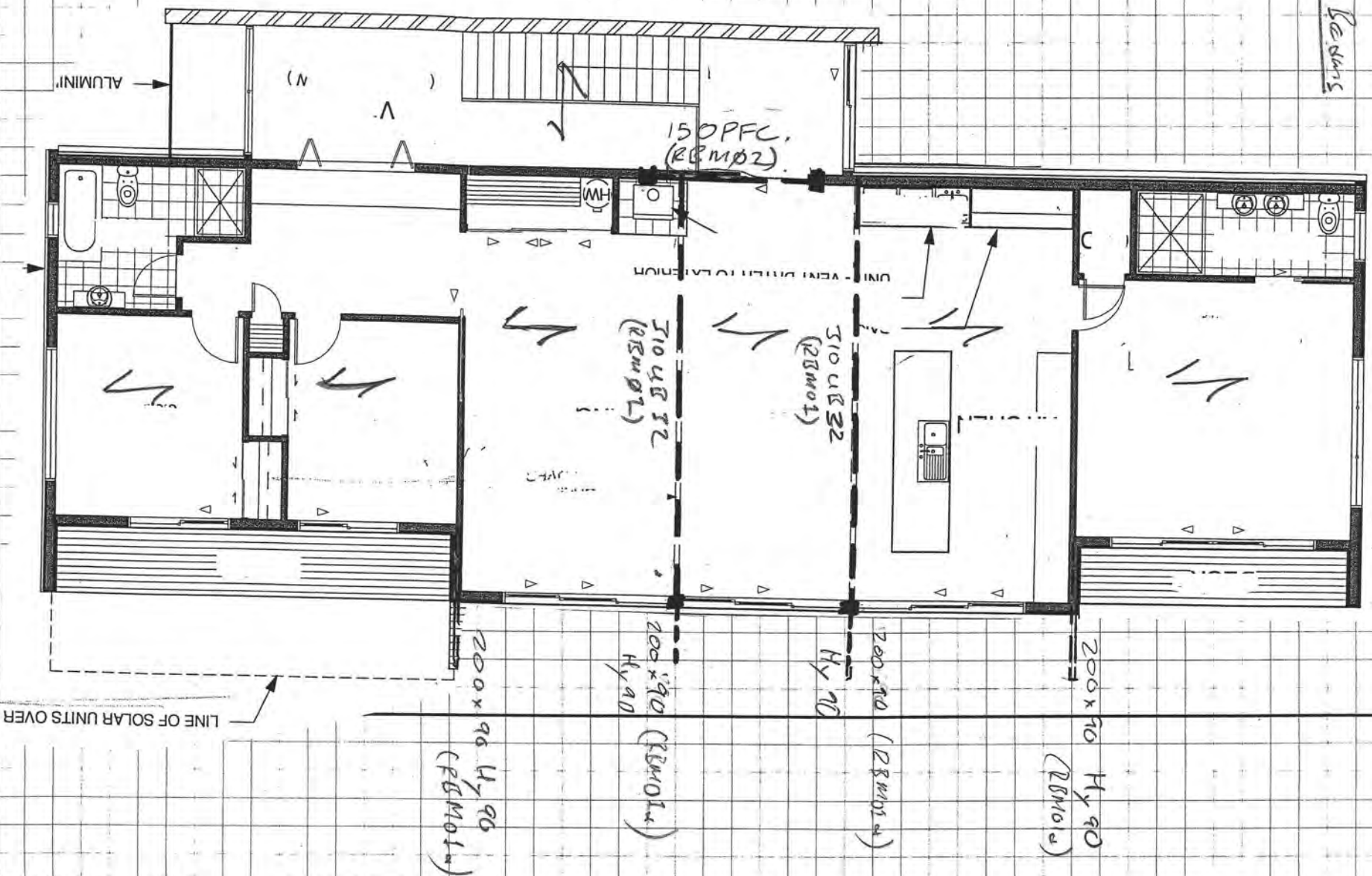
(NZS1170 wind pressure $P(z)$: 0.78 kPa ULS)

NZS 3604:1999 Wind Speed Zone: **Medium Wind Speed**

Date	3/12/09	Eng.	HAF	Job No.	23448	Sheet No.	5
Project	8 Ngaurua Rd.						



Root Beams



Date

7/1/07

Eng.

HAF

Job No.

23448

Sheet No.

8

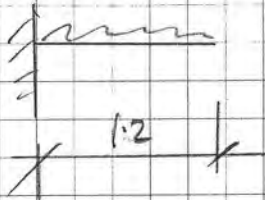
Project

3 Ngwano Rd



RBM01A.

Cantilever roof Beam



$$w^* = 3.10 \text{ kN/m}$$

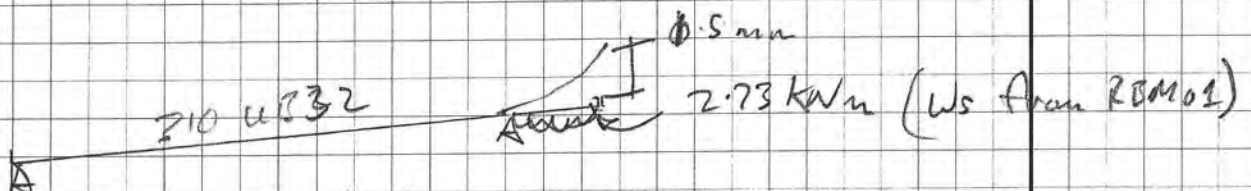
$$M^* = \frac{3.1 \times 1.2^2}{2} = 2.23 \text{ kNm}$$

Try 150 PFC

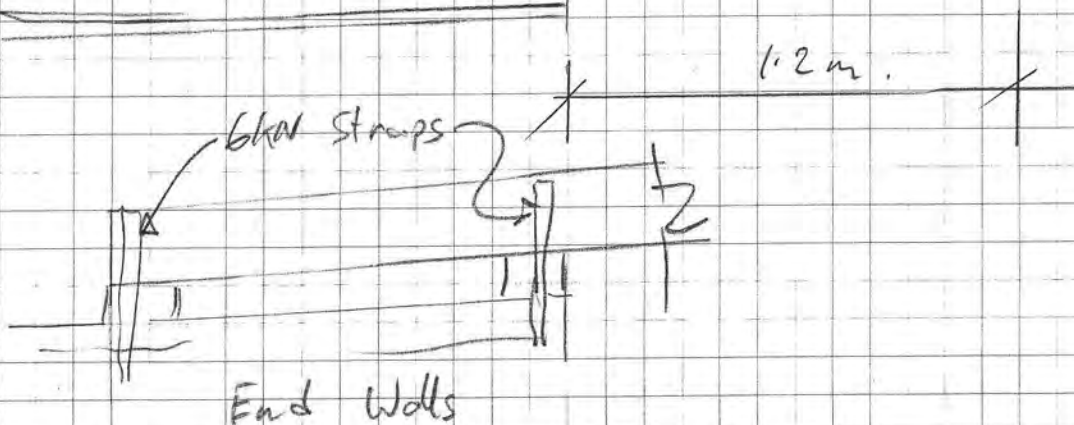
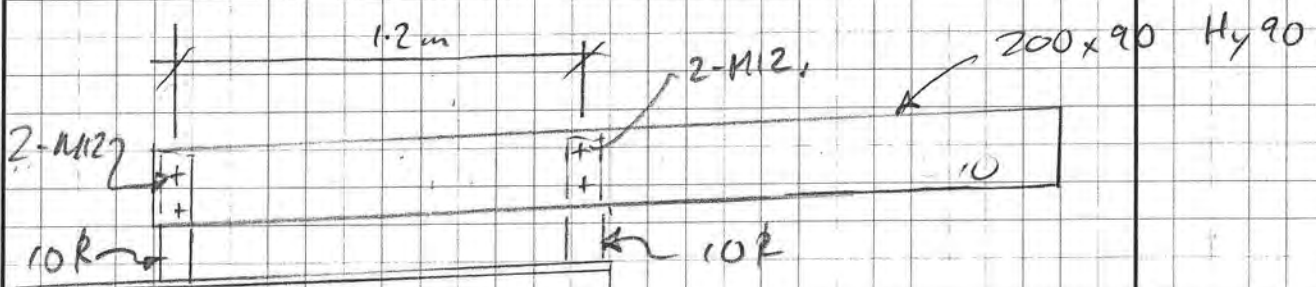
$$\phi M_b = 20.9 \text{ kNm} > 2.23 \text{ OKAY}$$

Consider 200x90 Hy 90

Model in space to check deflection.



$$\Delta_s = 1.5 = \frac{S_{max}}{860} \text{ OKAY}$$



AS/NZS1170 BEAM LOAD CALCULATION SHEET

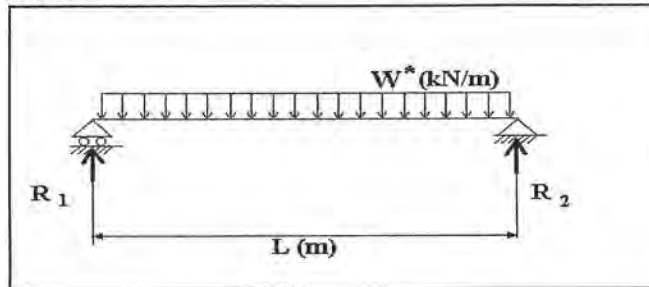
Steel Roof Beam Subjected To Wind Load

6

Job Name: 8 Ngarara Road
Waikanae
Date: 1-Dec-09

Job No. 23448

Engineer HAF
Beam No. RBM 01



L = 7.5 m
Trib Width = 3.5 m

LOADING

Uniformly Distributed Loads

	Amount
1. Dead Beam Self Weight	0.32 kN/m
Roof	0.3 kPa x Trib Width
	1.05 kN/m
Total Dead Load	G = 1.37 kN/m

$$Q_f = 1.8/A + 0.12 > 0.25 \text{ kPa} \quad \psi_a = 0.89$$

2. Roof Live Load	0.25 kPa x Trib Width x ψ_a	Q = 0.77 kN/m
-------------------	----------------------------------	----------------------

3. Site Wind Speed

$$V_{(z)} = 37.00 \text{ m/s} \quad \text{Upward Wind Loads} \quad q_{(z)} = 0.5(\delta_{air})V_{(z)}^2 \times 10^{-3} = 0.82 \text{ kPa}$$

$$\text{Downward Wind Loads} \quad 0.82 \text{ kPa}$$

External Pressures

$$p_e = C_{pe} K_a K_f K_p q_z \quad C_{pe}(\min) = -0.9 \quad C_{pe}(\max) = 0.3$$

$$K_a = 0.90 \quad p_e(\min) = -0.67 \text{ kPa} \quad p_e(\max) = 0.22 \text{ kPa}$$

$$K_f = 1.00 \quad K_p = 1.00$$

Internal Pressures

$$p_i = C_{pi} q_z \quad C_{pi}(\max) = 0.6 \quad C_{pi}(\min) = -0.3$$

$$p_i(\max) = 0.49 \text{ kPa} \quad p_i(\min) = -0.25 \text{ kPa}$$

Combined Pressures

$$\text{Note: } K_c > 0.8/K_a \quad K_c = 0.95 \quad K_c = 0.89$$

$$p_z = (p_e - p_i) K_c \quad p_z(\max) = -1.10 \text{ kPa} \quad p_z(\min) = 0.42 \text{ kPa}$$

$$W_u(\max) = -3.85 \text{ kN/m} \quad W_u(\min) = 1.46 \text{ kN/m}$$

Load Combinations - Ultimate Limit States

$$\text{Note: Roof } Q_u = 0.00 \text{ kN/m}$$

$$1.2 G + 1.5 Q = 2.81 \text{ kN/m}$$

$$1.2 G + Q_u + W_u = 3.10 \text{ kN/m}$$

$$0.9 G + W_u = -2.62 \text{ kN/m}$$

$$M^* = 21.80 \text{ kN/m}$$

$$W^* = 3.10 \text{ kN/m}$$

Profile Section $L_{e(m)} = 8$

$$\phi M_b = 28.4 \text{ OKAY}$$

$$I_{xx} = 63.20 \times 10^9 \text{ mm}^4$$

Load Combinations - Serviceability Limit States

$$\text{1kN Load} \quad \text{Long Term (G) } W_s = 1.37 \text{ kN/m}$$

$$\text{Deflection} = 0.7 \text{ mm} \quad 4.5 \text{ mm}$$

$$\text{Limit} \quad 2.0 \text{ mm} \quad \text{Span/ 1680}$$

$$\text{OKAY} \quad \text{Span/ 500}$$

$$G + 0.7 Q = 1.91 \text{ kN/m}$$

$$0.71 \times \text{Wind ult} = 2.73 \text{ kN/m}$$

$$\text{Short } W_s = 2.73 \text{ kN/m}$$

$$8.9 \text{ mm}$$

$$\text{Span/ 842}$$

$$\text{Span/ 300}$$

$$\text{OKAY}$$

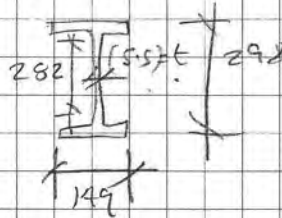
$$\text{Reactions} \quad G \quad Q \quad \text{Wind}_{down} \quad \text{Wind}_{up} \quad \text{Ult}_{down} \quad \text{Ult}_{up}$$

$$5.14 \text{ kN} \quad 2.91 \text{ kN} \quad 5.46 \text{ kN} \quad -14.44 \text{ kN} \quad 11.63 \text{ kN} \quad -9.82 \text{ kN}$$

Roof Beam - Holes

$$V_k = 11.63 \text{ kN} \approx 12 \text{ kN}$$

Use 310 UB 22

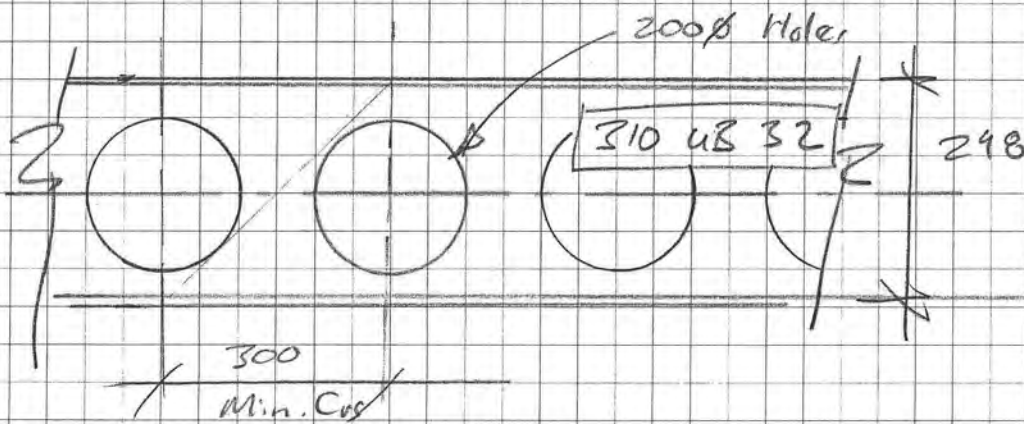


$$R_u = 283 \text{ kN}$$

Try 200 ϕ Holes.

$$R_u = 0.6 \times 0.6 \times 310 \times (282 - 200) \times 5.5 = 50.3 \text{ kN} > 12 \text{ kN} \text{ OKAY}$$

Bending Capacity Limited by buckling capacity for upward loading. Buckling Capacity is not significantly reduce due to holes being added



Date

3/12/09

Eng.

NAF

Job No.

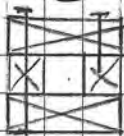
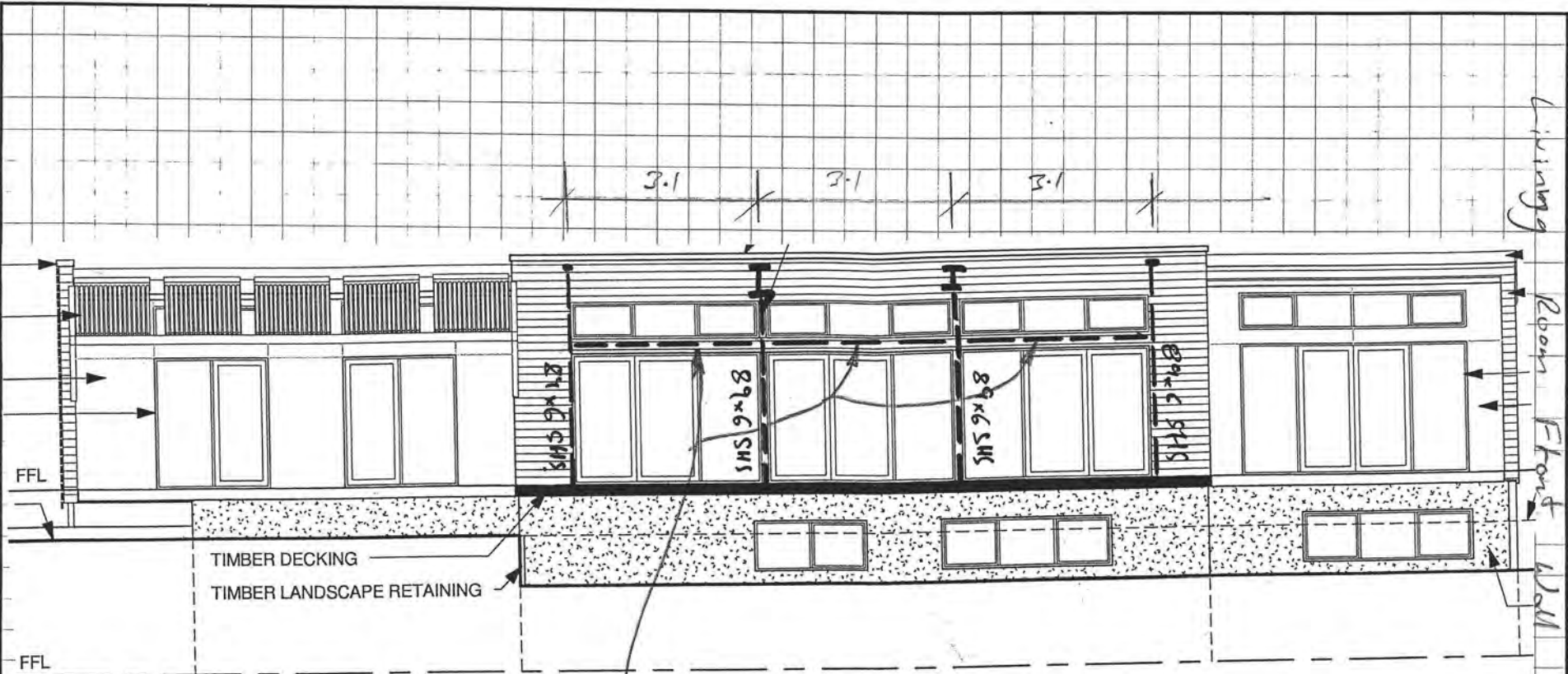
23443

Sheet No.

9

Project

8 Ngauru Rd



140x45
2-45x45
140x45

Mid height Lintel

AS/NZS 1170 STEEL BEAM CALCULATION SHEET

Job Name: 8 Ngarara Rd

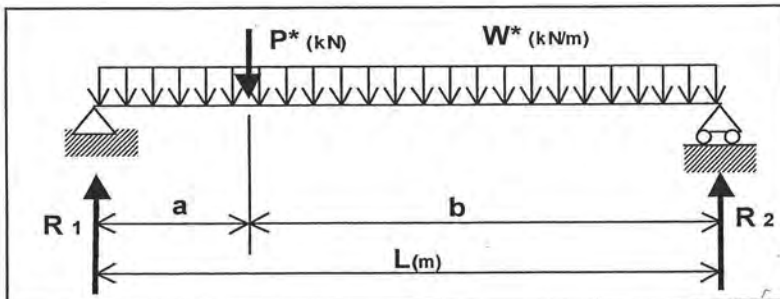
Job No. 23448

Sheet No.

Date: 3-Dec-09

Engineer HAF

Beam No. RBM02



L = 3 m

a = 0.7 m

b = 2.3 m

LOADING

1/. Uniformly Distributed Load

		Amount	kN/m
Dead	Self Weight		0.18
	Roof	0.35kPa x 1.3m	0.46
Total Dead Load		G =	0.63 kN/m

Live	Roof ($\Psi_c = 0$ for Q_f)	0.25ka x 1.3m	0.33
	Floor		
Total Live Load		Q =	0.33 kN/m

$$W^* = 1.2 G + 1.5 Q = 1.25 \text{ kN/m}$$

$$W_s = G + 0.4 Q_f = 0.63 \text{ kN/m}$$

2/. Point Load

		Amount	kN
Dead	RBM01		5.14
	Wind Adjustment Load	(11.63 - 10.53)/1.2	0.92
Total Dead Point Load		G =	6.06 kN
Live	RBM01		2.91
Total Live Point Load		Q =	2.91 kN

Le (m) 1

$$P^* = 1.2 G + 1.5 Q = 11.64 \text{ kN}$$

$$P_s = G + 0.4 Q_f = 7.22 \text{ kN}$$

Bending Moment

$$M^* = W^* L^2 / 8 + P^* ab / L$$

$$M^* = 7.65 \text{ kNm}$$

$$\phi M_b = 33.8 \text{ kNm}$$

okay

$$I_{xx} = 8.34 \times 10^6 \text{ mm}^4$$

Profile

Channel Section

All Steel is Grade 300

Section

150PFC

Serviceability Deflection

$$\text{(Under } W_s + P_s) \Delta = 2.0 \text{ mm}$$

$$= \text{Span} / 1514$$

$$\text{(Under 1 kN Point Load)} \Delta = 0.3 \text{ mm}$$

Reaction	Unfactored Dead & Live
R1	G=5.59kN Q=2.72kN
R2	G=2.36kN Q=1.17kN

Ultimate 1.2G+1.5Q
10.79kN
4.58kN

SLS G+0.4Q
6.49kN
2.63kN

Table 8.2 – Studs in loadbearing walls (see 8.5.1.1) – VSG 8 and MSG 8

1.5 kPa and 2 kPa floor loads

A Single or top storey – Light roof

Wind Zone	Loaded dimension* of wall	Stud sizes for maximum length (height) of:								
		2.4			2.7			3		
		At maximum stud spacing (mm) of:			At maximum stud spacing (mm) of:			At maximum stud spacing (mm) of:		
		400	480	600	400	480	600	400	480	600
	(m)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)
Very high	3.0	90 x 35	90 x 45	90 x 70	90 x 45	90 x 70	90 x 70	90 x 70	90 x 90	90 x 90
	4.5	90 x 35	90 x 45	90 x 70	90 x 45	90 x 70	90 x 70	90 x 70	90 x 90	90 x 90
	6.0	90 x 35	90 x 45	90 x 70	90 x 45	90 x 70	90 x 70	90 x 70	90 x 90	90 x 90
High	3.0	70 x 45	90 x 35	90 x 45	90 x 35	90 x 45	90 x 70	90 x 70	90 x 70	90 x 70
	4.5	70 x 45	90 x 35	90 x 45	90 x 35	90 x 45	90 x 70	90 x 70	90 x 70	90 x 70
	6.0	90 x 35	90 x 35	90 x 45	90 x 35	90 x 45	90 x 70	90 x 70	90 x 70	90 x 70
Medium	3.0	70 x 35	70 x 45	90 x 35	70 x 45	90 x 35	90 x 45	90 x 35	90 x 45	90 x 45
	4.5	70 x 35	70 x 45	90 x 35	70 x 45	90 x 35	90 x 45	90 x 35	90 x 45	90 x 70
	6.0	70 x 35	70 x 45	90 x 35	70 x 45	70 x 45	90 x 45	90 x 35	90 x 45	90 x 70
Low	3.0	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 35
	4.5	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 45
	6.0	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 45
Internal walls	3.0	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 35
	4.5	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 45
	6.0	70 x 35	70 x 35	70 x 45	70 x 35	70 x 45	90 x 35	90 x 35	90 x 35	90 x 45
	(m)	3.6			4.2			4.8		
		At maximum stud spacing (mm) of:			At maximum stud spacing (mm) of:			At maximum stud spacing (mm) of:		
		400	480	600	400	480	600	400	480	600
		(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)	(mm x mm)
Very high	3.0	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70	190 x 70
	4.5	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70	190 x 70
	6.0	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70	190 x 70
High	3.0	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70
	4.5	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70
	6.0	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	190 x 45	190 x 45	190 x 45	190 x 70
Medium	3.0	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	140 x 70	190 x 45
	4.5	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	140 x 70	190 x 45
	6.0	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70	140 x 70	190 x 45
Low	3.0	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70
	4.5	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70
	6.0	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70
Internal walls	3.0	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70
	4.5	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70
	6.0	90 x 70	90 x 70	90 x 70	90 x 90	140 x 45	140 x 45	140 x 45	140 x 70	140 x 70

* For definition of loaded dimension see 1.3.

NOTE –

- (1) Studs 70 mm and 90 mm thick may be replaced with studs of 35 mm and 45 mm thickness respectively, provided they are placed at no more than one half the spacing required for the 70 mm and 90 mm stud they are replacing.
- (2) 140 x 45 may be substituted for 90 x 90. 90 x 35 may be substituted for 70 x 45.
- (3) Studs 70 mm and 90 mm thick may be substituted with built-up members sized in accordance with 8.5.1.2 and nailed together in accordance with 2.4.4.7.

AS/NZS1170 BEAM LOAD CALCULATION SHEET

Timber ~~Beam~~ Beam Calculation Sheet

12

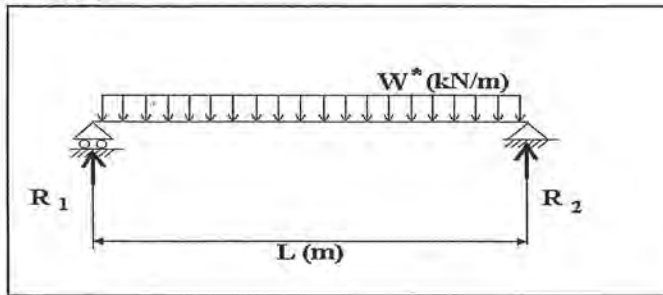
Job Name: 8 Ngarara Rd

Wind Only

Job No. 23448

Date: 3-Dec-09

Engineer HAF
Beam No. L01



L = 3 m
Trib Width = 1.5 m

LOADING

3. Site Wind Speed

$V_{(z)} = 37.00$ m/s

Inward Wind Loads
 $q_{(z)} = 0.5(6_{air})V_{(z)}^2 \times 10^{-3} = 0.82$ kPa

Outward Wind Loads
0.82 kPa

External Pressures

$p_e = C_{pe}K_aK_fK_pq_z$
 $K_a = 1.00$
 $K_f = 1.00$
 $K_p = 1.00$

$C_{pe}(\min) = 0.70$

$p_e(\min) = 0.57$ kPa

$C_{pe}(\max) = -0.5$

$p_e(\max) = -0.41$ kPa

Internal Pressures

$p_i = C_{pi}q_z$

$C_{pi}(\max) = -0.35$

$p_i(\max) = -0.29$ kPa

$C_{pi}(\min) = 0.5$

$p_i(\min) = 0.41$ kPa

Combined Pressures

$p_z = (p_e - p_i)K_c$

$K_c = 1.0$

$p_z(\max) = 0.86$ kPa

$W_{u(in)} = 1.29$ kN/m

$K_c = 1.0$

$p_z(\min) = -0.82$ kPa

$W_{u(out)} = -1.23$ kN/m

Load Combinations - Ultimate Limit State

$W^* = 1.29$ kN/m

$M^* = 1.46$ kNm

Beam Type MSG8/VSG8

Size

140x90

$f_b = 14$

$Z = 0.30$

$\phi = 0.8$ $k_1, k_4, k_5 = 1$

$\phi M_b = \phi \cdot k_1 \cdot k_4 \cdot k_5 \cdot f_b \cdot Z = 3.46$ kNm OKAY

$EI = 168.30$

Load Combinations - Serviceability Limit States

1.5 x 0.6kN Load

Deflection = 3.0mm

Span/ 997

Span/ 500

OKAY

0.71x Wind Ult

Short $W_s = 0.92$ kN/m

5.8mm

Span/ 521

Span/ 300

OKAY

Reactions

1.94 kN

3/12/09

14AF

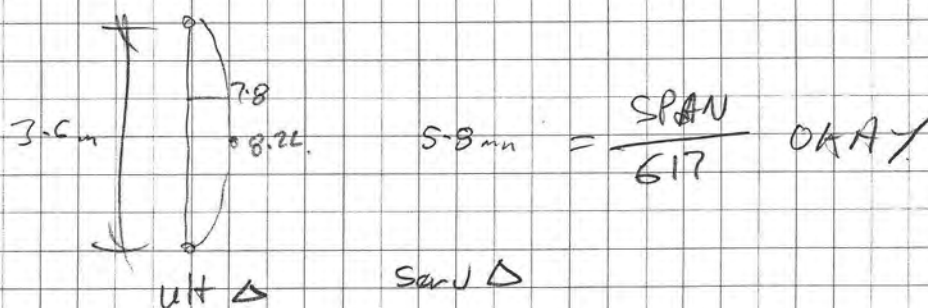
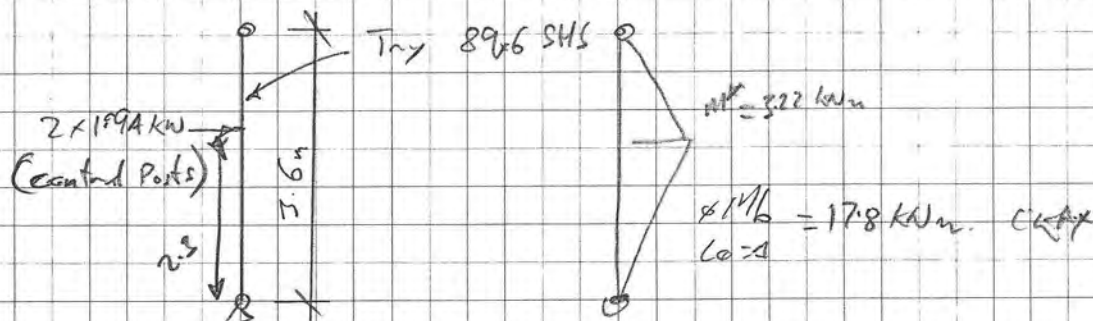
Job No.
27448

13

8 Ngurara Rd

Wind Post in living Room.

(140x90 Timber - No Good)



Use 89x6 SHS for all Posts.

Date 2/12/09

Eng. HAF

Job No. 23448

Sheet No. 14

Project

8 Ngarama Rd.



Floor system

1.5 kPa Live Load (required)

Additional Topping = 15mm conc + 25mm Poly

$$= 0.015 \times 24 + 0.004 = 0.364 \text{ kPa}$$

Allow for 0.5 kPa superimposed Dead Load.

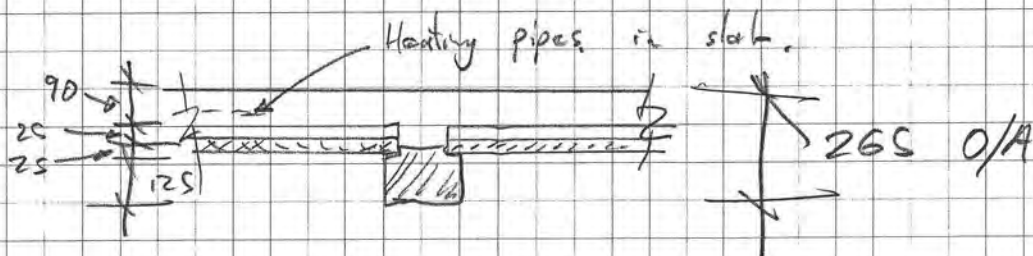
$$\text{Total superimposed load} = 1.5 + 0.364 + 0.5 = 2.4 \text{ kPa}$$

Max Span = 7.4 m

From Tables 125 Rib with 75 Topping - 2.5 kPa

for 8m span. (But vibration issue)

Additional 15mm topping and poly should solve this problem.



$$\text{Seismic Weight of Floor} = 2.5 + 0.364 \approx \underline{2.9 \text{ kPa}}$$

INTERSPAN LOAD SPAN TABLE

J.28448/15

Maximum live load in kPa for spans in metres

RIB DEPTH mm	OVERALL FLOOR THICKNESS mm	DEAD WEIGHT OF FLOOR (Including topping) kpa	SIMPLY SUPPORTED SPANS m									
			4	5	6	7	8	9	10	11	12	13
100	200	2.4	15.3	8.1	4.8	2.9	1.4					
125	225	2.5		10.8	7.0	4.3	2.5	1.5				
150	250	2.6			8.3	6.0	4.5	3.0	1.5			
175	275	2.7			12.6	8.4	5.7	4.0	2.6	1.7		
200	300	2.9				10.3	7.3	5.5	4.0	2.6	1.6	
225	325	3.0					9.2	6.7	4.9	3.0	2.3	1.5
250	350	3.1					11.2	8.0	6.0	4.4	3.5	2.3

This chart maximises live load capacity for individual, simply supported, Interspan ribs of various depth and span. The self weight of the prestressed floor system (including the topping) has been included. No superimposed dead load has been allowed, ie. SDL = 0 kPa.

Spans to the right of the bold (zig zagged) line exceed the maximum desirable span/overall depth ratio of 32 and should be used with caution. For spans exceeding this value, please check with Firth Engineering Services.

The live load values have been principally determined by:-

- 1) Serviceability limit considerations ie. deflection, precamber, extreme concrete fibre tensile and compressive stresses, and vibration.
- 2) Bond break requirements.
- 3) Differential precamber.
- 4) Fire Resistance Rating. For FRR in excess of 60 mins, please contact your local Firth Stresscrete precast flooring supplier.

INTERSPAN FLOORING NOTES:

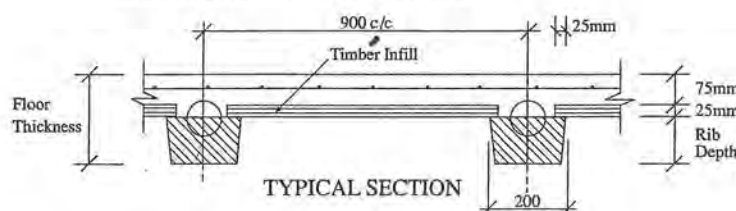
Increased Load Capacities

The load carrying capacity of the Interspan flooring system may be increased by specifying the following:-

- a) Double ribs
- b) Reducing the rib centres
- c) Increasing the topping strength
- d) Providing structural continuity

Seating: (Refer NZS 3101:1995 C1.4.3.6.4)

A seating of 75mm is recommended for the Interspan ribs. The timber infills require 25mm seating onto the ribs and the surrounding support structure.



Contact Your Local Firth Stresscrete Factory For Information on Available Sections

AUCKLAND

Phone: 0-9-274 5699 Fax: 0-9-527 1549
P.O. Box 14-212, Panmure

HAMILTON

Phone: 0-7-849 4879 Fax: 0-7-849 3150
P.O. Box 10090

MT MAUNGANUI

Phone: 0-7-575 3102 Fax: 0-7-575 6955
P.O. Box 4100, Mt Maunganui, South

NEW PLYMOUTH

Phone: 0-6-759 8113 Fax: 0-6-759 8116
P.O. Box 3122, Fitzroy

BULLS

Phone: 0-6-322 1267 Fax: 0-6-322 0835
P.O. Box 40

OTAKI

Phone: (06) 364 8126 Fax: (06) 8344
PO Box 169, Otaki

WELLINGTON

Phone: 0-4-560 9077 Fax: 0-4-566 9206

BLENHEIM

Phone: 0-3-578 5119 Fax: 0-3-578 5117
P.O. Box 250

CHRISTCHURCH

Phone: 0-3-343 0294 Fax: 0-3-343 0921
P.O. Box 8369, Riccarton

INVERCARGILL

Phone: 0-3-218 6709 Fax: 0-3-214 4636
P.O. Box 506

ENGINEERING SERVICES

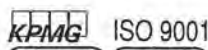
Phone: 0-9-274 5699 Fax: 0-9-527 1549
P.O. Box 14212, Panmure

NATIONAL SUPPORT OFFICE

Phone: 0-9-520 4654 Fax: 0-9-529 0963
Private Bag 99 904, Newmarket

TOLL FREE CUSTOMER SUPPORT

0800 800 576



Registered Firm

June 1997

All Stresscrete Plants have quality management systems certified to ISO9001. This covers the Design/Development and Manufacture of prestressed and precast concrete products.

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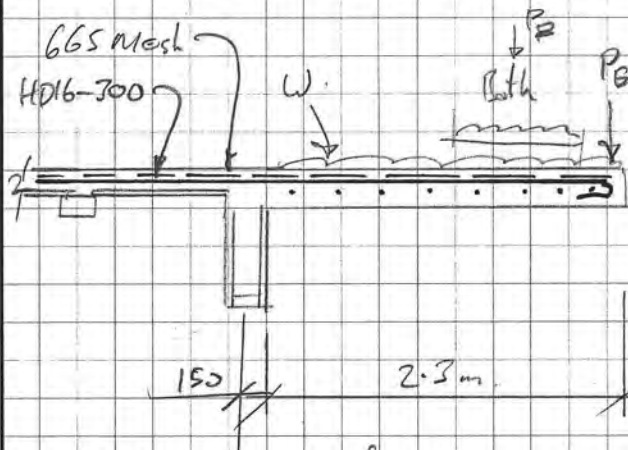
HAF

23448

16

8 Ngaurua Rd.

Cantilever slab



$$\begin{aligned} & \text{Assume } f_y = 300 \\ & 200 = \frac{2300}{15 (\text{min})} = 177 \text{ mm} \approx 200 \text{ mm} \\ & \frac{2300}{10} = 230 \text{ with ribs} \end{aligned}$$

$$\begin{aligned} P_E \quad G &= 1.7 \times 0.35 + 1.0 = 1.6 \text{ kN/m} \\ Q &= 1.7 \times 0.35 = 0.425 \text{ kN/m} \\ W \quad G &= 0.2 \times 24 = 4.8 \text{ kN/m} \\ Q &= 1.5 \text{ kPa} = 1.5 \text{ kN/m} \end{aligned}$$

P_B Allowance for additional load of bath = $5 \text{ kPa} \times 1.0 = 5 \text{ kN}$

$$P_E^* = 1.2 \times 1.6 + 1.5 \times 0.425 = 2.56 \text{ kN} \quad \frac{2.56}{2.4} = 1.07 \text{ kN/m}$$

$$P_B^* = 1.2 \times 5 = 6 \text{ kN} \quad \frac{6}{1.85} = 3.24 \text{ kN/m}$$

$$W^* = 1.2 \times 4.8 + 1.5 \times 1.5 = 8.01 \text{ kN} \quad \frac{8.01 \times 2.3^2}{2} = 24.0 \text{ kNm}$$

Reinforce with 66S mesh + HD16 at 150 mm

$$A_s = 817 \text{ mm}^2 \quad \text{use } f_y = 300 \text{ (for deflection control)}$$

$$\text{mesh } d = 165 \text{ (cover } = 32) \quad \text{HD16 } d = 150 \quad d_v = 152$$

$$\alpha = 11.57 \quad \phi M_L = 50.46 \text{ kNm} > 42.3 \text{ kNm} \quad \text{OKAY}$$

$$\text{If } f_y = 300 \quad \phi M_L = 84.67 \text{ kNm}$$

3/12/09

MAF

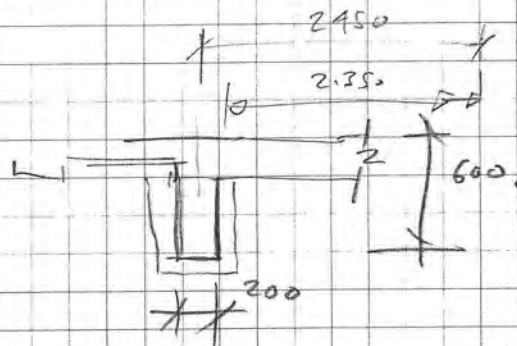
23448

18

8 Ngurano Rd

Garage Lintel

Span 4.8m

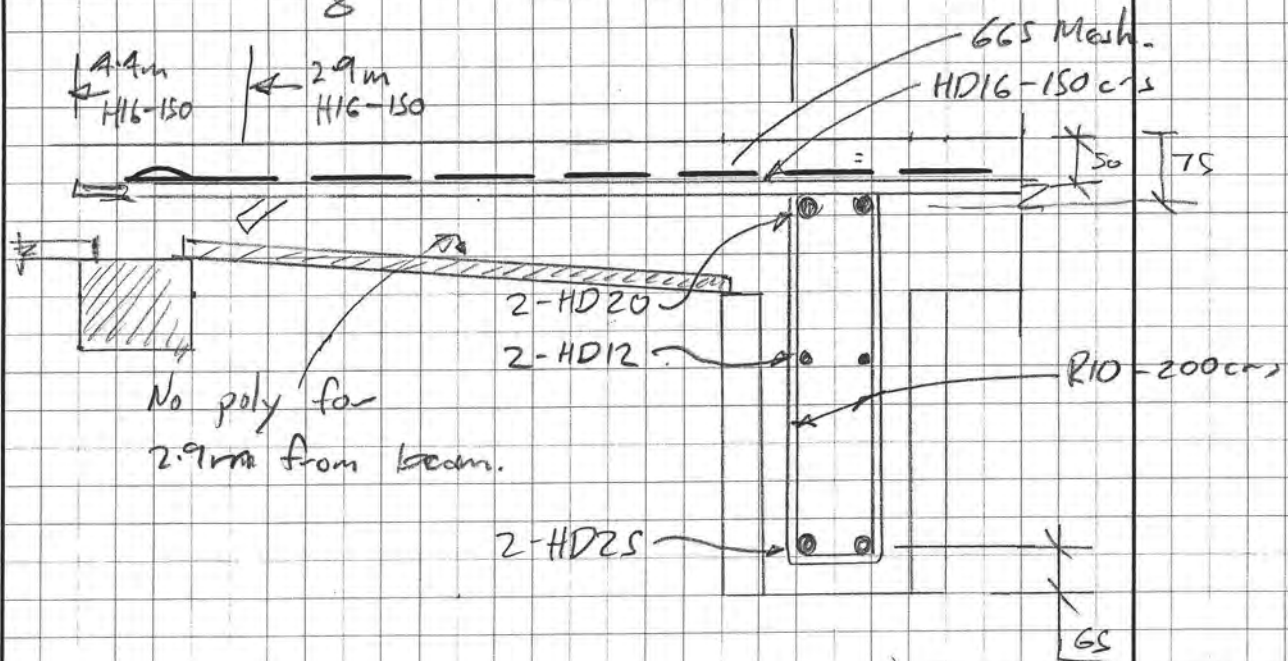


$$W_{\text{slab}}^* = 2.56 + 8.01 \times 2.450 = 22.18 \text{ kN/m}$$

$$W_{\text{cholo}}^* = 2 \times 22.18 + 1.2 \times \left(\frac{2 \times 4 \times 24}{1.92} \right) = 46.7 \text{ kN/m}$$

$$M^* = \frac{46.7 \times 4.8^2}{8} = 134.5 \text{ kNm}$$

$$V^* = 112 \text{ kN}$$



CONCRETE BEAM DESIGN SHEET

Job Name: 8 Ngarara Road

Job No. 23448

Engineer HAF

Beam: Garage Lintel

Date: 3-Dec-09

Beam Loads

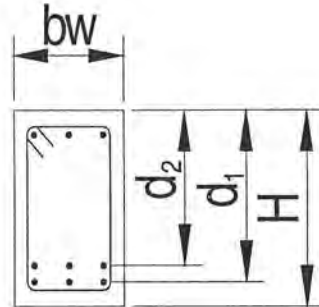
$M_{ult} = 134.5$ kNm

$V_{ult} = 112$ kN

Concrete Details

Depth 'H' = 600 mm

Width 'bw' = 200 mm



Exposure Exterior Mod
Conc ' f_c ' = 25MPa

Cover min = 40 mm

Cover = 43 mm

Okay

Tension Reinforcement

Tension Steel ' f_y ' = 500 MPa
Bar size = 25
Bar size = 0
Bar size = 0

No. = 2

$d_1 = 535$

No. = 0

$d_2 = 0$

No. = 0

$d_3 = 0$

$A_s = 980$

$d_{av} = 535$

Bending Capacity

Bending $\phi = 0.85$

$\rho_w = 0.009$ Okay

$a = A_s \cdot f_y / 0.85 \cdot b_w \cdot f_c = 115.29$ mm

Okay

$\phi M = \phi \cdot A_s \cdot f_y \cdot (d - a/2) = 198.82$ kNm

OKAY

Concrete Shear Capacity

Shear $\phi = 0.75$

$v_c = (0.07 + 10\rho_w) \cdot \sqrt{f_c} = 0.81$ MPa

$\phi V_c = \phi \cdot v_c \cdot d \cdot b_w = 65$ kN

Stirrups Required

Combined Steel & Concrete Shear Capacity

Shear Steel ' f_{ys} ' = 300 MPa

Okay

Bar size = 10

Legs = 2 Spacing = 200 mm

$v_s = A_v \cdot f_{ys} / b_w \cdot s = 1.17$ MPa

Okay

$A_v = 156$ mm²

$v_n = v_c + v_s = 1.98$ MPa

Okay

$\phi V = \phi v_n \cdot d \cdot b_w = 159$ kN

OKAY

2/12/09

HAF

23448

20

8 Ngarara Road.

Concrete Lintel

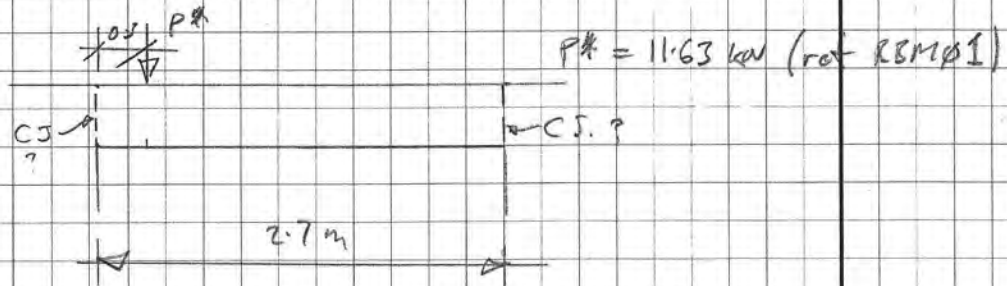
$$\text{Load } G \neq \text{Wall} = 1.0 \text{ kN/m} = 1.0$$

$$\text{Lintel} = 0.25 \times 4 \times 24 = 2.4$$

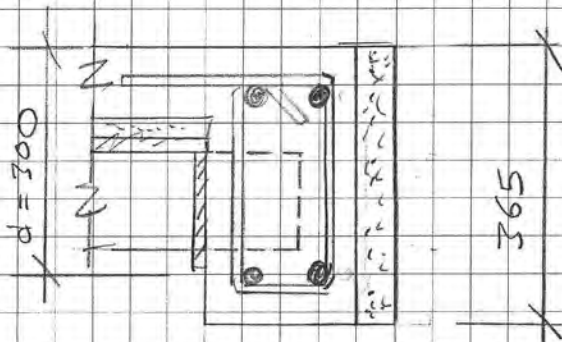
$$\text{Floor} = 2.9 \times \frac{7.9}{2} = \frac{10.73}{14.13}$$

$$Q \text{ Floor} = 1.5 \times \frac{7.9}{2} = 5.55$$

$$W^* = 1.2 \times 14.13 + 1.5 \times 5.55 = 25.3 \text{ kN/m}$$



$$M^* = \frac{W^* \times L^2}{8} + \frac{P^* \times a \times b}{L} = \frac{25.3 \times 2.7^2}{8} + \frac{11.63 \times 0.3 \times 2.4}{2.7} = 23 + 3.1 = 26.1 \text{ kNm}$$



$$b = 200$$

$$\text{Try } 2\text{-HD16} \quad A_s = 402 \text{ mm}^2 \quad f_y = 500$$

$$a = \frac{A_s f_y}{0.85 f_c b} = 47.3 \text{ mm} \quad f_c = 25$$

$$\phi M_b = 0.85 A_s f_y \left(d - \frac{a}{2} \right)$$

$$= 0.85 \times 402 \times 500 \times \left(300 - \frac{47.3}{2} \right) = 47.2 \text{ kNm}$$

OKAY

$$V^* = 25.3 \times \frac{2.7}{2} + 11.6 \times \frac{2.4}{2.7} = 44.5 \text{ kN}$$

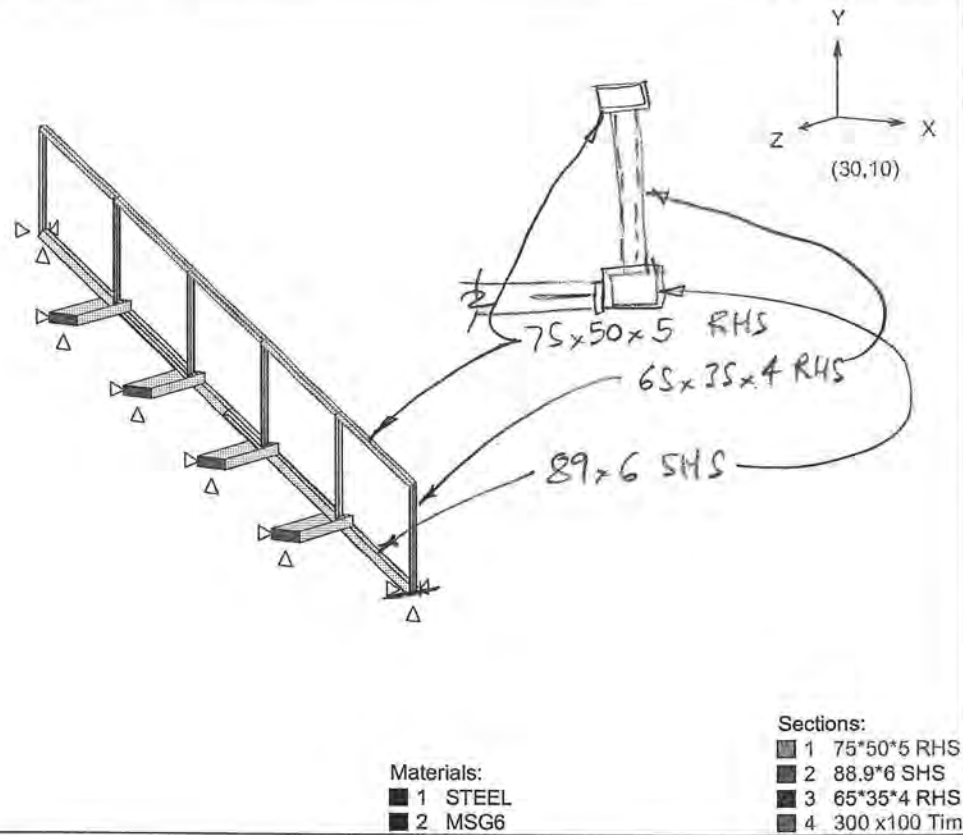
$$\text{Try } R6\text{-ISOcrs.}$$

$$v_c = (0.07 + 0.09) \sqrt{f_c} = 0.62 \text{ MPa}$$

$$v_s = \frac{A_v f_{ys}}{b_w s} = 0.9 \text{ MPa}$$

$$v_u = 1.51 \text{ MPa}$$

$$\phi V = \phi v_u \cdot d \cdot b_w = 73 \text{ kN} > 44.5 \text{ kN} \quad \text{OKAY}$$



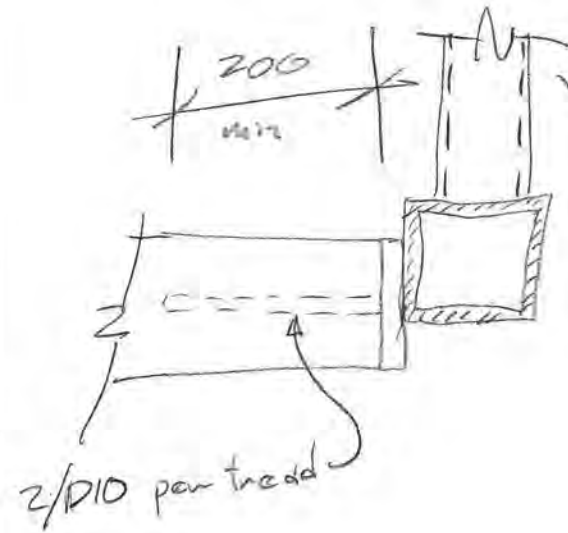
Job: I:\JOBFILES\ISP\23400\23448\23448 stair

Units - Len: m, Sec: mm, Mat: MPa, Dens: T/m³, Temp: Celsius, Force: kN, Mom: kNm, Mass: T, Acc: g's, Trans: mm, Stress: MPa

Scales - Frame: 1:71, Load: None, Disp: None, Moment: None, Shear: None, Axial: None, Torsion: None

Stair Design Summary

8/12/09



J.23448/21

Date

8/12/09

Eng.

HAF

Job No.

23442

Sheet No.

22

Project

8 Uguraru Rd



Stair stringer.

$$W_F = 0.25 \times 1.6 = 0.85 \text{ kN/m}$$

$$W^* = 1.2 \times 0.85 + 1.5 \times 1 = 2.52 \text{ kN/m}$$

$$M^* = \frac{2.52 \times 4^2}{8} = 5.04 \text{ kNm}$$

$$89 \times 6 \text{ SHS } L_e = 5 \quad \phi M_b = 17.9 \text{ kNm} \quad \text{OKAY.}$$

Stair Top rail

$$W^* = 0.35 \times 1.3 = 0.525 \text{ kN/m} \quad M^* = \frac{0.525 \times 0.85^2}{8} = 0.045 \text{ kNm}$$

$$75 \times 50 \times 3 \text{ RHS on flat } L_e = 1 \quad \phi M_b = 6.52 \text{ kNm} \quad \text{OKAY.}$$

Stair Post

$$P^* = (0.525 \times 0.85) = 0.45 \text{ kN} \quad M^* = 1 \times 0.45 = 0.45 \text{ kNm}$$

$$68 \times 35 \times 2.3 \text{ RHS } L_e = 2.0 \quad \phi M_b = 4.01 \text{ kNm} \quad \text{OKAY}$$

By inspection SHS will transfer load to treads with torsion.

$$\text{Load per tread} = \frac{0.45}{1.85} \times 2.3 = 0.15 \text{ kNm from}$$

$$\text{previous calc's capacity} = 0.85 \text{ kNm} \quad \text{OKAY}$$

Reactions.

Top Rtn

$$G \quad 1.4 \text{ kN} \quad 1.4 \text{ kN}$$

$$Q \quad 2.5 \text{ kN} \quad 2.5 \text{ kN}$$

$$\text{ult} \quad 5.4 \text{ kN} \quad 5.4 \text{ kN}$$

8/12/09

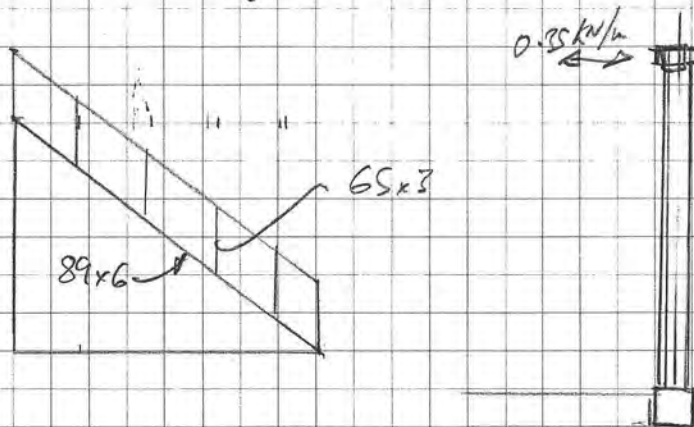
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123442

23

8 Ngarara Rd

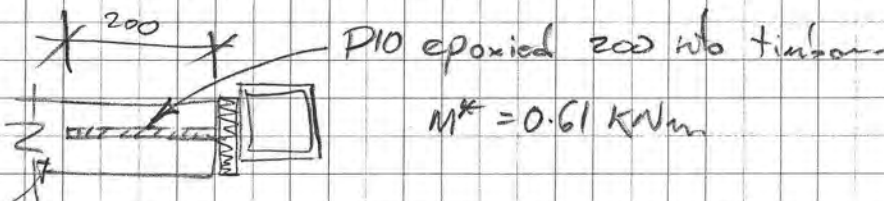
Stair stringer and handrail

Posts at $280 \times 2 = 560 \text{ cns max}$

$$\rightarrow (0.35 \times 1.5) \times 0.8 \times 1 = 0.441 \text{ kNm}$$

$$G = 1 \times 5 \text{ kN/m} \times 0.5 = 0.25 \text{ kPa} + \text{Rail weight}$$

$$Q = 1.5 \times 2.0 = 1.0 \text{ kPa}$$



$$M^* = 0.61 \text{ kNm}$$

300x100 Timber

$$\phi M_b = \frac{1.5 \times 2}{2} \times 10 \times 0.8 \times 0.8 = 3.2 \text{ kNm OKAY}$$

1-M10
78

$$f_c = 15 \text{ MPa}$$

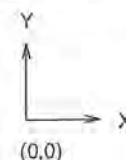
$$d_{min} = \frac{78 \times 300}{0.5 \times 15 \times 300} = 10.4 / 3 = 3.5$$

$$\phi M_b = 0.8 \times 78 \times (50 - 3.5) \times 300 = 0.87 \text{ kNm}$$

Load cases 3,12:

■ 3 ——— 1 kN
 ■ 12 ——— (SW) G+0.7 Q

Vertical Deflection



No general restraint

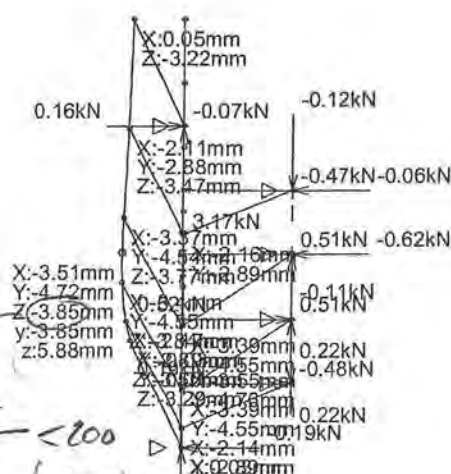
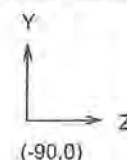
Materials:
 ■ 1 STEEL
 ■ 2 MSG6

Sections:
 ■ 2 88.9*6 SHS

Load cases:

■ 12 ——— (SW) G+0.7 Q

Lateral Deflection



No general restraint

Materials:
 ■ 1 STEEL
 ■ 2 MSG6

Sections:
 ■ 1 75*50*3 RHS
 ■ 2 88.9*6 SHS
 ■ 3 65*35*3 RHS
 ■ 4 300 x100 Tim

Date

14/12/09

Eng.

MAF

Job No.

23448

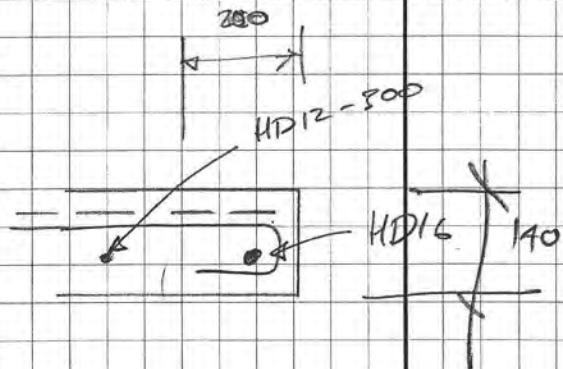
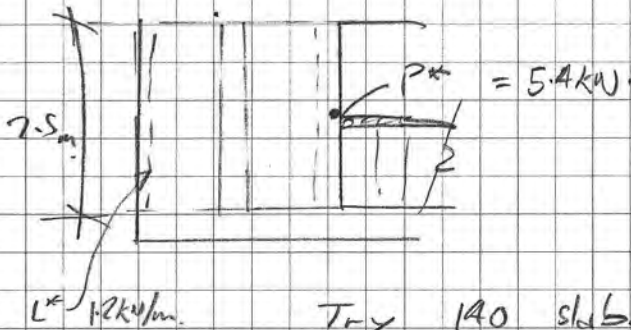
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Project

8 Ngara RS

Entry Foyer slab.



$$G = 1.2 \times 2.4 \times 1 = 3.36 \text{ kN/m}$$

$$Q = 1.5 \times 1 = 1.5 \text{ kN/m}$$

$$W^* = 1.2 \times 3.36 + 1.5^2 = 6.3 \text{ kN/m}$$

$$M^* = \frac{WL^2}{8} = \frac{6.3 \times 2.5^2}{8} = 4.9 \text{ kNm}$$

$$V^* = 1.25 \times 6.3 = 7.9 \text{ kN}$$

$$\phi M_b \text{ H12-300} = 10.57 \text{ kNm}$$

$$\phi V_c = 33 \text{ kN OKAY}$$

$$L^* \text{ Moment} = \frac{1.2 \times 2.5^2}{8} = 0.94 \text{ kNm (Not critical)}$$

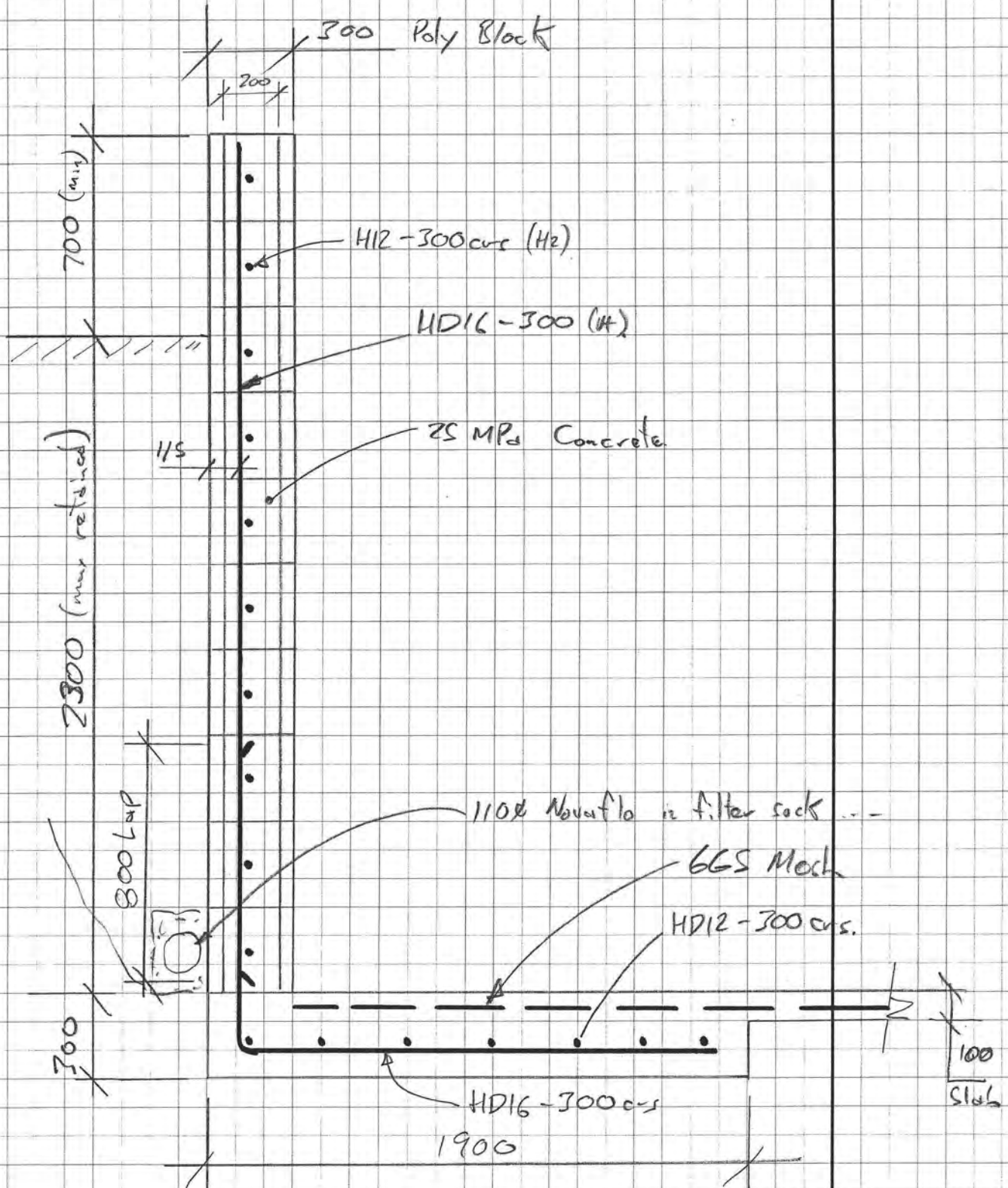
$$P^* \text{ Moment} = \frac{5.4 \times 2.5}{4} = 3.4 \text{ kNm}$$

Additional Capacity Due to edge HD16. (200 edge)

$$M^* = 3.4 + (4.9 \times 0.2) = 4.4 \text{ kNm}$$

$$\phi M_b = 4.97 \text{ kNm OKAY}$$

Entry Foyer Wall.



Job Name: 8 Ngarara Road

Job Number: 23448

Date: 2-Dec-09

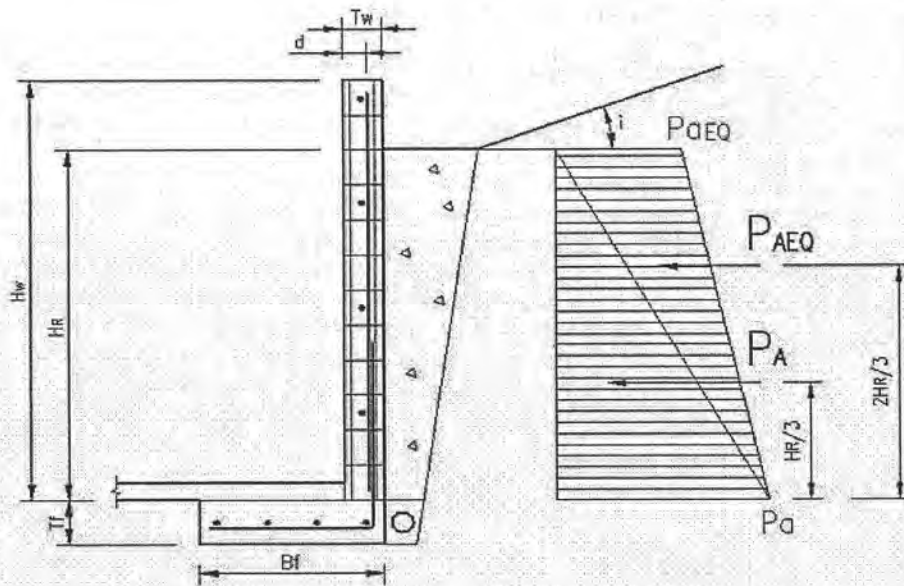
Location: Entry Foyer

Engineer: HAF



CALCULATIONS

Seismic Cantilever Retaining Wall Calculation Sheet



$$\theta = \tan^{-1} \left(\frac{k_h}{1 - k_v} \right)$$

$$C_h(T=0).S_p.Z.R=K_h=0.30$$

$$K_v=0.00$$

$$K_h/1-K_v=0.30$$

$$\text{Gives } \theta = 0.291$$

$$K_a(\phi, \delta) := \frac{\cos(\phi - \alpha)^2}{\cos(\alpha)^2 \cdot \cos(\delta + \alpha) \cdot \left(1 + \sqrt{\frac{\sin(\delta + \phi) \cdot \sin(\phi - i)}{\cos(\delta + \alpha) \cdot \cos(i - \alpha)}} \right)^2}$$

$$K_{aEQ}(\phi, \delta, \theta) := \frac{\cos(\phi - \alpha - \theta)^2}{\cos(\alpha)^2 \cdot \cos(\theta) \cdot \cos(\delta + \alpha + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\delta + \phi) \cdot \sin(\phi - i - \theta)}{\cos(\delta + \alpha + \theta) \cdot \cos(i - \alpha)}} \right)^2}$$

$$\begin{aligned} H_R &= 2.3 \text{ m} \\ H_w &= 3 \text{ m} \\ \gamma &= 18 \text{ kN/m}^3 \\ \phi &= 30 \text{ degrees} \\ \delta &= 15 \text{ degrees} \\ \alpha &= 0 \text{ degrees} \\ i &= 0 \text{ degrees} \end{aligned}$$

(Mononobe-Okabe Theory)

$$\text{Gives } K_a = 0.301$$

$$\text{Gives } K_{aEQ} = 0.563$$

Ultimate Limit State

(kN/meter length)

$$P_A = K_a \gamma H^2 / 2 = 14.35 \text{ kN}$$

$$P_a = P_A / 0.5 H_R = 12.48 \text{ kPa}$$

$$P' = P_{AEQ} = K_{aEQ} \gamma H^2 / 2 = 26.78 \text{ kN}$$

$$\Delta P_{AEQ} = P_{AEQ} - P_A = 12.43 \text{ kN}$$

$$P_{aEQ} = \Delta P_{AEQ} / 0.5 H_R = 10.81 \text{ kPa}$$

$$\text{Static case} = 1.6 P_A$$

$$M_{\text{static}} = 1.6 \times P_A \times H_R / 3 = 17.60 \text{ kNm}$$

$$\text{Seismic case} = P_A + \Delta P_{AEQ}$$

$$M_{\text{seismic}} = P_A \times H_R / 3 + \Delta P_{AEQ} \times 2 H_R / 3 = 30.07 \text{ kNm}$$

Wall Capacity

$$M' = 30.07 \text{ kNm}$$

Restoring Moment

$$B_f = 1.90 \text{ m}$$

$$T_f = 0.3 \text{ m}$$

$$\begin{aligned} \text{Weights } W_w &= 22 \text{ kN/m}^3 \times T_w \times H_w = 13.2 \text{ kN/m} \quad (14.4) \\ W_f &= 24 \text{ kN/m}^3 \times T_f \times B_f = 13.68 \text{ kN/m} \\ W_t &= 26.88 \text{ kN/m} \end{aligned}$$

Flexural Capacity

$$f_c = 25 \text{ MPa}$$

$$d = 125 \text{ mm}$$

$$T_w \text{ (wall thickness)} = 200 \text{ mm}$$

$$f_y = 500 \text{ MPa}$$

$$\text{Bar Diameter} = 16 \text{ mm}$$

$$\text{Bar Spacing} = 300 \text{ mm}$$

$$\text{Gives } A_s = 670 \text{ mm}^2/\text{m}$$

$$\text{Compressive Block Centroid Depth } a = 15.8 \text{ mm}$$

$$\phi M_R = 0.9 [W_w \times (b_f - T_w / 2) + W_f \times B_f / 2] = 33.08 \text{ kNm}$$

> M* - OK Restoring Moment

$$\phi M_b = 0.85 A_s f_y (d - a / 2) = 33.36 \text{ kNm}$$

> M* - OK Flexural

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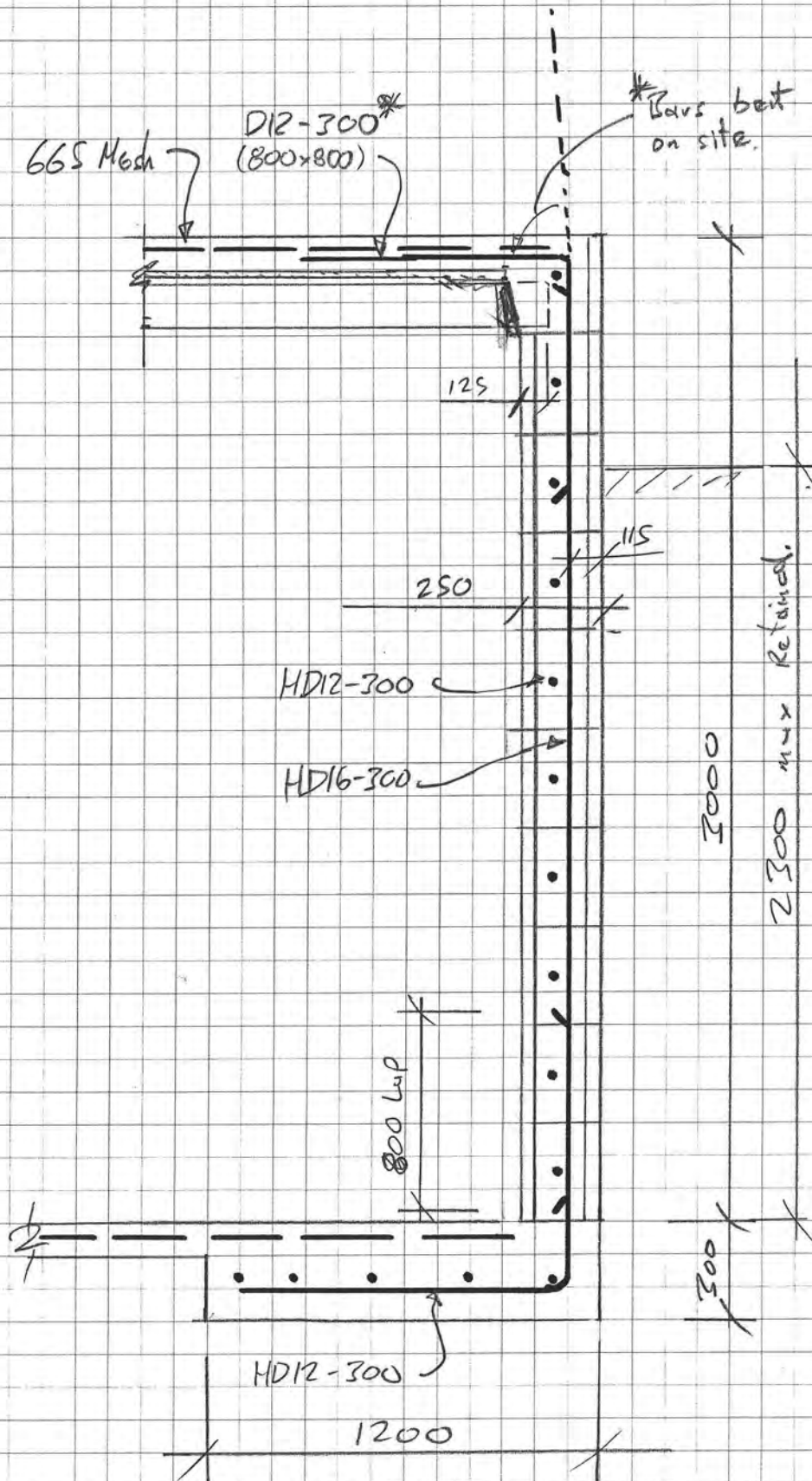
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Project

3 Ngarama Rd.

SP
CALCULATIONS

Date

2/12/09

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Job No.

23448

Sheet No.

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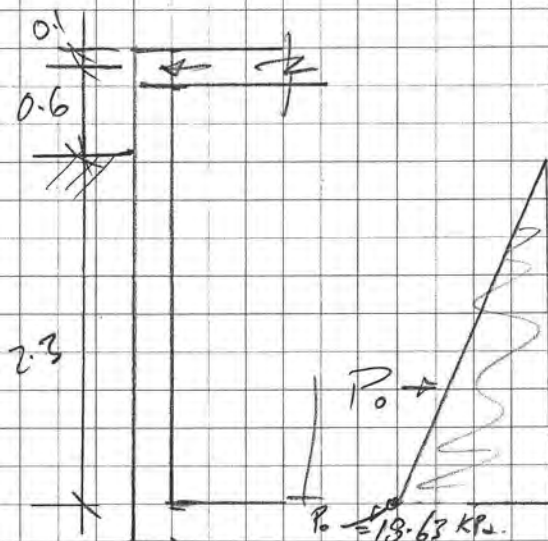
Project

8 Ngwura Rd.



 CALCULATIONS

Retain walls of basement.



$$P_0 = k_0 \times H^2 / 2$$

$$0.45 \times 18 \times 2.3^2 / 2 = 21.4 \text{ kN}$$

 P_E

$$P_E = 9.315 \text{ kPa}$$

$$\Delta P_E = 0.7 \times 0.7 \times 18 \times 2.3^2$$

$$= 21.4 \text{ kN}$$

Model is space gress

$$M^* = 18.4 \text{ kNm}$$

$$d = 75$$

Try HD16-300cur

and

$$8.94 \text{ kNm mid height}$$

$$d = 75$$

and

HD16-300cur

$$M_b = 19.18 \text{ kNm}$$

$$M_b = 19.12 \text{ kNm}$$

OKAY

Consider Restoring Moment.

$$\text{Wall Wt} = 15 \times 3 \times 24 = 10.8 \text{ kN}$$

$$\text{Floor Wt} = 2.8 \text{ kPa} \times (1.5) = 3.9$$

$$\text{W. Wall} = 1 \text{ kN/m} = 1.0$$

$$15.8 \text{ kN} \times 0.9 \times 1.2 = 15.95$$

$$\text{Footing} = 3 \times 1.2 \times 24 = 8.64 \times 0.9 \times 0.6 = 4.66$$

$$\text{Total Wt} = 21.9$$

$$21.6 \text{ kNm} > 18.4$$

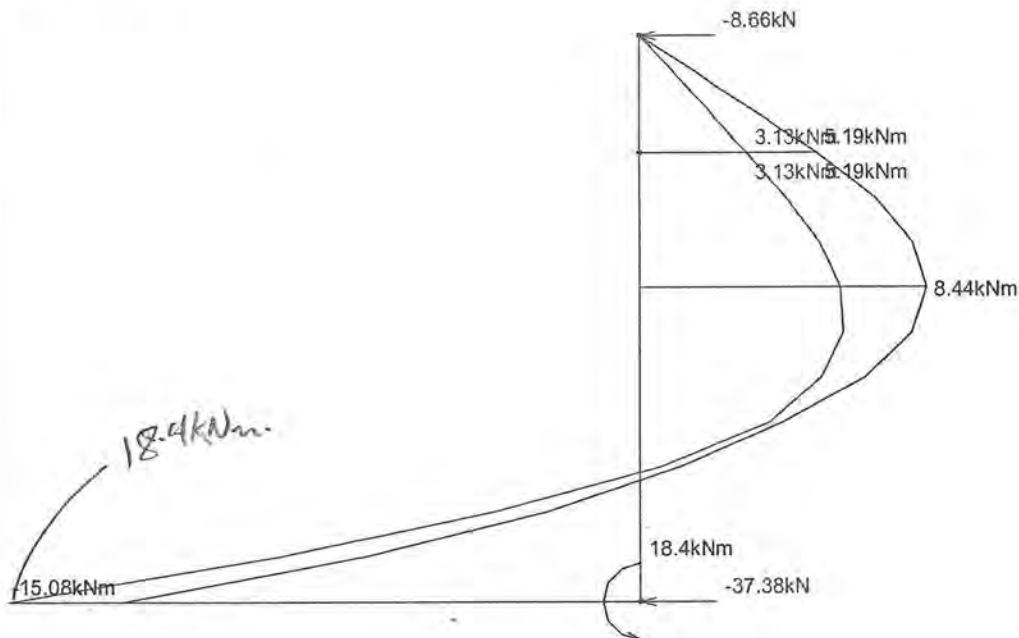
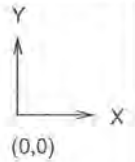
$$e = \frac{21.60 - 18.4}{21.9} = 0.14 \text{ m}$$

$$\sigma_{1/2} = \frac{21.6}{2 \times 18} = 78 \text{ kPa OKAY}$$

30

Envelope for all combination load cases:

■ Min
 ■ Max



Materials:
 ■ 1 CONCRETE-25

Sections:
 ■ 1 Concrete Wall

Job: I:\JOBFILES\ISP\23400\23448\23448 Basement walls

Units - Len: m, Sec: mm, Mat: MPa, Dens: T/m³, Temp: Celsius, Force: kN, Mom: kNm, Mass: T, Acc: g's, Trans: mm, Stress: MPa

Scales - Frame: 1:39, Load: None, Disp: None, Moment: 0.221184, Shear: None, Axial: None, Torsion: None

Date

3/12/09

Eng.

MAF

Job No.

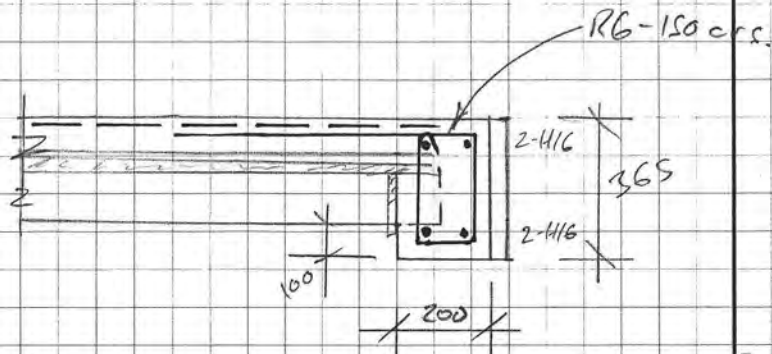
23448

Sheet No.

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Project

8 Ngara Rd



LINTEL (max span 2.7m)

125 Posts
at 1.0 c/c
1000 min

250

50

1000 max

equal to wall height

HD12-300 c/c

HD12-300 c/c

800 up

1500

(1500 max below)

300

1200

WALL BELOW BASEMENT

WINDOWS.

Job Name: 8 Ngarara Road

Job Number: 23448

Date: 2-Dec-09

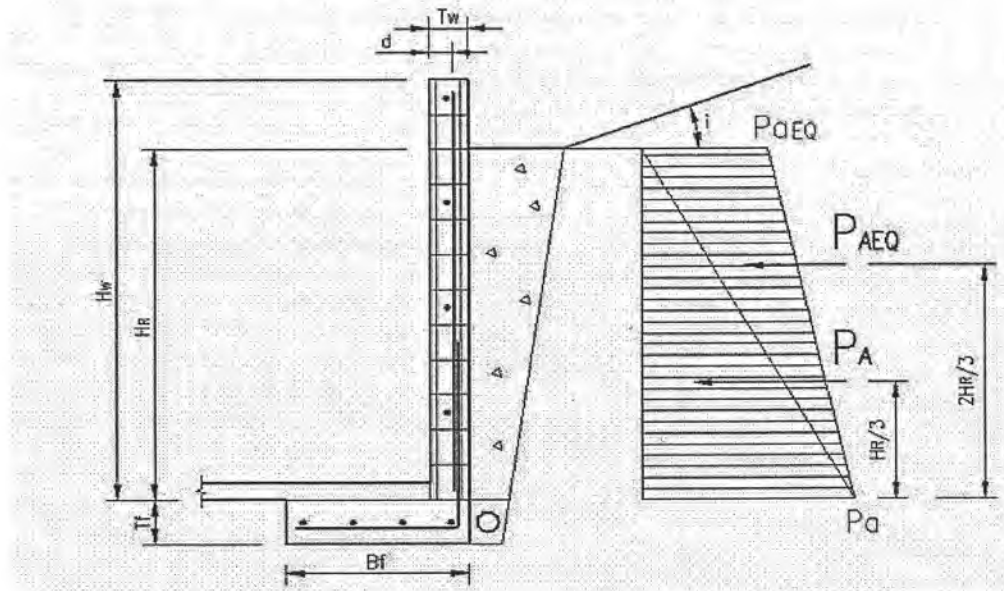
Location: Below Window

Engineer: HAF



CALCULATIONS

Seismic Cantilever Retaining Wall Calculation Sheet



$$\theta = \tan^{-1} \left(\frac{k_h}{1 - k_v} \right)$$

$$C_h(T=0), S_p, Z, R = K_h = 0.30$$

$$K_v = 0.00$$

$$K_h/1 - K_v = 0.30$$

$$\text{Gives } \theta = 0.291$$

$$K_a(\phi, \delta) := \frac{\cos(\phi - \alpha)^2}{\cos(\alpha)^2 \cdot \cos(\delta + \alpha) \cdot \left(1 + \sqrt{\frac{\sin(\delta + \phi) \cdot \sin(\phi - i)}{\cos(\delta + \alpha) \cdot \cos(i - \alpha)}} \right)^2}$$

$$K_{aEQ}(\phi, \delta, \theta) := \frac{\cos(\phi - \alpha - \theta)^2}{\cos(\alpha)^2 \cdot \cos(\theta) \cdot \cos(\delta + \alpha + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\delta + \phi) \cdot \sin(\phi - i - \theta)}{\cos(\delta + \alpha + \theta) \cdot \cos(i - \alpha)}} \right)^2}$$

$$\begin{aligned} H_R &= 1.5 \text{ m} \\ H_w &= 1.5 \text{ m} \\ \gamma &= 18 \text{ kN/m}^3 \\ \phi &= 30 \text{ degrees} \\ \delta &= 15 \text{ degrees} \\ \alpha &= 0 \text{ degrees} \\ i &= 0 \text{ degrees} \end{aligned}$$

(Mononobe-Okabe Theory)

$$\text{Gives } K_a = 0.301$$

$$\text{Gives } K_{aEQ} = 0.563$$

Ultimate Limit State

(kN/meter length)

$$P_A = K_a \gamma H^2 / 2 = 6.10 \text{ kN}$$

$$P_a = P_A / 0.5 H_R = 8.14 \text{ kPa}$$

$$P^* = P_{aEQ} = K_{aEQ} \gamma H^2 / 2 = 11.39 \text{ kN}$$

$$\Delta P_{aEQ} = P_{aEQ} - P_A = 5.29 \text{ kN}$$

$$P_{aEQ} = \Delta P_{aEQ} / 0.5 H_R = 7.05 \text{ kPa}$$

$$\text{Static case} = 1.6 P_A$$

$$M_{\text{static}} = 1.6 \times P_A \times H_R / 3 = 4.88 \text{ kNm}$$

$$\text{Seismic case} = P_A + \Delta P_{aEQ}$$

$$\begin{aligned} M_{\text{seismic}} &= P_A \times H_R / 3 + \\ &\quad \Delta P_{aEQ} \times 2 H_R / 3 = 8.34 \text{ kNm} \end{aligned}$$

Wall Capacity

$$M^* = 8.34 \text{ kNm}$$

Restoring Moment

$$B_f = 1.20 \text{ m}$$

$$T_f = 0.3 \text{ m}$$

$$\text{Weights } W_w = 22 \text{ kN/m}^3 \times T_w \times H_w = 5.0 \text{ kN/m}$$

$$W_f = 24 \text{ kN/m}^3 \times T_f \times B_f = 8.64 \text{ kN/m}$$

$$W_t = 13.59 \text{ kN/m}$$

Flexural Capacity

$$f_c = 25 \text{ MPa}$$

$$d = 75 \text{ mm}$$

$$T_w (\text{wall thickness}) = 150 \text{ mm}$$

$$f_y = 500 \text{ MPa}$$

$$\text{Bar Diameter} = 12 \text{ mm}$$

$$\text{Bar Spacing} = 300 \text{ mm}$$

$$\text{Gives } A_s = 377 \text{ mm}^2/\text{m}$$

$$\text{Compressive Block Centroid Depth } a = 8.9 \text{ mm}$$

$$\phi M_R = 0.9 [W_w \times (b_f T_w / 2) + W_f \times B_f / 2] = 9.68 \text{ kNm}$$

> M* - OK Restoring Moment

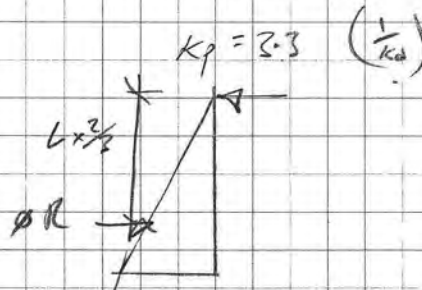
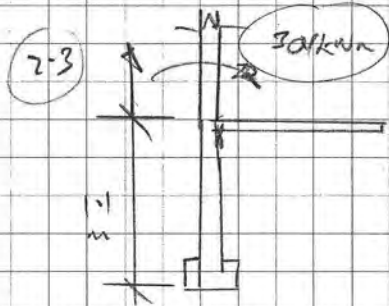
$$\phi M_b = 0.85 A_s f_y (d - a / 2) = 11.31 \text{ kNm}$$

> M* - OK Flexural

Cantilever Wall Footings.

$$M^* = 30.1 \text{ kNm} \quad (300 \text{ series}) \quad R^* = 27 \text{ kN}$$

$$M^* = 19.2 \text{ kNm} \quad (250 \text{ series})$$



$$R^* = 27 \quad L = 1.2 \text{ m}$$

$$\phi R = 0.6 \times 3.3 \times 18 \times 1.2^2/2 = 25.6 \text{ kN}$$

$$\phi M_f = 20.63 \text{ kNm} \quad \text{OKAY for 250 series}$$

$$L = 1.4$$

$$\phi R = 0.6 \times 3.7 \times 18 \times 1.4^2/2 = 34.9 \text{ kN}$$

$$\phi M_o = 32.76 \text{ kNm} \quad \text{OKAY for 300 series}$$

Job Name: 8 Ngarara Road

Job Number: 23448

Date: 2-Dec-08

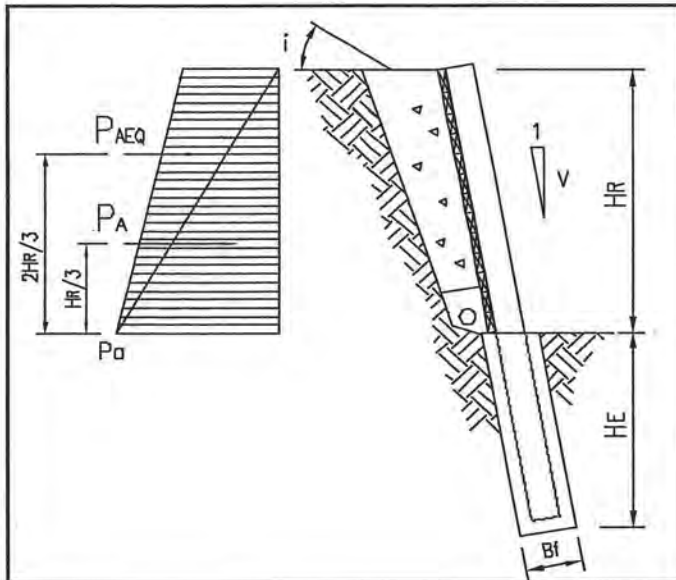
Location:

Engineer: HAF



CALCULATIONS

1170 Seismic Cantilever Timber Pole Retaining Wall Calculation Sheet



$$\theta = \tan^{-1} \left(\frac{k_h}{1 - k_v} \right)$$

(Kh=0.25ZR :4203)

Kh = 0.30

Kv = 0.00

Kh/1-Kv = 0.30

Gives $\theta = 0.291$

$$K_a(\phi, \delta) := \frac{\cos(\phi - \alpha)^2}{\cos(\alpha)^2 \cdot \cos(\delta + \alpha) \cdot \left(1 + \frac{\sin(\delta + \phi) \cdot \sin(\phi - i)}{\cos(\delta + \alpha) \cdot \cos(i - \alpha)} \right)^2}$$

$$K_{aEQ}(\phi, \delta, \theta) := \frac{\cos(\phi - \alpha - \theta)^2}{\cos(\alpha)^2 \cdot \cos(\theta) \cdot \cos(\delta + \alpha + \theta) \cdot \left(1 + \frac{\sin(\delta + \phi) \cdot \sin(\phi - i - \theta)}{\cos(\delta + \alpha + \theta) \cdot \cos(i - \alpha)} \right)^2}$$

Pole Spacing (L) =	1.00 metres
HR =	1 m
γ =	18 kN/m ³
ϕ =	30 degrees
δ =	24 degrees
V =	50 pole slope 50:1
α =	-1.14576 degrees
i =	0 degrees

(Mononobe-Okabe Theory)

Gives $K_a = 0.288$ Gives $K_{aEQ} = 0.571$

Ultimate Limit State

$$P_A = K_a \gamma H^2 / 2 = 2.59 \text{ kN per metre run}$$

$$P_a = P_A / 0.5 H_R = 5.18 \text{ kPa per metre run}$$

$$P' = P_{aEQ} = K_{aEQ} \gamma H^2 / 2 = 5.14 \text{ kN}$$

$$\Delta P_{aEQ} = P_{aEQ} - P_A = 2.55 \text{ kN}$$

$$P_{aEQ} = \Delta P_{aEQ} / 0.5 H_R = 5.10 \text{ kPa}$$

Static case = 1.6P_ASeismic case = P_A + ΔP_{aEQ}

$$M_{static} = 1.6 \times P_A \times H_R / 3 = 1.38 \text{ kNm (per metre run)}$$

$$M_{seismic} = P_A \times H_R / 3 + \Delta P_{aEQ} \times 2 H_R / 3 = 2.56 \text{ kNm per metre run}$$

$$M' = 2.56 \text{ kNm per pole (governing } M^* \text{ from above multiplied by pole spacing } L)$$

Wall Pole Flexural Capacity

☐ Round SED

$$\Phi M_b = \Phi k_1 f_b Z$$

☒ Square

$$\Phi = 0.8, k_1 = 1, f_b = 11.7 \text{ MPa}$$

$$I \text{ Nominal Call Size } d = 125 \text{ mm SQ}$$

$$\text{Gives } Z = 297094 \text{ mm}^3 \quad (Z = d^3/6)$$

$$\text{Gives } \Phi M_b = 2.78 \text{ kNm OKAY}$$

Check static case ($k_1=0.6$):

$$\text{Gives } \Phi M_b = 1.66848 \text{ kNm OKAY}$$

Wall Pole Embedment

Determine height of action $M^* / P^* = H_A$

$$\text{Gives } H_A = 0.50 \text{ m}$$

$$P^* \text{ per post} = 5.14 \text{ kN per pole}$$

$$B_f = 300 \text{ mm}$$

$$S = 60 \text{ kPa}$$

$$\text{Gives } A = 0.334$$

$$H_E = 0.98 \text{ m}$$

$$A = 1.17 P_x / (S B_f)$$

$$H_E = 1.2 \times A (1 + (1 + 2.18 H_R / 3A) 0.5)$$

Date

1/12/09

Eng.

HAF

Job No.

23948

Sheet No.

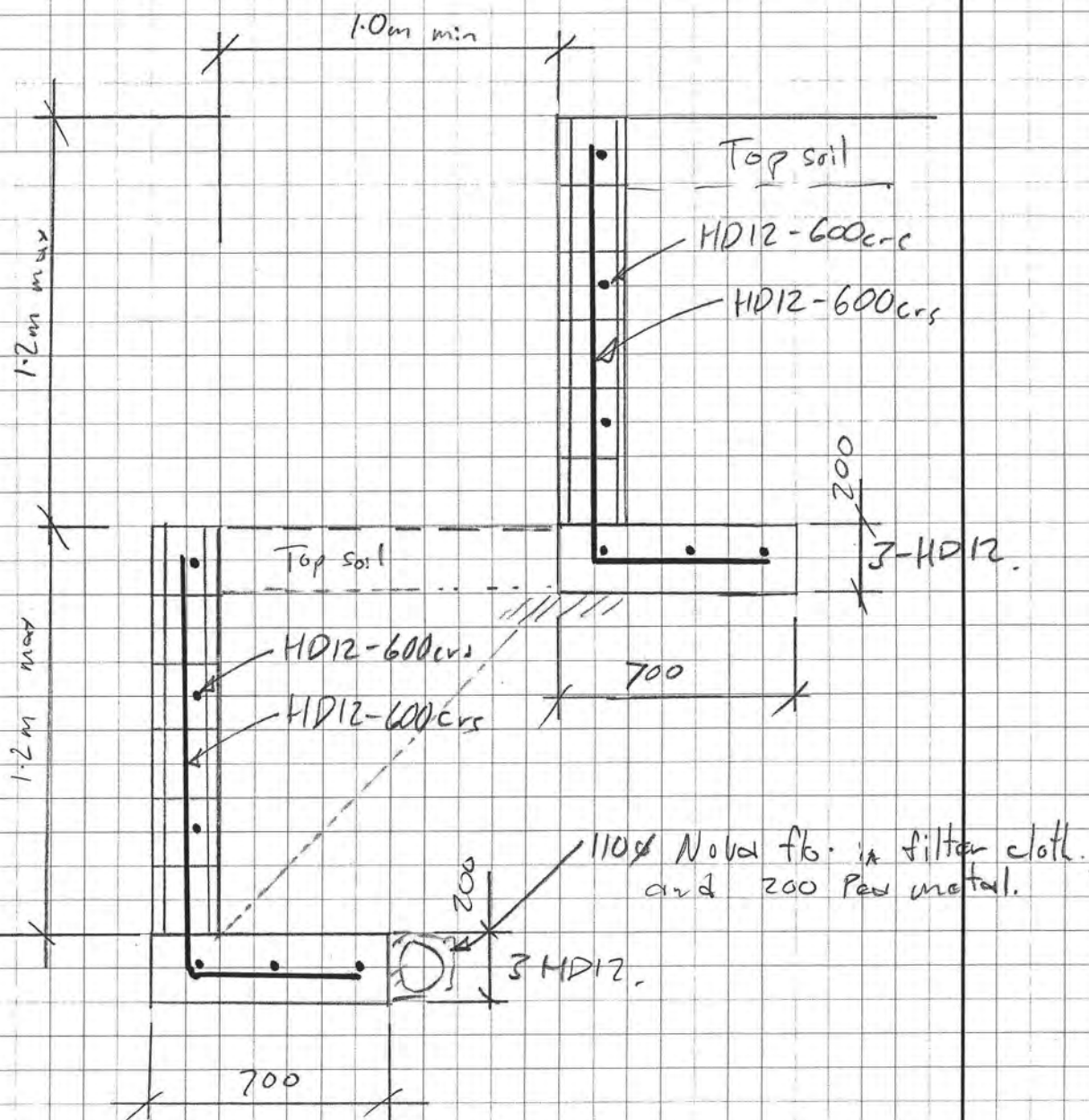
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Project

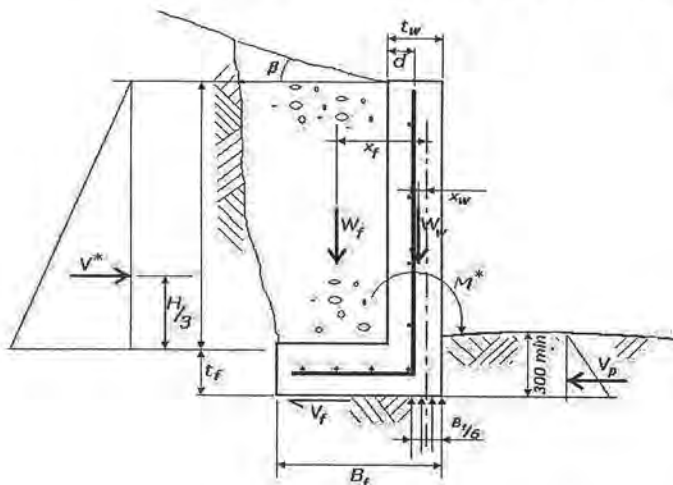
8 Ngara Rd



 SP

 CALCULATIONS


1.2m CANTILEVERED CONCRETE RETAINING WALL



Date: 1-Dec-09 Job. No: 23448
 Engineer: HAF
 Job Name: 8 Ngarara Road
 Item: 1.2m High Masonry Walls
 Supporting garden only

Soil & Wall Properties

Total Wall Height $H_T =$	1.2 m	
Retaining Height $H =$	1.2 m	Put $B_f =$ 0.70 m
Angle of Internal Friction $\phi =$	30 °	$t_w =$ 0.19 m
Soil Weight Per Unit Volume $\gamma =$	18 kN/m ³	$t_f =$ 0.20 m
Angle of Friction on Back of Wall $\delta =$	20 °	Gives $x_w =$ 0.10 m
Angle of Surcharge $\beta =$	0 °	and $x_f =$ 0.35 m
		and $x_s =$ 0.45 m
		and $d =$ 95 mm

From Coulomb Theory

Coefficient of Active Pressure $K_a =$

0.30

Gives $V^* = 1.6 K_a \gamma H^2/2 =$

6.17 kN (per m length)

$$K_a = \left(\frac{\sin(\alpha - \phi) / \sin \alpha}{\sqrt{[\sin(\alpha + \delta)] + \frac{\sin(\phi + \delta) \sin(\phi - \beta)}{\sin(\alpha - \beta)}}} \right)^2$$

Overturning Moment

$M^* = V^* H/3 =$

2.47 kNm (per m length)

Restoring Moment

Wall Weight $W_w = 24 \text{ kN/m}^3 \times H_T \times t_w =$

5.47 kN (per m lgth)

Soil Weight $W_s = \gamma \times H \times (B_f - t_w) =$

11.02 kN (per m lgth)

Footing Weight $W_f = 24 \text{ kN/m}^3 \times t_f \times B_f =$

3.36 kN (per m lgth)

Weight per m $W =$

19.85 kN (per m lgth)

$\phi M_R = 0.9(W_f x_f + W_w x_w + W_s x_s) =$

5.28 kNm (per m length)

Okay

Wall Flexural Strength

Vertical Bar Diameter 12 mm

Bar Spacing 600 mm

Gives Area Longitudinal Steel $A_s =$ 188 mm² per m

Steel Yield Strength $f_y =$ 500 MPa

Concrete Compressive Strength $f_c =$ 12 MPa

Depth of Compression Block

$a = A_s f_y / (0.85 f_c b) =$ 9.2 mm

(where $b = 1000 \text{ mm}$)

$\phi M_b = 0.85 A_s f_y (d - a/2) =$

7.24 kNm (per m length)

Okay

Sliding Resistance

Passive Pressure $V_p = K_p \gamma \times t_f^2/2 =$

1.21 kN

$\phi_p =$ 0.6

$V_f = (W_f + W_w + W_s) \tan \delta =$

11.46 kN

$\phi_f =$ 0.9

(Where $\delta = \phi$)

$K_p = K_a^{-1} =$ 3.36

$\phi V_s = \phi_p V_p + \phi_f V_f =$

11.04 kN(per m) > 6.17

Okay

Bearing Pressure Check

$e = (M_f - M^*)/W =$ 0.172 m

$q^* = W / 2e =$ 57.9 kPa

Dependable Ultimate Bearing Pressure $\phi q_u =$ 150 kPa

Okay

37

Project:	8 Ngarara Road	Date:	7-Dec-09
Location:	Waikanae	Engineer:	HAF
		Job No.	23448

DETERMINATION OF AS/NZS1170 SEISMIC COEFFICIENT

Applicable to Structure Of Period $T < 0.7$ Seconds

Base Shear Force $V = C_d \cdot W_t$

Location = Kapiti

First Mode Period (> 0.4 sec) = 0.4

Site Subsoil Category

Deep or Soft Soil

Structural Ductility Factor $\mu = 1.25$

From AS/NZS1170 $C_h(T_1) = 3.00$

$S_p = 0.925$

$C(T) = C_h(T_1) R Z N(T, D) = 1.20$

$R = 1.0$

$K_u = (\mu - 1) T_1 / 0.7 + 1 = 1.14$

$Z = 0.40$

Ultimate $C_d(T_1) = C(T) S_p / K_u = 0.97$

$N(T, D) = 1$

$R = 0.25 S_p = 0.7 K_u = 1$

Service $C_d(T_1) = C(T) S_p / K_u = 0.21$

Service $C_d(T_1) / \text{Ultimate } C_d(T_1) = 0.22$

EQUIVALENT STATIC METHOD

Building Weight Determination

Roof

Roofing	0.35 kPa x 217m ²	76.0
1/2 Upper Walls External	0.4 kN/m x 67m	26.8
1/2 Upper Walls Internal	0.35 kN/m x 58m	20.3
W Roof =		123.1

First Floor

		First Floor Area	162 m2
		Deck Area	29 m2
1/2 Upper Walls External	0.4 kN/m x 67m		26.8
1/2 Upper Walls Internal	0.35 kN/m x 58m		20.3
Upper Floor	3.11kPa x U.F.area m2		503.8
Seismic Live	0.3 x 1.5kPa x U. F.area m2 x LLR		37.7
Upper Deck	0.3 kPa x 29m2		8.7
U. Deck Seismic Live	0.3 x 2kPa x U.D. area m2 x LLR		9.0
1/2 Lower Concrete Walls	4.95 kN/m x 54m		267.3
1/2 Lower Timber Walls	0.30 kN/m x 30m		9.0
		W Upper Floor =	882.6
(Live Load Reduction Factor)	$\psi_a=0.3+(3/\sqrt{A})$ where $1>\psi_a>0.5$		0.52

$W_t = 1005.7$

$V = C_d W_t$ **$V = 976.7$ kN**

Consider Roof Level as a Part

Ductility of Part $\mu = 3$

$C_p(T_p) = C_h(0) \cdot Z \cdot R \cdot N(T, D) \cdot C_{hi} \cdot C_i(T_p) = 1.34$

$C_p \cdot C_{ph} \cdot R_p = 0.60$

$C_{ph} = 0.45$

$Ch(0) = 1.12$

Bracing Distribution

Roof $< 20\%$ W_t OKAY

$Chi = 1.50$

Level	Wi	Hi	WiHi	Ratio WiHi/SumWiHi	Vi = 0.92(Ratio x V)	Vi Cum.
Roof	123	6.2			Fph = $C_p \cdot W_t$ 74.4 (+8% V) 976.7	279 74.4
First Floor	883	3	3017	1.000		976.7
	1006		3017			

First Floor Load = 74.4 kN or 1488 Bu

Date

3/12/09

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Project

8 Nganema Rd



Determine Seismic Mass

$$\text{Roof} = 23 \times 7.5 + 12.5 \times 2.7 + 7 \times 1.5 = 217 \text{ m}^2$$

$$\text{Exterior Wall Length} = (10.2 + 23) \times 2 = 66.4 \text{ m}$$

$$\text{Inter walls} = 6.1 + 1 + 6.1 + (2 \times 3.6) + 2.5 + 7.1 + 4.8 + 1.2 + 1.5 + 1.2 = 58 \text{ m}$$

$$\text{Deck Area} (4.7 \times 1 + 11 \times 1.2 + 7 \times 1.2 + 1.2 \times 2) = 29 \text{ m}^2$$

Concrete Floor slab

$$\text{Interspan (with 90 Topping)} \quad 4.7 \times 6.1 + 10.7 \times 7.4 + 2 \times 6.2 = 122 \text{ m}^2 \quad \left(\text{at } 2.9 \text{ kPa} \right) \quad 354 \text{ kN}$$

$$\text{Interspan (115 Topping)} \quad 2.9 \times 6.2 = 18 \text{ m}^2 \quad \text{at } (3.5 \text{ kPa}) \quad 63 \text{ kN}$$

$$\text{Insitu} \quad 23 \times 6.6 = 152 \text{ m}^2 \quad \text{at } 4.8 \text{ kPa} \quad 73 \text{ kN}$$

$$\text{Interspan 75 Topping} \quad 2.5 \times 2.5 = 6.25 \text{ m}^2 \quad \text{at } 2.4 \text{ kPa} \quad 15 \text{ kN}$$

$$\text{Area } \boxed{162 \text{ m}^2}$$

505 kN

(3.11 kPa Average)

$$\text{Concrete Wall Weight} = .2 \times 137 \times 24 = 4.95 \text{ kN/m}$$

$$\text{Wall length} = 2 \times 21 + 1.2 + 4.0 + 2.4 + 6 \times 2.4 = 54 \text{ m}$$

$$\text{Timber walls} = 6 + 12 + 4.2 + 1.2 + 6 = 30 \text{ m}$$

(Not including cantilever entry wall 10.7m)

Date

7/12/09

Eng.

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23448

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Project

8 Ngawara Rd

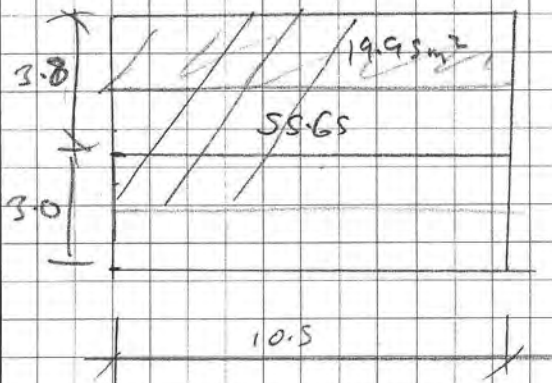


Wind Loads - Bracing

Medium Wind Zone. $V_z = 37 \text{ m/s}$ (36 m/s specific)

$$q_{(z)} = 0.6 \times 37^2 = 0.82 \text{ kPa} \quad C_{pe} = 0.7 - 0.5 = 1.2$$

Wind Along



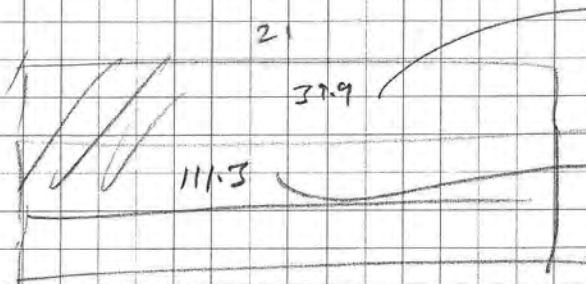
$$F = \frac{A}{2} \times C_{pe} \times K = 10.5 \times 3.8 \times 0.82 \times 1.2 \times 0.8 = 15.7 \text{ kN}$$

314 Bu

$$F = 10.5 \times (3.8 + 1.5) \times 0.82 \times 1.2 \times 0.8 = 47.9 \text{ kN}$$

Seismic greater.

Wind Across



$$F = 21 \times 1.9 \times 0.82 \times 1.2 \times 0.8 = 31.4 \text{ kN}$$

628 Bu

$$F = 21 \times (3.8 + 1.5) \times 0.82 \times 1.2 \times 0.8 = 87.6 \text{ kN}$$

Seismic greater.

GIB® EzyBrace™ FP for GIB® EzyBrace™ Systems, 2009 **(Using Engineer's specific demand values)**



GIB® Wall Bracing Calculation Sheet B								Along	single storey	V01/09
Bracing Line		Bracing Elements provided						Wind	Earthq.	
1	2	3	4	6	5	7	8	9W	10EQ	
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved	
A	150	1	3.6		2.3	GS1(10)	GIB®	248	198	
	OK	2								
line totals		3								
W	248	4								
EQ	198	5								
B	400	1	4.4		2.45	GS1(10)	GIB®	297	237	
	OK	2	5		2.45	GS1(10)	GIB®	338	269	
line totals		3								
W	635	4								
EQ	506	5								
C	400	1	2.1		2.8	BL1(10)	GIB®	250	180	
	OK	2	2		2.8	BLG	GIB®	257	231	
line totals		3								
W	507	4								
EQ	411	5								
D	300	1	1.2		3.4	BL1(10)	GIB®	112	90	
	OK	2	1		3.4	BL1(10)	GIB®	92	77	
line totals		3	1		3.4	BL1(10)	GIB®	92	77	
W	383	4	0.5		3.4	BL1(10)	GIB®	44	40	
EQ	324	5	0.5		3.4	BL1(10)	GIB®	44	40	
E	100	1	0.7		3.6	BL1(10)	GIB®	59	52	
	OK	2	0.7		3.6	BL1(10)	GIB®	59	52	
line totals		3								
W	118	4								
EQ	104	5								
F	enter	1								
		2								
line totals		3								
W		4								
EQ		5								
G	enter	1								
		2								
line totals		3								
W		4								
EQ		5								
H	enter	1								
		2								
line totals		3								
W		4								
EQ		5								
#REF!								Wind	Earthq.	
Totals Achieved	Achieved/Demand	W	603%	EQ	104%	1892	1544			
Concrete Slab								OK	OK	
Totals Required (from Engineer's specific calculations)								314	1488	

GIB® EzyBrace™ FP for GIB® EzyBrace™ Systems, 2009 (Using Engineer's specific demand values)



GIB® Wall Bracing Calculation Sheet B							Across	single storey	V01/09
Across		Bracing Elements provided						Wind	Earthq.
1	2	3	4	6	5	7	8	9W	10EQ
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved
M	130	1	1.5		3.3	HR1	Hardies	105	83
	OK	2	2		2.8	HR1	Hardies	165	130
line totals		3							
W	269	4							
EQ	213	5							
N	420	1	1.5		2.6	BLG	GIB®	208	187
	OK	2	3.5		3	BLG	GIB®	420	378
line totals		3	1		3.5	BL1(10)	GIB®	89	74
W	717	4							
EQ	639	5							
O	360	1	0.9		2.5	BLG	GIB®	127	117
	OK	2	2		3.3	BLG	GIB®	218	196
line totals		3	1		3.5	BL1(10)	GIB®	89	74
W	435	4							
EQ	387	5							
P	250	1	1		2.5	BL1(10)	GIB®	125	104
	OK	2	2		3	GS2(10)	GIB®	144	128
line totals		3	1.2		3.3	GS2(10)	GIB®	65	61
W	334	4							
EQ	293	5							
Q	80	1	1.7		2.8	HR1	Hardies	140	111
	OK	2	2.2		3.4	HR1	Hardies	149	118
line totals		3							
W	289	4							
EQ	229	5							
R	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
S	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
T	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
#REF!								Wind	Earthq.
Totals Achieved	Achieved/Demand	W	325%	EQ	118%	2044	1762		
Concrete Slab								OK	OK
Totals Required (from Engineer's specific calculations)								628	1488

Date 7/12/09

Eng. NAF

Job No. 23448

Sheet No.

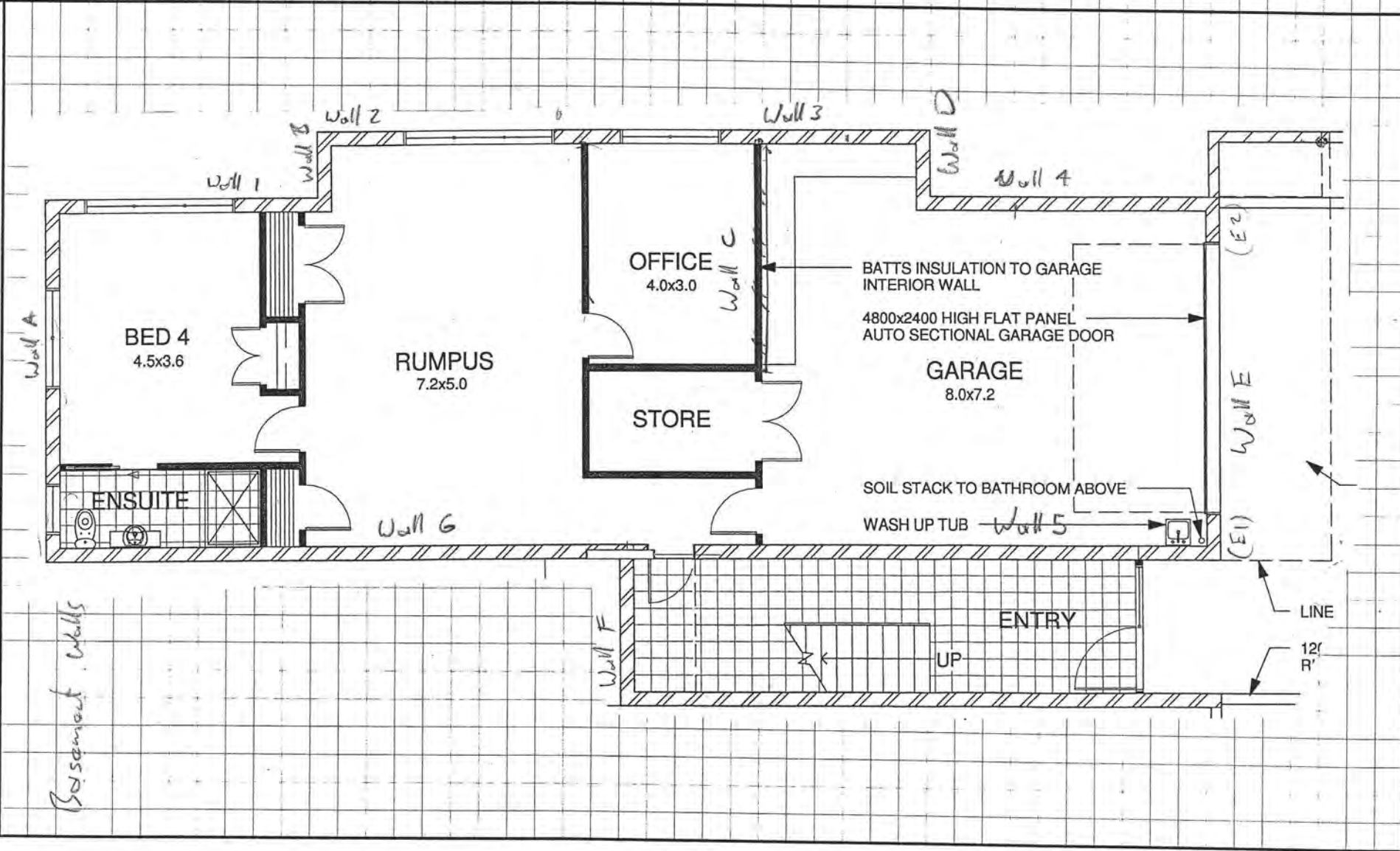
42



CALCULATIONS

Project

8 Ngara Rd.



Consider Along direction wall capacity

$$\text{Load} = 1134 \text{ kW} / 2 = 567 \text{ kW. per side}$$

Spore capacity in wall

$$M_{K5} = \frac{15.1}{1.5} = 10.0 \text{ kNm}$$

$$\frac{0.96}{1.96} = 0.48$$

M12-200ers

$$\phi M_b = 19.46 - 10 = 9.46 \text{ ft-k}$$

Floor	Wall	Foot	Slab
-------	------	------	------

$$w_c = 11 + 13.2 + 8.6 + 3.6 = 36.4 \text{ kN/m}$$

$$q_u = 32.7 \text{ kN/m}$$

$$\phi W = 32.7 \text{ kN/m}$$

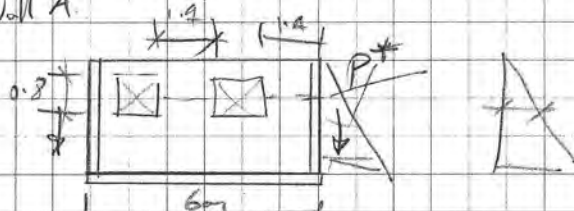
Walls Have H12-300 but due to retaining loads have only 48% of this capacity for bracing

⇒ Design Wall with HD-2 - $\left(\frac{360}{1.8}\right)$ 625 c/s

Wall	Length	Reo HP12	(Shewn)	(Bending)		H	W _{SW}	Rocking	
			PV_0	PV_1	M_k			PUR	
1	1.6 (4.6)	625	280	105	0.8	131	32.7	346	115.
2	1.4 (4.4)	625	245	87	0.8	108	32.7	316	105
3	3.6 (6.6)	625	631	450	3	(130) Consistent	32.7	712	237
4	5.3	625	929	955	3	318	32.7	460	153
			2025	567	599	OKAY		567	610 OKAY
5	9	400	1577	4109	3	1369	32.7	1324	441 kN.
6	10	625	1752	3370	3	1028	32.7	1635	545 kN
			3329	7064				567	986 kN OKAY

Consider Across Direction

Wall A



$$\text{Shear capacity} = 2 \times 1.4 \text{ Length} = 2 \times 245 \text{ kN} = 490 \text{ kN}$$

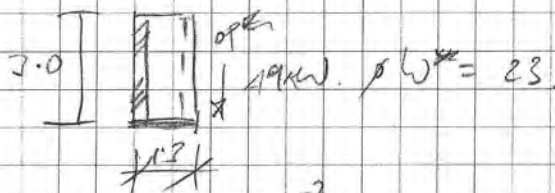
$$\text{Bending upper section} = 2 \times 17 = 234 \text{ kNm} / 0.8 = 292 \text{ kN}$$

$$\text{Rocking } P^* = 32.7 \times 2 = 65.4 \text{ kN}$$

$$W^* = 13.2 + 86 + 3.6 = 29.4 \text{ kN/m} \times 0.9 = 27 \text{ kN/m}$$

$$\phi M_R = \frac{23 \times 6^2}{2} + 6 \times 65 = 806 \text{ kNm} / 2.2 = 366 \text{ kN} \quad (\text{Rocking (head)})$$

Wall B & Wall D

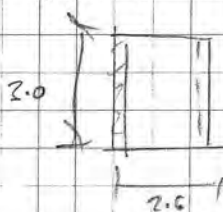


$$\phi M_R = \frac{23 \times 2.7^2}{2} + 1.7 \times 65 = 104 \text{ kNm} / 2.7 = 38.5 \text{ kN} \times 2 = 77 \text{ kN}$$

→ 2.2 (Soil) reduction

$$= 94 \text{ kN}$$

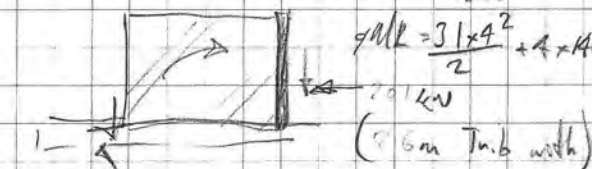
Wall F



$$\phi M_R = \frac{23 \times 2.6^2}{2} + 2.6 \times 65 = 246 / 2.7 = 91 \text{ kN}$$

Wall C

$$\phi M_R = 23 + (8 \times 26 + 1.5 \times 24) \times 0.9 = 31$$



$$\phi M_R = \frac{31 \times 4^2}{2} + 4 \times 40 = 808 \text{ kNm} / 2.2 = 367 \text{ kN}$$

Wall E

$$67 \text{ kN}$$

$$\phi U_{\text{rocking}} = 935 \text{ kN} > 976.7 \text{ OKAY}$$

7/12/09

HAF

22442

45

8 Ngawaru Rd

Wall Resistance to sliding from walls

$\mu = 0.0$

$$\phi F = 0.6 \times 6.1 \times 18 \times \frac{1}{2} = 76.5 \text{ kN/m}$$

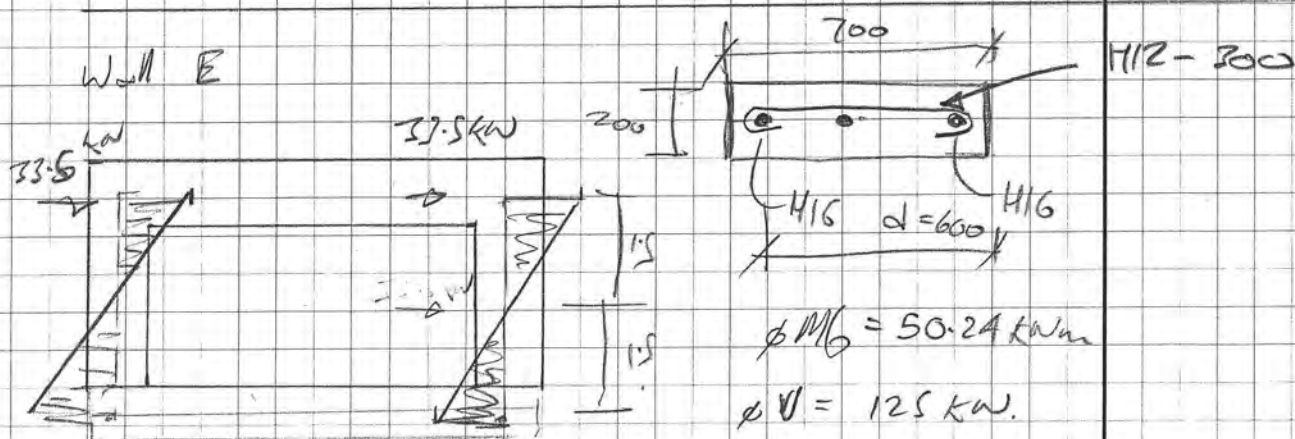
$$76.5 \times 21 = 1606 \text{ kN} > 1148 \text{ OKAY}$$

Check sliding Resistance from weight

$$Wt = 1134 + 229 + 102 \times 29 + 5.76 \times 65 = 2326 \text{ kN}$$

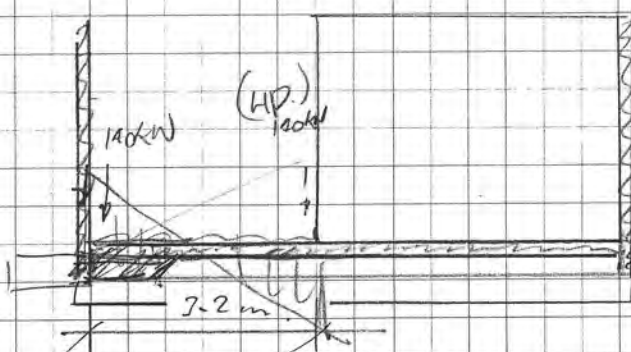
$$\phi R = 0.6 \times 0.35 \times 2326 = 488 \text{ kN}$$

$$\phi R_s = 488 + 1606 = 2094 > 1148 \text{ kN. OKAY}$$

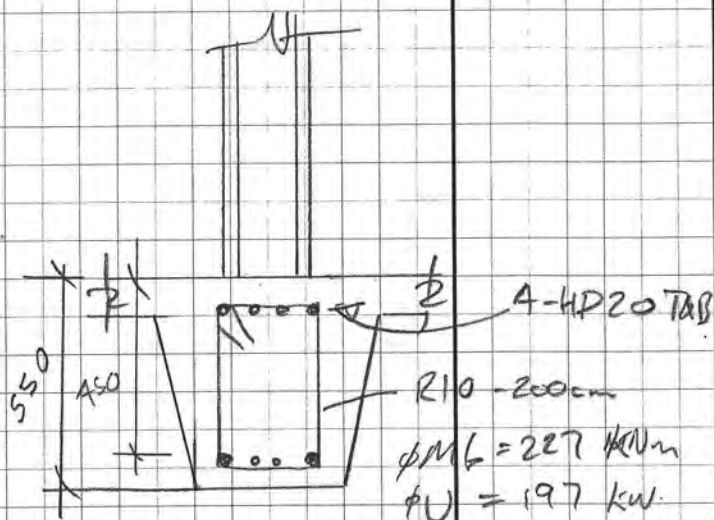


$$\text{Total} = \underline{67 \text{ kN}}$$

Ground Beam for Wall C



$$M^* = 140 \times 1.6 \text{ m} = 224 \text{ kNm}$$



$$\phi M_b = 227 \text{ kNm}$$

$$\phi U = 197 \text{ kN}$$

Check Bending and shear in across walls

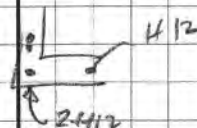
Wall B & D

$$M^* = 104 \text{ kNm}$$

$$\phi M_b = 144 \text{ kNm}$$

$$V^* = 38 \text{ kN}$$

$$\phi U = 140 \text{ kN}$$



Wall F

$$M^* = 246$$

$$\phi M_b = 332 \text{ kNm}$$

$$V^* = 91 \text{ kN}$$

$$\phi U = 302 \text{ kN}$$

Wall C

$$M^* = 808 \text{ kNm}$$

$$\phi M_b = 1098 \text{ kNm}$$

$$V^* = 367 \text{ kN}$$

$$\phi U = 516 \text{ kN}$$

(H12-300c/c)

$$d = 26 \quad A_s = 9 \times 114$$

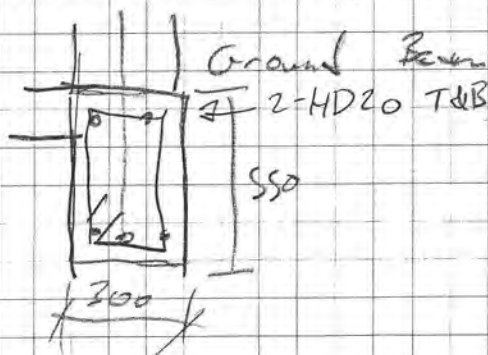
Wall E (column okay)

$$M^* = 50.3 \text{ kNm}$$

$$\phi M_b = 50.3 \text{ kNm}$$

$$V^* = 335$$

$$\phi U = 125 \text{ kN}$$



$$\phi M_b = \frac{227}{2} = 113 \text{ kNm}$$

OKAY

$$\phi U = \frac{177}{2} = 88.5 \text{ kN}$$

OKAY

CONCRETE BEAM DESIGN SHEET

Job Name: 8 Ngarara Road

Job No. 23448

Engineer HAF

Beam: Wall C Ground Beam

Date: 8-Dec-09

Beam Loads

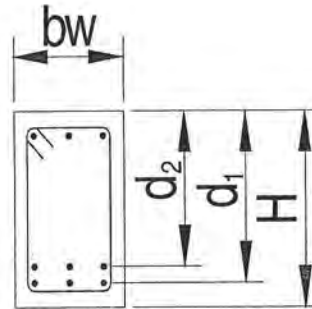
$M_{ult} = 224 \text{ kNm}$

$V_{ult} = 140 \text{ kN}$

Concrete Details

Depth 'H' = 550 mm

Width 'bw' = 600 mm



Exposure Exterior Mod
Conc ' f_c ' = 25MPa

Cover min = 40 mm

Cover = 80 mm

Okay

Tension Reinforcement

Tension Steel ' f_y ' = 500 MPa
Bar size = 20
Bar size = 0
Bar size = 0

No. = 4

$d_1 = 450$

No. = 0

$d_2 = 0$

No. = 0

$d_3 = 0$

$A_s = 1256$

$d_{av} = 450$

Bending Capacity

Bending $\phi = 0.85$

$\rho_w = 0.005$ Okay

$a = A_s \cdot f_y / 0.85 \cdot b_w \cdot f_c = 49.25 \text{ mm}$

Okay

$\phi M = \phi \cdot A_s \cdot f_y \cdot (d - a/2) = 227.06 \text{ kNm}$

OKAY

Concrete Shear Capacity

Shear $\phi = 0.75$

$v_c = (0.07 + 10\rho_w) \cdot \sqrt{f_c} = 0.58 \text{ MPa}$

$\phi V_c = \phi \cdot v_c \cdot d \cdot b_w = 118 \text{ kN}$

Stirrups Required

Combined Steel & Concrete Shear Capacity

Shear Steel ' f_{ys} ' = 300 MPa

Okay

Bar size = 10

Legs = 2 Spacing = 200 mm

$v_s = A_v \cdot f_{ys} / b_w \cdot s = 0.39 \text{ MPa}$ Okay

$A_v = 156 \text{ mm}^2$

$v_n = v_c + v_s = 0.97 \text{ MPa}$ Okay

$\phi V = \phi \cdot v_n \cdot d \cdot b_w = 197 \text{ kN}$

OKAY

Job Number		23448		ISP Consulting Engineers Ltd	
Date		17-Nov-09		Signed	
Location		8 Ngarara Road Waikanae		Scala Penetrometer Results Sheet	
Client				ISP Centre, 14 Laings Road P O Box 30535, Lower Hutt Tel (04) 566 8004 Fax (04) 566 8037	

Notes		Probe Number 4				Probe Number 5				Probe Number 6							
Depth	No.	0	5	10	15	Depth	No.	0	5	10	15	Depth	No.	0	5	10	15
50	0					50	0					50	0				
100	0					100	0					100	0				
150	0					150	0					150	0				
200	0					200	0					200	0				
250	0					250	0					250	0				
300	0					300	0					300	0				
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450	0					450	0					450	0				
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2000	1					2000	0					2000	0				
2050	1					2050	0					2050	0				
2100	2					2100	0					2100	0				
2150	2					2150	0					2150	0				
2200	1					2200	0					2200	0				
2250	2					2250	0					2250	0				
2300	4					2300	0					2300	0				
2350	4					2350	0					2350	0				
2400	5					2400	0					2400	0				
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2500	6					2500	0					2500	0				
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3150	0					3150	0					3150	0				
3200	0					3200	0					3200	0				
3250	0					3250	0					3250	0				
3300	0					3300	0					3300	0				
3350	0					3350	0					3350	0				
3400	0					3400	0					3400	0				
3450	0					3450	0					3450	0				
3500	0					3500	0					3500	0				



BRANZ Appraised
Appraisal No.436 [2005]

BRANZ Appraisals

Technical Assessments of products
for building and construction

**BRANZ
APPRAISAL
CERTIFICATE
No. 436 (2005)**

**BUTYNOL®
ROOFING
MEMBRANE**

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Christchurch

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Fax: +61 2 9938 8811
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Readers are advised to check the validity of this Certificate by referring to the Valid Certificates listing on the BRANZ website, or by contacting BRANZ.

Product

1.1 Butynol® Roofing Membrane is a synthetic rubber waterproofing membrane designed to be used on roofs and decks.

1.2 The product is supplied as single-ply, flexible synthetic rubber sheet in roll form. The product is installed as a single layer system.



Current View of Christchurch Town Hall.
1 mm Butynol® Roof Membrane laid 1972.

Scope

2.1 Butynol® Roofing Membrane has been appraised for use as waterproofing membrane for buildings within the following scope:

- scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- with timber supporting structures designed and constructed in accordance with the NZBC; and,
- with nominally flat or pitched roofs constructed to drain water to gutters and drain outlets complying with NZBC; and,
- with substrates of plywood sheet; and,
- with decks that have a maximum size of 40m².

2.2 Butynol® Roofing Membrane has also been appraised for use as waterproofing membrane for external reinforced concrete and plywood roofs, pedestrian decks and balconies for buildings within the following scope:

- up to 3 storeys with a maximum height from ground to eaves of 10m and with a floor plan area limited only by seismic and structural control joints; and,
- with the reinforced concrete structure designed and constructed in accordance with the NZBC; and,
- with timber supporting structures designed and constructed in accordance with the NZBC; and,
- with nominally flat, curved or pitched roofs constructed to drain water to gutters and drain outlets complying with NZBC.

2.3 This Appraisal is limited to roofs, decks and balconies within the following scope:

- constructed to suitable falls (Refer Paragraph 13.1 – 13.9); and,
- with no steps within the deck level, no integral roof gardens and no down pipe discharging directly onto the deck.

2.4 The design and construction of the substrate and movement and control joints is specific to each building, and therefore the responsibility of the building designer and building contractor and is outside the scope of this Certificate.

2.5 The membrane must be installed by Ardex NZ Ltd approved applicators.

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Butynol® Roof Membrane, if designed, used, installed and maintained in accordance with the statements and conditions of this Certificate, will meet or contribute to meeting the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1 (b) 15 years. Butynol® Roof Membrane meets this requirement. See Paragraph 9.1.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.1 and E2.3.2. Roofs, Decks and balconies incorporating Butynol® Roof Membrane meets these requirements. See Paragraphs 12.1 – 12.9.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. Butynol® Roof Membrane meets this requirement and will not present a health hazard to people.

3.2 This Certificate appraises an Acceptable Solution in terms of New Zealand Building Code compliance and the product complies with NZBC Acceptable Solution E2/AS1 Paragraph 8.5. This product is also appraised as an Alternative Solution as outlined in Paragraph 2.2

4.1 Materials supplied by Ardex NZ Ltd are as follows:

Butynol® Membranes

- All membranes are single-ply, flexible synthetic rubber membranes. They are supplied in rolls nominally 1.4 metres wide by 17.9 metres long. Each roll is packed in polythene wrapper trademarked 'Butynol®' with thickness identified. Gauges available are 1.0, 1.5 and 2.25mm in black and 1.5mm in six colours.

Adhesive WA98

- A specially formulated solvent-based adhesive for all Butynol® applications. Supplied in 1, 4 and 20 litre containers.

Seam Primer

- A water resistant primer adhesive, used with seam tape for general lap bonding.

Seam Tape

- Uncured cold gum tape used for general lap bonding and laps likely to be subject to periodic ponding. Supplied in 50mm x 30.5 metre rolls.

Flashing Tape

- A malleable tape for moulding gussets, pipe flashings and awkward situations. Supplied in widths of 50-100mm x 5 metres long.

Butynol Sealant

- A specially designed and formulated sealant for sealing Butynol® flashings into chases. Supplied in 375mm tubes.

Handling and Storage

5.1 Handling and storage of all materials whether on or off site is under the control of the Ardex NZ Ltd trained installers. Dry storage must be provided for all products and the rolls of membrane must be stored in an upright position.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Butynol® Roofing Membrane. The Technical Literature must be read in conjunction with this Certificate. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Certificate must be followed.

General

7.1 Butynol® Roofing Membrane is for use on roofs, decks and balconies where an impervious waterproof membrane is required to prevent damage to building elements and adjoining areas.

7.2 The 1.0mm thickness product is designed for use on roofs and gutters, and will accommodate light traffic; the 1.5mm is for walk out decks and high maintenance areas; and the 2.25mm is a heavy duty product that is custom made on request.

7.3 The effective control of internal moisture must be considered at the design stage due to the impermeability of the membrane. Refer to BRANZ publication "Good Practice Guide to Membrane Roofing".

7.4 Timber framing systems must comply with NZS 3604, or where specific engineering design is used, the framing shall be of at least equivalent stiffness to the framing provisions of NZS 3604, or comply with the serviceability criteria of NZS 4203. In all cases framing must be provided so that the maximum span of the substrate as specified by the substrate manufacturer is met and that all sheet edges are fully supported.

Building to NZBC Acceptable Solution E2/AS1

7.5 NZBC Acceptable Solution E2/AS1 limits the size of decks to 40 m² as covered by the scope of this Appraisal. Butynol® Roofing Membrane is suitable for use on decks larger than 40 m². These decks are the subject of specific design and are outside the scope of this Appraisal.

Substrates

Plywood

8.1 Plywood must be treated to H3 (CCA treated). LOSP treated plywood must not be used. Plywood must comply with NZBC Acceptable Solution E2/AS1 Paragraph 8.5.3 and 8.5.5. Where specific design is used (i.e. outside the scope of E2/AS1), the plywood thickness and fixing size may increase and centres may decrease to meet specific wind loadings.

Concrete

8.2 Concrete substrates must be to a specific engineering design meeting the requirements of the NZBC, such as concrete construction to NZS 3101.

Durability

Serviceable Life

9.1 Butynol® Roofing Membrane when subjected to normal conditions of environment and with proper maintenance can expect to have a serviceable life of at least 20 years.

Maintenance

10.1 No maintenance of the membrane is normally required provided significant substrate movement does not occur.

10.2 In the event of damage to the membrane, the membrane must be repaired by removing the damaged portion and applying a patch as for new work.

10.3 Drainage outlets must be maintained to operate effectively.

Outbreak of Fire

11.1 The membrane must be protected from heat sources such as flues and chimneys in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9 for the protection of combustible materials.

External Moisture

12.1 Roofs, decks and balconies must be designed and constructed to shed precipitated moisture. They must also take account of snowfalls in snow prone areas. A means of meeting code compliance with NZBC Clause E2.3.1 is given by the Technical Literature which matches details in NZBC Acceptable Solution E2/AS1.

12.2 When installed in accordance with this Certificate and the Technical Literature, Butynol® Roofing Membrane will prevent the penetration of water and will therefore meet code compliance with Clause E2.3.2. The membrane is impervious to water and will give a weathertight roof, roof deck or balcony.

12.3 The minimum fall to roofs is 1 in 40 and to decks, balconies and gutters are 1 in 60. All falls must slope to an outlet. Inadequate falls will allow moisture to collect and may increase the risk of deterioration of the membrane.

12.4 Butynol® Roofing Membrane is impermeable; therefore a means of dissipating construction moisture must be provided in the building design and construction to meet code compliance with Clause E2.3.6.

12.5 Roof, deck and balcony falls must be built into the substrate and not created with mortar screeds applied over the membrane.

12.6 Allowance for deflection and settlement of the substrate must be made in the design of the deck or balcony to ensure falls are maintained and no ponding of water can occur.

12.7 Drainage flanges must be used for any outlet and must be fitted with a grate or cage to reduce potential sources of blockages. An overflow must be provided where the deck or balcony does not drain to an external gutter or spouting.

12.8 Penetrations and upstands of the membrane must be raised above the level of any possible flooding caused by blockage of deck and balcony drainage.

12.9 The design of details not covered by the Technical Literature is subject to specific weathertightness design and is outside the scope of this certificate.

Water Supplies

13.1 Butynol® Roofing Membrane is suitable for roofs used for the collection of water supplies in compliance with the provisions of NZBC G12.3.1. Water collection systems are the subject of specific design and are outside the scope of this Certificate.

Installation Information

Installation Skill Level Requirement

14.1 Installation of the membrane must be completed by trained applicators, approved by Ardex NZ Ltd.

14.2 Installation of substrates must be completed by tradespersons with an understanding of roof, deck and balcony construction, in accordance with instructions given within the Ardex NZ Ltd Technical Literature and this Certificate.

Preparation of Substrates

15.1 Substrates must be dry, clean and stable before installation commences. Surfaces must be smooth and free from nibs, sharp edges, dust, dirt or other materials such as oil, grease or concrete formwork release agents. All surface defects must be filled to achieve an even and uniform surface.

15.2 Concrete substrates can be checked for dryness by using a hygrometer, as set out in BRANZ Bulletin No. 424. The relative humidity of the concrete must be 75% or less before membrane application.

15.3 The moisture content of a timber substructure must be a maximum of 20% and plywood sheet must be dry at time of membrane application. This will generally require plywood sheets to be covered until just before the membrane is laid, to prevent rain wetting.

15.4 Substrates must be primed with a 50/50 solution of WA98 and adhesive solvent and left to dry before membrane is installed.

Membrane Installation

16.1 The membrane must be installed in accordance with the Technical Literature.

16.2 Plywood joints must be taped with 25mm wide PVC pressure sensitive tape.

16.3 The membrane must be unrolled without tension onto the prepared substrate and allowed to 'relax' for at least 20 minutes prior to installation.

16.4 Adhesive must be applied to both the membrane and the substrate, one half at a time. When the adhesive is tack dry, the sheet is rolled onto the substrate. The process is then repeated for the other half of the sheet. Joints in substrates with a pitch of 5° or less, all coloured membranes irrespective of pitch, all guttering and areas subjected to periodic ponding require lap bonding using Ardex seam tape. Joints in substrates with a pitch above 5° can be sealed using WA98 adhesive. This applies to the black Butynol® only.

Inspections

17.1 The Technical Literature must be referred to during the inspection of membrane installations by Building Consent Authorities and Territorial Authorities.

17.2 Critical areas of inspection for waterproofing systems are:

- Construction of substrates, including crack control and installation of bond breakers and movement control joints.
- Moisture content of the substrate prior to the application of the membrane.
- Acceptance of the substrate by the membrane installer prior to application of the membrane.
- Installation of the membrane to the manufacturer's instructions.

Health and Safety

18.1 Safe use and handling procedures for the membrane system is provided in the Technical Literature.

The products must be used in conjunction with the relevant Materials Safety Data Sheet for each membrane.

Basis of Appraisal

The following is a summary of the technical investigations carried out:

Tests

19.1 Tests have been carried out on the membrane by Materials and Quality Consultancy Ltd. This testing covered specific gravity, shore hardness, tensile strength, modulus of elongation, elongation at break, tensile and elongation retention after heat aging, tear strength, ozone resistance and water absorption as detailed in NZBC Acceptable Solution E2/AS1 Paragraph 8.5.4(b). Results and test methods have been reviewed by BRANZ and found to be satisfactory.

19.2 Water vapour permeability tests have been undertaken by BRANZ in accordance with ASTM E96.

19.3 Tests have been carried out on the membrane to assess its suitability for use with potable water supplies. This testing showed the product was satisfactory.

19.4 The adhesives, primers and seam tapes used with Butynol® Roofing Membrane meet the intended performance requirements of NZBC Acceptable Solution E2/AS1 Paragraph 8.5.4(c). *Note: At the time of this Certificate's issue BRANZ EM5 as outlined on Paragraph 8.5.4(c)(i) was not published.*

Other Investigations

20.1 An assessment was made of the durability of the Butynol® Roofing Membrane by BRANZ technical experts using NZBC B2/VM1 History of Use.

20.2 Site visits have been carried out by BRANZ to assess the practicability of installation, and to examine completed installations.

20.3 The Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

21.1 The manufacture of the Butynol® Roofing membrane has been examined by BRANZ, and details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory. The membrane manufacturer is the subject of AS/NZS ISO 9001 Certificate by Telarc Limited, Registration No. 621.

21.2 The quality of manufacture of the product is the responsibility of Ardex NZ Ltd.

21.4 The quality of supply of the product to the market is the responsibility of Ardex NZ Ltd.

21.5 Quality on site is the responsibility of the Ardex NZ Ltd approved applicators.

21.6 Designers are responsible for the substrate design, and building contractors are responsible for the quality of construction of substrate systems in accordance with the instructions of the substrate manufacturer, Ardex NZ Ltd and this Certificate.

Sources of Information

- AS/NZS 2269:1994 Plywood – Structural
- ASTM E 96-02 Water vapour transmission of materials in sheet form, American Society of Testing Materials, Philadelphia, 1992.
- NZS 3101: 1995 The design of concrete structures.
- NZS 3604: 1999 Timber framed buildings.
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to, and including October 2004 Amendment.
- Membrane Roofing Good Practice Guide, BRANZ, November 1999



BRANZ

In the opinion of BRANZ, Butynol® Roofing Membrane is fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided it is used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Ardex NZ Ltd, and is valid until further notice, subject to the Conditions of Certification.

Conditions of Certification

1. This Certificate:
 - 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. The Certificate Holder:
 - 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.
3. The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
4. BRANZ makes no representation 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 the Certificate Holder.
5. Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

For BRANZ

P Robertson
Chief Executive

Date of issue: 11 July 2005



BRANZ Appraised

Appraisal No.238 [2008]

BRANZ Appraisals

Technical Assessments of products
for building and construction

BRANZ APPRAISAL No. 238 (2008)

This Appraisal replaces Appraisal No.
238 (2004) issued 27 August 2004.

Amended 24 November 2008.

PINK® BATTS® GLASSWOOL INSULATION

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Ltd

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Product

1.1 Pink® Batts® glasswool, is a range of resin bonded fibrous glasswool insulation used as thermal insulating material in walls, roofs, floors and ceilings of buildings.

1.2 Pink® Batts®, Building Insulation Blanket, and Cosyfloor® Glasswool Insulation products are pre-cut to suit a wide range of thermal insulation requirements and framing set-outs.

Scope

2.1 Pink® Batts® has been appraised as a thermal insulation material for walls, ceilings, roofs, and under floors of buildings within the following scope:

- framed or part-framed domestic and commercial buildings where the insulation remains dry during its serviceable life.

2.2 Pink® Batts® must be installed in accordance with the manufacturer's Technical Literature to meet the stated thermal performance rating of the insulation. See Paragraph 6.1.



Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Pink® Batts®, 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(a) not less than 50 years and B2.3.1(b) 15 years. Pink® Batts® will meet this requirement. See Paragraph 8.1.

Clause E3 INTERNAL MOISTURE: Performance E3.3.1. Pink® Batts® will contribute to meeting this requirement. See Paragraphs 12.1 – 12.2.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. Pink® Batts® meets this requirement and will not present a health hazard to people.

Clause H1 ENERGY EFFICIENCY: Performance H1.3.1(a) and H1.3.2 E. Pink® Batts® will contribute to meeting these requirements. See Paragraphs 13.1 – 13.8.

3.2 This is an Appraisal of an **Acceptable Solution** in terms of New Zealand Building Code Compliance. Pink® Batts® thermal resistance (R-Value) has been determined by AS/NZS 4859.1 which is an acceptable method.

Glasswool Insulation

4.1 The Pink® Batts® glasswool product range is a resin bonded fibrous glasswool insulation. The main ingredients of Pink® Batts® glasswool are:

- Glass, recycled and/or virgin
- Cured Urea Extended Phenolic Resin
- Recycled Glass.

4.2 Cosyfloor® has Flamestop 522 (a fire retardant perforated foil insulation) bonded to one surface.

4.3 Building Insulation Blanket is supplied in rolls for commercial applications.

4.4 The product is available as set out in Table 1.

Table 1: Product Range

Product	R Value	Nominal Thickness (mm)	Size	GSM (g/m ²)	Pieces per Bale	Coverage per Bale (m ²)*	Area per Bale (m ²)
Ceiling Insulation	1.8	95	1220 x 432 mm	788	26	14.4	13.7
Ceiling Insulation	2.2	115	1220 x 432 mm	944	24	13.3	12.6
Ceiling Insulation	2.6	140	1220 x 432 mm	1124	20	11.1	10.5
Ceiling Insulation	3.2	170	1220 x 432 mm	1381	16	8.8	8.4
Ceiling Insulation (Ultra™)	3.6	180	1220 x 432 mm	1500	14	7.7	7.4
Ceiling Insulation	4.0	190	1220 x 432 mm	1698	12	6.6	6.3
Ceiling Insulation (Ultra™)	4.6	195	1220 x 432 mm	2358	10	5.5	5.3
Ceiling Insulation (Ultra™)	5.0	200	1220 x 432 mm	2952	8	4.4	4.2
Handypack	2.2	94	610 x 432 mm	940	24	7.0	6.3
Wall Insulation	1.8	90	1140 x 580 mm	791	26	19.6	17.2
Wall Insulation	2.2	90	1140 x 580 mm	1014	21	15.8	13.9
Narrow Wall Insulation	2.2	90	1140 x 380 mm	1021	22	10.0	9.5
Wall Insulation	2.4	90	1140 x 580 mm	1330	16	12.1	10.6
Wall Insulation (Ultra™)	2.6	90	1140 x 580 mm	1879	15	11.3	9.9
Wall Insulation (Ultra™)	2.8	90	1140 x 580 mm	2574	10	7.5	6.6
Cosyfloor 450	1.3	50	10 m x 420 mm	700	1	4.6	4.2
Cosyfloor 600	1.3	50	10 m x 570 mm	700	1	6.2	5.7
Cosyfloor	2.0	70	10 m x 420 mm	1239	1	4.6	4.2
Building Insulation Blanket	1.8	75	8 m x 1200 mm	900	2	19.2	19.2
Building Insulation Blanket	1.8	75	16 m x 1200 mm	1050	1	19.2	19.2
Masonry Blanket	1.0	40	1220 mm x 580 mm	560	30	22.3	21.2

* Note: Coverage includes the total area calculated including standard timber framing set outs and is included in Table 1 as a guide only. The net area of the insulation is supplied on the packaging label. Insulation must not be fitted into sealed cavities that are less than the labeled insulation nominal thickness.

4.5 Pink® Batts® glasswool insulation is pink in colour and is packaged in pink, silver or purple print and also clear compression packaging.

Each packet is supplied with labelling in compliance with AS/NZS 4859.1.

4.6 Accessories used with Pink® Batts® which are supplied by the Insulation Installer are:

- Plastic strapping – Where plastic strapping is used to control the insulation material from movement that would affect the performance of the thermal insulation, strapping that meets the requirements of NZBC Clause B2 DURABILITY: Performance B2.3.1(a) 50 years, must be used.

- Plastic strapping fixings – Plastic strapping fixings such as hot dipped galvanised clouts or zinc plated staples that meet the requirements of NZBC Clause B2 DURABILITY: Performance B2.3.1(a) 50 years.

Handling and Storage

5.1 Pink® Batts® must be stored under cover and in dry conditions. Heavy objects must not be stacked on the packs. The packs must be stored in an orientation that avoids excessive compression of the product.

5.2 Compression packaged glasswool is subjected to a maximum combination of compression density and storage time after which the product may not loft to its nominal thickness and therefore may not achieve its designed thermal performance.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for Pink® Batts®. 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

7.1 Pink® Batts® Glasswool Insulation is designed to be used as thermal insulation to meet the energy efficiency and other NZBC insulation requirements, or to provide greater ratings when required by the designer, when installed in building walls, roofs, ceilings and floors.

7.2 Pink® Batts® (Ceiling Insulation, Wall Insulation, and Handy Packs) are designed to be friction-fitted between wall, ceiling or roof framing. They are supplied in an R-value range designed to meet a variety of construction forms that will enable compliance with the minimum requirements of NZS 4218 for roofs and walls.

7.3 Cosyfloor® is intended to fit between floor joists in new installations, or for retrofitting. The R-value of 1.3 is designed to meet the energy efficiency requirements in accordance with NZBC Acceptable Solution H1/AS1. The quoted R-value does not take into account any additional insulation performance that may accrue from the presence of a reflective air gap.

7.4 Building Insulation Blanket is designed specifically for commercial roof and commercial wall applications, where its form aids in installation by being installed in a continuous run.

7.5 Subject to the maximum compression density and storage conditions not being exceeded, all products covered by this Appraisal should recover to their nominal thickness within 24 hours after being removed from their compressed bales.

7.6 The building envelope must be constructed to meet the requirements of the NZBC. The insulation must remain dry during installation and throughout the life of the building.

7.7 To prevent moisture transfer to Pink® Batts® Glasswool Insulation, a separation (minimum 25 mm) is required between Pink® Batts® Glasswool Insulation and any flexible roof underlay. Where there is a rigid sheathing or roofing substrate such as plywood, provided there is no design requirement for roof space ventilation, a separation between Pink® Batts® Glasswool Insulation and the sheathing or substrate is not required.

7.8 The clearances specified in the Technical Literature, or specified by the manufacturer of heating appliances and recessed light fittings, must be met. The use of recessed light fittings may, therefore, reduce the thermal performance of insulated ceilings. This factor must be taken into account in the assessment of compliance with NZBC Clause H1.

7.9 When the insulation is installed in a wall with a drained cavity where the stud spacings are greater than 450 mm, an intermediate means of restraining the insulation from bulging into the cavity must be installed in accordance with NZBC Acceptable Solution E2/AS1 Paragraph 9.1.8.5.

7.10 Where the insulation is installed in exterior walls, the insulation material nominal thickness must be selected to provide a snug close fit of the insulation between building wrap and the interior wall lining.

7.11 Where the insulation material is not laid directly on a ceiling lining or over ceiling battens or joists, it must be adequately supported by galvanised wire netting or some other suitable corrosion resistant material.

Durability

Serviceable Life

8.1 Where the building is maintained so that provisions of the NZBC E2 and E3 Clauses are met, and where the insulation is not crushed or exposed to conditions that will diminish its thermal performance, (e.g. moisture), then it can expect to have a serviceable life of at least 50 years. Pink® Batts® must be installed in a dry, protected construction cavity.

Maintenance

9.1 The building must be maintained weatherproof at all times. If, during normal routine maintenance it is discovered that moisture has entered the building envelope, or that dampness has occurred because of leaking plumbing or some other source, then that source must be repaired immediately. Wet or damp insulation must be removed and then replaced with new insulation of an equivalent thermal rating. Cavities must be clean, dry and free of all contaminants and mould before fitting new insulation. NZS 4246 Paragraph 3.3 gives guidance on thermal insulation maintenance due to water damage.

Outbreak of Fire

10.1 Pink® Batts® must be separated or protected from sources of heat such as chimneys, fireplaces, flues and fuel burning appliances in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9.

External Moisture

11.1 The total building envelope must comply with the requirements of NZBC E2 to ensure that the insulation remains dry in use.

11.2 The moisture content of the construction materials at the time of enclosing the insulation must meet the requirements of NZBC Acceptable Solution E2/AS1, or lower moisture content if required by the lining manufacturer.

Internal Moisture

12.1 Buildings other than communal non-residential, commercial, industrial, outbuildings or ancillary buildings, must be constructed with an adequate combination of thermal resistance, ventilation, and space temperature must be provided to all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated or may accumulate.

12.2 Roofs and walls complying with the Schedule Method for Compliance with Clause H1.3.2 E will have adequate thermal resistance. Other buildings may require more thermal insulation to satisfy the requirements of NZBC E3/AS1 than that to satisfy the energy efficiency provisions alone.

Energy Efficiency

Building Thermal Envelope

13.1 NZBC Verification Method H1/VM1 can be used for housing, communal residential, communal non-residential and commercial buildings.

Modelling of housing and smaller buildings

13.2 The modelling method described in NZS 4218 section 3.3 (as modified by NZBC Verification Method H1/VM1 Paragraphs 1.1.2 and 1.1.3) is a Verification Method for NZBC Clause H1.3.1(a) for the following types of buildings:

a) Housing, regardless of total floor area (the method is also a means of compliance with H1.3.2 E, which applies only to housing), and

- b) Small buildings other than housing having a net lettable area no greater than 300 m².

Building performance index for housing

13.3 Compliance with NZBC Clause H1.3.2 E (Building Performance Index or BPI) satisfies Clause H1.3.1(a).

Modelling of large buildings other than housing

13.4 The modelling method described in NZS 4243.1 section 4.4 is a Verification Method for NZBC Clause H1.3.1(a) for buildings other than Housing having a net lettable area greater than 300 m².

Determining thermal resistance

13.5 The thermal resistance (R-values) of building elements may be verified by using NZS 4214.

The BRANZ 'House Insulation Guide' Third Edition provides thermal resistances of common building elements and is based on calculations using NZS 4214.

Building Thermal Envelope

13.6 NZBC Acceptable Solution H1/AS1 can be used for housing, communal residential, communal non-residential and commercial buildings.

Housing and Small Buildings

13.7 Construction in accordance with NZS 4218 sections 3.1 or 3.2 (as modified by NZBC Acceptable Solution H1/AS1 Paragraphs 2.1.3 and 2.1.4) satisfies NZBC H1.3.1 (a) for housing of any size and all buildings having a net lettable area no greater than 300 m².

13.8 Construction in accordance with NZS 4218 sections 3.1 or 3.2 (as modified by NZBC Acceptable Solution H1/AS1 Paragraphs 2.1.3 and 2.1.4) satisfies NZBC H1.3.2 E for housing of any size, including the external walls of multi-unit dwellings. (Note that common walls between household units of multi-unit dwellings need not comply with NZS 4218.)

Installation Skill Level Requirements

14.1 Installation of Pink® Batts® must be completed by an installer with an understanding of insulation installation, in accordance with the instructions given within the Technical Literature, Installation Instructions and this Appraisal.

General

15.1 Installation of Pink® Batts® must be in accordance with the manufacturer's Technical Literature, Installation Instructions and this Appraisal. Installation is to be carried out by trained installers only. NZS 4246 should be used as a guide for installing insulation in residential buildings.

15.2 The product must be installed only when the building is enclosed and when the construction materials have achieved the required maximum moisture content or less, to ensure the insulation does not become wet.

15.3 Pink® Batts® must be released from the packaging and allowed to re-loft prior to installation. The time to loft will depend upon the length of time the product has been packaged and stored.

15.4 Pink® Batts® are manufactured in segment and roll sizes to allow cutting to suit wall, floor and ceiling framing spaces.

(See Table 1.)

15.5 Pink® Batts® must be cut to fit into cavities where required.

15.6 Where Pink® Batts® are installed in wall cavities, the wall cavities must be completely filled to prevent sagging and thermal convection.

15.7 The insulation must either be neatly friction fitted between framing members and linings, or fitted over framing members and butted tightly so that the potential for gaps and convective heat loss is eliminated. The material must not be folded, tucked or compressed. A close, even fit provides the most efficient thermal performance.

15.8 The insulation must be continuous across the entire roof or ceiling plane between top plates of external walls, and fitted either between or over rafters, ceiling joists or truss chords. Wherever possible the insulation should be fitted beneath wiring or plumbing.

15.9 Cosyfloor® must be friction fitted between floor joists, and the foil lap stapled to the timber supports. In exposed situations, such as under pole houses, the product should be stapled through plastic strapping applied to the foil lap. Stainless steel staples should be used for maximum durability.

15.10 Where recessed light fittings are fitted, installation of the insulation material and the light fittings must be in accordance with NZBC C/AS1 Paragraph 9.4. If a gap in the insulation material is required around light fittings, the effectiveness of the thermal envelope will be diminished when the insulation does not form a continuous envelope.

Inspections

15.11 The Technical Literature must be referred to during the inspection of Pink® Batts® installations by the building consent authorities and territorial authorities.

Health and Safety

16.1 Pink® Batts® are easy to handle. NZS 4246 gives guidance for health and safety requirements such as personal protective clothing and installation hazard assessment.

16.2 Pink® Batts® Ultra Range of products has been assessed for its environmental impact by the New Zealand Ecolabelling Trust and complies with the requirements of the Environmental Choice Specification, Licence No. 2504017 - Thermal (resistive type) building insulants.

The following is a summary of the technical investigations carried out:

Tests

17.1 BRANZ has carried out thermal resistance testing of Pink® Batts® in accordance with AS/NZS 4859.1: 2002.

Other Investigations

18.1 An assessment of the durability of Pink® Batts® has been made by BRANZ technical experts.

18.2 The manufacturer's Technical Literature and Installation Instructions have been reviewed by BRANZ and found to be satisfactory.

18.3 Site inspections have been undertaken by BRANZ to assess the practicability of installation.

Quality

19.1 The manufacture of Pink® Batts® has been examined by BRANZ, including methods adopted for quality control. Details of the manufacturing processes, and quality and composition of the raw materials used were obtained and found to be satisfactory.

19.2 The quality control systems of Tasman Insulation New Zealand Ltd have been assessed and registered by Telarc SAI

Limited as meeting the requirements AS/NZS ISO 9001:2000, registration No 80.

19.3 Tasman Insulation New Zealand Ltd is responsible for the quality of the product supplied.

19.4 Quality of installation of the product on site is the responsibility of the installer.

19.5 Quality of maintenance of the building to ensure the insulation material remains dry is the responsibility of the building owner.

Sources of Information

- AS/NZS 4859.1: 2002 Materials for the thermal insulation of buildings.
- BRANZ House Insulation Guide, Third Edition 2007.
- NZS 4214: 2006 Method of determining the total thermal resistance of parts of buildings.
- NZS 4218: 2004 Energy efficiency – housing and small building envelope.
- NZS 4243: 1996 Energy efficiency – large buildings.
- NZS 4246: 2006 Energy efficiency – Installing Insulation In Residential Buildings
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition, July 2005.
- Compliance Document for New Zealand Building Code Energy Efficiency Clause H1, Department of Building and Housing, Third Edition, August 2007.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition, May 2007.
- The New Zealand Building Regulations 1992, up to, and including June 2007 Amendment.

Amendment No. 1, dated 29 September 2008.

The Appraisal has been amended to update reference to NZBC Clause H1 made effective 30 September 2008.

Amendment No. 2, dated 24 November 2008.

The Appraisal has been amended to update Product Range table.



BRANZ

In the opinion of BRANZ, Pink® Batts® Glasswool Insulation 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 Tasman Insulation New Zealand 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. Tasman Insulation New Zealand 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.
3. 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.
4. 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 Tasman Insulation New Zealand Ltd.
5. 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.
6. BRANZ provides no certification, guarantee, indemnity or warranty, to Tasman Insulation New Zealand Ltd or any third party.

For BRANZ

C Preston
Chief Executive

Date of issue: 2 April 2008

**APPRAISAL
CERTIFICATE
No. 321**

**STANDARD
9.5 MM GIB®
PLASTERBOARD**

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Please refer to this document as "BRANZ
Appraisal Certificate No.321, May, 1996".

Readers are advised to check that this Certificate has not been withdrawn or superseded by a later issue, by either referring to the "Current Certificates Index" in BUILD, the bi-monthly magazine published by the Building Research Association of New Zealand (BRANZ), or by contacting Building Technology Limited (BTL).



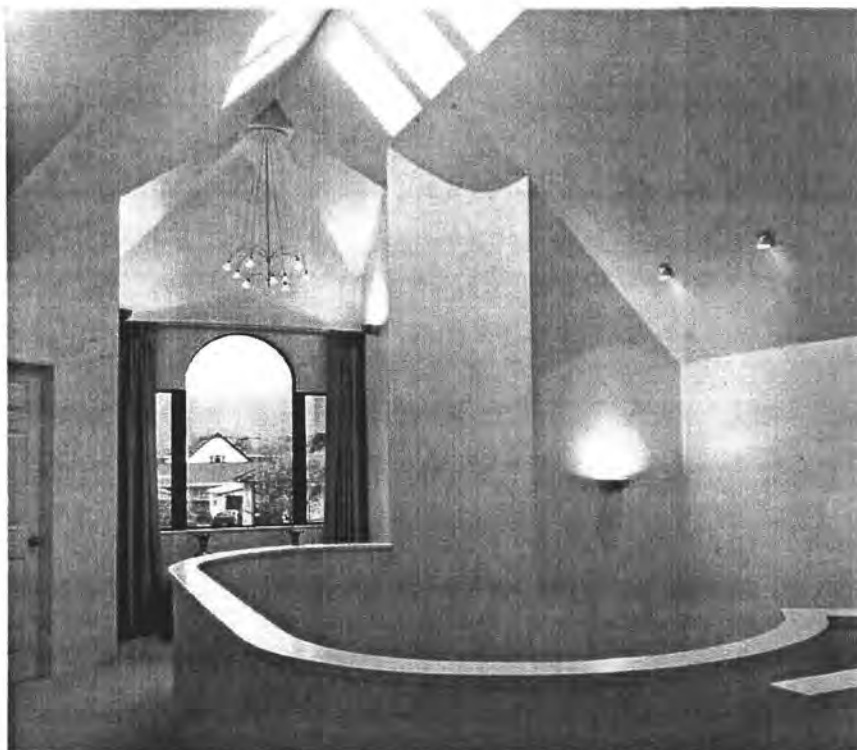
BTL, Private Bag 50908, Porirua
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This Appraisal was produced by BTL,
a company wholly owned by BRANZ.

Product

This Certificate relates to standard 9.5 mm Gib® plasterboard, which is a gypsum-core, paper-faced sheet lining material. The product is manufactured and marketed by Winstone Wallboards Limited, PO Box 12 256, Penrose, Auckland, New Zealand.

The product has been appraised for use as a general, fire-rated, and bracing-rated, interior wall and ceiling lining material, horizontally or vertically fixed over timber framing, and timber or galvanised steel battens, in all classified uses of new and existing buildings.



Building Regulations

New Zealand Building Code (NZBC)

In the opinion of BTL, if standard 9.5 mm Gib® plasterboard is used and installed in accordance with the statements and conditions of this Certificate, the relevant provisions of the following NZBC Clauses will be met:

B1 STRUCTURE; B2 DURABILITY; C1 OUTBREAK OF FIRE; C3 SPREAD OF FIRE; and F2 HAZARDOUS BUILDING MATERIALS.

Specific NZBC compliance details are contained within this Certificate.

Product Information

Description

Standard 9.5 mm Gib® plasterboard is a 9.5 mm thick, paper-bound, gypsum plaster core sheet lining material with either a joint taper or a square edge on the sheet sides. A combination of both taper and square edge on the one sheet is available upon request from the manufacturer.

Sheets are fixed with joints stopped and reinforced to provide a seamless, crack-resistant surface. Once the stopping of joints and nail or screw indentations has been completed, it provides a blemish-free, smooth, monolithic surface suitable for decorating with paint finishes and thin wall and ceiling coverings.

Sheet Sizes and Weight

Standard 9.5 mm Gib® plasterboard is available in sheets 1200 mm wide in the following lengths: 2400, 2700, 3000, 3300, 3600, 3900, 4200, and 4800 mm. The maximum weight is 6.8 kg/m².

Accessories

The following accessories are available from Winstone Wallboard Limited's stockists:

- 30 x 2.5 mm Gib® Clouts for fixing sheets to timber.
- 25 mm x 6 gauge gypsum drywall screws for fixing sheets to timber framing or steel battens.
- Gib® Bedding Compound for bedding joints.
- Gib Tradeset™ Stopping Compound.
- Gib® Finishing Compound for finishing joints and nail/screw indentations.
- Gib® Fix Adhesive for gluing sheets to timber framing or battens.
- Gib® Slim Angle.
- Beadex tape-on trims for internal and external corners.
- Paper reinforcing tape for bedding into joints as joint reinforcement.

Handling and Storage

The board must always be stored inside, protected from moisture and direct sunlight. Sheets must be kept in a neat, flat stack, clear of the floor on pallets or timber dunnage to avoid sagging and damage to the ends, edges and surface of the sheets. Sheets should be lifted from a stack and not dragged as dragging can damage the surface of the sheet.

The manufacturer's technical information should be consulted regarding the stacking of the board on site, and the limitations required for avoiding structural damage to floors.

Design Information

General

The "Gib Board® Fixing and Jointing Instructions" manual, dated November 1992, is a stand alone document for the use of standard 9.5 mm Gib® plasterboard as a complete general wall and ceiling lining system. The manual provides all the technical information required to install and finish the sheet linings to various levels of finish for final decorative effect. The decorative finishes are not covered by this Appraisal.

Standard 9.5 mm Gib® plasterboard may also be used for fire rated partitions and wall and ceiling bracing elements. Specific details for fire resistance ratings (FRR) and bracing ratings are set out in the manufacturer's technical literature for each specific use. These are entitled respectively: "Gib Board® Fire Rated Systems", dated November 1992, and "Gib® Bracing Systems", dated November 1994. Both systems are also covered by BTL Appraisal Certificates, these being No. 289 (1995) for Fire Rated Systems, and No. 294

(1995) for Bracing Systems. Other sections of this Certificate will also reference the FRR and bracing capabilities of standard 9.5 mm Gib® plasterboard.

Sheet lay out, especially for ceilings, should be considered at the design stage of a project, to minimise end-joints of the sheets. This may be achieved by selecting a sheet length to suit the room size.

Curved Applications

Standard 9.5 mm Gib® plasterboard can be applied to curved surfaces, with the minimum radius determined by whether it is applied dry or wet. The minimum bending radii of dry and wet board are 2300 and 1100 mm respectively.

The manufacturer's technical information "Gib Board® Fixing and Jointing Instructions", dated November 1992, gives specific details for the curved applications and how to treat and install wet board.

Framing

Standard 9.5 mm Gib® plasterboard is for use on all classified uses of buildings with timber framing designed and constructed in accordance with NZS 3604: 1990, or to a specific design using NZS 3603: 1993 and NZS 4203: 1992. Sheets may also be fixed to timber or galvanised steel battens which are fixed over new or existing timber framing as above, or battens fixed over concrete or masonry structures designed and constructed in accordance with the relevant NZ standards.

In all cases the supporting battens or framing must meet the following requirements:

- It must be of regular dimensions, set plumb, level, and in true alignment.
- Service piping, ducts, outlets and switch boxes should be set within the framing and not protrude beyond the timber face unless they pass through the sheet, where permitted.
- The maximum framing centres for walls is 600 mm and ceilings 450 mm, except where heavy texture coatings are proposed for ceilings then Winstone Wallboards Ltd must be consulted for special framing requirements.
- Framing is required to all ceiling perimeters for fixing sheets. The only exception to this requirement, which does not apply to structural ceiling diaphragms, is where the junction between the wall and ceiling is either finished with Gib® Cove (not covered by this Appraisal), or where the junction joint is tape reinforced.
- Where truss construction is used, the minimum batten size for 900 mm truss centres is 75 x 40 mm, and for 1200 mm truss centres 75 x 50 mm on edge.
- If ceiling joists are used as an alternative to truss/batten construction, the joists must be stabilised by ceiling runners at 1500 mm maximum centres. Dimensions, spans and fixings for joists and ceiling runners must be to NZS 3604: 1990, or to a specific design. Framing or battens must be provided at a

maximum of 450 mm centres in all cases for fixing ceiling sheets.

Timber Frame Moisture Content

If standard 9.5 mm Gib® plasterboard is fixed over framing containing excessive moisture, problems can occur with the finished appearance of the wall or ceiling, such as:

- Mould growth as moisture migrates to the surface of the board.
- Nail popping as the timber shrinks.
- Peaking joint as the framing twists or shrinks as it dries.

To achieve the best finish, the moisture content of timber framing at the time of lining, must not exceed the following for the levels of finish as defined under the finishing section of this Certificate:

Levels of finish 1 and 2	24%
Levels of finish 3, 4 and 5	16%

Finishing

The finish of the board for a specific final decorative effect is dependent on a number of factors, including the intended use of the room(s), as well as aesthetic reasons. Various levels of finish are achievable using the methods set out in the manufacturer's technical literature, "Gib Board® Fixing and Jointing Instructions", dated November 1992.

These levels of finish are set on a scale of 0 - 5, with 0 being for temporary construction where the final decoration has not been determined, and 5 being the best finish achievable where gloss, semi-gloss, low sheen, or non-textured flat paints are used, or where critical lighting conditions occur. Four other levels of finish fit within this scale.

Some typical finishes or treatments (not covered by this Appraisal) are:

- Medium or heavy texture (spray or hand-applied) finishes before painting.
- Light textures, with flat paints applied.
- Light, medium or heavy grade wall coverings.
- All paint systems with flat, low sheen, semi-gloss or gloss finishes.

B1 Structure

When used as directed by this Certificate, standard 9.5 mm Gib® plasterboard will meet the relevant provisions of NZBC B1.3.1, B1.3.2 and B1.3.4 for the relevant physical conditions of B1.3.3.

In the opinion of BTL, the product meets the requirements of NZS 3604: 1990 Sections 9.1.1 and 12.1.1, and is therefore a suitable wall and ceiling lining material.

Bracing

The product may be used as a bracing element in terms of NZS 3604: 1990.

Specific details for the installation of sheets which form part of a bracing element are contained within Winstone Wallboards Limited's technical literature "Gib® Bracing Systems", dated November 1994. Procedures for fixing

sheets, and the installation of all connections between the bracing element and the structure, as set out in this technical literature, must be followed at all times.

Standard 9.5mm Gib® plasterboard also meets the requirements of NZS 3604:1990 Clause 12.5.2 (b) for a structural ceiling diaphragm. Details relating to this use are contained within NZS 3604:1990.

Table 1 sets out the ratings in bracing units per metre of element length.

TABLE 1.

Type	Primary Bracing Element	Secondary Bracing Element	Wind	Earthquake
GIB 1	9.5 mm standard Gib® lining on one face, not less than 1.8 m long: 1.8 m and less than 2.4 m 2.4 m and longer	Diagonal Brace* Diagonal Brace*	55 75	50 50
GIB 2	9.5 mm standard Gib® lining on both faces, not less than 1.8 m long: 1.8 m and less than 2.4 m 2.4 m and longer	Diagonal Brace* Diagonal Brace*	75 80	60 70
GIB 3	9.5 mm standard Gib® lining on both faces, not less than 1.2 m in length	N/A	65	60

*Diagonal brace in this instance is a galvanised steel angle brace with the minimum dimensions of 19 x 19 x 1.0 mm.

Impact Resistance

When installed in accordance with this Certificate, standard 9.5 mm Gib® plasterboard has adequate resistance to soft body impact, based upon experience in use for domestic and light commercial applications.

B2 Durability

Standard 9.5 mm Gib® plasterboard, when used as a general wall and ceiling, bracing-rated, or fire-rated sheet lining material in dry internal situations, will satisfy the performance provisions of NZBC B2.3.(a), (b), (c) or (d), 50, 15, or 5 years, depending on its use and ease of access within the building.

The ability of the systems, including their fixings, to perform as general wall and ceiling linings, bracing, and to maintain their FRR for at least 50 years is dependant on them remaining dry in service.

Framing and cladding systems must also have a durability which meets the relevant performance requirements of NZBC B2.

Maintenance

The building must be maintained weathertight and all lining systems protected from internal and external moisture.

Impact damage to the linings resulting in small holes and cracks may be patched, stopped and finished as is appropriate. Independent

expert advice must be sought in assessing the effect and repair of larger areas of damage.

Fire-rated linings and bracing sheets must be maintained as set out in the Maintenance Sections of Appraisal Certificates numbered 289 and 294 respectively.

C1 Outbreak of Fire

In buildings lined with standard 9.5 mm Gib® plasterboard, fixed appliances using the controlled combustion of solid, liquid or gaseous fuel, shall be installed in a way which reduces the likelihood of fire.

Acceptable Solution C1/AS1 and Verification Method C1/VM1 set out separation distances and protection measures which may be used to achieve this requirement.

C3 Spread of Fire

Standard 9.5 mm Gib® plasterboard can be used to achieve a two way fire-rated wall system of the types set out in Table 2 when fixed to timber framing.

TABLE 2.

Specification Number	Loadbearing Capability	Fire Resistance Rating	Lining Requirements
GBT 15 GBTL 15	NLB* LB**	-/15/15 15/15/15	1 x 9.5 mm standard Gib Board® each side

* Non load-bearing

** Load-bearing

Standard 9.5 mm Gib® plasterboard has the following AS 1530: Part 3 surface finish properties, without paint or wallpaper finish:

- Spread of Flame Index (SFI) 0
- Smoke Developed Index (SDI) 5

The product, with a surface finish applied, must only be used where the SFI and SDI meets the surface finish requirements for walls and ceilings (unsprinklered buildings) and ceilings (sprinklered buildings only) of Acceptable Solution C3/AS1 Table 4. There are no restrictions on use within buildings for Purpose Groups SH (detached dwellings) and SR (multi-unit residential).

The publication "Gib Board® Fire Rated Systems", dated November 1992 provides full details of the construction, fixings, dimensions and limitations of the above FRR construction, and all details must be followed to meet compliance.

E3 Internal Moisture

Standard 9.5 mm Gib® plasterboard lining systems are for use in dry internal situations and must not be used where they are exposed to liquid water, or be installed where extended exposures to humidities above 90% RH can reasonably be expected, e.g. sauna rooms or commercial laundries.

F2 Hazardous Building Materials

BTL considers that at no stage during handling, installation, or serviceable life does the product constitute a health hazard. Standard 9.5 mm Gib® plasterboard will therefore meet the

provisions of NZBC F2.3.1.

Dust resulting from the sanding of stopping and finishing compounds may be a respiratory irritant and the use of a suitable face mask is recommended.

H1 Energy Efficiency

Standard 9.5 mm Gib® plasterboard has a thermal resistance rating (R-value) for the lining material only of 0.04 m² °C/W.

Installation Information

General

Installation must be in accordance with the manufacturer's instructions which are contained in the following publications:

- For general wall and ceiling linings - "Gib Board® Fixing and Jointing Instructions", dated November 1992.
- For fire-rated linings - "Gib Board® Fire Rated Systems", dated November 1992.
- For bracing-rated linings - "Gib® Bracing Systems", dated November 1994.

Cutting Sheets

Standard 9.5 mm Gib® plasterboard can easily be cut by scoring or sawing, always working from the face side. The face side must be scored using a drywall knife or similar, along a straight edge. The board must be snapped away from the cut edge (the sheet may need to be turned over), and using the knife again, the back paper must be cut.

Sawing may be carried out using a medium toothed (7-8 points per 25mm) hand saw or key hole saw.

Cut edges can be tidied up using a knife or rasp. Paper dags may be torn or cut off.

Cut outs for switch boxes and other penetrations must be scored on both the face and back papers before removal. Care must be taken to prevent core breakout at the back of the board.

Fixing

The manufacturer's instructions set out full fixing details and the installer must strictly adhere to these specifications.

The instructions include information such as: orientation of sheets (e.g., horizontal or vertical fixing); the type, length, spacing and fixing pattern of all mechanical fasteners; the options for and how to use adhesive fixing; edge distances for mechanical fasteners; joint layout; and advantages and disadvantages of various fixing options.

The following will generally apply to sheet fixing in all situations and uses:

- Screws and nails must be driven at right angles to the sheet and the fastener heads must be set just below the surface of the sheet, but must avoid breaking the paper surface.
- Ceiling sheets must be fixed across the battens or joists, and prior to the wall sheets being fixed.

- Adhesive must not be placed around the perimeter of the sheet, or under nails or screws, as drying and shrinkage of the adhesive towards the framing may result in movement and cracking of the sheet joints and popping of nail or screw heads.
- All wall sheets, whether fixed horizontally or vertically, must have a 10 mm gap between the bottom of the sheet and the floor to allow for shrinkage of the framing. When fixing wall sheets horizontally, the top sheet must be installed first.
- Where possible, run sheets continuously under and over doors and windows to avoid joints in line with the opening, and then cut the waste material away from the opening. Joints on load bearing studs directly supporting door or window lintels should be avoided as structural movement of the frame may cause movement of the sheet joints.
- All cut edges should, as far as possible, be fitted into corners so as to avoid the forming of joints in sheets where no tapered edge is available. To provide a neat, "shadowless" effect around grooved door and window jambs, only cut edges which completely remove the tapered edge should be inserted into the groove.
- End-jointing of sheets may be made between framing members using the back-blocking method set out in the manufacturer's technical literature. These joints must always be staggered to avoid a continuous run of jointing, and must not coincide on opposite sides of walls. Back-blocking is particularly recommended for Levels of Gib® Finish 4 and 5.
- External corners may be formed using a Gib® Slim Angle as reinforcement. The slim angle must be fixed at 100 mm maximum centres with 30 x 2.5 mm galvanised Gib® Clouts. Alternatively, Beadex tape-on trims may be used. The trims eliminate the need for fasteners as they are adhered with jointing compounds.
- Control joints, to provide stress release imposed by structural movement, must be inserted at not greater than 9 metre centres in long unbroken walls. Extensive ceiling areas must have control joints spaced at not more than 15 metre centres in either direction. These may be placed to intersect lighting fittings, heating vents and air diffusers. The manufacturer's technical literature provides details on how to form control joints.
- Where Gib® plasterboard abuts dissimilar materials, it must be isolated by an edge trim or casing bead.

Basis of Appraisal

In the opinion of BTL, the following tests and investigations demonstrate standard 9.5 mm Gib® plasterboard is fit for its intended purpose and that it can be used to meet the relevant provisions of the New Zealand Building Code. This statement is conditional on the statements and conditions of this Certificate.

Tests

Racking tests were carried out in accordance with BRANZ Technical Paper P21:1988 by the Forest Research Institute, Rotorua, and BRANZ, to determine the performance of Gib® Bracing Systems when the building is subjected to lateral wind or earthquake loading.

Tests were carried out by the Commonwealth Experimental Building Station, BRANZ and BTL to determine the surface finish spread of fire properties of standard Gib Board® and to determine the FRR of a range of wall and floor/ceiling systems, penetrations and closures.

Fire resistance tests were carried out in accordance with AS 1530.4: 1990 to determine the FRR of construction elements.

Early Fire Hazard Tests were carried out in accordance with AS 1530.3: 1989 to determine the Spread of Flame Index and Smoke Developed Index.

Soft body impact testing of selected Winstone gypsum-based wall linings, following International Standard ISO 7892:1988 (E), was carried out by BRANZ to determine the impact resistance of gypsum-based wall linings.

Other Investigations

Opinions on the fire resistance were given by BRANZ and BTL on variations to the systems tested in accordance with AS 1530.4: 1990.

The durability of Gib Board® Fire Rated Systems has been assessed by BRANZ.

The durability of Gib® Bracing Systems has been assessed by BRANZ.

Opinions were obtained from BTL Structures

Jointing and Finishing

The standard method for jointing standard 9.5 mm Gib® plasterboard is to use Gib® Bedding Compound or Gib Tradeset™ for the first coats and Gib® Finishing Compound as the top coat. For details of the various options available reference should be made to the manufacturer's literature entitled "Gib Board® Stopping and Finishing Systems", dated 1992.

The following points apply when carrying out any stopping:

- Gib® Bedding Compound must be allowed to harden and dry before overcoating.
- All joints must have a paper reinforcing tape bedded into the first joint coat.
- Nail and screw spotting must be carried out using similar procedures, except no paper reinforcing tape is used.
- All areas of stopping may be lightly sanded in the direction of the joint with a 220 grit sandpaper when the stopping is completely dry. Care must be taken not to scuff the face paper as this can lift the fibres and spoil the finish.
- Internal "Boxed Corners" can be formed using procedures as set out in the manufacturer's technical literature. Paper reinforcing tape or Beadex tape-on trims must be used for all internal corner joints.

Group on the effect of Gib® formulation changes, the use of Gib® Fix Adhesive, and screw fixing standard 9.5 mm Gib® plasterboard.

The manufacturing process, methods adopted for quality control, and the quality and composition of materials used have been examined by BTL and found to be satisfactory.

Winstone Wallboards Ltd is an ISO 9002 quality assured manufacturer.

Site inspections to assess installation methods and to examine completed installations were made by BTL.

The manufacturer's publications entitled "Gib Board® Fire Rated Systems", dated November 1992; "Gib® Bracing Systems", dated November 1994; and "Gib Board® Fixing and Jointing Instructions", dated November 1992, have been examined by BTL.

Sources of Information

- AS 1530: Part 3: 1989, Simultaneous determination of ignitability, flame propagation, heat release and smoke release.
- AS 1530: Part 4: 1990, Fire resistance tests on elements of construction.
- BTL Appraisal Certificate No. 289 (1995) Gib Board® Fire Rated Systems.
- BTL Appraisal Certificate No. 294 (1995) Gib® Bracing Systems.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- NZS 3603: 1993 Timber structures standard.
- NZS 3604:1990 Code of practice for light timber frame buildings not requiring specific design.
- NZS 4203: 1992 Code of practice for general structural design and design loading for buildings.
- The Building Regulations 1992.



In the opinion of BTL, standard 9.5 mm Gib® plasterboard is suitable for the appraised use.

This Certificate is valid until further notice, subject to the conditions below.

Conditions of Certification

1. The Certificate holder continues to have the product reviewed by BTL.
2. The product continues to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this Certificate. These specifications and quality assurance measures are as considered by BTL.
3. The overall quality of the product is maintained by the manufacturer. The Certificate holder shall notify BTL of any changes in product specification or quality assurance measures prior to the product being marketed.
4. The product is installed and used in accordance with the manufacturers instructions and any instructions and limitations contained in this Certificate.
5. The Certificate does not cover uses of the product outside the scope of this appraisal, nor does it infer fitness for purpose of products similar in function, appearance, or standard of workmanship that are not specifically included in the scope of this Certificate.
6. The product is appraised against performance provisions contained in the NZBC at the time of the appraisal. BTL is not responsible for the product failing to meet any subsequent or revised provisions introduced after the date of Certification.


R. Burnett for BTL


G. H. Rowe for BTL
May 1996

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BRANZ Appraised
Appraisal No.324 [2006]

BRANZ Appraisals

Technical Assessments of products
for building and construction

**BRANZ
APPRAISAL
CERTIFICATE
No. 324 (2006)**

This Certificate replaces BRANZ
Appraisal Certificate No. 324 (1996)
issued July 1996.
Amended 16 July 2007.

**GIB ULTRALINE® PLUS
LINING SYSTEM**

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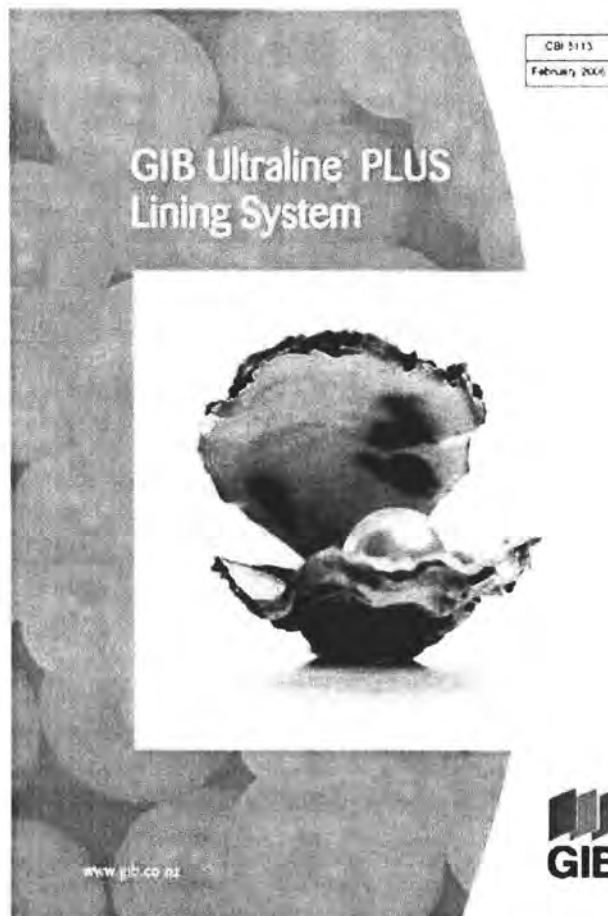
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1.1 GIB Ultralene® PLUS Lining System is for the interior lining of timber and steel framed walls and ceilings where a high quality paint finish is required.

1.2 GIB Ultralene® PLUS Lining System is based on a 13 mm thick paper-bound, gypsum-plaster core sheet lining material which is stronger and more rigid than standard plasterboard. The face lining paper is white and has a smoother finer texture Pearlcoat™ coated paper.



2.1 GIB Ultralene® PLUS Lining System has been appraised for use as general, bracing-rated, fire-rated, and sound transmission rated interior wall and ceiling lining system in buildings within the following scope:

- on framed walls and ceilings within the scope limitations on NZS 3604; and,
- on timber and light gauge steel framed walls and timber framed floor/ceilings subject to specific design.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the GIB Ultralene® PLUS, if designed, used, installed and maintained in accordance with the statements and conditions of this Certificate, will meet or contribute to meeting the following provisions of the NZBC:

Clause B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. GIB Ultralene® PLUS meet the requirements for loads arising from self-weight, earthquake, wind and impact [i. e. B1.3.3 (a), (f), (h) and (j)]. See Paragraphs 8.1 - 8.8.

Clause B2 DURABILITY: Performance B2.3.1 (a) not less than 50 years, B2.3.1 (b) 15 years and B2.3.1 (c) 5 years. GIB Ultralene® PLUS Lining System meets these requirements. See Paragraphs 9.1 - 9.4.

Clause C3 SPREAD OF FIRE: Performance C3.3.1, C3.3.2 and C3.3.5. GIB Ultralite® PLUS Lining System meets this requirement by providing passive fire and smoke protection. See Paragraph 12.1.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. GIB Ultralite® PLUS Lining System meets this requirement and will not present a health hazard to people.

Clause G6 AIRBORNE AND IMPACT SOUND: Performance G6.3.1 and G6.3.2. GIB Ultralite® PLUS Lining System meets the requirements. See Paragraphs 14.1 and 14.2.

This Certificate appraises an **Alternative Solution** in terms of New Zealand Building Code compliance.

4.1 The GIB® plasterboards and accessories used in the GIB Ultralite® PLUS Lining System and supplied or specified by Winstone Wallboards Limited are as follows:

GIB® Plasterboards

• GIB Ultralite® PLUS

4.2 GIB Ultralite® PLUS is a paper-bound, gypsum-plaster core sheet lining material which is stronger and more rigid than standard plasterboard. The face lining paper is white and has a smoother finer texture Pearlcoat™ coated paper. GIB Ultralite® PLUS is available in a sheet thickness of 13 mm and a sheet width of 1200 mm and 1350 mm. The sheets have a taper on the two long sheet edges and are also available with a square edge. GIB Ultralite® PLUS sheets are available in lengths between 3000 mm and 6000 mm. The nominal weight is 9.0 kg/m².

• GIB Aqualine®

4.3 GIB Aqualine® is a paper-bound, modified water-resistant gypsum-plaster core sheet lining material. The sheets have a taper on the two long sheet edges. GIB Aqualine® is available in 10 mm and 13 mm sheet thicknesses, a sheet width of 1200 mm and in lengths of 2400 mm, 2700 mm, 3000 mm and 3600 mm. The nominal weights are 7.8 kg/m² and 10.2 kg/m² for 10 mm and 13 mm thick sheets respectively. GIB Aqualine® face paper is green in colour.

Fastenings

- GIB® Grabber® High Thread Drywall screws for fixing to timber:
6g x 25, 32, mm and 7g x 51 mm.
- GIB® Grabber® Self Tapping Drywall screws for fixing to light gauge steel:
6g x 25, 32, 41 mm;

Ceiling Diaphragms

4.4 Ceiling diaphragms are constructed using timber, or GIB® Rondo™ or USG Donn® ScrewFix™ metal ceiling batten system. The perimeter of the ceiling diaphragm is fixed to GIB® Rondo™ perimeter channel, or alternatively, to an additional ex150 x 40 mm timber plate fixed to the top plate.

Adhesive and Sealants

- GIBFix® Wood Bond (Acrylic)
- GIBFix® All-Bond (Solvent)
- GIB Soundseal® is a flexible water-based acoustic sealant.

GIB® Accessories and GIB® Jointing Compounds

- As specified in the GIB Ultralite® PLUS Lining System and GIB® Site Guide Technical Literature.

Plywood

- Plywood must be a minimum of 7 mm thick complying with AS/NZS 2269 D-D Grade Structural.
- Plywood fixing are 30 x 2.8 mm hot-dipped galvanised flat-head nails.

Accessories

- GIB® Rondo™ metal ceiling batten and clip system and GIB Clips®.

Sound Control Infill

- Pink® Batts® Silencer glass wool insulation.

Fasteners, braces and connections

- Angle braces, galvanised steel.
- Angle brace fixing 30 x 2.8 mm hot-dipped galvanised flat-head nails.
- GIB® HandiBrac™, galvanised steel 90 x 62 x 54 x 1.55 mm thick angle bracket.
- GIB® HandiBrac™ Washer, 50 x 60 x 5 mm thick electroplated.
- GIB® HandiBrac™ Fixings, 8 Type 17 screws 5 x 35 mm.
- Coach screws 12 mm x 150 mm and 50 x 50 x 3 mm washer hot-dipped galvanised for fixing to timber floors.
- Bolts M12 x 150 mm minimum and 50 x 50 x 3 mm washers for fixing to concrete floors. Proprietary fixings with a minimum characteristic strength of 15 kN may be used.
- Shot fired fasteners minimum 75 mm x 3.8 mm with 16 mm discs for fixing GS1a and GS2 internal line bracing elements to concrete slabs.
- Galvanised or Stainless steel strap 25 x 0.9 mm top and bottom plate connections.
- Strap fixings 30 x 2.5 mm hot-dipped galvanised flat-head nails.

Note: For corrosion protection requirements refer to NZS 3604 Section 4.

Handling and Storage

5.1 The best results are achieved when GIB® plasterboards are treated as a finishing material and protected from damage. Sheets must be stacked flat and kept dry at all times. For limits on stack heights see the GIB® Site Guide. Sheets must be carried on edge and not dragged.

5.2 All accessories must be kept dry.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the GIB Ultralite® PLUS Lining System. The Technical Literature must be read in conjunction with this Certificate. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Certificate must be followed.

General

7.1 GIB Ultralite® PLUS Lining System is for the interior lining of timber and steel framed walls and steel battened ceilings where a high quality paint finish is required. It combines best practice products, systems and installation practices.

7.2 GIB Ultralite® PLUS Lining System includes wall bracing elements, ceiling diaphragms and noise control.

7.3 GIB Ultralite® PLUS may be substituted for some other GIB® Plasterboard products in specific GIB® Noise Control Systems and GIB® Fire Rated Systems.

7.4 In wet areas, GIB® recommends that 13 mm GIB Aqualine® replaces GIB Ultralite® PLUS.

7.5 GIB® plasterboards must not be exposed to temperatures of 52°C or greater for prolonged periods. Refer to appliance and fitting manufacturer's for installation details.

GIB Ultralite® PLUS Lining System

7.6 The GIB Ultralite® PLUS Lining System Technical Literature describes in detail, design and installations considerations to achieve high levels of finish. There is also design and construction information to achieve noise control for internal walls and floor/ceiling. Specific Bracing Unit ratings are also given for GIB Ultralite® PLUS and 13 mm GIB Aqualite®.

General Framing

7.7 Supporting framing must comprise one of the following subject to the minimum sizes, dwang centres and all other frame requirements of GIB® Ultralite PLUS Lining System Technical Literature:

- Timber framing must be designed and constructed in accordance with NZS 3604, or to a specific design using NZS 3603 and NZS 4203. (AS/NZS 1170.)
- Steel framing must be designed to withstand loads in accordance with NZS 4203. (AS/NZS 1170.)
- Ceiling battens must be steel.

Bracing Framing

7.8 Timber framing grade, spacing and construction must comply with NZS 3604.

7.9 The minimum actual framing dimensions are 90 x 35 mm for external walls and 75 x 35 mm for internal walls.

7.10 Angle braces provide some bracing resistance for holding the frames square during construction and transportation. Angle braces, where required in the bracing panel, must be fixed with three 30 x 2.8 mm GIB® Nails at the bottom and top plates, and two 30 x 2.8 mm GIB® Nails at intermediate studs.

7.11 Joints in the top plates of bracing panels must be tied together with 3kN and 6 kN top plate connectors using 2.5 x 0.9 mm galvanised mild steel strap, 3 nails each side of joint for 3 kN and 6 nails each side of joint for 6kN.

Structure

Bracing

8.1 The Bracing Units achieved (wind and earthquake) when using GIB Ultralite® PLUS Bracing System are given in Table 1.

8.2 The GIB Ultralite® PLUS Lining System Technical Literature provides comprehensive construction and panel hold-down details. Panel hold-downs may be bolts or screws with nailed straps or the GIB® HandiBrac™.

8.3 The bracing units are derived from BRANZ P21 test method based on a wall height of 2.4 m. For any other wall height the bracing rating can be calculated by multiplying the appropriate value shown in Table 1 by 2.4 and dividing by the wall height in metres, except that panels less than 1.8 m high shall be rated as if they were 1.8 m high.

Ceiling Diaphragms

8.4 GIB Ultralite® PLUS ceiling diaphragms are limited to not steeper than 25° to the horizontal and not exceeding 10 m in length.

Openings in Bracing Elements

8.5 Openings are allowed within the middle third of bracing elements (length and height walls, length and width ceilings). The opening dimension in either direction must not exceed one third of the element height (width). Small openings of 90 x 90 mm or less may be placed anywhere except within 90 mm of the edge of the bracing element.

8.6 The GIB Ultralite® PLUS Lining System Technical Literature provides comprehensive installation details.

Water-splash Areas

8.7 GIB Ultralite® PLUS bracing systems must not be located in shower cubicles or behind baths and the like. They may be used in water-splash areas provided they are protected as required by NZBC Clause E3. The use of 13 mm GIB Aqualite® is recommended in wet areas.

Impact Resistance

8.8 GIB® plasterboards provide adequate resistance to soft body impact, based upon experience of use in domestic and light commercial applications.

Durability

9.1 GIB Ultralite® PLUS Lining System, including linings and their fixings have a serviceable life of at least 50 years. The ability of the system to remain durable is dependent on them remaining dry in service, and being maintained in accordance with this Certificate.

Maintenance

9.2 The building must be maintained weatherproof and GIB Ultralite® PLUS Lining System must be protected from external and internal moisture in accordance with NZBC Clauses E2 and E3.

Table 1: Bracing Unit ratings for 13 mm GIB Ultralite® PLUS and 13 mm GIB Aqualite®.

Type	Length (m) Minimum	Lining Requirements	Other Requirements		BU Per Metre	
			Diagonal Brace	Hold-Downs ⁽²⁾	Wind	Earthquake
UP1	0.6	13 mm GIB Ultralite® PLUS one face fixed horizontal or vertical	N/A	Yes	100	85
	1.2		N/A	Yes	110	85
UP1a	1.8		Yes	Yes	125	100
UPP	0.6	13 mm GIB Ultralite® PLUS one face fixed horizontal or vertical, 7.0 mm D-D plywood on the other ⁽¹⁾	N/A	Yes	130	130
	0.9		N/A	Yes	150	150
UP2	1.2	13 mm GIB Ultralite® PLUS both faces fixed horizontal or vertical ⁽¹⁾	N/A	Yes	140	120

Note: 1) For bracing elements lined both sides (UPP and UP2) each side must be fastened as a bracing element.

2) Refer to the Technical Literature for hold-down details.

9.3 Holes resulting from damage to the lining, up to 100 x 100 mm square, will have no significant effect on the performance of the bracing panel. Such holes may be repaired by patching, stopping and finishing as appropriate. Independent expert advice must be sought to assess the effect and repair of larger areas of damage.

9.4 Bracing elements require no ongoing maintenance, apart from decoration and the repair of any damage.

Outbreak of Fire

11.1 Separation or protection must be provided to GIB Ultralite® PLUS Lining System from heat sources such as stoves, heaters, flues and chimneys.

11.2 NZBC Acceptable Solution C/AS1, Part 9 and Verification Method C/VM1 provide methods for separation and protection of combustible materials from heat sources.

Spread of Fire

12.1 13 mm GIB Ultralite® PLUS may substitute for 10 mm GIB Fyrelite®, 10 mm GIB® Standard plasterboard and 13 mm GIB® Standard plasterboard in all fire resistant wall construction. Refer to GIB® Fire Rated Systems Technical Literature.

Internal Moisture

13.1 GIB Ultralite® PLUS Lining System must be used in dry internal situations, and must not be used where likely to be exposed to liquid water, or where extended exposure to humidity above 90% RH is expected, e.g., such as may be expected in sauna rooms, commercial kitchens and the like.

Airborne and Impact Sound

14.1 13 mm GIB Ultralite® PLUS may substitute for 13 mm GIB® Standard plasterboard and 10 mm GIB Noiseline® in GIB® Noise Control Systems. Refer to GIB® Noise Control Systems Technical Literature.

14.2 The GIB Ultralite® PLUS Lining System Technical Literature provides specific details for sub-tenancy (same tenancy) Quiet Zone Internal Wall and Floor/Ceiling constructions.

Installation Skill Level Requirement

14.1 Installation of GIB Ultralite® PLUS Lining System can be carried out by any competent building contractor.

General

15.1 GIB Ultralite® PLUS Lining System must be installed in accordance with the Technical Literature. For inspection, reference must be made to the Technical Literature.

Cutting

15.2 GIB® plasterboard is easily cut by scoring the face paper with a sharp short-bladed trimming knife, and then snapping the plasterboard away from the cut face and cutting the back paper or by sawing. Use of a metal straightedge facilitates clean straight cuts. Cut edges can be tidied up by using a knife. Paper dags should be removed.

Health and Safety

15.3 Dust resulting from the sanding of stopping and finishing compounds may be a respiratory irritant, and the use of a suitable facemask is recommended.

Framing

15.4 To achieve an acceptable decorative finish, GIB Ultralite® PLUS Lining System and GIB® Site Guide specifies that walls must not be lined unless the moisture content of timber framing is less than 18%. GIB® recommend a moisture content of 8–12% where buildings are to be air conditioned or centrally heated.

Sheet Fixing

15.5 The recommended installation method for GIB Ultralite® PLUS is horizontal fixing.

15.6 GIB Ultralite® PLUS is screw fixed to wall framing at 300 centres around the perimeter and single screw fixing at each stud where the horizontal joint crosses the stud. Screws are to be no closer than 12 mm from the sheet edge. Fixing to intermediate studs is by GIBFix® Adhesive at 300 centres. Adhesive must not be used under screws.

15.7 GIB Ultralite® PLUS is screw fixed to ceiling battens at sheet edges and centre. Perimeter screw fasteners are at 600 mm centres or closer depending on the wall/ceiling details.

15.8 GIB Ultralite® PLUS and 13 mm GIB Aqualite® bracing elements are fixed at 150 mm centres around the perimeter framing of the wall bracing element. Fixing to other framing is either mechanical or by using GIBFix® Adhesives. All edge fixings must be in accordance with the edge fixing pattern. Corner fixings must be 50 mm away from the sheet corner. Bracing elements require a special fastening pattern with three fasteners at 50 mm centres from each corner. Ceiling diaphragms require the first corner fastening at 50 mm, the second at 100 mm and there after at 150 mm.

15.9 The GIB Ultralite® PLUS Lining System requirements for horizontal or vertical sheet installation must be met. Full sheets must be used wherever possible. Fixings must be no closer than 12 mm from the sheet edge and driven at right angles to the sheet until the head is seated in a slight dimple just below the surface of the paper liner. Fixings must not be over-driven. Mechanical fixings must be spaced between the daubs of adhesive.

15.10 Plywood used in System Type UPP is nail fixed at 150 mm centres around the perimeter of each sheet and at 300 mm centres to intermediate framing.

15.11 Where a bracing element is also used as a fire-rated element, the method of fixing (including the length of the fixing specified) for the fire-rated element must be used, but the perimeter fixings of the bracing element must be at 150 mm centres.

Jointing and Finishing

15.12 All bracing element joints must be reinforced with paper tape and finished in accordance with GIB Ultralite® PLUS Lining System and GIB® Site Guide Technical Literature.

The following is a summary of the technical investigations carried out:

Tests

16.1 Bracing tests were carried out by Ensis, Rotorua in accordance with BRANZ Technical Paper P21 to determine the performance of GIB Ultralite® PLUS Lining System when the building is subjected to lateral wind or earthquake loading. Nail and screw slip tests were carried out by BRANZ. The results of tests were reviewed by BRANZ experts and found to be satisfactory.

Other Investigations

17.1 The GIB Ultralite® PLUS Lining System Technical Literature has been reviewed by Marshall Day Acoustics Limited and an opinion given on the sound insulation performance of the system.

17.2 The GIB Ultralite® PLUS Lining System and GIB® Site Guide Technical Literature have been examined by BRANZ and found to be satisfactory.

17.3 Site visits were carried out by BRANZ to assess the practicability of the installation of the systems, and to view completed installations.

17.4 An assessment was made of the durability of the systems by BRANZ technical experts and found to be satisfactory.

17.5 Winstone Wallboards Limited GIB® plasterboards have been assessed for the following properties: MOR, MOE, paper tensile strength, paper shear strength, nail pull resistance, Hunter hardness, inspection for fungal spores, hard and soft body impact tests.

Quality

18.1 Winstone Wallboards Limited's manufacturing process and details of the quality and composition of the materials, have been examined by BRANZ and found to be satisfactory.

18.2 The quality management systems of Winstone Wallboards Limited have been assessed and registered by TELARC as meeting the requirements of ISO 9001, Registration No. 581.

18.3 Winstone Wallboards Limited is responsible for the quality of the product supplied.

18.4 The quality of the application and finish on site is the responsibility of the installation and stopping contractors.

18.5 Designers are responsible for the design of buildings.

18.6 Building owners are responsible for the maintenance in accordance with the instructions of Winstone Wallboards Limited.

Sources of Information

- AS/NZS 1170: 2002 Structural design actions.
- AS/NZS 2269: 1994 Structural plywood.
- AS/NZS 2588: 1998 Gypsum Plasterboard.
- BRANZ Technical Paper P21:1979 (revised 1982, 1987, 1988) A wall bracing test and evaluation procedure.
- BRANZ Technical Recommendation No. 10 - December 1991, Supplement to P21: An evaluation method of P21 test results for use with NZS 3604: 1990.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- NZS 3603: 1993 Timber structures standard.
- NZS 3604: 1999 Timber and framed buildings.
- NZS 4203: 1992 Code of practice for general structural design and design loadings of buildings.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to, and including October 2004 Amendment.



In the opinion of BRANZ, GIB Ultralite® PLUS Lining System is fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided it is used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Winstone Wallboards Limited, and is valid until further notice, subject to the Conditions of Certification.

Conditions of Certification

1. This Certificate:
 - 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. The Certificate Holder:
 - 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.
3. The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
4. BRANZ makes no representation 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 the Certificate Holder.
5. Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

For BRANZ

P Robertson
Chief Executive

Amendment No. 1, dated 16 July 2007.

GIB® HandiBrac™ hold-down option included.

Date of issue: 22 November 2006



BRANZ Appraised

Appraisal No.614 [2008]

BRANZ Appraisals

Technical Assessments of products
for building and construction

**BRANZ
APPRAISAL
No. 614 (2008)**

ALUBAND™ / ALUMINIUM WINDOW SEALING SYSTEM

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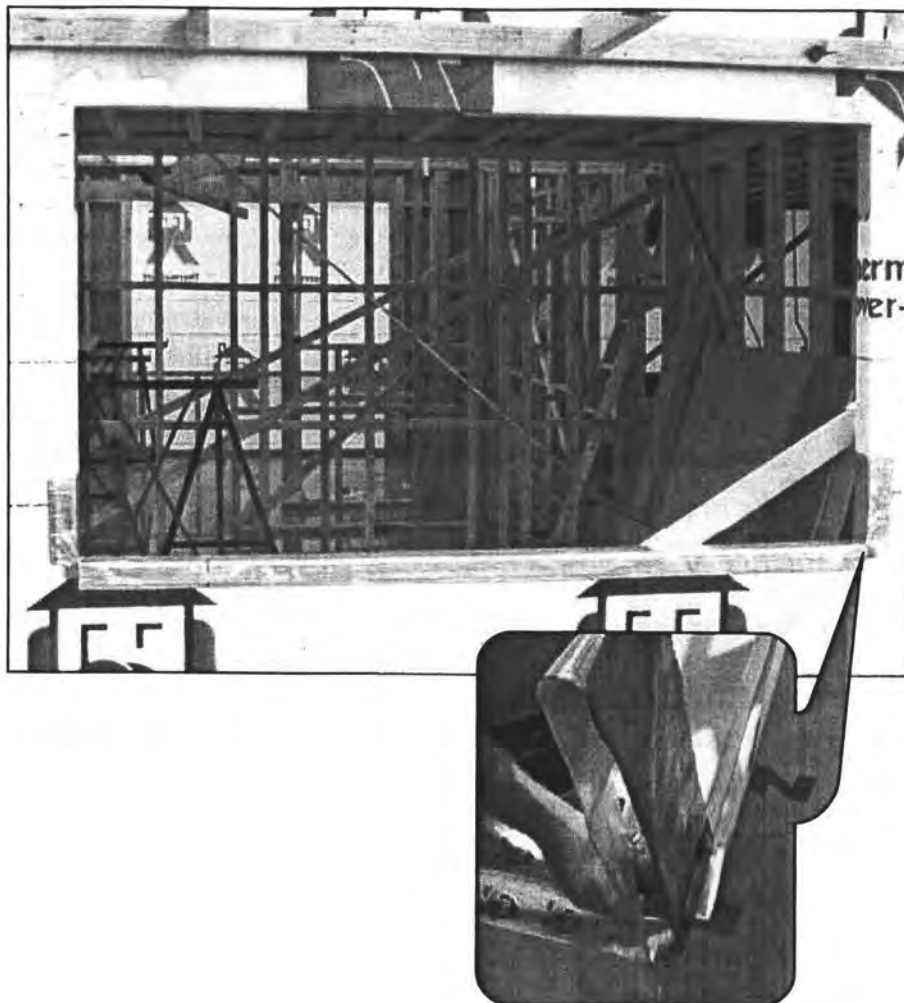
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Product

1.1 The Aluband™ / Aluminium Window Sealing System comprises Aluband™ / Aluminium Window Sealing Tape and the Aluband™ Corner Moulded Piece™. The system is used 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 wrap and exposed frame to cover both the face and edge of the opening framing. Aluband™ / Aluminium Window Sealing Tape is also used at joinery heads to seal flashing upstands to the building wrap.



Scope

2.1 The Aluband™ / Aluminium Window Sealing System 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 wall wraps compatible with the flashing tape; and,
- situated in NZS 3604 Building Wind Zones up to, and including, 'Very High'.

2.2 The Aluband™ / Aluminium Window Sealing System 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 wall wraps compatible with the flashing tape and steel frame; and,
- situated in NZS 3604 Building Wind Zones up to, and including, 'Very High'.

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the Aluband™ / Aluminium Window Sealing System, 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. The Aluband™ / Aluminium Window Sealing System meets these requirements. See Paragraphs 8.1 and 8.2.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. The Aluband™ / Aluminium Window Sealing System contributes to meeting this requirement. See Paragraphs 7.1 - 7.4 and 11.1.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Aluband™ / Aluminium Window Sealing System 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.

Technical Specification

4.1 System components and accessories supplied by Thermakraft Industries (N.Z.) Ltd are:

- Aluband™ / Aluminium Window Sealing Tape is a polymeric faced, high quality, bituminous modified, self adhesive tape with a polyethylene release backing paper. The tape is supplied in rolls 200, 150, 75 and 50 mm wide x 25 m long and 150 mm wide x 10 m long. The product is printed with the Aluband™ / Aluminium Window Sealing System logo repeated along the length of the roll. The rolls are wrapped in clear polythene film.
- The Aluband™ / Aluminium Corner Moulded Piece™ is made from inert polyethylene and is coloured orange. It is used in conjunction with the Aluband™ / Aluminium Window Sealing Tape and building wraps as part of the Aluband™ / Aluminium Window Sealing System.
- The Aluband™ / Aluminium Tool is used to ensure proper adhesion of the Aluband™ / Aluminium Window Sealing Tape and to achieve a tight fit into corners.

4.2 Accessories used with the system which are supplied by the installer are:

- Aluband™ / Aluminium Corner Moulded Piece™ fixings - staples, clouts or other temporary fixings to attach the corner mould to the framing prior to the installation of the Aluband™ / Aluminium Window Sealing Tape.

Handling and Storage

5.1 Handling and storage of all materials supplied by Thermakraft Industries (N.Z.) Ltd, whether on or off site, is under the control of the installer. The Aluband™ / Aluminium Window Sealing System components must be protected from damage and weather. Rolls must be stored under cover, in clean, dry conditions away from direct exposure to sunlight.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Aluband™ / Aluminium Window Sealing System. 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

7.1 The Aluband™ / Aluminium Window Sealing System meets the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.5(b). Refer to the Technical Literature for details of the wall wraps that are compatible with the system. The installation method for the Aluband™ / Aluminium Window Sealing System is an alternative solution to the installation method shown within NZBC Acceptable Solution E2/AS1, Figure 72.

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 The Aluband™ / Aluminium Window Sealing System 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 The Aluband™ / Aluminium Window Sealing System 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. The Aluband™ / Aluminium Window Sealing System is designed to be used in conjunction with air seals and joinery flashing systems, not as a substitute.

7.5 When the Aluband™ / Aluminium Window Sealing System 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 Aluband™ / Aluminium Window Sealing System 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 90 days, and provided the exterior cladding is maintained in accordance with the cladding manufacturer's instructions and the cladding remains weather resistant, the Aluband™ / Aluminium Window Sealing System is expected to have a serviceable life equal to that of the cladding.

Maintenance

9.1 No maintenance is required for the Aluband™ / Aluminium Window Sealing System. 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.

Outbreak of Fire

10.1 The Aluband™ / Aluminium Window Sealing System must be separated from chimneys and flues in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9 for the protection of combustible materials.

External Moisture

11.1 Where a cladding manufacturer specifies the use of generic flashing tapes 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), the Aluband™ / Aluminium Window Sealing System may be used.

Installation Skill Level Requirements

12.1 Installation of the Aluband™ / Aluminium Window Sealing System must be completed by tradespersons with an understanding of flexible flashing systems, in accordance with instructions given within the Aluband™ / Aluminium Window Sealing System Technical Literature and this Appraisal.

General

13.1 The selected building wrap must be installed in accordance with the manufacturer's instructions, and must completely cover the joinery opening. The wrap 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 Fit an Aluband™ / Aluminium Moulded Corner Piece™ into each of the bottom corners to create a seal at the corner junction. The corner piece must be fixed to the framing with staples or clouts.

13.3 Before the Aluband™ / Aluminium Window Sealing 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.

13.4 A length of Aluband™ / Aluminium Window Sealing Tape must be cut to the length of the sill plus 400 mm. The tape is installed flush with the interior face of the opening and is applied along the entire length of the sill and 200 mm up each jamb. The overhanging tape is cut at the corner of the opening to allow the tape to be folded onto the face of the building wrap. The Aluband™ / Aluminium Tool must be used to ensure that adequate adhesion of the tape is achieved and that the tape is installed tight into the sill/jamb junction.

13.5 A 400 mm length of Aluband™ / Aluminium Window Sealing Tape must be installed 200 mm down the jamb and 200 mm along the lintel at each of the top corners of the window or door joinery opening. A 50 mm wide x 100 mm long sealing tape 'butterfly' must be installed at 45° across the corner of the head/jamb junction overlapping the corner by 3 mm to create a seal at the corner junction.

13.6 Aluband™ / Aluminium Window Sealing Tape must not be stretched. To avoid wastage, the tape can be lapped 100 mm minimum onto itself without reducing the performance of the Aluband™ / Aluminium Window Sealing System.

13.7 If the Aluband™ / Aluminium Window Sealing System is exposed to the weather or UV light for more than 90 days, then it must be replaced with new material.

Installation Temperature

13.8 The Aluband™ / Aluminium Window Sealing System must not be installed at temperatures of less than 10°C.

Inspections

13.9 The Technical Literature must be referred to during the inspection of Aluband™ / Aluminium Window Sealing System installations.

The following is a summary of the technical investigations carried out:

Tests

14.1 Testing of Aluband™ / Aluminium Window Sealing Tape has been completed by BRANZ to the requirements of ICC Evaluation Service Acceptance Criteria for Flashing Materials AC148. The adhesion of Aluband™ / Aluminium Window Sealing Tape to black bituminous Kraft building paper complying with the requirements of NZBC Acceptable Solution E2/AS1, Table 23 and selected other synthetic wall wraps has been tested and found to be satisfactory.

Other Investigations

15.1 An assessment was made of the durability of the Aluband™ / Aluminium Window Sealing System 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.

Quality

16.1 The manufacture of the Aluband™ / Aluminium Window Sealing System has not been examined by BRANZ, but 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 Thermakraft Industries (N.Z.) Ltd.

16.3 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing systems and building wraps 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 Thermakraft Industries (N.Z.) Ltd.

Sources of Information

- ICC Evaluation Service, Inc, AC148 Acceptable Criteria for Flexible Flashing Materials, July 2001.
- NZS 3604: 1999 Timber framed buildings.
- Compliance Document for the New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992 up to, and including, July 2007 amendment.



BRANZ

In the opinion of BRANZ, Aluband™ / Aluminium Window Sealing System 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 Thermakraft Industries (N.Z.) 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. Thermakraft Industries (N.Z.) 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.
3. 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.
4. 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 Thermakraft Industries (N.Z.) Ltd.
5. 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.
6. BRANZ provides no certification, guarantee, indemnity or warranty, to Thermakraft Industries (N.Z.) Ltd or any third party.

For BRANZ

C Preston
Chief Executive

Date of issue: 7 July 2008



BRANZ Appraised

Appraisal No.633 [2009]

BRANZ Appraisals

Technical Assessments of products
for building and construction

BRANZ APPRAISAL No. 633 (2009)

GRAPHEX CAVITY SYSTEM

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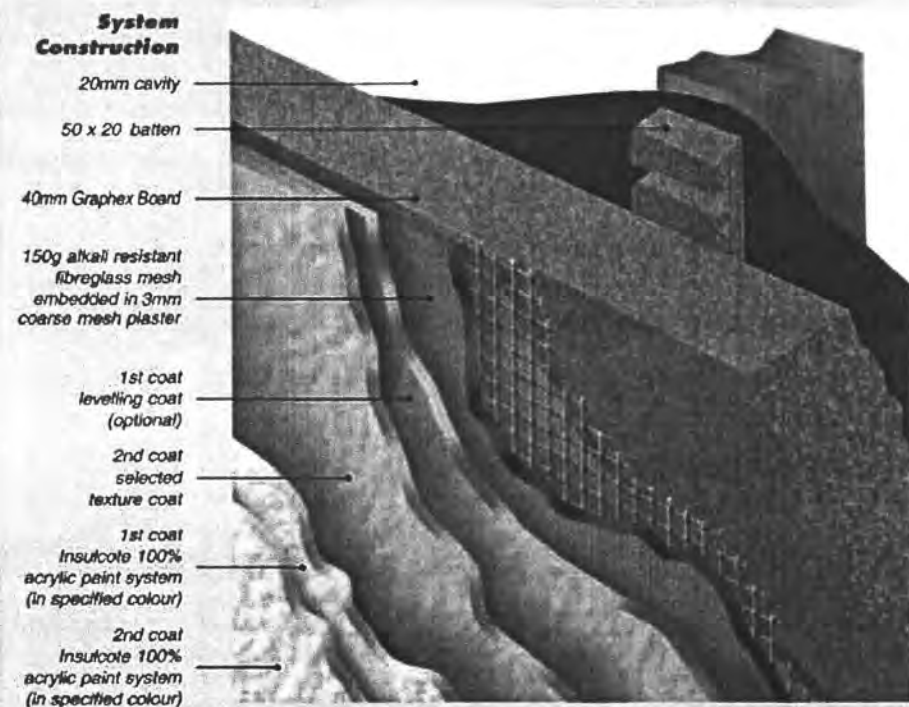


Product

1.1 The Graphex Cavity System is a cavity-based Exterior Insulation and Finishing System (EIFS) wall cladding. It is an external wall cladding system for residential and light commercial type buildings where domestic construction techniques are used.

1.2 The system consists of Neopor®, a graphite composite board fixed over polystyrene battens to form the cavity. The plaster coating system consists of a 3-4 mm thickness of fibreglass mesh reinforced, polymer-modified, cement-based plaster, which is finished with a cement-based finishing plaster that is then painted with a 100% acrylic-based paint system. The chosen finishing plaster is applied to give a range of different appearances, such as a sponge, patterned, adobe or spray textured finish.

1.3 The system incorporates a primary and secondary means of weather resistance (first and second line of defence) against water penetration by separating the cladding from the external wall framing with a nominal 20 mm drained cavity.



Scope

2.1 The Graphex Cavity System has been appraised as an external wall cladding system for buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- constructed with timber 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,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.

2.2 The Graphex Cavity System has also been appraised for weathertightness and structural wind loading when used for timber and steel framed buildings subject to specific design up to a design differential ultimate limit state (ULS) wind pressure of 2.5 kPa.

2.3 The Graphex Cavity System must only be installed on vertical surfaces (except for tops of parapets, sills and balustrades, which must have a minimum 15° slope and be waterproofed in accordance with the Technical Literature).

2.4 The system is appraised for use with aluminium window and door joinery that is installed with vertical jambs and horizontal heads and sills. (*The Appraisal of the Graphex Cavity System relies on the joinery meeting the requirements of NZS 4211 for the relevant Building Wind Zone or wind pressure.*)

2.5 Installation of components and accessories supplied by PSL and approved installers must be carried out only by PSL approved installers.

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the Graphex Cavity System 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 B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. The Graphex Cavity System meets the requirements for loads arising from self-weight, wind, impact and creep (i.e. B1.3.3 (a), (h), (j) and (q)). See Paragraphs 10.1 - 10.4.

Clause B2 DURABILITY: Performance B2.3.1 (b), 15 years, B2.3.1 (c), 5 years and B2.3.2. The Graphex Cavity System meets these requirements. See Paragraphs 11.1 and 11.2.

Clause C3 SPREAD OF FIRE: Performance C3.3.5. The Graphex Cavity System meets this requirement. See Paragraphs 14.1 - 14.3.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. The Graphex Cavity System meets this requirement. See Paragraphs 16.1 - 16.5.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Graphex Cavity System 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.

4.1 System components and accessories supplied by PSL are as follows:

Cavity Battens

- Graphex peel 'n' stick battens are manufactured from high density (Class H) expanded polystyrene (EPS) with an approximate density of 24 kg/m³. The battens are 21 mm thick by 45 mm wide and have a slotted face to allow air movement. The battens are coated on the back face with an acrylic adhesive, which is protected prior to installation by a removable film.

Neopor®

- Neopor® boards are 40 or 60 mm thick with an approximate density of 24 kg/m³. The boards are supplied in lengths ranging from 2.4 to 3.6 m x 1.2 m wide and are manufactured to meet the requirements of AS 1366 Part 3.

Plasters

- Coarse Mesh Render* is a polymer-modified, Portland cement-based plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is applied as the base coat in a minimum 2 mm layer followed by the embedment of fibreglass mesh reinforcement in the outer surface. Coarse Mesh Render can also be used to achieve a spray textured finish.
- Ezytex* is a polymer-modified, Portland cement-based finishing plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is available in three grades to provide a textured, patterned or sponge finish.

Paint System Specification

- At least two coats of a 100% acrylic-based exterior paint must be used over the finishing plasters to make the system weathertight and give the desired finish colour to exterior walls. Insulcote is a 100% acrylic-based exterior paint formulated for use over cement-based plasters and can be used over Coarse Mesh Render and Ezytex finishing plasters. Insulcote is supplied in 4 litre, 10 litre and 20 litre pails.

- PSL allows the use of other latex exterior paint systems over Coarse Mesh Render and Ezytex finishing plasters. A latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730 must be used over the finishing plasters to make the system weathertight and give the desired finish colour to exterior walls. Paint colours must have a light reflectance value of 40% minimum regardless of gloss value. Proprietary paint systems not supplied by PSL have not been assessed and are therefore outside the scope of this Appraisal.

Accessories

- Reinforcing mesh - alkali-resistant fibreglass mesh with a nominal mesh size of approximately 4 mm square and a weight of 150 g/m² for use in domestic and light commercial situations. Where a greater level of impact resistance is required, 360 g/m² alkali-resistant fibreglass mesh with a nominal mesh size of approximately 3 mm square is available.
- uPVC components - sill flashing, jamb flashing and head flashing, base caps, corner beads, cavity vent strip, Z-flashing and horizontal and vertical control joint flashings.
- Neopor® board fixings (timber frame) - 90 x 3.6 mm (for 40 mm thick) and 110 x 4.0 mm (for 60 mm thick) hot-dipped galvanised flat head nails with 22 or 40 mm diameter washers.
- Neopor® board fixings (steel frame) - 8-gauge x 75 mm (for 40 mm thick) and 8-gauge x 95 mm (for 60 mm thick) self-drilling AS 3566 Corrosion Class 3 or 4 screws in NZS 3604 defined Corrosion Zones, 1, 2, 3 and 4 and Grade 304 stainless steel screws in the sea spray zone with 40 mm diameter washers.
- Washers - 22 or 40 mm diameter polypropylene washers.

4.2 Accessories used with the system which are supplied by the approved applicator are:

- Waterproof membrane tapes - tapes covered by a valid BRANZ Appraisal for use as waterproofing membranes over tops of plastered parapets, balustrades, fixing blocks and the like.
- Flexible sealant - sealant complying with NZBC Acceptable Solution E2/AS1, or sealant covered by a valid BRANZ Appraisal for use as a weather sealing sealant for exterior use.
- Adhesive - EPS compatible adhesive for gluing uPVC components to the Neopor® boards as and where required.

4.3 Accessories used with the system which are supplied by the building contractor are:

- Building wrap - paper or wrap complying with NZBC Acceptable Solution E2/AS1 Table 23, or breather-type membranes covered by a valid BRANZ Appraisal for use as wall wraps.
- Building wrap support - polypropylene strap for securing the building wrap in place and preventing bulging of the bulk insulation into the drainage cavity where cavity battens are installed at greater than 450 mm centres. (Note: additional vertical battens may also be installed to provide support.)
- Flexible sill and jamb flashing tapes - flexible flashing tapes complying with NZBC Acceptable Solution E2/AS1 Paragraph 4.3.11, or flexible flashing tapes covered by a valid BRANZ Appraisal for use around window and door joinery openings.
- Window and door trim cavity airseal - air seals complying with NZBC Acceptable Solution E2/AS1 Paragraph 9.1.6, or self-expanding, moisture cure polyurethane foam air seals covered by a valid BRANZ Appraisal for use around window, door and other wall penetration openings.

Handling and Storage

5.1 Handling and storage of all materials supplied by PSL or the approved installer, whether on or off site, are under the control of PSL approved installers. Dry storage must be provided on site for the fibreglass mesh and bags of plaster. Neopor® boards, battens, uPVC flashings and profiles must be protected from direct sunlight and physical damage, and should be stored flat and under cover. Liquid components must be stored in frost-free conditions.

5.2 Handling and storage of all materials supplied by the building contractor, whether on or off site, are under the control of the building contractor. Materials must be handled and stored in accordance with the relevant manufacturer's instructions.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Graphex Cavity System. 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. The Graphex Cavity System listing on the BRANZ website excludes specific details. These details are outside the scope of this Appraisal.

Framing

Timber Treatment

7.1 Timber wall framing behind the Graphex Cavity System must be treated as required by NZS 3602.

Timber Framing

7.2 Timber framing must comply with NZS 3604 for buildings or parts of buildings within the scope limitations of NZS 3604. Buildings or parts of buildings outside the scope of NZS 3604 must be to a specific design in accordance with NZS 3603 and AS/NZS 1170. Where specific design is required, the framing must be of at least equivalent stiffness to the framing provisions of NZS 3604. In all cases studs must be at maximum 600 mm centres for buildings designed to NZS 3604 and at maximum 400 mm centres for specifically designed buildings situated in Building Wind Zones above NZS 3604 defined 'Very High'. Dwaags must be fitted flush between the studs at maximum 800 mm centres.

7.3 Timber framing must have a maximum moisture content of 24% at the time of the cladding application. *(If Neopor® boards are fixed to framing with a moisture content of greater than 24% problems may occur at a later date due to excessive timber shrinkage.)*

Steel Framing

7.4 Steel framing must be to a specific design meeting the requirements of the NZBC.

7.5 The minimum framing specification is 1C' section studs and nogs of overall section size of 75 mm web and 32 mm flange. Steel thickness must be minimum 0.55 mm.

7.6 For steel framed buildings situated within NZS 3604 defined Building Wind Zones up to, and including, 'Very High', studs must be at maximum 600 mm centres. For all other buildings studs must be at maximum 400 mm centres. Dwaags must be fitted flush between the studs at maximum 800 mm centres.

Neopor® Board Setout

7.7 All vertical Neopor® board edges must be supported and fixed through the cavity battens to the framing. Horizontal board edges must be supported at fixing locations with cavity spacers in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.2(f). At the base of the wall, the Neopor® boards must hang 50 mm below the supporting framing.

7.8 Additional framing will be required at soffits, internal and external corners and window and door openings for the support and fixing of sheet edges.

General

8.1 When the Graphex Cavity System is used for specifically designed buildings up to 2.5 kPa design differential ULS wind pressure, only the weathertightness aspects of the cladding and maximum framing centres and sheet fixing centres are within the scope of this Appraisal. All other aspects of the building need to be specifically designed and are outside the scope of this Appraisal.

8.2 Openings in the cavity vent strip provide a minimum ventilation opening area of 1000 mm² per lineal metre of wall in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.3(b).

8.3 The ground clearance to finished floor levels as set out in NZS 3604 must be adhered to at all times. At ground level, paved surfaces, such as footpaths, must be kept clear of the bottom edge of the cladding system by a minimum of 100 mm, and unpaved surfaces by 175 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Table 18.

8.4 At balcony, deck or roof/wall junctions, the bottom edge of the Graphex Cavity System must be kept clear of any adjacent surface, or above the top surface of any adjacent roof flashing by a minimum of 35 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.3.6.

8.5 All buildings must have barriers to airflow in the form of interior linings with all joints stopped, or alternatively, unlined gables and walls must incorporate a rigid sheathing or an air barrier which meets the requirements of NZBC Acceptable Solution E2/AS1, Table 23. Where rigid sheathings are used, the fixing length must be increased by a minimum of the thickness of the sheathing.

8.6 Where penetrations through the Graphex Cavity System are wider than the cavity batten spacing, allowance must be made for airflow between adjacent cavities. A minimum 10 mm gap must be left between the bottom of the vertical cavity batten and the flashing to the opening.

8.7 Where the system abuts other cladding systems, designers must detail the junction to meet their own requirements and the performance requirements of the NZBC. The Technical Literature provides some guidance. Details not included within the Technical Literature have not been assessed and are outside the scope of this Appraisal.

Electrical Cables

8.8 PVC sheathed electrical cables must be prevented from direct contact with the Neopor®. When cables must penetrate the Neopor® for exterior electrical connections, the cable must be directly supported by passing through an electrical conduit.

Control Joints

9.1 Control joints must be constructed in accordance with the Technical Literature, and be provided as follows:

- Horizontal control joints - at maximum 6 m centres.

- Vertical control joints - at maximum 20 m centres; aligned with any control joint in the structural framing; where the system abuts different cladding types, or where the system covers different structural materials.

(Note: Horizontal and Vertical Control joints must be located over structural supports. The design of vertical control joints where the system abuts different cladding types is outside the scope of this Appraisal and is the responsibility of the designer - see Paragraph 8.7.)

Inter-storey Junctions

9.2 Inter-storey drained joints must be provided for walls over 2 storeys in height in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.9.4(b). Inter-storey junctions must be constructed in accordance with the Technical Literature.

(Note: Refer to Paragraph 14.2 for the requirements for barriers to vertical fire spread at inter-storey junctions for buildings of three or more floors.)

Structure

Mass

10.1 The mass of the Graphex Cavity System is approximately 7 kg/m², therefore it is considered a light wall cladding in terms of NZS 3604.

Impact Resistance

10.2 The system has adequate resistance to hard body impacts likely to be encountered in normal residential use. Where a greater level of impact protection is required a heavier grade of reinforcing mesh may be used. The heavy-grade fibreglass reinforcing mesh (360 g/m²) embedded in 5 mm thick plaster provides approximately 4 times the hard body impact strength of the standard grade mesh in 3 mm thick plaster. The likelihood of impact damage to the system when used in light commercial situations should be considered at the design stage, and appropriate protection such as the installation of bollards and barriers should be considered for vulnerable areas.

Wind Zones

10.3 The Graphex Cavity System is suitable for use in all Building Wind Zones of NZS 3604, up to, and including Very High where buildings are designed to meet the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 1.1, or up to 2.5 kPa design differential ULS wind pressure where buildings are specifically designed.

Neopor® Board Fixing

10.4 Neopor® boards must be fixed through the cavity battens and cavity spacers to the wall framing at maximum centres specified in Table 1.

Table 1: EPS Sheet Fixing Centres for Edges and Intermediate Studs

NZS 3604 Building Wind Zone with studs at maximum 600 mm centres	Maximum fixing centres (mm) beyond 1.5 m from an external corner	Maximum fixing centres (mm) within 1.5 m of an external corner
Low	300	300
Medium	300	200
High	300	150
Very High	300	150

Note: One fixing is also required into each dwang at mid-dwang length.

Note: In Low, Medium or High Building Wind Zones, 22 or 40 mm diameter washers may be used. In Very High Building Wind Zones, 40 mm diameter washers must be used.

Specifically designed buildings up to 2.5 kPa design differential ULS wind pressure with studs at maximum 400 mm centres.

Maximum vertical fixing centres (mm) along studs	Maximum horizontal fixing centres (mm) along top and bottom plates	Maximum horizontal fixing centres (mm) along dwangs
150	200	150

Note: 40 mm diameter washers must be used in all situations.

Durability

11.1 The Graphex Cavity System meets code compliance with NZBC Clause B2.3.1 (b), 15 years for the cavity system and plaster finish, and code compliance with NZBC Clause B2.3.1 (c), 5 years for the exterior paint system.

Serviceable Life

11.2 The Graphex Cavity System is expected to have a serviceable life of at least 30 years provided the system is maintained in accordance with this Appraisal, and the Neopor® boards, fixings and plaster are continuously protected by a weathertight coating and remain dry in service.

Maintenance

12.1 Regular maintenance is essential to ensure the performance requirements of the NZBC are continually met and to ensure the maximum serviceability of the system.

12.2 Regular cleaning (at least annually) of the paint coating is required to remove grime, dirt and organic growth and to maximise the life and appearance of the coating. Grime may be removed by brushing with a soft brush, warm water and detergent. Paint systems must be recoated at approximately 5-10 yearly intervals in accordance with the paint manufacturer's instructions.

12.3 Annual inspections must be made to ensure that all aspects of the cladding system, including the coating system, plaster, flashings and any sealed joints remain in a weatherproof condition. Any cracks, damaged areas or areas showing signs of deterioration which would allow water ingress, must be repaired immediately. Sealant, coatings and the like must be repaired in accordance with the instructions of PSL.

12.4 Minimum ground clearances as set out in this Appraisal and the Technical Literature must be maintained at all times during the life of the system. (Failing to adhere to the minimum ground clearances given in this Appraisal and the Technical Literature will adversely affect the long term durability of the Graphex Cavity System.)

Control of Internal Fire and Smoke Spread

13.1 The Neopor® board used with the system meets the flame propagation criteria of AS 1366. The Neopor® board must also be protected from ignition in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 6, Paragraphs 6.20.11 and 6.20.12. Where required by NZBC Acceptable Solution C/AS1 Part 6, Table 6.3, flame barriers meeting the requirements of C/AS1 Part 6, Paragraph 6.20.13 and Appendix C, Paragraph C10.1 must be provided.

Control of External Fire Spread

14.1 The Graphex Cavity System has a performance level A in accordance with NZBC C/AS1 Table 7.5. The system is suitable for use as an external wall cladding system on buildings in all Purpose Groups, at any distance to the boundary.

14.2 For buildings of three or more floors where the cladding system extends to cover the walls of at least three floors, the requirements for barriers to vertical fire spread in the cladding as set out in NZBC Acceptable Solution C/AS1 Part 7, Paragraphs 7.9.18 and 7.9.19 must be met. These joints are not covered by the Technical Literature, and are outside the scope of this Appraisal. Design of the barrier joint must be specifically detailed by the designer to meet the NZBC, including blocking of the cladding cavity and wall framing cavity, and installation of flashing and sealing systems to collect and direct any moisture to the outside of the cladding system at this point.

Outbreak of Fire

15.1 The Graphex Cavity System must be separated from chimneys and flues in accordance with the requirements of NZBC Acceptable Solution C/AS1, Part 9 for the protection of combustible materials.

External Moisture

16.1 The Graphex Cavity System, when installed in accordance with this Appraisal and the Technical Literature, prevents the penetration of moisture that could cause undue dampness or damage to building elements.

16.2 The cavity must be sealed off from the roof and sub-floor space to meet code compliance with Clause E2.3.5.

16.3 The Graphex Cavity System allows excess moisture present at the completion of construction to be dissipated without permanent damage to building elements to meet code compliance with Clause E2.3.6.

16.4 The details given in the Technical Literature for weather sealing are based on the design principle of having a first and second line of defence against moisture entry for all joints, penetrations and junctions. The ingress of moisture must be excluded by detailing joinery and wall interfaces as shown in the Technical Literature. Weathertightness details that are developed by the designer are outside the scope of this Appraisal and are the responsibility of the designer for compliance with the NZBC.

16.5 The use of the Graphex Cavity System where there is a designed cavity drainage path for moisture that penetrates the cladding, does not reduce the requirement for junctions, penetrations, etc to remain weather resistant.

Internal Moisture

17.1 The Graphex Cavity System alone does not meet NZBC Acceptable Solution E3/AS1, Paragraph 1.1.1(a). Buildings must be constructed with an adequate combination of thermal resistance and ventilation, and space temperature must be provided to all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated or may accumulate.

Water Vapour

17.2 The Graphex Cavity System is not a barrier to the passage of water vapour, and when correctly installed will not create or increase the risk of moisture damage resulting from condensation.

17.3 When the Graphex Cavity System is installed over a steel frame, the EPS battens and insulated drainage cavity will act as a thermal break to the steel frame in accordance with NZBC Acceptable Solution E3/AS1.

Energy Efficiency

Building Thermal Envelope

18.1 NZBC Acceptable Solution H1/AS1 or NZBC Verification Method H1/VM1 can be used for housing, communal residential, communal non-residential and commercial buildings.

Determining Thermal Resistance

18.2 The thermal resistance (R-values) of building elements may be verified by using NZS 4214. The BRANZ 'House Insulation Guide' Third Edition provides thermal resistances of common building elements and is based on calculations from NZS 4214. Calculations in accordance with NZS 4214 require that the ventilated air gap and the thermal resistance of each layer between the ventilated air gap and outside air be de-rated by a factor of 0.45. Therefore, in the Graphex Cavity System, unless better information is available for a specific case, the R-value of the Neopor® layer must be taken as R0.69 (40 mm thick) and R1.03 (60 mm thick) based on a thermal conductivity (k value) of 0.032 W/m °C.

Installation Skill Level Requirements

19.1 Installation and finishing of components and accessories supplied by PSL and the approved installers must be completed by P.P.C.S. qualified tradespersons, approved by PSL.

19.2 Installation of the accessories supplied by the building contractor must be completed by tradespersons with an understanding of cavity construction, in accordance with instructions given within the Graphex Cavity System Technical Literature and this Appraisal.

System Installation

Building Wrap and Flexible Sill and Jamb Flashing Tape

20.1 The selected building wrap and flexible sill and jamb tape system must be installed by the building contractor in accordance with the wrap and tape manufacturer's instructions prior to the installation of the cavity battens and the rest of the Graphex Cavity System. Building wrap must be installed horizontally and be continuous around corners. The wrap must be lapped 75 mm minimum at horizontal joints and 150 mm minimum over studs at vertical joints. Particular attention must be paid to the installation of the building wrap and sill and jamb tapes around window and door openings to ensure a continuous seal is achieved and all exposed wall framing in the opening is protected.

Aluminium Joinery Installation

20.2 Aluminium joinery and associated head flashings must be installed by the building contractor in accordance with the Technical Literature. A 7.5-10 mm nominal gap must be left between the joinery reveal and the wall framing so a PEF rod and air seal can be installed after the joinery has been secured in place.

Graphex Cavity System

20.3 The system must be installed in accordance with the Technical Literature by PSL approved installers.

20.4 The Graphex plaster system must only be applied when the air and substrate temperature is within the range of +5°C to +30°C.

Inspections

20.5 The Technical Literature must be referred to during the inspection of Graphex Cavity System installations.

Finishing

20.6 Insulcote or other paint manufacturers' instructions must be followed at all times for application of the paint finish. The plaster must be cured for a minimum of 2-3 days and must be dry before commencing painting.

Health and Safety

21.1 Safe use and handling procedures for the components that make up the Graphex Cavity System are provided in the relevant manufacturer's Technical Literature.

The following is a summary of the technical investigations carried out:

Tests

22.1 The following testing has been completed by BRANZ:

- BRANZ expert opinion on NZBC E2 code compliance for the Graphex Cavity System was based on testing and evaluation of the Insulclad Cavity System incorporating all of the details within the scope and as stated within this Appraisal. The Insulclad Cavity System was tested to E2/VM1. The testing assessed the performance of the foundation detail, window head, jamb and sill details, meter box head, jamb and sill details, vertical and horizontal control joints, internal and external corners and balustrade to wall junction with a plastered cap. In addition to the weathertightness test, the details contained within the Technical Literature have been reviewed, and an opinion has been given by BRANZ technical experts that the system will meet the performance levels of Acceptable Solution E2/AS1 for drained cavity claddings.
- Wind face load and fastener pull through testing for EIFS cladding systems. BRANZ determined design wind suction pressures, and by comparing these pressures with NZS 4203 pressure coefficients, the fixing requirements were determined for timber and steel framed walls.
- Cone Calorimeter testing of the Graphex plaster system over 40 mm EPS. The testing was carried out in accordance with AS/NZS 3837.

Other Investigations

23.1 The performance of Insulclad External Insulation and Finishing Systems in New Zealand since 1985 has been considered.

23.2 Structural and durability opinions have been given by BRANZ technical experts.

23.3 Site visits have been carried out by BRANZ to assess the practicability of installation, and to examine completed installations.

23.4 The manufacturer's Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

24.1 The manufacture of the plasters has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

24.2 The quality management system of PSL is covered by the Nuplex Industries Ltd quality management system which has been assessed and registered as meeting the requirements of AS/NZS ISO 9001:2000 by Telarc Limited, Registration Number 158.

24.3 Quality on site is the responsibility of the PSL approved installers.

24.4 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing systems and joinery, building wraps, flashing tapes, air seals and joinery head flashings in accordance with the instructions of PSL.

24.5 Building owners are responsible for the maintenance of the Graphex Cavity System in accordance with the instructions of PSL.

Sources of Information

- AS 1366.3 - 1992 Rigid cellular plastic sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS-M)
- AS 3566 - 2002 Self-drilling screws for the building and construction industries.
- AS/NZS 1170: 2002 Structural design action - General principles.
- AS/NZS 3837: 1998 Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- NZS 3603: 1993 Timber Structures Standard.
- NZS 3604: 1999 Timber framed buildings.
- NZS 4211: 2008 Specification for performance of windows.
- NZS 4214: 2006 Methods of determining the total thermal resistance of parts of buildings.
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992, up to, and including August 2008 Amendment



BRANZ

In the opinion of BRANZ, the Graphex Cavity System 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 Nuplex Industries 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. Nuplex Industries 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.
3. 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.
4. 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 Nuplex Industries Ltd.
5. 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.
6. BRANZ provides no certification, guarantee, indemnity or warranty, to Nuplex Industries Ltd or any third party.

For BRANZ

P Burghout
Chief Executive

Date of issue: 30 October 2009



BRANZ Appraised

Appraisal No.470 [2005]

BRANZ Appraisals

Technical Assessments of products
for building and construction

BRANZ APPRAISAL CERTIFICATE No. 470 (2005)

DUROSET® AND DUROQIK® WET AREA MEMBRANES

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Product

1.1 DuroSET® and DuroQIK® Wet Area Membranes are liquid-applied waterproofing membranes for use under vinyl, ceramic or stone tile finishes in internal wet areas.



Scope

2.1 DuroSET® and DuroQIK® Wet Area Membranes have been appraised for use as waterproofing membranes for internal wet areas of buildings, within the following scope:

- on floor substrates of concrete, flooring grade particleboard, plywood, compressed fibre cement sheet and fibre cement sheet tile underlay, and on wall substrates of concrete, concrete masonry, wet area fibre cement sheet lining systems and wet area plasterboard lining systems; and,
- when protected from physical damage by vinyl, ceramic or stone tile finishes; and,
- where floors are designed and constructed such that deflections do not exceed 1/360th of the span.

2.2 The use of DuroSET® and DuroQIK® Wet Area Membranes on concrete slabs where hydrostatic or vapour pressure is present from below is outside the scope of this Certificate.

2.3 Movement and control joints in the substrate must be carried through to the tile finish. The design and construction of the substrate and movement and control joints is specific to each building, and therefore the responsibility of the building designer and building contractor and is outside the scope of this Certificate.

2.4 The vinyl, ceramic or stone tile finishes are outside the scope of this Certificate.

2.5 The membranes must be installed by trained applicators, approved by Waterproofing Systems Ltd.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, DuroSET® and DuroQIK® Wet Area Membranes if designed, used, installed and maintained in accordance with the statements and conditions of this Certificate, will meet or contribute to meeting the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1 (b), 15 years. DuroSET® and DuroQIK® Wet Area Membranes meet this requirement. See Paragraph 9.1.

Readers are advised to check the validity of this Certificate by referring to the Valid Certificates listing on the BRANZ website, or by contacting BRANZ.

Clause E3 INTERNAL MOISTURE: Performance E3.3.6. Interior wet area floors and walls incorporating DuroSET® and DuroQIK® Wet Area Membranes will meet this requirement. See Paragraphs 11.1 - 11.7.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. DuroSET® and DuroQIK® Wet Area Membranes meet this requirement and will not present a health hazard to people.

3.2 This Certificate appraises an Alternative Solution in terms of New Zealand Building Code compliance.

4.1 Materials supplied by Waterproofing Systems Ltd are as follows:

DuroSET®

- DuroSET® is a styrene-butadiene copolymer-based, one-part, ready-to-use, liquid-applied membrane supplied as a beige thixotropic paste in 20 litre pails.

DuroQIK®

- DuroQIK® is a quick drying, latex based, two-part, flexible, cementitious-based, liquid-applied membrane. It is supplied as DuroQIK® liquid in 15 litre pails and DuroMIX® powder in 18.75 kg bags. When dry, the membrane is light grey in colour.

duroPRIME™

- duroPRIME™ is a multi-purpose, two-in-one primer and waterproof bonding agent. It is used to prime substrates prior to the application of the membranes. It is supplied as a white coloured liquid in 20 litre pails.

Reinforcing Fabric (RF)

- The reinforcing fabric is a 100% non-woven polypropylene used as reinforcement flashing fabric in DuroSET® and DuroQIK® membranes. The fabric has a weight of 40 g/m² and is available in rolls 100 m long x 100 mm and 200 mm wide.

Elastofabric Tapes and Corners

- Elastomeric bond-breaker tapes are used at movement and expansion joints, and elastomeric formed corner sections for use at internal and external corner wall/floor junctions as set out in Technical Literature. The tapes are available in rolls 10 m long x 120 mm wide. The corner sections are approximately 150 mm long and are available for internal corner/floor junctions (90°) and external corner/floor junctions (270°).

EF Polyurethane Sealant

- EF Polyurethane Sealant is an elastomeric, single component, moisture curing polyurethane, multi-purpose construction sealant used for forming the bond breaker joints at junctions under the membrane. The sealant can be used in conjunction with backing rods where required. It is available in 600 ml sausages for use in a caulking gun.

DuroFIX®

- DuroFIX® is a polymer-modified, flexible, quick-drying tile adhesive used to adhere tiles to the membranes. It is available in 20 kg bags and must be mixed with clean water.

Handling and Storage

5.1 All materials must be stored inside, up off concrete floors, in dry conditions, out of direct sunlight and out of freezing conditions. The materials in the original unopened packaging

have a shelf life of 12 months from date of manufacture. Once opened, the materials must be used within 3 months.

6.1 Refer to the Appraisals listing on the BRANZ website for reference to the current Technical Literature for the DuroSET® and DuroQIK® Wet Area Membranes. The Technical Literature must be read in conjunction with this Certificate. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Certificate must be followed.

General

7.1 DuroSET® and DuroQIK® Wet Area Membranes are for use in buildings where an impervious waterproof membrane is required to floors and walls to prevent damage to building elements and adjoining areas.

7.2 DuroQIK® is designed to be used where a quicker curing time is required, such as in cool or humid conditions.

7.3 The membranes must be protected from physical damage by the application of vinyl, ceramic or stone tile finishes.

7.4 Movement and control joints may be required depending on the shape and size of the building or room, and the tile finish specified. Design guidelines can be found in the BRANZ Tiling Good Practice Guide.

7.5 Timber framing must comply with NZS 3604, or where specific engineering design is used, the framing shall be of at least equivalent stiffness to the framing provisions of NZS 3604, or comply with the serviceability criteria of NZS 4203. In all cases framing must be provided so that the maximum span of the substrate as specified by the substrate manufacturer is met and all sheet edges are fully supported. Timber framing supporting the substrates must be constructed such that deflections do not exceed 1/360th of the span. Where NZS 3604 is used, the allowable joist spans given in Table 7.1 shall be reduced by 20%.

Substrates

Plywood

8.1 Plywood must be a minimum of 17 mm thick complying with AS/NZS 2269, CD Grade Structural with sanded C face upwards and treated to H3 (CCA treated). LOSP treated plywood must not be used. The plywood must be supported with dwangs or framing with a maximum span of 400 mm in each direction and fixed with 10 g x 50 mm stainless steel countersunk head screws at 150 mm centres on the edges and 200 mm through the body of the sheets.

Fibre Cement Compressed Sheet/ Fibre Cement Sheet Tile Underlay

8.2 Fibre cement compressed sheet must be manufactured to comply with the requirements of AS 2908.2 and must be specified by the manufacturer as being suitable for use as a wet area substrate. Fibre cement sheet tile underlay must be suitable for use in internal wet areas. Installation must be in accordance with the instructions of the manufacturer.

Particleboard

8.3 Particleboard must be specified for the end use in accordance with NZS 3602.

Concrete and Concrete Masonry

8.4 Concrete and concrete masonry substrates must be to a specific engineering design meeting the requirements of the NZBC, such as concrete construction to NZS 3101, concrete slab-on-ground to NZS 3604, and concrete masonry to NZS 4229 and NZS 4230.

Wet Area Wall Linings

8.5 Plasterboard wall linings must be manufactured to comply with AS/NZS 2588 and be suitable for use in internal wet areas.

8.6 Fibre cement sheet must be suitable for use in wet areas.

Durability

Serviceable Life

9.1 The DuroSET® and DuroQIK® Wet Area Membranes, when subjected to normal conditions of environment and use, are expected to have a serviceable life of at least 15 years and be compatible with ceramic or stone tile finishes with a design service life of 15-25 years.

Maintenance

10.1 No maintenance of the membranes will be required provided significant substrate movement does not occur and the vinyl or tile finish remains intact. Regular checks must be made of vinyl and tiled areas to ensure they are sound and will not allow moisture to penetrate. Any cracks or damage must be repaired immediately by repairing the vinyl or tiles, grouts and sealants.

10.2 In the event of damage to the membranes, the vinyl or tiling must be removed and the membrane repaired by removing the damaged portion and applying a patch as for new work.

10.3 Drainage outlets must be maintained to operate effectively, and vinyl, ceramic or stone tile finishes must be kept clean.

Internal Moisture

11.1 DuroSET® and DuroQIK® Wet Area Membranes are impervious to water and when appropriately designed and installed will avoid the likelihood of water penetrating behind linings or entering concealed spaces.

11.2 DuroSET® and DuroQIK® Wet Areas Membranes are suitable for use to contain accidental overflow to meet NZBC Clause E3.3.2. A means of code compliance for overflow is given in NZBC Acceptable Solution E3/AS1 Paragraph 2.

11.3 Surfaces must be finished with vinyl, ceramic or stone tile finishes. A means of code compliance to NZBC Clause E3.3.3 is given in NZBC Acceptable Solution E3/AS1 Paragraph 3.1.1 (b) and 3.1.2 (b).

11.4 Falls in showers and shower areas must be a minimum of 1 in 50. In unenclosed showers, falls must extend a minimum of 1500 mm out from the shower rose. Floor wastes must be provided and the floor must fall to the outlet.

11.5 The waterproofing membrane must completely cover shower bases, and for unenclosed showers it must extend a minimum of 1500 mm out from the shower rose. Further design guidance on waterproofing wet areas, including waterproofing walls and junctions can be obtained from AS 3740, the BRANZ Good Practice Guide – Tiling, and flooring and wallboard manufacturers.

11.6 Where water resistant wall finishes such as prefinished sheet materials are used, they must flash over the membrane a minimum of 30 mm.

11.7 BRANZ recommends the entire floor be covered by a waterproof membrane for bath, shower and spa rooms where timber, plywood or particleboard floors are used. This is also a requirement of particleboard manufacturers.

Installation Skill Level Requirement

12.1 Installation of the membranes must be completed by trained applicators, approved by Waterproofing Systems Ltd.

12.2 Installation of substrates must be completed by tradespersons with an understanding of internal wet area construction, in accordance with instructions given within the Waterproofing Systems Ltd Technical Literature and this Certificate.

Preparation of Substrates

13.1 Substrates must be dry, clean and stable before installation commences, with surfaces that are even and free from nibs, sharp edges, dust, dirt or other materials such as oil, grease or concrete formwork release agents.

13.2 The relative humidity of concrete substrates must be 75% or less before membrane application. The concrete can be checked for dryness by using a hygrometer as set out in BRANZ Bulletin No. 424.

13.3 All voids, cracks, holes, joints and excessively rough areas must be filled to achieve an even and uniform surface. Junctions of substrate abutments, such as at wall/floor and wall/wall junctions must have a Elastofabric bond breaker joint system or RF underflashing installed as set out in the Technical Literature.

13.4 Substrates must be primed with duroPRIME™ and allowed to dry fully before the membrane is installed.

Membrane Installation

14.1 Installation must not be undertaken where the substrate surface temperature is below 5°C or above 35°C.

14.2 DuroQIK® liquid and DuroMIX® powder must be mixed and left to stand for 5 minutes before re-mixing, then applying. DuroSET® must be thoroughly stirred before application.

14.3 The membrane must be applied in a minimum of two coats at the rates set out in the Technical Literature to give a total minimum finished thickness of 1.2 mm. Subsequent coats must be applied in an opposite direction to the previous coat.

14.4 Application can be made by roller (medium/long nap), brush (long bristle), or a non-edge serated flat steel trowel.

14.5 Elastofabric tapes and corners must be used at junctions as set out in the Technical Literature.

14.6 Clean up may be undertaken with water.

Tiling

15.1 The membranes must be fully cured before tiling. The cured membranes must be protected at all times to prevent mechanical damage, so may require temporary covers until the finishing is completed.

15.2 Tiling must be undertaken in accordance with AS 3958.1 and the BRANZ Good Tiling Practice Guide. The compatibility of the tile adhesive must be confirmed with the adhesive manufacturer or Waterproofing Systems Ltd, if using other than DuroFIX® tile adhesive.

Inspections

16.1 The Technical Literature must be referred to during the inspection of membrane installations by Building Consent Authorities and Territorial Authorities.

16.2 Critical areas of inspection are:

- Construction of substrates, including crack control and installation of under flashings and movement control joints.
- Moisture content of the substrate prior to the application of the membrane.
- Acceptance of the substrate by the membrane installer prior to application of the membrane.
- Installation of the membrane to the manufacturer's instructions, particularly installation to the correct thickness and use of reinforcement.
- Membrane curing and integrity prior to the installation of tiles including protection from mechanical damage during curing and prior to tile installation.

Health and Safety

17.1 Safe use and handling procedures for the membranes are provided in the Technical Literature. The materials must be used in conjunction with the relevant Material Safety Data Sheet.

The following is a summary of the technical investigations carried out:

Tests

18.1 The following testing of DuroSET® has been undertaken by the following organisations:

- Amdel Limited, Australia – water absorption; tensile strength and elongation; shore A hardness; water vapour transmission; accelerated weathering and low temperature flexibility.
- CSIRO, Australia – mass per unit area and gravimetric thickness; tensile strength and elongation at break; tensile strength and elongation at break after UV exposure, including immersion in water, bleach and detergent; loss on heating; moving joint test and cyclic strain.

Test methods and results have been reviewed by BRANZ and found to be satisfactory.

18.2 The following testing of DuroQIK® has been undertaken by Amdel Limited, Australia – wet area durability testing in accordance with AS/NZS 4858 covering immersion in water, bleach, detergent, and heat ageing; UV ageing; water absorption; low temperature flexibility and water vapour transmission. Test methods and results have been reviewed by BRANZ and found to be satisfactory.

18.3 The following testing of Elastofabric has been undertaken by Amdel Limited, Australia – wet area durability testing in accordance with AS/NZS 4858 covering immersion in water, bleach, detergent, and heat ageing; cyclic movement; low temperature flexibility; water absorption and water vapour transmission.

Test methods and results have been reviewed by BRANZ and found to be satisfactory.

18.4 Although not required by the standard AS/NZS 4858 as water vapour transmission testing had already shown compliance, additional testing of DuroSET® and DuroQIK® was also undertaken by Amdel Limited for suitability over particleboard in accordance with AS/NZS 4858, Appendix C, and found to be satisfactory.

18.5 Testing of DuroFIX® has been undertaken by Amdel Limited, Australia for tile adhesion shear strength to both

membranes in accordance with ATM D2919-01 before and after heat ageing and water immersion. Test methods and results have been reviewed by BRANZ and found to be satisfactory.

Other Investigations

19.1 An assessment was made of the durability of the DuroSET® and DuroQIK® Wet Area Membranes by BRANZ technical experts.

19.2 Site visits have been carried out by BRANZ to assess the practicability of installation and to examine completed installations.

19.3 The Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

20.1 The manufacture of the membranes has been examined by BRANZ, and details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

20.2 The quality management system of the membrane's manufacturer has been assessed and found to be satisfactory.

20.3 The quality of supply of the membrane system to the market is the responsibility of Waterproofing Systems Ltd.

20.4 Quality on site is the responsibility of the trained applicators, approved by Waterproofing Systems Ltd.

20.5 Designers are responsible for the substrate design, and building contractors are responsible for the quality of construction of substrate systems in accordance with the instructions of the substrate manufacturer, Waterproofing Systems Ltd and this Certificate.

20.6 Building owners are responsible for the maintenance of the tiling or stone finishing systems in accordance with the instructions of Waterproofing Systems Ltd.

Sources of Information

- AS 2908.2 – 2000 Cellulose-cement products – flat sheet.
- AS 3740 – 2004 Waterproofing of wet areas within residential buildings.
- AS 3958.1 – 1991 Guide to the installation of ceramic tiles.
- ASTM D2919-01 Standard test method for determining durability of adhesive joints stressed in shear by tension loading.
- AS/NZS 4858: 2004 Wet area membranes.
- AS/NZS 2269:1994 Plywood – Structural.
- NZS 3101: 1995 The design of concrete structures.
- NZS 3602: 2003 Timber and wood-based products for use in buildings.
- NZS 3604: 1999 Timber framed buildings.
- NZS 4229:1999 Concrete masonry buildings not requiring specific engineering design.
- NZS 4230:1990 Code of practice for the design of masonry structures.
- BRANZ Good Practice Guide – Membrane Roofing, reprint October 2003.
- BRANZ Good Practice Guide – Tiling, reprint March 2004.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to, and including October 2004 Amendment.



In the opinion of BRANZ, DuroSET® and DuroQIK® Wet Area Membranes are fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided they are used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Waterproofing Systems Ltd, and is valid until further notice, subject to the Conditions of Certification.

Conditions of Certification

1. This Certificate:
 - 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. The Certificate Holder:
 - 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.
3. The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
4. BRANZ makes no representation 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 the Certificate Holder.
5. Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

For BRANZ

P Robertson
Chief Executive

Date of issue: 9 August 2005



BRANZ Appraised

Appraisal No.611 [2008]

BRANZ Appraisals

Technical Assessments of products
for building and construction

**BRANZ
APPRAISAL
No. 611 (2008)**

**HOMERAB™
PRECLAD™ LINING**

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Product

1.1 HomeRAB™ PreClad™ Lining is a sealed fibre cement sheet designed for use as a rigid sheathing behind wall cladding systems and as a bracing system to resist wind and earthquake loads on timber framed buildings. It is manufactured using Ceramic Low Density (CLD) fibre cement technology.



Scope

2.1 HomeRAB™ PreClad™ Lining has been appraised for use as a rigid sheathing and temporary weather-protecting sheathing on timber framed buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1 with regards to building height and floor plan area; and,
- with absorbent wall claddings directly fixed to framing; and,
- with absorbent and non-absorbent wall claddings installed over an 18 mm minimum drained cavity; and,
- with masonry veneer in accordance with NZS 3604; and,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.

2.2 HomeRAB™ PreClad™ Lining has also been appraised for use as wall bracing systems for timber framed buildings within the scope of NZS 3604.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, HomeRAB™ PreClad™ Lining, if used, designed, 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 B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. HomeRAB™ PreClad™ Lining meets the requirements for loads arising from earthquake and wind [i.e. B1.3.3 (f) and (h)]. See Paragraphs 8.1 - 8.6.

Clause B2 DURABILITY: Performance B2.3.1(a), not less than 50 years, B2.3.1(b), 15 years and B2.3.2. HomeRAB™ PreClad™ Lining meets these requirements. See Paragraphs 9.1 - 9.3.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. When used as part of the cladding system, HomeRAB™ PreClad™ Lining will contribute to meeting this requirement. See Paragraphs 12.1 and 12.2.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. HomeRAB™ PreClad™ Lining meets this requirement and will not present a health hazard to people.

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.

3.2 HomeRAB™ PreClad™ Lining is an **Acceptable Solution** rigid sheathing material in terms of compliance with NZBC Acceptable Solution E2/AS1, Table 23. This is an Appraisal of an **Alternative Solution** in terms of the New Zealand Building Code compliance.

3.3 HomeRAB™ PreClad™ Lining is used to satisfy the bracing demand requirements of Section 5 of NZS 3604 which is an NZBC Compliance Document.

4.1 System components and accessories for HomeRAB™ PreClad™ Lining, which are supplied by James Hardie New Zealand Ltd are:

HomeRAB™ PreClad™ Lining

- HomeRAB™ PreClad™ Lining is a 3.5 mm thick fibre cement sheet, manufactured from a CLD cellulose fibre cement formulation. It is produced in sheet material form with an embedded chequered pattern with 'HomeRAB™ PreClad™' embossed on the front face. The sheets are formed, cut to length, and then cured by high pressure autoclaving. The sheet is coated on the front face and four edges with a green tinted water repellent sealer.
- HomeRAB™ PreClad™ Lining is available in sizes of 1200 mm wide and 2460 and 2760 mm long. It is manufactured to conform to the requirements of AS/NZS 2908.2.

Accessories

- HomeRAB™ PreClad™ Lining horizontal flashing - uPVC, available in 3000 mm lengths.
- HomeRAB™ PreClad™ Lining vertical jointer - uPVC, available in 2760 mm lengths.
- Inseal® 3259 joint sealing tape - black, compressible, medium density PVC (Polyvinyl Chloride) closed cell foam. The foam is coated on one side with pressure sensitive acrylic adhesive and the other face is covered by a silicone release paper. The tape is 1.5 mm thick and is supplied in rolls 50 and 80 mm wide and 50 m long.

4.2 System components and accessories for HomeRAB™ PreClad™ Lining, which are supplied by the building contractor are:

- Flexible sill and jamb flashing tape system - AluBand (Thermakraft Industries (N.Z.) Ltd) and Protecto Sill (Marshall Waterproofing NZ/AUS Ltd).
- Joint sealing tape - 75 mm wide AluBand and 75 mm wide Protecto Sill.
- HomeRAB™ PreClad™ Lining sheet fixing - Paslode 32 x 3.06 mm ring shank stainless steel collation type gun nails with a 9 mm diameter head, Paslode 32 x 3.06 mm hot-dip galvanised collation type gun nails with a 9 mm diameter head, or Sifco 32 x 3.05 mm stainless steel collation type gun nails with a 9 mm diameter head.
- Bracing panel end straps - 25 x 1.0 mm hot-dip galvanised or stainless steel strap.
- End strap fixings - 30 x 2.5 mm hot-dip galvanised flat head nails.
- Timber floor end stud hold down - M12 x 150 mm hot-dip galvanised coach screw with 50 x 50 x 3 mm hot-dip galvanised washer.
- Concrete floor end stud hold down - M12 x 150 mm minimum hot-dip galvanised bolts with 50 x 50 x 3 mm hot-dip galvanised washer or proprietary anchors with a minimum characteristic pull-out strength of 10 kN.

Handling and Storage

5.1 Handling and storage of all materials supplied by James Hardie New Zealand Ltd or the building contractor, whether on site or off site, is under the control of the building contractor. HomeRAB™ PreClad™ Linings must be stacked flat, off the ground and supported on a level platform. They must be kept dry at all times either by storing under cover or providing waterproof covers to the stack. Care must be taken to avoid damage to edges, ends and surfaces. The lining must always be carried on edge. uPVC flashings and jointers must be protected from direct sunlight and physical damage, and should be stored flat and under cover.

5.2 Other accessories must be stored so they are kept clean, dry and undamaged.

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Installation Manual for HomeRAB™ PreClad™ Lining. The Installation Manual must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Installation Manual and within the scope of this Appraisal must be followed.

Framing

Timber Treatment

7.1 Timber wall framing behind HomeRAB™ PreClad™ Lining must be treated as required by NZS 3602.

Timber Framing

7.2 Timber framing must comply with NZS 3604 for buildings or parts of buildings within the scope limitations of NZS 3604. Buildings or parts of buildings outside the scope of NZS 3604 must be to a specific design in accordance with NZS 3603 and NZS 4203 (AS/NZS 1170). Where specific design is required, the framing must be of at least equivalent stiffness to the framing provisions of NZS 3604. In all cases studs must be at maximum 600 mm centres for buildings situated in NZS 3604 defined Low, Medium and High Building Wind Zones, and at maximum 400 mm centres for buildings situated in NZS 3604 defined Very High Building Wind Zone. Dwangs must be fitted flush between the studs at maximum 1200 mm centres. *(Note: The timber framing must also be suitable for the selected wall cladding. Refer to the selected cladding system's Technical Literature for specific framing requirements.)*

7.3 Timber wall framing where HomeRAB™ PreClad™ Lining is joined must be nominal 50 mm width (i.e. 45 mm minimum finished width).

7.4 Timber framing must have a maximum moisture content of 20% at the time of the HomeRAB™ PreClad™ Lining application. *(Note: If HomeRAB™ PreClad™ Lining is fixed to framing with a moisture content of greater than 20% problems may occur at a later date due to excessive timber shrinkage.)*

HomeRAB™ PreClad™ Lining Set Out

7.5 HomeRAB™ PreClad™ Lining must be installed vertically.

7.6 When HomeRAB™ PreClad™ Lining is used as rigid sheathing only, the lining can be jointed on or off-stud. When HomeRAB™ PreClad™ Linings are used to achieve wall bracing, the lining must be jointed on-stud only. At the base of the wall, the lining must hang below the bottom plate a minimum of 15 mm, up to a maximum of 40 mm.

General

7.7 HomeRAB™ PreClad™ Lining is intended for use as a rigid sheathing fixed over timber framed walls in order to support the wind pressures, and to act as a secondary barrier to wind-driven rain.

7.8 Commencing from installation, HomeRAB™ PreClad™ Lining must not be exposed to the weather for more than 90 days.

7.9 HomeRAB™ PreClad™ Lining may be used as a temporary weather protecting sheathing to allow the internal lining of the building to proceed before the wall cladding is installed. To achieve temporary weathertightness, all joints, internal and external corners of the HomeRAB™ PreClad™ Lining must be sealed, the roof cladding and soffit linings must be installed, the flexible sill and jamb flashing tape system must be installed around the window and door openings, and the window and door joinery must be installed complete with head flashings and airseals. The timber wall framing must have a maximum moisture content as specified by the internal lining system supplier at the time of the insulation installation and internal lining application.

7.10 When used in accordance with this Appraisal and the Installation Manual, HomeRAB™ PreClad™ Lining can be used to meet the wall bracing element requirements of NZS 3604, for timber framed buildings not requiring specific design. The Installation Manual contains details of the construction of the various bracing systems and the bracing unit ratings achieved for each system. The bracing types and ratings are also given within Table 3.

7.11 HomeRAB™ PreClad™ Lining is suitable for use under wall claddings as a rigid sheathing as called up in NZBC Acceptable Solution E2/AS1, Table 23 on timber framed buildings, except that non-absorbent claddings must not be installed directly over the HomeRAB™ PreClad™ Lining. Refer to Table 1.

Table 1: NZBC E2/AS1 Table 23 Requirements

NZBC E2/AS1 Table 23 Rigid Sheathing Properties	Property Performance Requirement	HomeRAB™ PreClad™ Lining Actual Property Performance
Vapour Resistance	< 7 MN s/g	0.6 MN s/g
Water Resistance	> 20 mm	Pass

Structure

Mass

8.1 The mass of HomeRAB™ PreClad™ Lining is approximately 4.5 kg/m² at equilibrium moisture content. This mass must be added to the selected wall cladding system mass when determining the overall wall cladding mass in terms of NZS 3604.

Wind Zones

8.2 HomeRAB™ PreClad™ Lining is suitable for use in all Building Wind Zones of NZS 3604, up to, and including, 'Very High'. The sheets must be fixed at centres as specified in Table 2. The fixings must be positioned a minimum of 12 mm from all sheet edges, and a minimum of 50 mm horizontally and 75 mm vertically from sheet corners. The fastener heads must finish flush with the sheet surface.

Table 2: HomeRAB™ PreClad™ Lining Fixing Centres

NZS 3604 Building Wind Zone	Framing Set Out	HomeRAB™ PreClad™ Lining Nailing Centres to Studs, Plates and Dwangs
Very High	Studs at 400 mm centres and dwangs at 1200 mm	150 mm
	Studs at 400 mm centres and dwangs at 800 mm	200 mm
High, Medium and Low	All framing options as per NZS 3604	200 mm

8.3 The length of the selected wall cladding fixing must be increased by minimum 5 mm to maintain the face load strength of the wall cladding system.

Bracing

8.4 The bracing units achieved (wind and earthquake) when using HomeRAB™ PreClad™ Lining are given in Table 3. The HomeRAB™ PreClad™ Lining Installation Manual provides comprehensive construction and panel hold-down details.

8.5 The bracing units are derived from the BRANZ P21 test method based on a wall height of 2.4 m. For any other wall height, the bracing rating can be calculated by multiplying the appropriate value by 2.4 and dividing by the wall height in metres, except that panels less than 1.8 m high must be rated as if they were 1.8 m high.

Table 3: Bracing Ratings for HomeRAB™ PreClad™ Lining

System Number	Minimum Bracing Element Length (mm)	End Straps Required	Flooring Construction		BU Per Metre	
			Timber	Concrete	Wind	Earthquake
HR1	1200	Yes		✓	98	76
HR2	1200	Yes	✓		98	76
HR3	2400	Yes		✓	98	76
HR4	2400	Yes	✓		98	76

Note: Bracing ratings are applicable for HomeRAB™ PreClad™ Lining fixed at 150 or 200 mm centres as detailed in Table 2.

Penetrations for Services

8.6 Holes up to 100 x 100 mm positioned no closer than 200 mm to the edge of a sheet or to another hole, may be allowed for services in HomeRAB™ PreClad™ Lining without affecting the bracing rating of the panel.

Durability

9.1 HomeRAB™ PreClad™ Lining meets code compliance with NZBC Clause B2.3.1 (a), not less than 50 years when used for bracing or where the cladding durability requirement or expected serviceable life is not less than 50 years, e.g. behind masonry veneer, and code compliance with NZBC Clause B2.3.1 (b), 15 years where the cladding durability requirement is 15 years.

Serviceable Life

9.2 Provided it is not exposed to the weather or ultra-violet light for a total of more than 90 days, and provided the exterior cladding is maintained in accordance with the cladding manufacturer's instructions and the cladding remains weather resistant, HomeRAB™ PreClad™ Lining is expected to have a serviceable life of at least 50 years.

9.3 Areas of geothermal activity and coastal locations can be very corrosive to fasteners, especially coastal locations within distances of up to 500 metres of the sea including harbours, or 100 metres from tidal estuaries and sheltered inlets in some instances. These coastal locations are defined in NZS 3604 as Sea Spray Zone and Zone 1. For the HomeRAB™ PreClad™ Lining when used as a rigid sheathing to achieve a 50 year serviceable life in the Sea Spray Zone and Zone 1 where increased corrosion resistance is required, it must be fixed with stainless steel fasteners. Fasteners outside the Sea Spray Zone and Zone 1 may be hot dipped galvanised steel. In all corrosion zones where HomeRAB™ PreClad™ Lining is used to achieve wall bracing, it must be fixed with stainless steel fasteners.

Maintenance

10.1 HomeRAB™ PreClad™ Lining will not normally require maintenance. However, if damage occurs to the cladding or lining protecting HomeRAB™ PreClad™ Lining or to the HomeRAB™ PreClad™ Lining itself, the repairs or replacement must be carried out to ensure the integrity of the rigid sheathing or wall bracing system.

Outbreak of Fire

11.1 The HomeRAB™ PreClad™ Lining system must be separated from chimneys and flues in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9 for the protection of combustible materials.

External Moisture

12.1 HomeRAB™ PreClad™ Lining must be used behind claddings that meet the performance requirements of NZBC Clause E2.

12.2 HomeRAB™ PreClad™ Lining, when installed in accordance with the Installation Manual and this Appraisal, will assist in the total cladding system's compliance with NZBC Clause E2.

Installation Information

Installation Skill Level Requirements

13.1 Installation must always be carried out in accordance with the HomeRAB™ PreClad™ Lining Installation Manual and this Appraisal, by competent tradespersons with an understanding of rigid sheathing and wall bracing system installation.

System Installation

HomeRAB™ PreClad™ Lining Installation

14.1 HomeRAB™ PreClad™ Lining may be cut by scoring and snapping, hand guillotine, hand or power saw. Holes and cut-outs may be formed by drilling a number of holes around the perimeter of the opening required and tapping out the centre with a hammer, or by using a hole saw.

14.2 Lining sheets must be dry prior to installation. Cut lining edges that are left exposed must be sealed prior to installation.

14.3 Prior to fixing HomeRAB™ PreClad™ Lining as wall bracing, a check must be made to ensure all sheet edges will be supported by framing. HomeRAB™ PreClad™ Lining when used as a rigid sheathing only, can be jointed on-stud using a joint sealing tape or off-stud using a uPVC jointer.

14.4 HomeRAB™ PreClad™ Lining must be fixed to the timber framing with Paslode 32 x 3.06 mm ring shank stainless steel collation type gun nails with a 9 mm diameter head, Paslode 32 x 3.06 mm hot-dip galvanised collation type gun nails with a 9 mm diameter head, or Sifco 32 x 3.05 mm stainless steel collation type gun nails with a 9 mm diameter head. Refer to Table 2 for fixing centres and Paragraph 9.3 for material selection.

14.5 Lining at vertical joints must be installed with a 1-2 mm gap between the lining edges. Linings at horizontal joints between floor levels must be installed with a minimum 10 mm gap between the lining edges and must be supported over horizontal framing. Linings at inter-storey floor levels must not be fixed to inter-storey joists or blocking and must have a minimum 15 mm gap between the lining edges at this point to allow for shrinkage of the framing. All horizontal joints must be flashed with a uPVC flashing.

14.6 Any damaged areas of HomeRAB™ PreClad™ Lining, such as holes or gaps around service penetrations, must be repaired. Damaged areas can be repaired by covering with joint sealing tape.

Joint Sealing Tape Installation

14.7 When HomeRAB™ PreClad™ Lining is used as wall bracing or as a rigid sheathing without uPVC vertical jointers, all vertical sheet joints, internal and external corners must be covered with Aluband or Protecto Sill joint sealing tape. Inseal® 3259 tape can also be used, however it must be covered with cavity battens as soon as it is installed. The manufacturer's instructions regarding the application temperatures for the joint sealing tapes, and the requirements for the use of adhesive primer must be followed.

14.8 The HomeRAB™ PreClad™ Lining must be cleaned of dust and other surface contaminants prior the application of the joint sealing tape to ensure adequate adhesion is achieved.

Flexible Sill and Jamb Tape Installation

14.9 The selected flexible sill and jamb tape flashing system must be installed in accordance with the tape manufacturer's instructions, except where varied by the HomeRAB™ PreClad™ Lining Installation Manual. Particular attention must be paid to the installation of the sill and jamb tapes around window and door joinery openings to ensure all exposed timber wall framing in the opening is protected.

Inspections

14.10 The Installation Manual must be referred to during the inspection of HomeRAB™ PreClad™ Lining installations.

Health and Safety

15.1 Cutting of HomeRAB™ PreClad™ Lining must be carried out in well ventilated areas, and a dust mask and eye protection must be worn.

15.2 When power tools are used for cutting, grinding or forming holes, health and safety measures as set out in the

Installation Manual must be undertaken because of the amount of dust generated.

15.3 Safe use and handling procedures for HomeRAB™ PreClad™ Lining and the components that make up the cladding system are provided in the relevant manufacturer's Installation Manual.

The following is a summary of the technical investigations carried out:

Tests

16.1 Racking tests were carried out by BRANZ in accordance with BRANZ Technical Paper P21. The earthquake and wind bracing ratings were determined using the evaluation procedures outlined in BRANZ Technical Recommendation No. 10. Nail slip tests were completed to determine the suitability of alternative nail fixings.

16.2 Testing has been carried out by James Hardie Building Products to determine the face load pressure resistance of HomeRAB™ PreClad™ Lining. The testing was completed in a NATA Accredited laboratory and was observed by BRANZ. The test method and results have been reviewed by BRANZ and found to be satisfactory.

16.3 The resistance of HomeRAB™ PreClad™ Lining to water vapour transmission in accordance with AS/NZS 4200.1 and resistance to water penetration in accordance with AS/NZS 4201.4 has been completed by BRANZ.

Other Investigations

17.1 Structural and durability opinions were given by BRANZ technical experts.

17.2 BRANZ expert opinion on NZBC E2 code compliance for HomeRAB™ PreClad™ Lining was based on evaluation of all details within the scope and as stated within this Appraisal. The details contained within the Installation Manual have been reviewed, and an opinion has been given by BRANZ technical experts that the system will meet the performance levels of Acceptable Solution E2/AS1 for rigid sheathings.

17.3 Site inspections were carried out by BRANZ to assess the practicability of installation.

17.4 The Installation Manual for HomeRAB™ PreClad™ Lining has been examined by BRANZ and found to be satisfactory.

Quality

18.1 The manufacture of HomeRAB™ PreClad™ Lining has been examined by BRANZ, including methods adopted for quality control. Details regarding the composition of the materials used were obtained by BRANZ and found to be satisfactory.

18.2 The quality of materials, components and accessories supplied by James Hardie New Zealand Ltd is the responsibility of James Hardie New Zealand Ltd. The quality control system of James Hardie New Zealand Ltd has been assessed and registered as meeting the requirements of ISO 9001: 2000 by Telarc Limited, Registration Number 409.

18.3 Quality of installation on site of components and accessories supplied by James Hardie New Zealand Ltd and the building contractor is the responsibility of the installer.

18.4 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of the framing systems, uPVC flashings, joint seal tapes and flexible sill and jamb tape systems in accordance with the instructions of James Hardie New Zealand Ltd.

Sources of Information

- AS/NZS 1170: 2002 Structural design action – General principles.
- AS/NZS 2908.2: 2000 Cellulose-cement products - Flat sheet.
- AS/NZS 4200.1: 1994 Pliable building membranes and underlays - materials.
- AS/NZS 4201.4: 1994 Pliable building membranes and underlays - Methods of test – Resistance to water penetration.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- NZS 3603: 1993 Timber Structures Standard.
- NZS 3604: 1999 Timber framed buildings.
- NZS 4203: 1992 General structural design and design loadings for buildings.
- Compliance Document for the New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992 up to, and including, July 2007 amendment.



In the opinion of BRANZ, HomeRAB™ PreClad™ Lining 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 James Hardie New Zealand 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. James Hardie New Zealand 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.
3. 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.
4. 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 James Hardie New Zealand Ltd.
5. 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.
6. BRANZ provides no certification, guarantee, indemnity or warranty, to James Hardie New Zealand Ltd or any third party.

For BRANZ

C Preston
Chief Executive

Date of issue: 25 June 2008



BRANZ Appraised
Appraisal No.447 [2005]

BRANZ Appraisals
Technical Assessments of products
for building and construction

BRANZ
APPRAISAL
CERTIFICATE
No. 447 (2005)

This Certificate replaces BRANZ
Appraisal Certificate No. 447 (2004)
issued 23 February 2004.

Amended 6 March 2007.

LINEA®
WEATHERBOARD
- CAVITY
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1.1 Linea® Weatherboard - Cavity Construction is a cavity-based bevel-backed fibre cement weatherboard wall cladding. It is designed to be used as part of an external cladding system for residential and light commercial type buildings where domestic construction techniques are used.

1.2 Linea® Weatherboard - Cavity Construction consists of Linea® Weatherboard, which is a bevel-backed fibre cement weatherboard, fixed over timber battens to form the cavity. The cladding is finished with a latex paint system.

1.3 The cladding incorporates a primary and secondary means of weather resistance (first and second line of defence) against water penetration by separating the cladding from the external wall framing with a nominal 20 mm cavity. The cavity allows for any occasional ingress of water that may get past the external skin to drain to the exterior of the building, and any remaining moisture to dry by evaporation.



2.1 Linea® Weatherboard - Cavity Construction has been appraised as an external wall cladding for buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- constructed with timber 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,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.

2.2 Linea® Weatherboard - Cavity Construction must only be installed horizontally on vertical surfaces.

2.3 Linea® Weatherboard - Cavity Construction is appraised for use with aluminium window and door joinery that is installed with vertical jambs and horizontal heads and sills. (*The Appraisal of Linea® Weatherboard - Cavity Construction relies on the joinery meeting the requirements of NZS 4211 for the relevant Building Wind Zone.*)

(*Note: Linea® Weatherboard - Cavity Construction can be used to provide structural bracing and fire resistance rated construction, but these aspects have not been assessed by this Certificate and are outside its scope.*)