Structural Calculations

for

Replacement Dwelling

at

Aucklands
St Ives Road
Carbis Bay
St Ives
Cornwall
TR26 2PG

DAS Structures Ltd

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2267

January 2018


St Ives
TREGENNA PARC
Highlands
Hanjague
Bodanna
Woodfield
Hunters Moon
Chy-an-Cleswyth
Parkdale
Saint Quentin
Carn Everis
Ash Trees
Gwel Towans
Chy an Carthew
TRELOYHAN PARK
Salt House
Ke Men
Buen Ayre
Belvedere
Gwelmor Vean
Treskelly
Chyvean
ROAD
Landrevy
Trevenna
Little Gayton
Pordewetha
The Haven
VENTON ROAD
Leavesden
Trewood Lodge
Elm Cottage
Titania
Yerryl Haven
Ponsm
El Sub Sta
Knill Cott
Cornish Arms (PH) TCB
Ballingate
Venayr
Lantall
MANOR DRIVE
TRELOYHAN CL
Bryn Mor
Ros Bryn
Treliske
Zyat
Sandbanks
Pine Croft
Brandwood
Tremorva
Knill Cottages
The Beehive
Trenance
Birdsong
Knill House
Aucklands
Runnymede
The Chimes
Tarawa
Broomhill
Hartsholme
Chy Gwyn
Tremorna
Hillgrove
Hillcrest
Trengilly
Lamorna
Tregwyn
Garden Flat
Trenwith Vean
STIVES ROAD
Lanteglos
Lally Do
Boswenna
VENTURE ROAD
WHEAL MARGERY
Lightwoods
Suncourt
Godolphin House
Tall Trees
Rosemerryn
Little Parc Owles
St Merryn
The Garden House
Chy an Gwedhen
Chy-an-Garth
Tradewinds
Trebartha
The Pines
KEW VEAN
St Ro
HELCA DRIVE
A 3074
Godolphin Bungalow
Cornerstone
Higher Parc Owles
Gardenside
San Lorenzo Court
Tangiefoot
Avon Cottage
Chy-An-Trevean
Palm Court
The Oakes
Chy-an-Gweal Gardens
Shelter
Car Park
Gorse Cottage
Benesek
Chalfont Cottages
Trum House
Cornerstone
LB
The Moorings
Meravista
Carn Dhu
Superstore
Chyreene
El Sub Sta
Celtic Mist
© Crown copyright and database rights 2018 Ordnance Survey 100049047.
Centre point X: 152234 Y: 39100 2,500 Sheet ref.: SW5239 10,000 Sheet ref.: SW53NW Scale 1:2000

Calculation Preamble

1. It is proposed to demolish an existing dated bungalow property, and construct a new single storey, flat-roofed 'L' shaped dwelling.

2. The Architects brief was to design a single-storey contemporary dwelling to be constructed in place of the existing bungalow, in the style of a 'Case-Study' house. The design would have to suit modern construction methods, whilst also recognising that there would be less focus on views off the site. Therefore, glass has been used more modestly, with large openings facing the courtyard, and solar shading on the courtyard side has is provided with an open-slatted canopy. Load-bearing concrete blockwork walls are used, within which high performance insulation will be concealed to keep the house warm in winter and cool in the summer. The external walls and cantilevered canopy over the front entrance will be covered with smooth white render, which along with white powder-coated Aluminium windows and doors will create a clean, minimal appearance to suit the simple form.

3. The Clients would like to future-proof the roof for it to be used either as a terrace or for a partial first floor extension (subject to Planning Approval). In both cases, the imposed load is the same - i.e. 1.5 kN/m^2. Therefore, although the building will be constructed with a flat roof (behind a low parapet), the joists and supporting steelwork have been designed for domestic floor loading.

4. The Architects drawing shows engineered roof joists and this will suit both some of the longer spans, and also any future change of use, where services could be run within the webs. As it is also the Clients wish to have concealed curtain tracks, so the engineered joists will be under-drawn with a slightly lower ceiling.

5. The ground slopes across the site, being lower adjacent to St Ives Road, but ground floor level has been set at roughly the same level as existing in the courtyard. Although a partially suspended floor with storage void were considered, a decision was made to provide a ground supported slab on layered and compacted sub-base.

Timber is designed in accordance with BS 5268-2:2002
Masonry is designed in accordance with BS 5628-1:2005
Steelwork is designed in accordance with BS 5950-1:2000

DAS Structures Ltd

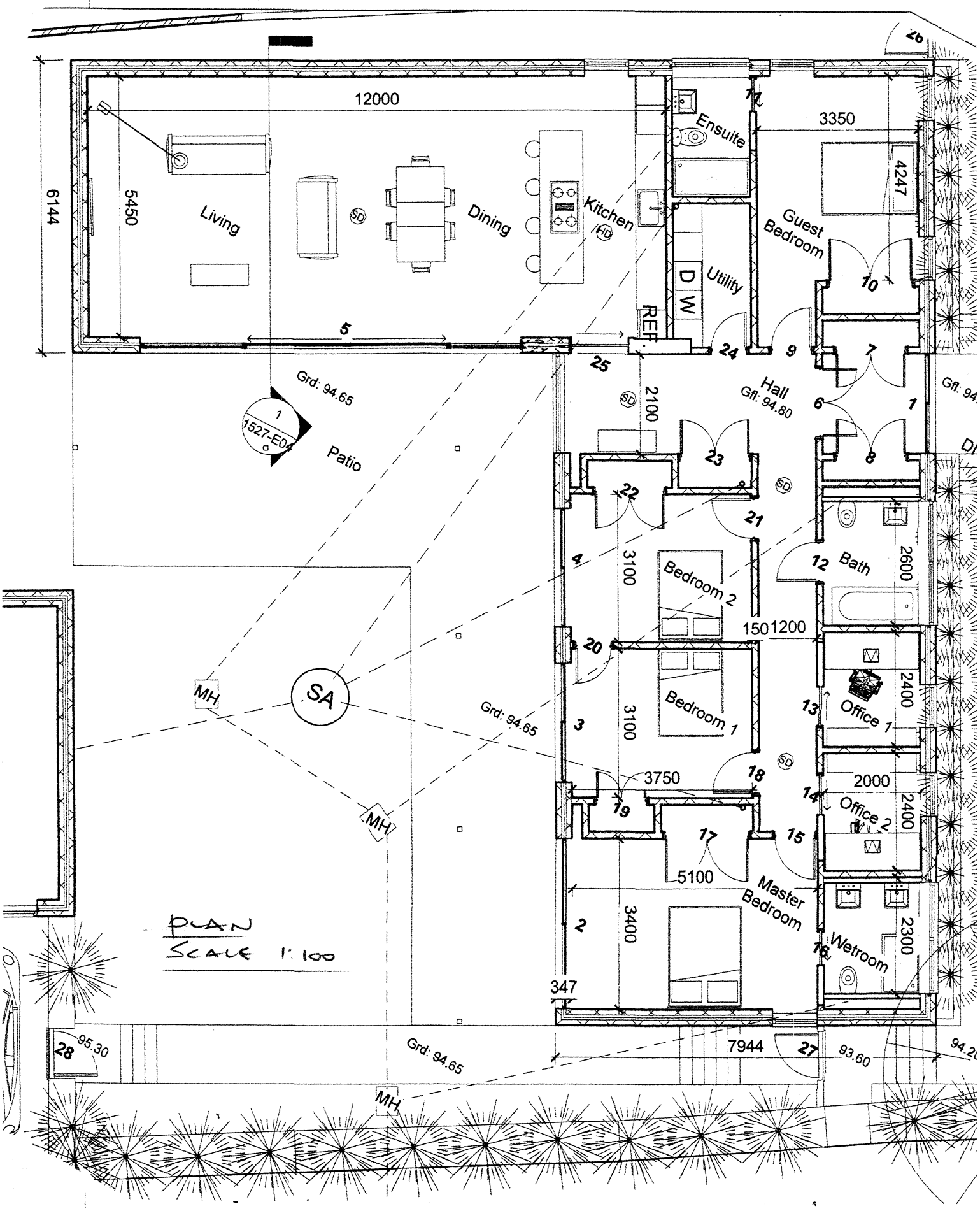
Job No: 2267

Sheet No: (1)

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING

Date: JAN 16

Calc By: OT



DAS Structures Ltd

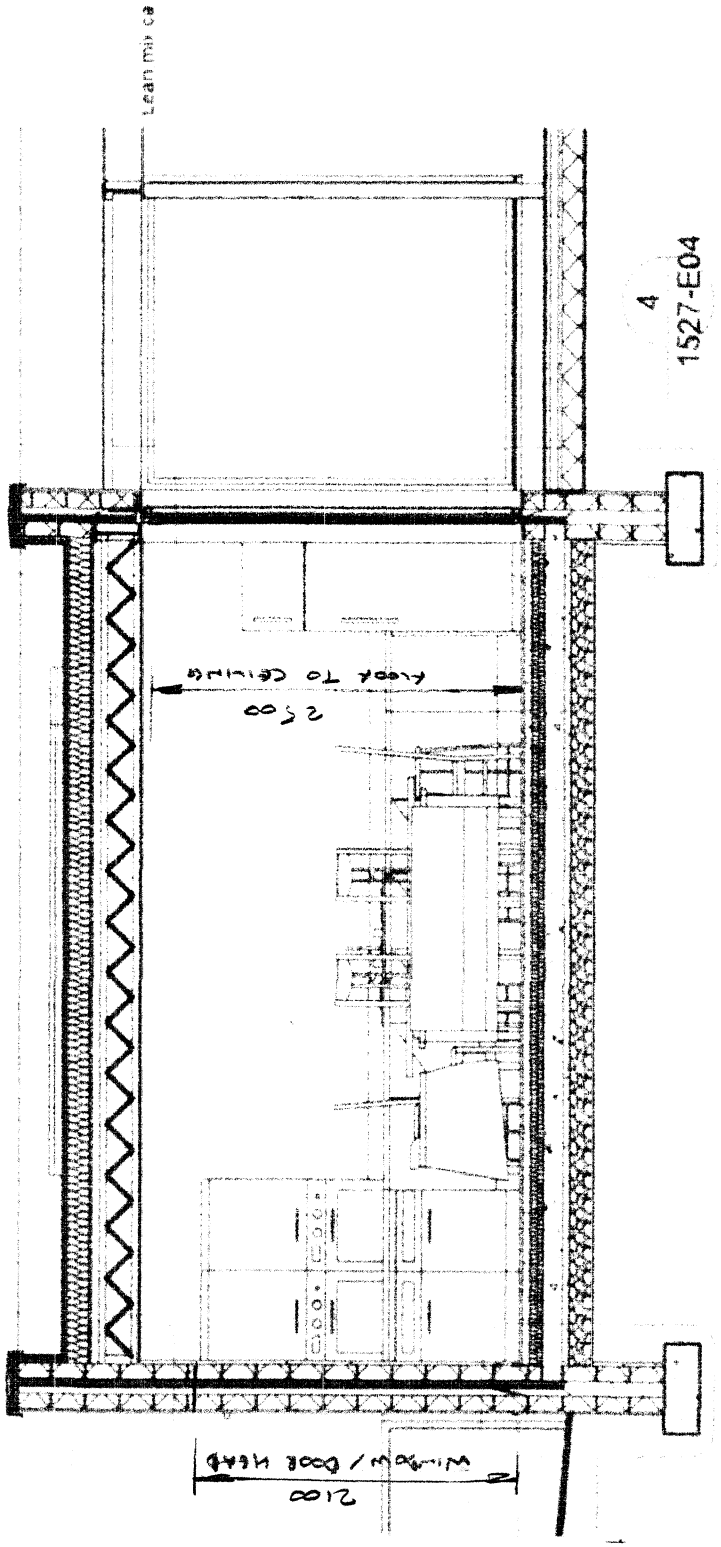
Job No: 2267

Sheet No: (ii)

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING

Date: JAN 16

Calc By: OR



SECTION - SCALE 1:50

DAS Structures Ltd

Job No: 2267

Sheet No: 1

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2DG
REPLACEMENT DWELLING

Date: FEB '18

Calc By: OAT

- LOADING
- ROOF LOADING (ALLOWANCE FOR BALCONY / FLOOR)

DEAD LOADS

GRP FINISH	=	5.0 kg/m²
18mm PLY DECK	=	12.6
130mm CELOTEX	=	4.7
18mm PLY OSB DECK	=	12.6
FIRRINGS TO FALL	=	2.5
ENGINEERED JOISTS	=	16.0
CEILING BATTENS	=	5.0
P/BOARD + SKIM	=	13.0
		71.4 kg/m²

DL = 71.4 x 9.81 / 1000 = 0.70 kN/m²

IMPOSED LOAD

ALLOWANCE FOR FUTURE POSSIBLE USE AS FLOOR OR ROOF TERRACE

UDL = 1.50 kN/m²
CONC = 1.4 kN

- EXTERNAL WALL

OUTER LEAF

22mm RENDER	=	45.0 kg/m²
100mm DENCE BLOCK	=	200.0
		245.0 kg/m²

DL = 245 x 9.81 / 1000 = 2.40 kN/m²

INNER LEAF

100mm MED DENCE BLOCK	=	200.0 kg/m²
P/BOARD & SKIM	=	15.0
		215.0 kg/m²

DL = 215 x 9.81 / 1000 = 2.10 kN/m²

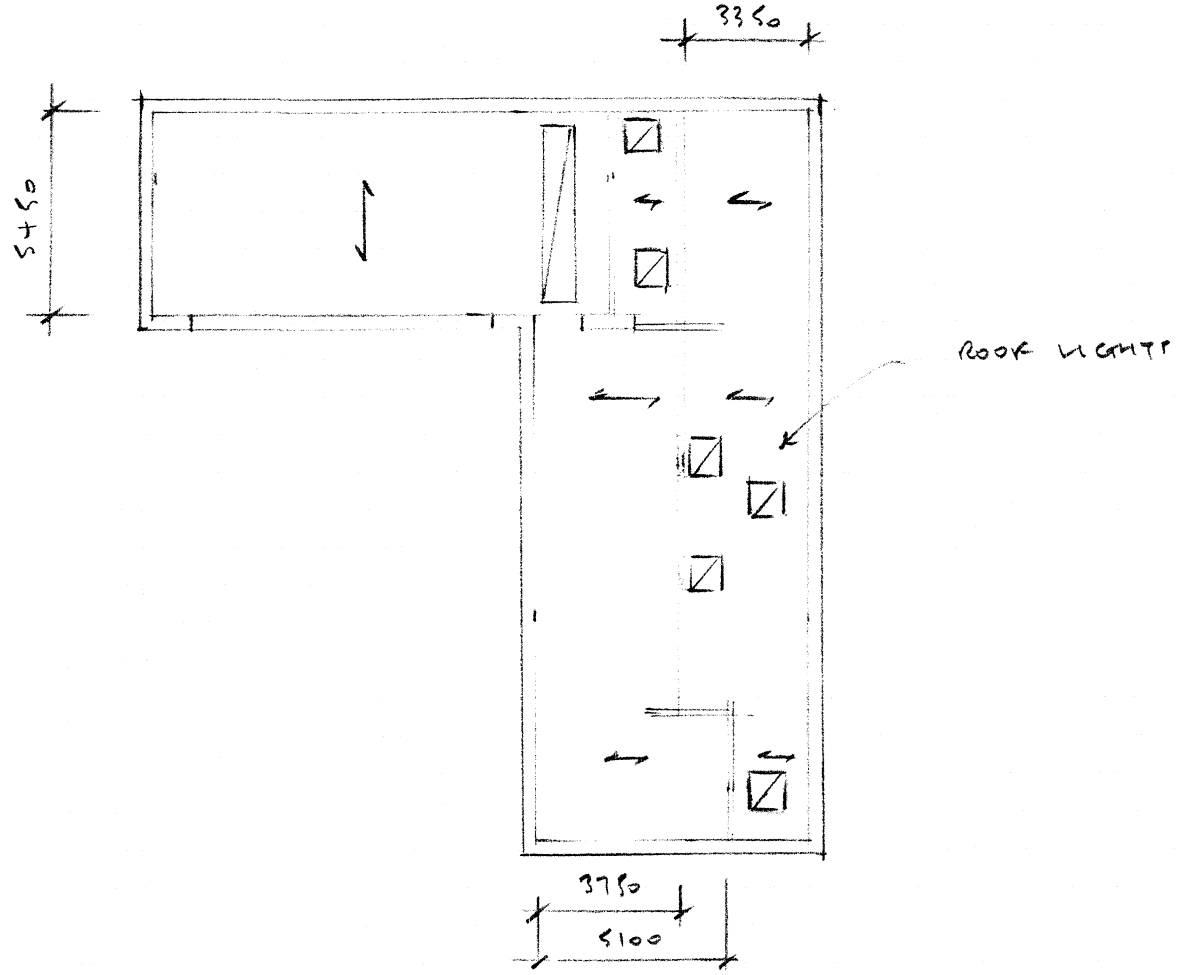
- FLAT ROOF / TERRACE JOISTS

EASI-JOIST OR POZI-JOIST OR SIMILAR METAL WEB ENGINEERED JOISTS FOR ACCOMMODATING SERVICES.

ALLOW FOR IMPOSED LOAD OF 1.5 kN/m² UDL OR 1.4 kN CONCENTRATED FOR POSSIBLE USE AS ROOF TERRACE OR FIRST FLOOR.

MAX SPAN (CLEAR INSIDE W/PLATES) = 5450 mm MAX

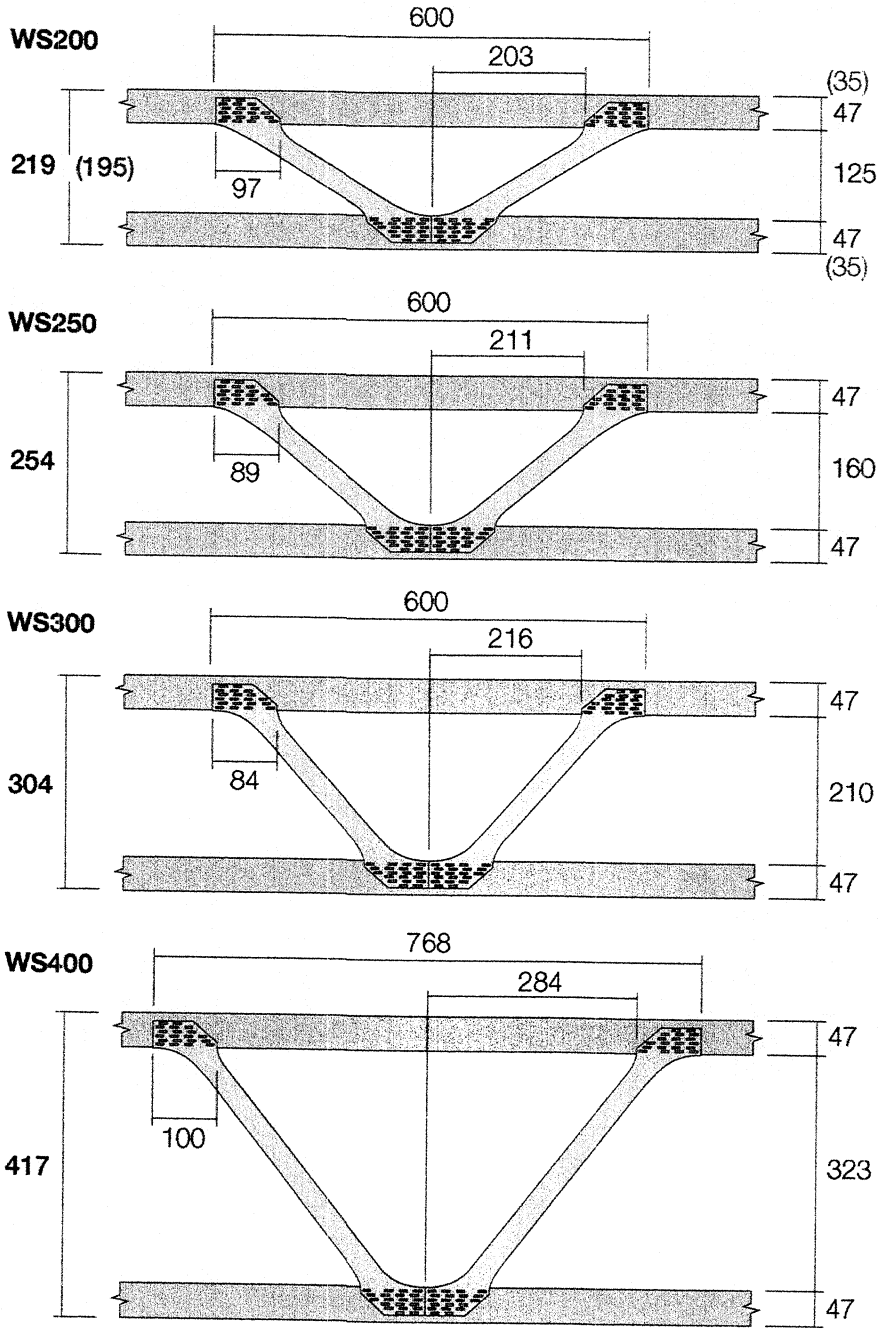
TYPICAL DEPTH = 254 mm O/A.
CALCULATIONS BY FABRICATOR / SUPPLIER



ROOF PLAN - SCALE 1:200
INDICATING JOIST SPAN

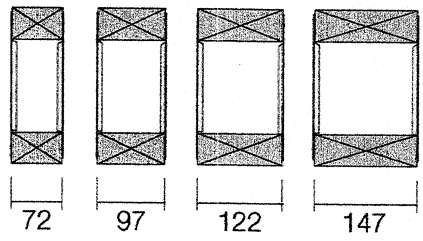
Joist Specification

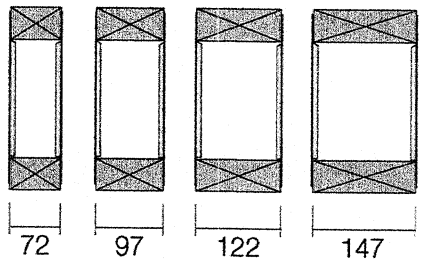
(All dimensions in mm)

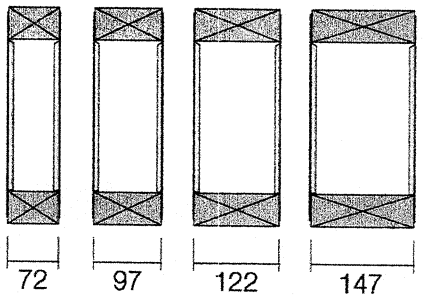


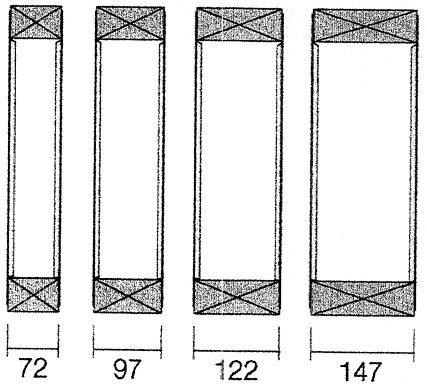
Joist widths

Single joist widths









'easi-joist' metal web joists are available in 5 different depths utilising 35mm and 47mm top and bottom timber chords.

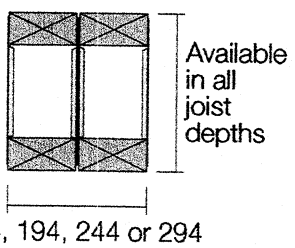
Web code	Joist depth	Chord depth
WS200	219	47
WS250	254	47
WS300	304	47
WS400	417	47

Fixing

Fastening of multi-ply joists to be carried out to manufacturer's instructions using Cullen Timberlok or Simpson SDS screws.

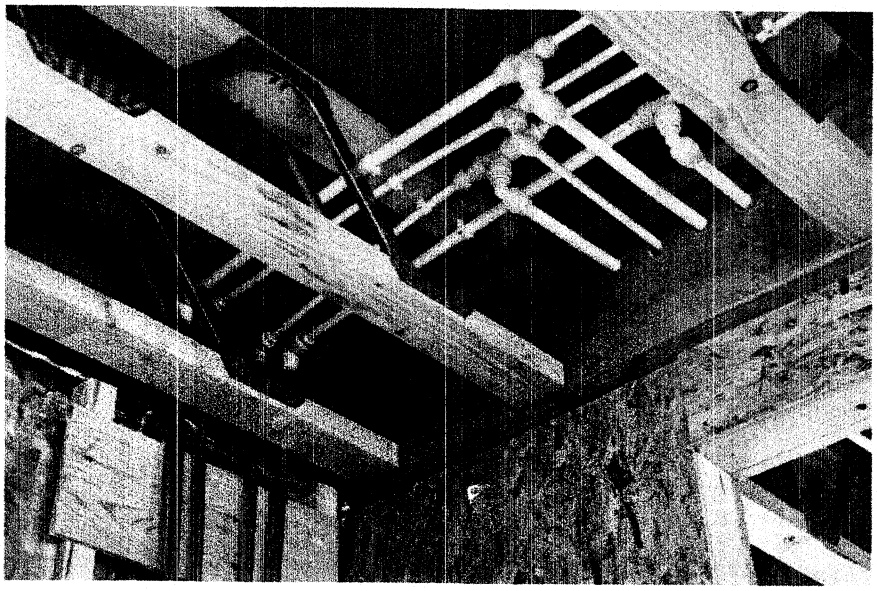
Type and spacing as specified by 'easi-joist' software.

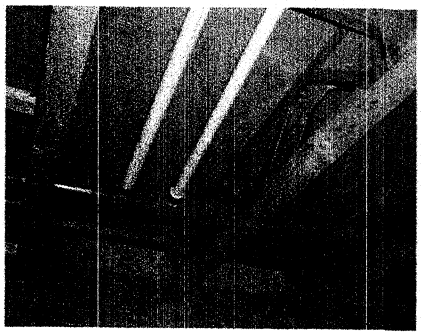
Multi-ply joist widths

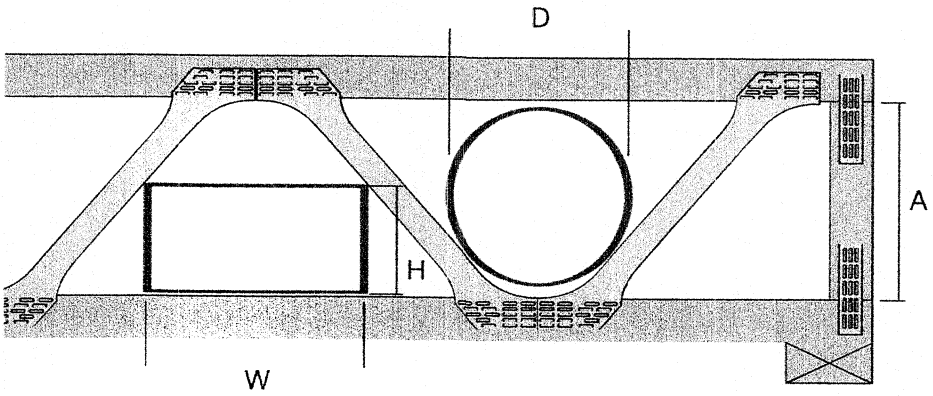


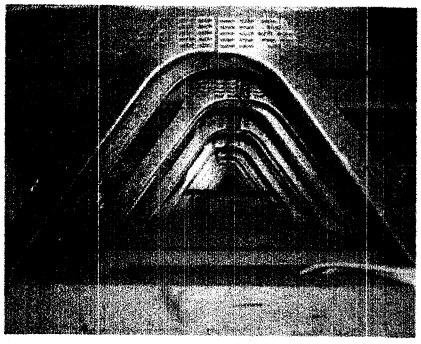
Accommodation of Services

east-joist' is designed to allow for easy accommodation of electrical, plumbing, waste water and other services required within the floor joist area with no cutting or notching required.



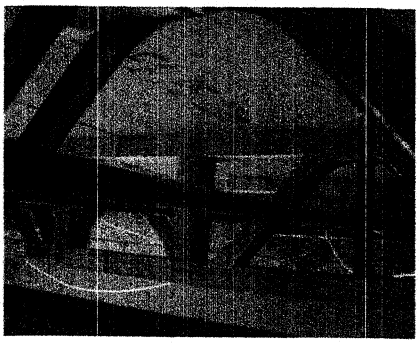






Clearance for circular services

	WS200	WS250	WS300	WS400
A (mm)	125	160	210	323
D (mm)	100	150	200	280

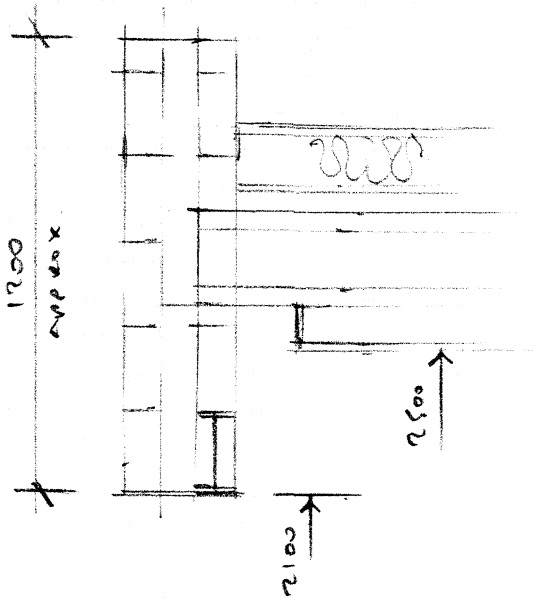


Clearance for rectangular services

	WS200	WS250	WS300	WS400
H mm	W mm	W mm	W mm	W mm
50	300	300	330	500
100	100	200	250	410
150	50	70	170	330
200	N/A	N/A	70	250
250	N/A	N/A	N/A	170
300	N/A	N/A	N/A	70

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING

- BEAM OVER GLAZED OPENING - 8m CLEAR WITHOUT COLUMNS



REACTION FROM JOISTS

DL = 0.7 x 5.5/2 = 1.93 kN/m

IL = 1.5 x 5.5/2 = + 1.13 kN/m

LOAD FROM INNER LEAF

DL = 2.1 x 1.0 = 2.1 kN/m

DESIGN LOAD = (1.93 + 2.1) x 1.4 + (4.13 x 1.6)
= 5.64 + 6.61 = 12.25 kN/m

$M_x = \frac{wl^2}{8} = 12.25 \times \frac{8^2}{8} = \underline{98\ kNm}$

$F_v = \frac{wl}{2} = 12.25 \times \frac{8}{2} = \underline{49\ kN}$

* SEE ALSO COMPUTER CALCS

ASSUME NO LATERAL RESTRAINT / DEAD BEARING ONLY.
THERE IS NO BEAM AVAILABLE OF A SUITABLE WIDTH.

A 406 x 178 x 85 UB (S275) IS ADEQUATE

M_b = 111.0 kNm > 98 ∴ ok.

DEFLECTION DL = 3.3 mm IL = 3.3 mm
LIMIT = 8000 / 360 = 22.2 ∴ ok.

HOWEVER BEAM WEIGHTS 85 x 8.5 = 722 kg!

CONSIDER REDUCING SPAN USING SHS POSTS

- BEAMS OVER GLAZED OPENING - MAX SPAN 4.2 m ?

LOADS AS PREVIOUSLY

$M_x = \frac{wl^2}{8} = 12.2 \times \frac{4.2^2}{8} = 27.0$ kNm

$F_v = \frac{wl}{2} = 12.2 \times \frac{4.2}{2} = 25.73$ kN

* SEE ALSO COMPUTER CALCS

ASSUME NO LATERAL RESTRAINT - CLEATED ENDS

USING A 254 x 102 x 28 UB (S275)

M_b = 27.4 kNm > 27.0 ∴ ok

DEFLECTION DL = 2.0 mm LL = 2.0mm
LIMIT = 4200 / 360 = 11.6 mm ∴ ok

∴ 254 x 102 x 28 UB (S275) ADEQUATE

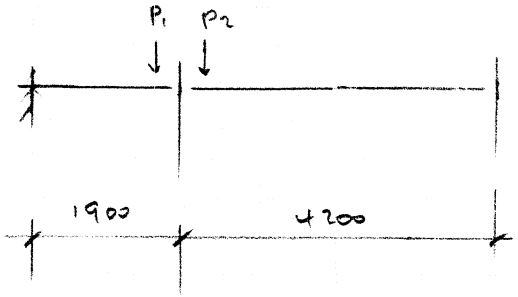
USING A 305 x 102 x 33 UB (S275)

M_b = 33.6 kNm > 27.0 ∴ ok

DEFLECTION DL = 1.2 mm LL = 1.2 mm
LIMIT = 11.6 mm ∴ ok

∴ 305 x 102 x 33 UB (S275) ADEQUATE

- COLUMNS TO SUPPORT BEAMS



P_1 = 12.2 x 1.9 / 2 = 11.64 kN

P_2 = 12.2 x 4.2 / 2 = 25.73 kN

TOTAL AXIAL LOAD

= 11.64 + 25.73 = 37.37 kN

DESIGN AS SHS COLUMN IN SIMPLE CONSTRUCTION

M_x add = 25.73 x (0.1 + 0.09 / 2) = 3.73 kNm

M_y add = 1.0 kNm (NOMINAL)

ASSUME COLUMN ALSO USED TO SUPPORT GLAZING FRAMES

TAKE WIND LOAD W_K = 1.0 kN/m²

W = 1.0 × (1.9 + 1.2) / 2 = 3.05 kN/m

PROVIDE TIE BEAM WITHIN CEILING - LENGTH = 2.7m

$M_x = \frac{wl^2}{8} = \frac{3.05 \times 2.7^2}{8} \times 1.4 =$ 3.89 kNm

LIMIT DEFLECTION = 2700 / 360 = 7.5mm MAX

RECOMMEND LIMITING DEFLECTION TO 5mm.

I_x REQD = $\frac{5}{384} \times \frac{w \times L^3}{E \times \Delta}$

= $\frac{5}{384} \times \frac{3.05 \times 2.7 \times 2700^3}{205 \times 5 \times 10^4}$ = 206 cm⁴

TRY 90x90x5 SHS (S275) I_x = 200 cm⁴

* SEE ALSO COMPUTER CALCS.

p_c = 207.13 N/mm² P_c = 345.9 kN > 37.37 kN :ok.

M_{cx} = 14.57 kNm > (3.89 + 3.73 = 7.62 kNm) :ok

M_{cy} = 275 × 44.4 / 1000 = 12.21 kNm > 1.0 :ok.

Combined = 37.37 / 345.9 + 7.62 / 14.57 + 1.0 / 12.21
= 0.108 + 0.523 + 0.082 = 0.71 < 1.0 :ok

∴ 90 x 90 x 5 SHS (S275) ADEQUATE

TIE / RESTRAINT BEAM - SPAN 5.5m.

AXIAL FORCE = 3.05 × 2.7/2 × 1.4 = 5.76 kN.

USING 80x80x4 SHS L_e/r_y = 178
p_c = 58.3 N/mm² P_c = 70.0 kN > 5.76

SELF WT DEFLECTION = $\frac{5}{384} \frac{0.1 \times 5.5 \times 5500^3}{205 \times 114 \times 10^4}$ = 5.1mm
< 5500/360 :ok.

∴ 80 x 80 x 4 SHS (S275) ADEQUATE.

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Job No: 2267

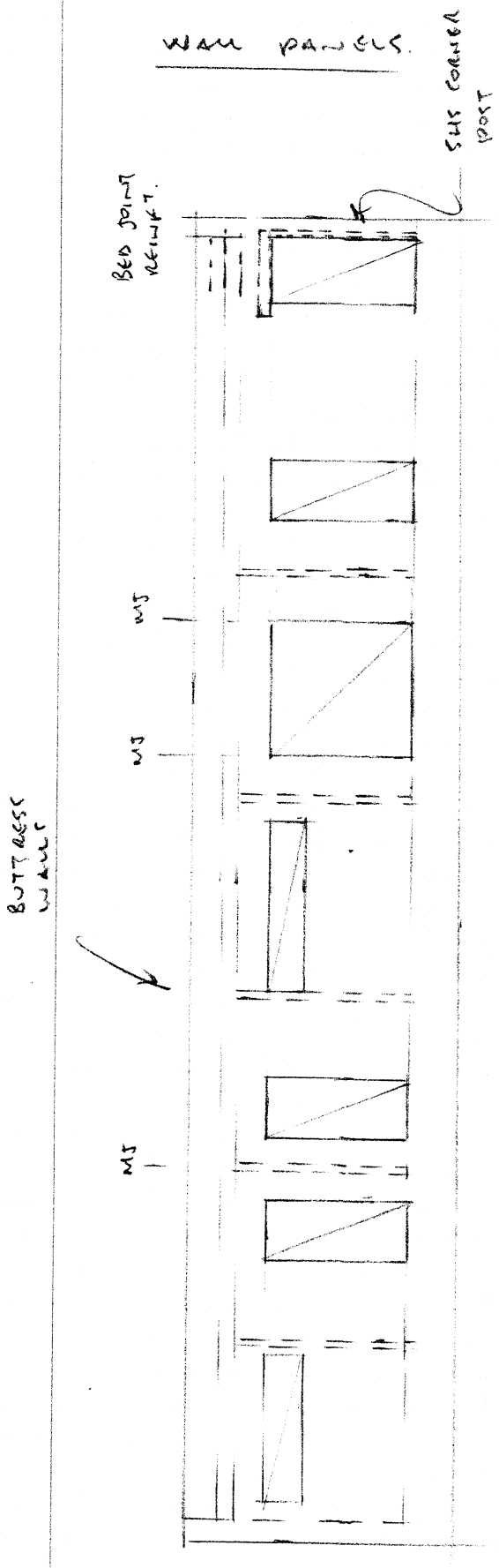
Sheet No: 6

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING

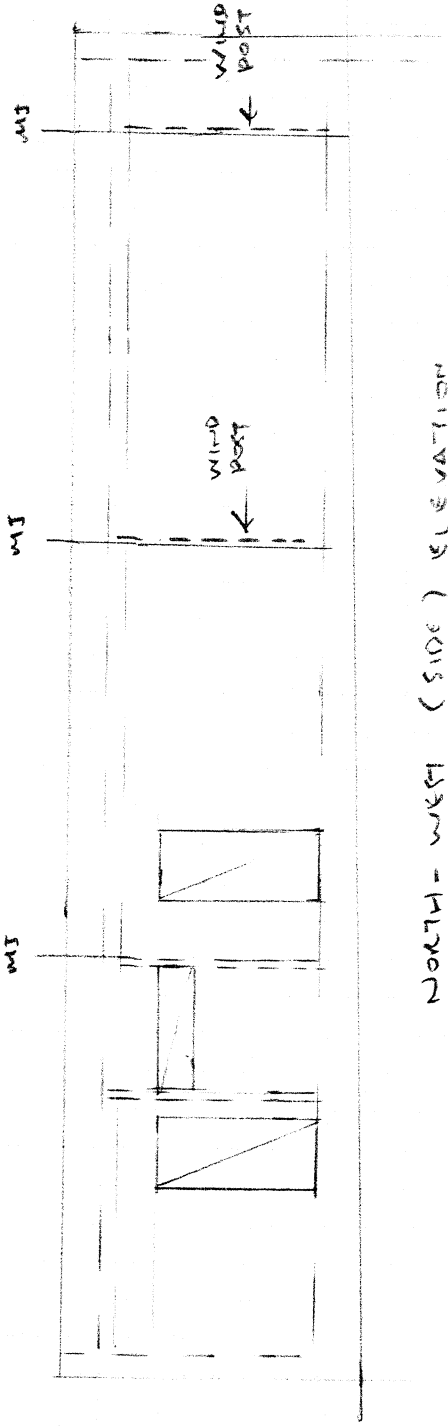
Date: FEB '16

Calc By: JAS

WALL PANELS.



NORTH - EAST (FRONT) ELEVATION
SCALE 1:100

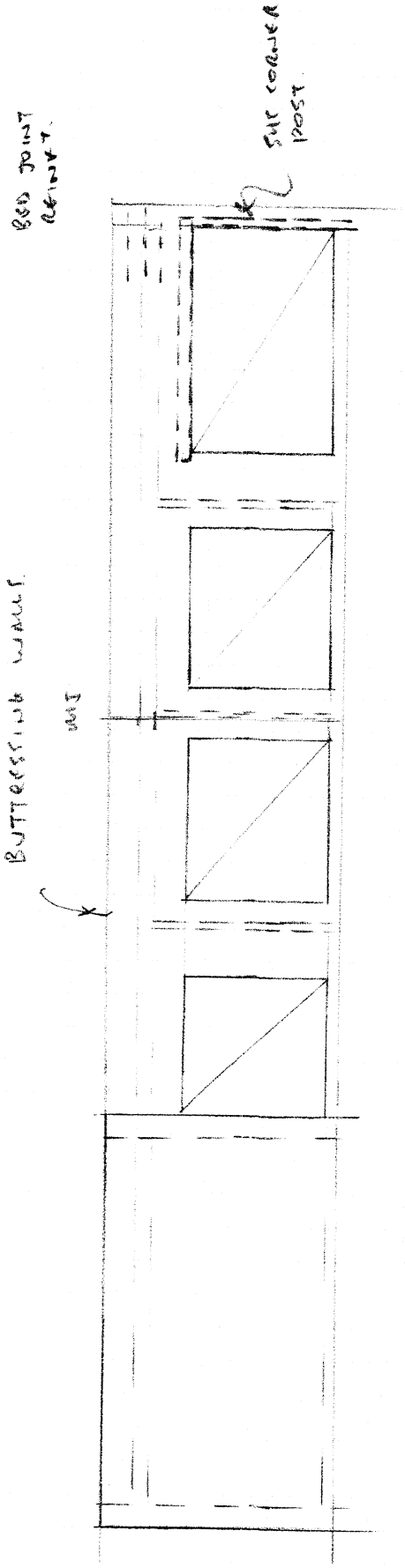


NORTH - WEST (SIDE) ELEVATION
SCALE 1:100

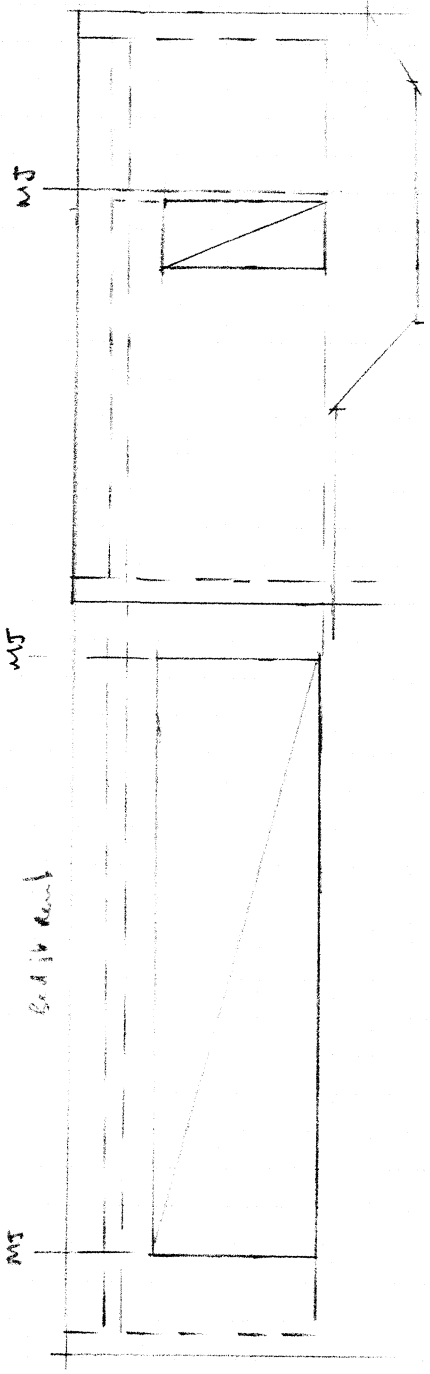
DAS Structures Ltd

Job No:	2267
Sheet No:	7
Date:	FEB 18
Calc By:	OAR

Project: AUCKLANDS
ST IVES ROAD, CARRIS BAY TR26 2PG
REPLACEMENT DWELLING.



SOUTH - WEST (COURTYARD) ELEVATION
SCALE 1:100

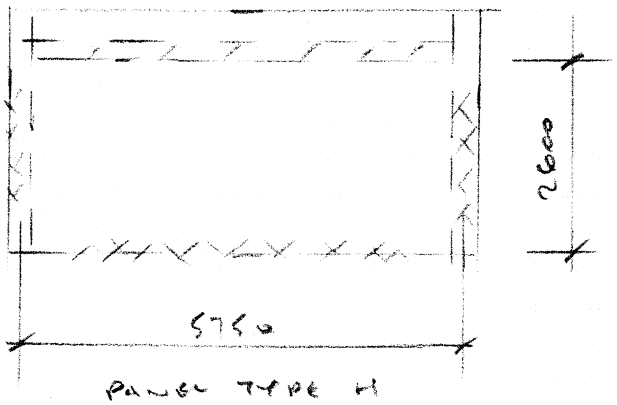


SOUTH - EAST (COURTYARD / SIDE) ELEVATION
SCALE 1:100

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2RG
REPLACEMENT DWELLING

• CHECK PANELS 100 / 100 / 100 (7N/mm² BLOCKS)

– SOUTH-WEST ELEV.



PANEL TYPE H

WIND LOAD
± 0.9 kN/m²

* SEE ALSO COMPUTER CALCS

$l_{ef} = 2/7 \times (100 + 100) = 133.3$ m

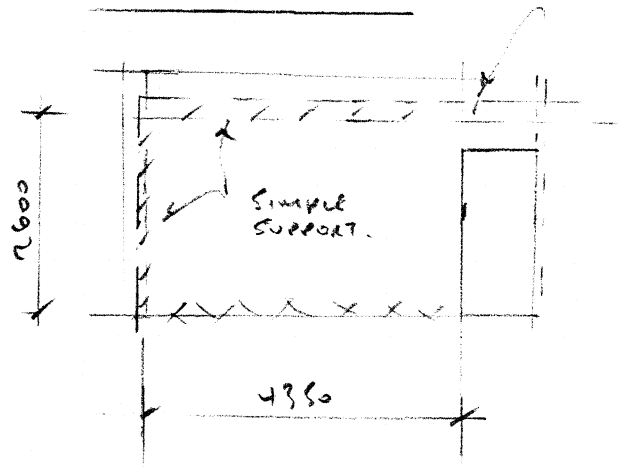
$5 \times l_{ef} = 6.67$ m > MAX LENGTH
> MAX HEIGHT

MAX PERMITTED AREA = 40m² > MAX AREA

ALLOWABLE LOAD ON OUTER LEAF = 0.496 kN/m²
" " INNER LEAF = 0.476 kN/m² (MED DENSITY)
TOTAL = 0.97 kN/m² > 0.9 ∴ ok

∴ PANEL CONSIDERED ADEQUATE.

– SOUTH EAST ELEV FREE EDGE



PANEL TYPE B

MAX PERMITTED AREA = 24 m²

AREA OF PANEL = 11.91 m² < 24 ∴ ok

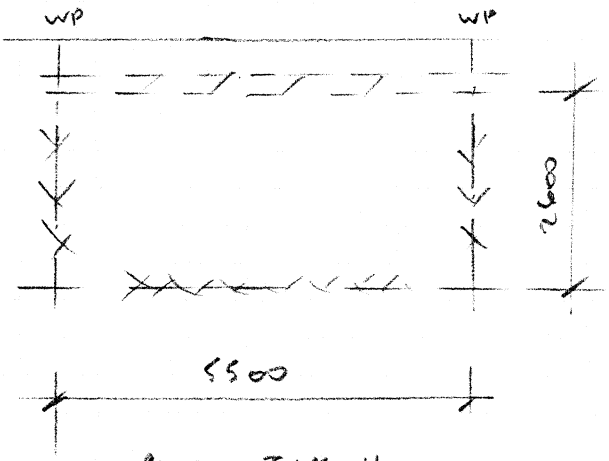
OUTER LEAF CAPACITY = 0.51 kN/m²
INNER " " = 0.51
1.02 kN/m²
> 0.9 ∴ ok

∴ PANEL CONSIDERED ADEQUATE.

Project: DUCKCAMBS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING

- NORTH-WEST ELEV (1)

REDUCED WIND PRESSURE ON NORTH ELEV SAY MAX 0.8 kN/m²



PANEL TYPE H.

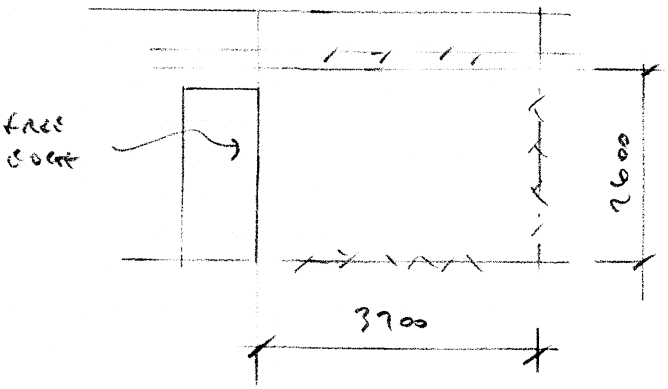
MAX PERMITTED AREA = 40 m²

AREA OF PANEL = 14.3 m² < 40 ∴ ok

OUTER LEAF CAPACITY = 0.51 kN/m²
INNER " " = 0.49 kN/m²
1.00 kN/m²
> 0.8 kN/m²
∴ ok

∴ PANEL CONSIDERED ADEQUATE.

- NORTH WEST ELEV (2)



PANEL TYPE L

MAX PERMITTED AREA = 26.67 m²

AREA OF PANEL = 9.62 m² < 26.67

OUTER LEAF CAPACITY = 0.41 kN/m²
INNER " " = 0.39 kN/m²
0.80 kN/m²
= 0.8 ∴ ok.

∴ PANEL CONSIDERED ADEQUATE

- WIND POSTS - SPAN FROM SLAB TO W/PLATE.
SPAN = 2.6 m

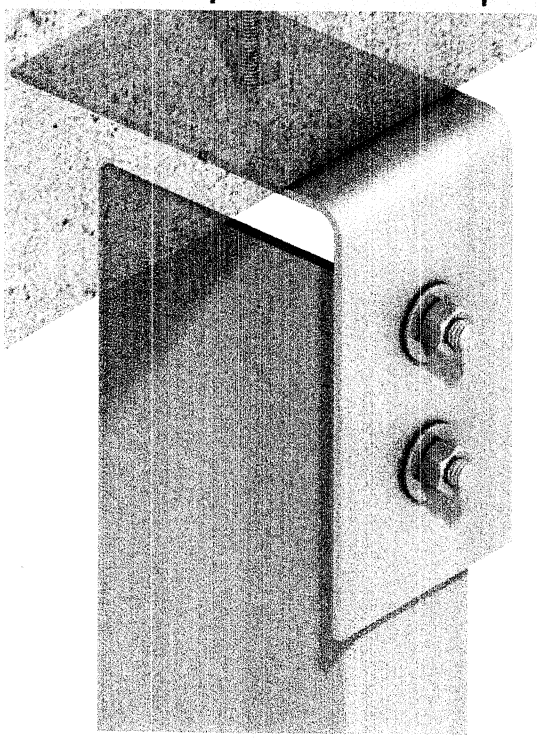
MAX WIND LOAD FROM HORIZONTAL SPANNING PANELS.
W = 0.8 × 11 / 2 = 4.4 kN/m.

∴ LOAD / POST = 4.4 × 2.6 = 11.44 kN. (UDL).

FROM SAFE LOAD TABLES USE TYPE WP2 130 × 70 × 6
SAFE UNFACTORED LOAD = 13.8 kN FOR SPAN = 2.5 m

TIES TO OUTER LEAF AT 225 mm CENTRES.

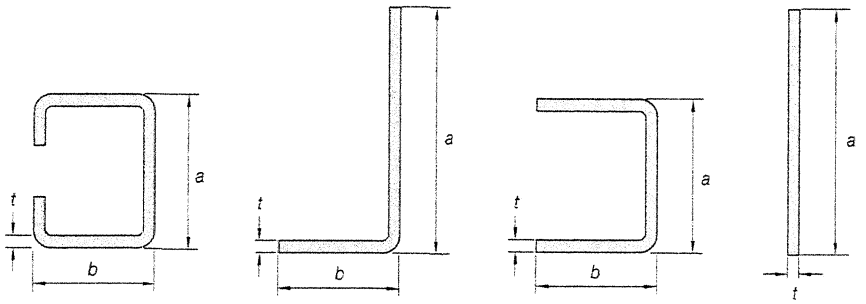
Windposts & Parapet Posts



Properties and Recommended Loads for Windposts

Ancon Windposts are designed as 'simply supported beams' with a maximum stress of 181N/mm² and a maximum deflection of span/360.

The tables below include examples of Ancon's range of windposts. For further information or advice on specific applications, including fixed-base 'Propped Cantilever' designs please contact Ancon's Technical Services Team.



Properties and Performance of WP1 and WP3 Windposts

	Size a x b x t	Ixx cm⁴	Zxx cm³	TOTAL Unfactored Load (kN) per Post (uniformly distributed) 2.5m	3.0m	3.5m	4.0m	4.5m	5.0m	5.5m	6.0m
WP1	60 x 60 x 4	41.9	14.0	2.9	2.0	1.5	-	-	-	-	-
	80 x 60 x 4	84.4	21.1	5.8	4.0	2.9	2.3	1.8	1.4	-	-
WP3	55 x 60 x 4	32.7	11.9	2.2	1.6	-	-	-	-	-	-
	55 x 60 x 5	38.7	14.1	2.6	1.8	-	-	-	-	-	-
	65 x 60 x 4	48.0	14.8	3.3	2.3	1.7	-	-	-	-	-
	65 x 60 x 5	57.1	17.6	3.9	2.7	2.0	1.5	-	-	-	-
	75 x 60 x 4	66.7	17.8	4.6	3.2	2.3	1.8	-	-	-	-
	75 x 60 x 5	79.7	21.3	5.4	3.8	2.8	2.1	1.7	-	-	-
	85 x 60 x 4	88.9	20.9	6.1	4.2	3.1	2.4	1.9	1.5	-	-
	85 x 60 x 5	106.7	25.1	7.3	5.1	3.7	2.8	2.3	1.8	1.5	-
	95 x 60 x 5	138.3	29.1	**9.4**	6.6	4.8	3.7	2.9	2.4	2.0	1.6
	105 x 60 x 5	174.9	33.3	**11.9**	8.3	6.1	4.7	3.7	3.0	2.5	2.1
	115 x 60 x 5	216.6	37.7	**14.8**	**10.3**	7.5	5.8	4.6	3.7	3.1	2.6
	115 x 60 x 6	246.2	42.8	**16.7**	**11.7**	8.6	6.6	5.2	4.2	3.5	2.9
	115 x 65 x 8	327.3	56.9	**16.7**	**15.5**	11.4	8.73	6.9	5.6	4.6	3.8

Note: *Figures in* **bold** *indicate that these posts require ties at 225mm centres.*

Properties and Performance of WP2 Windposts

	Size a x b x t	Ixx cm⁴	Zxx cm³	TOTAL Unfactored Load (kN) per Post (uniformly distributed) 2.5m	3.0m	3.5m	4.0m	4.5m	5.0m	5.5m	6.0m
WP2	125 x 70 x 4	125.9	15.2	**8.6**	6.0	4.4	3.4	2.7	2.1	1.8	1.5
	140 x 70 x 4	171.1	18.8	**10.9**	8.1	6.0	4.6	3.6	2.9	2.4	2.0
	130 x 70 x 6	202.1	24.0	**13.8**	9.6	7.0	5.4	4.3	3.4	2.9	2.4
	155 x 70 x 4	225.3	22.7	**13.2**	**10.7**	7.8	6.0	4.7	3.8	3.2	2.7
	170 x 70 x 4	289.2	27.0	**15.6**	**13.0**	10.1	7.7	6.1	4.9	4.1	3.4
	150 x 70 x 6	298.5	31.4	**16.7**	**14.1**	10.4	8.0	6.3	5.1	4.2	3.5
	160 x 70 x 6	355.8	35.4	**16.7**	**16.9**	**12.4**	9.5	7.5	6.1	5.0	4.2
	185 x 70 x 4	363.5	31.5	**16.7**	**15.2**	**12.7**	9.7	7.7	6.2	5.1	4.3
	150 x 80 x 8	406.6	42.2	**16.7**	**19.3**	**14.2**	10.8	8.6	6.9	5.7	4.8
	185 x 70 x 5	448.8	39.1	**16.7**	**18.9**	**15.6**	12.0	9.5	7.7	6.3	5.3
	160 x 80 x 8	485.1	47.7	**16.7**	**20.0**	**16.9**	12.9	10.2	8.3	6.8	5.7
	200 x 70 x 5	554.5	45.2	**16.7**	**20.0**	**18.7**	**14.8**	11.7	9.5	7.8	6.6

Note: *Figures in* **bold** *indicate that these posts require ties to the outer leaf at 225mm centres. Ties to the inner leaf will always be at 225mm centres.*

Properties and Performance of WP4 Windposts

	Size a x t	Ixx cm⁴	Zxx cm³	TOTAL Unfactored Load (kN) per Post (uniformly distributed) 2.5m	3.0m	3.5m	4.0m	4.5m	5.0m	5.5m	6.0m
WP4	90 x 8	48.6	10.8	3.3	2.3	1.7	-	-	-	-	-
	100 x 8	66.6	13.3	4.6	3.2	2.3	1.8	1.4	-	-	-
	110 x 8	88.7	16.1	6.1	4.2	3.1	2.4	1.9	1.5	-	-
	120 x 8	115.2	19.2	7.9	5.5	4.0	3.1	2.4	2.0	1.6	1.4

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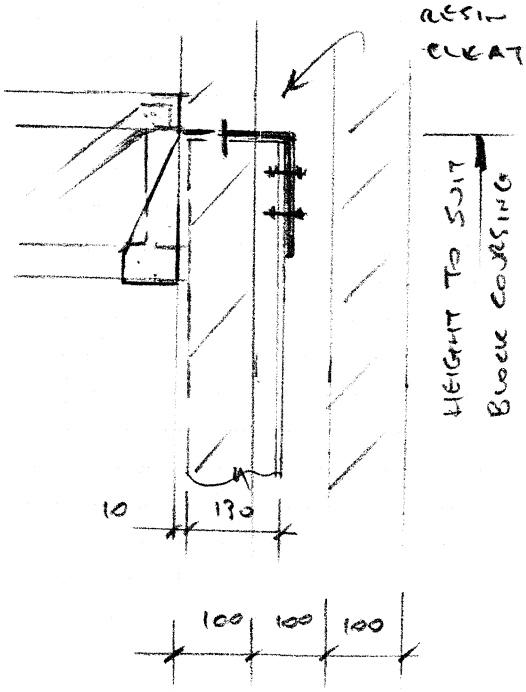
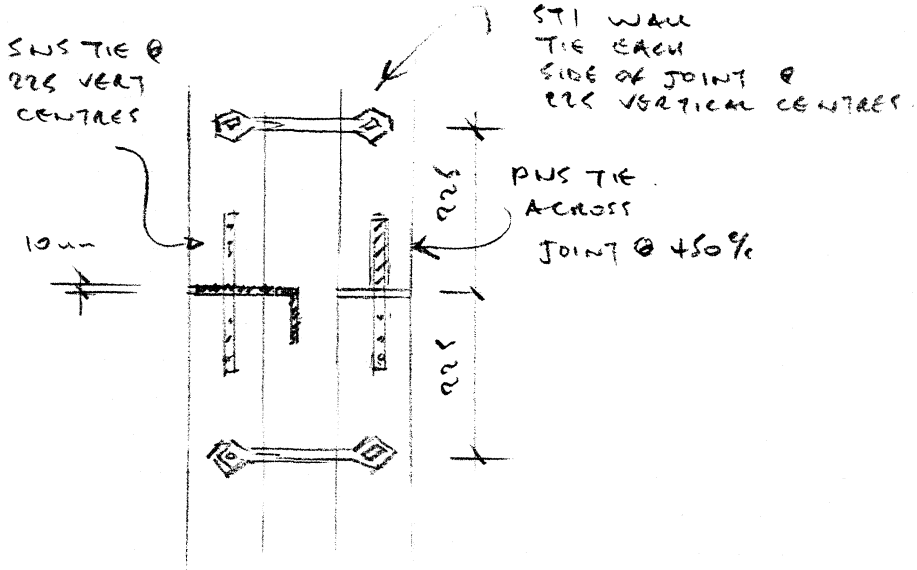
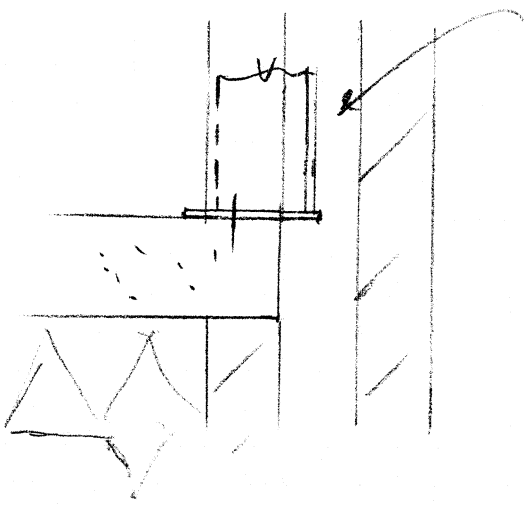
Calc By:	OAT

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING.



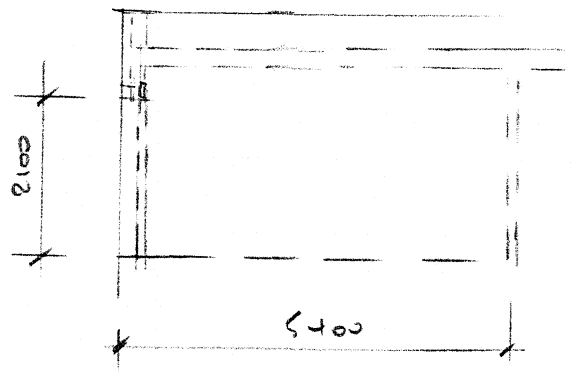
TOP CONNECTION AT ROOF DIAPHRAGM





BASE PLATE

- CORNER POSTS (SUB-STANDARD RETURN)



WK = 1.0 kN/m² (MAX)

w = 1.0 × 5.4/2 = 2.7 kN/m

$M_x = \frac{wl^2}{8} = \frac{2.7 \times 2.1^2 \times 1.4}{8}$

= 2.08 kNm

TRY 80×80×4 SHS (S275)

$I_x = 114 \times 10^4$ mm⁴

$\text{DEFLECTION} = \frac{5}{384} \times \frac{2.7 \times 2.1 \times 2100^3}{205 \times 114 \times 10^4} = 2.9$mm

LIMIT = 2100/360 = 5.8mm > 2.9 ∴ ok

M_{cx} = 275 × 34/1000 = 9.35 kNm > 2.08 ∴ ok.

∴ 80×80×4 SHS POSTS ADEQUATE.

- BEAM OVER OPENING '2' - SPAN = 3.4m CLEAR.

REACTION FROM JOISTS
DL = 0.7 × 5.1/2 = 1.78 kN/m
IL = 1.5 × 5.1/2 = 3.83 kN/m.

LOAD FROM INNER LEAF = 2.1 × 1.0 = 2.1 kN/m

DESIGN LOAD = (1.78 + 2.1) × 1.4 + (3.83 × 1.6)
= 5.43 + 6.13 = 11.56 kN/m

$M_x = \frac{wl^2}{8} = \frac{11.56 \times 3.4^2}{8} =$ 16.7 kNm

$F_v = \frac{wl}{2} = \frac{11.56 \times 3.4}{2} =$ 19.65 kN.

* SEE ALSO COMPUTER CALCS. CHECK 203×102×23 UB.
NO LATERAL RESTRAINT / DEAD BEARING ONLY.

M_b = 20.8 kNm > 16.7
DEFLECTION DL = 1.5mm IL = 1.5mm LIMIT = 9.4mm

∴ 203 × 102 × 23 UB (S275) ADEQUATE.

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REPLACEMENT DWELLING

• LINTELS KEYSTONE HI-THERM OR CATNIC

- DOORS 3 & 4 - SPAN 2.5m CLEAR ∴ LENGTH 2.8m MIN

LOAD OUTER LEAF - BLOCK DL = 2.4 × 1.2 = 2.88 kN/m

LOAD INNER LEAF - BLOCK DL = 2.1 × 1.2 = 2.52 kN/m
ROOF DL = 0.7 × 3.75/2 = 1.31
" IL = 1.5 × 3.75/2 = 2.81
TOTAL = 9.52 kN/m

LOAD RATIO INNER : OUTER
6.64 : 2.88
2.3 : 1.0

LOAD ON LINTEL = 9.52 × 2.5 × 1.1 = 26.2 kN

HI THERM - RECOMMEND HT/HD 100 × 2850 (SWL = 35 kN)

CATNIC - RECOMMEND CX 90/100 × 2850 (SWL = 55 kN)

- DOOR 1 - SPAN 2.1m CLEAR ∴ LENGTH = 2.4m MIN.

LOAD OUTER LEAF - BLOCK DL = 2.4 × 1.2 = 2.88 kN/m

LOAD INNER LEAF - BLOCK DL = 2.1 × 1.2 = 2.52 kN/m
ROOF DL = 0.7 × 3.35/2 = 1.17
" IL = 1.5 × 3.35/2 = 2.51
TOTAL = 9.08 kN/m

LOAD RATIO INNER : OUTER
6.2 : 2.88
2.15 : 1.0

LOAD ON LINTEL = 9.08 × 2.1 × 1.1 = 21 kN.

HI THERM - RECOMMEND HT/S 100 × 2400 (SWL = 27 kN)

CATNIC - RECOMMEND CQ 90/100 × 2400 (SWL = 22 kN)

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REPLACEMENT DWELLING

Date: FEB 18

Calc By: OAT

- WINDOWS (SPAN 2.1m CLEAR) LENGTH = 2.4m MIN

LOAD AT DOOR 3 & 4

LOAD ON LINTEL = 9.52 x 2.1 x 1.1 = 22 kN

HI THERM - RECOMMEND HT/S 100 x 2400 (SWL = 27 kN)

CATNIC - RECOMMEND CH90/100 x 2400 (SWL = 45 kN)

- WINDOWS (SPAN 2.6m CLEAR) LENGTH = 2.9m MIN

LOAD AT DOOR 1

LOAD ON LINTEL = 9.08 x 2.6 x 1.1 = 26 kN

HI THERM RECOMMEND HT/S 100 x 3000 (SWL = 27 kN)

CATNIC RECOMMEND CX90/100 x 300 (SWL = 55 kN)

- WINDOWS (SPAN 0.9m CLEAR) LENGTH = 1.2m MIN

LOAD AT DOOR 1

LOAD ON LINTEL = 9.08 x 0.9 x 1.1 = 9 kN

HI THERM RECOMMEND HT/S 100 x 1200 (SWL = 20 kN)

CATNIC RECOMMEND CG90/100 x 1200 (SWL = 15 kN)

- WINDOW (SPAN 0.9m CLEAR) LENGTH = 1.2m MIN

LOAD OUTER LEAF - BLOCK DL = 2.4 x 1.2 = 2.88 kN/m

LOAD INNER LEAF - BLOCK DL = 2.1 x 1.2 = 2.52 kN/m
ROOF DL = 0.7 x 5.5/2 = 1.93
ROOF IL = 1.5 x 5.5/2 = 4.13

TOTAL = 11.46

LOAD RATIO INNER : OUTER
3 : 1

LOAD ON LINTEL = 11.46 x 0.9 x 1.1 = 11.34 kN

HI THERM RECOMMEND HT/S 100 x 1200 (SWL = 20 kN)

CATNIC RECOMMEND CG90/100 x 1200 (SWL = 15 kN)

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REPLACEMENT DWELLING

- BEAMS OVER OPENINGS IN INTERNAL LOAD-BEARING WALL

MAX OPENING 2.1m (ASSUME ABOVE CEILING LEVEL)

ROOF DL = 0.7 x 7.25/2 = 2.54 kN/m
IL = 1.5 x 7.25/2 = 5.44 kN/m

DESIGN LOAD = (2.54 x 1.4) + (5.44 x 1.6)
= 3.55 + 8.7 = 12.25 kN/m

$M_x = \frac{wl^2}{8} = \frac{12.25 \times 2.1^2}{8} = 6.75$ kNm

TRY 152 x 89 x 16 UB (S275)
* SEE ALSO COMPUTER CALCS

M_b = 16.1 kNm

DEFLECTION DL = 0.4mm IL = 0.8mm LIMIT = 5.8mm : ok.

∴ 152 x 89 x 16 UB ADEQUATE

- LINTELS OVER DOOR OPENINGS IN INTERNAL LB WALL

MAX OPENING 0.9m

LOADS AS ABOVE - SERVICE LOAD = 2.54 + 5.44
= 7.98 kN/m

RECOMMEND RISA (140x100) SWL = 34.96
(P100 (65x100) SWL = 6.97 < 7.98

- CHECK LOAD CAPACITY OF 1m CAVITY WALL (7.3 BLOCKS)

Ref = 2/3 x (100+100) = 133.3mm
ht = 2600 SR = 2600 / 133.3 = 19.5

fk = 6.4 N/mm² RF = 0.7 + (1.5 x 1 x 0.1) = 0.85

fk REV = 6.4 x 0.85 = 5.44 N/mm²

e = 0.05 MIN β = 0.717

LOAD RESISTANCE OF INNER LEAF = $\frac{0.717 \times 5.44 \times 1000 \times 100}{3.5 \times 1000}$
= 111.4 kN.

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REPLACEMENT DWELLING

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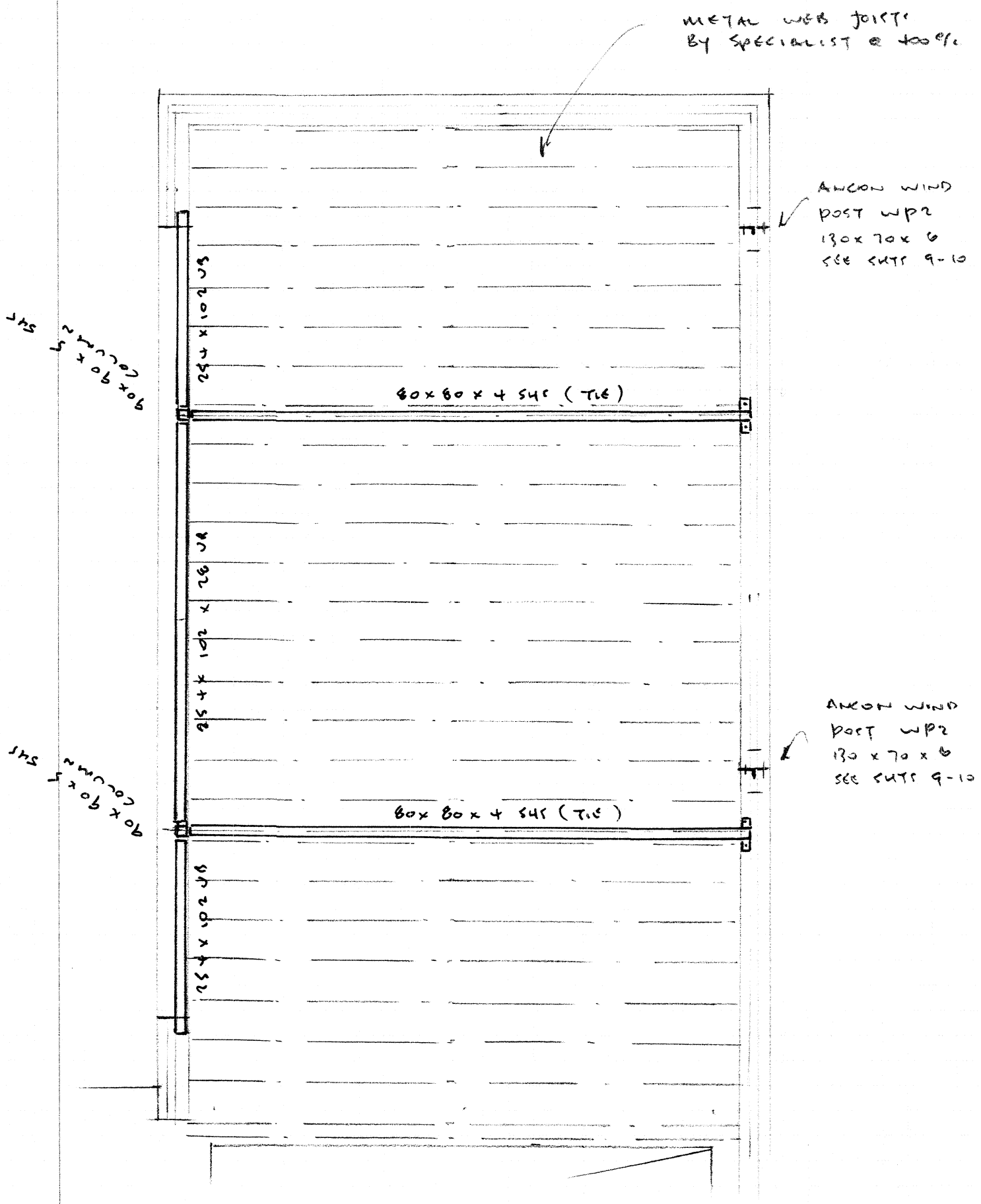

ROOF PLAN – SHT 1 OF 3 (SCALE 1:50)

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Date:	FEB 18
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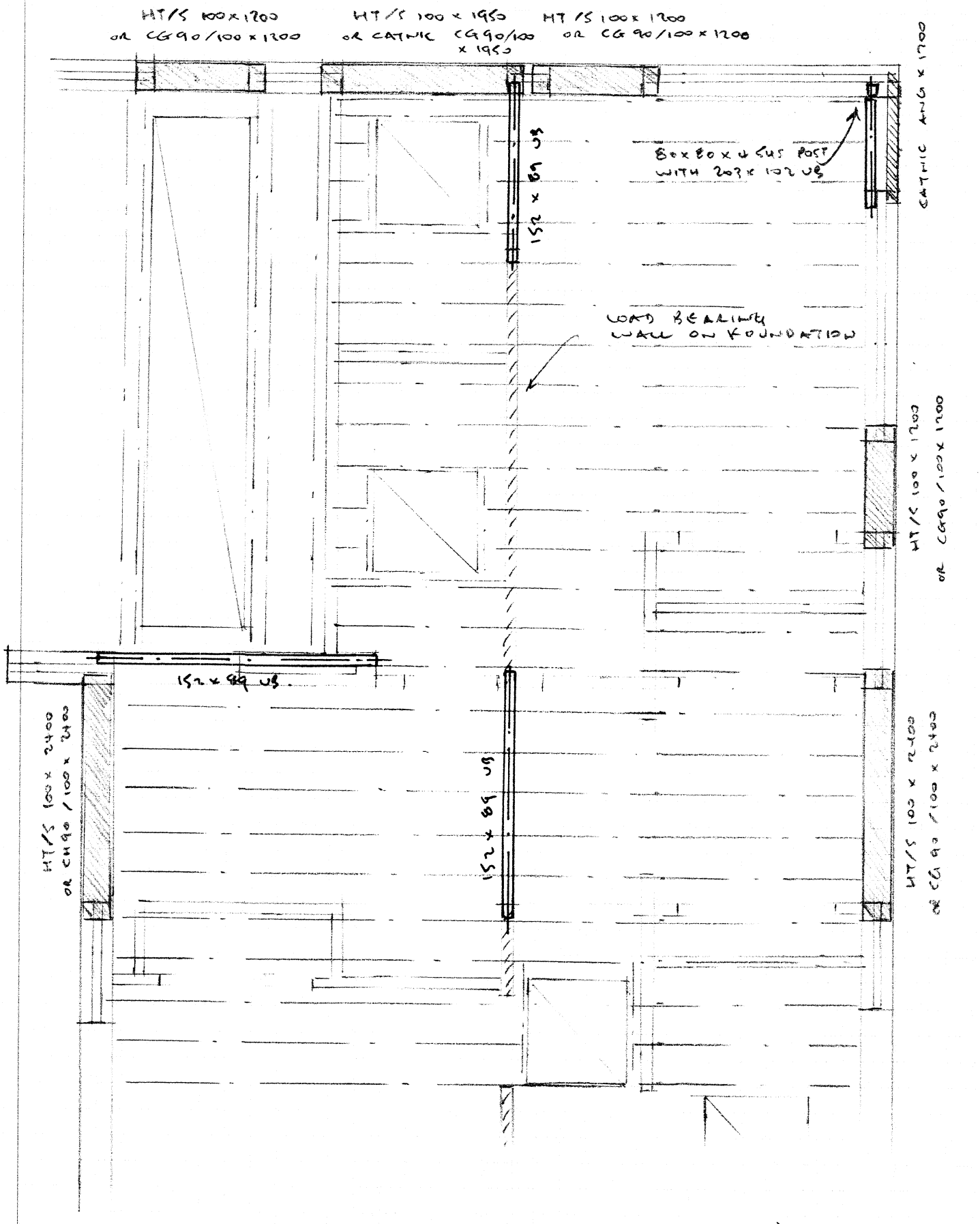
Project: DUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2PG
REPLACEMENT DWELLING



ROOF PLAN - SHT 2 OF 7 (SCALE 1:50)

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Project: AUCKLANDS
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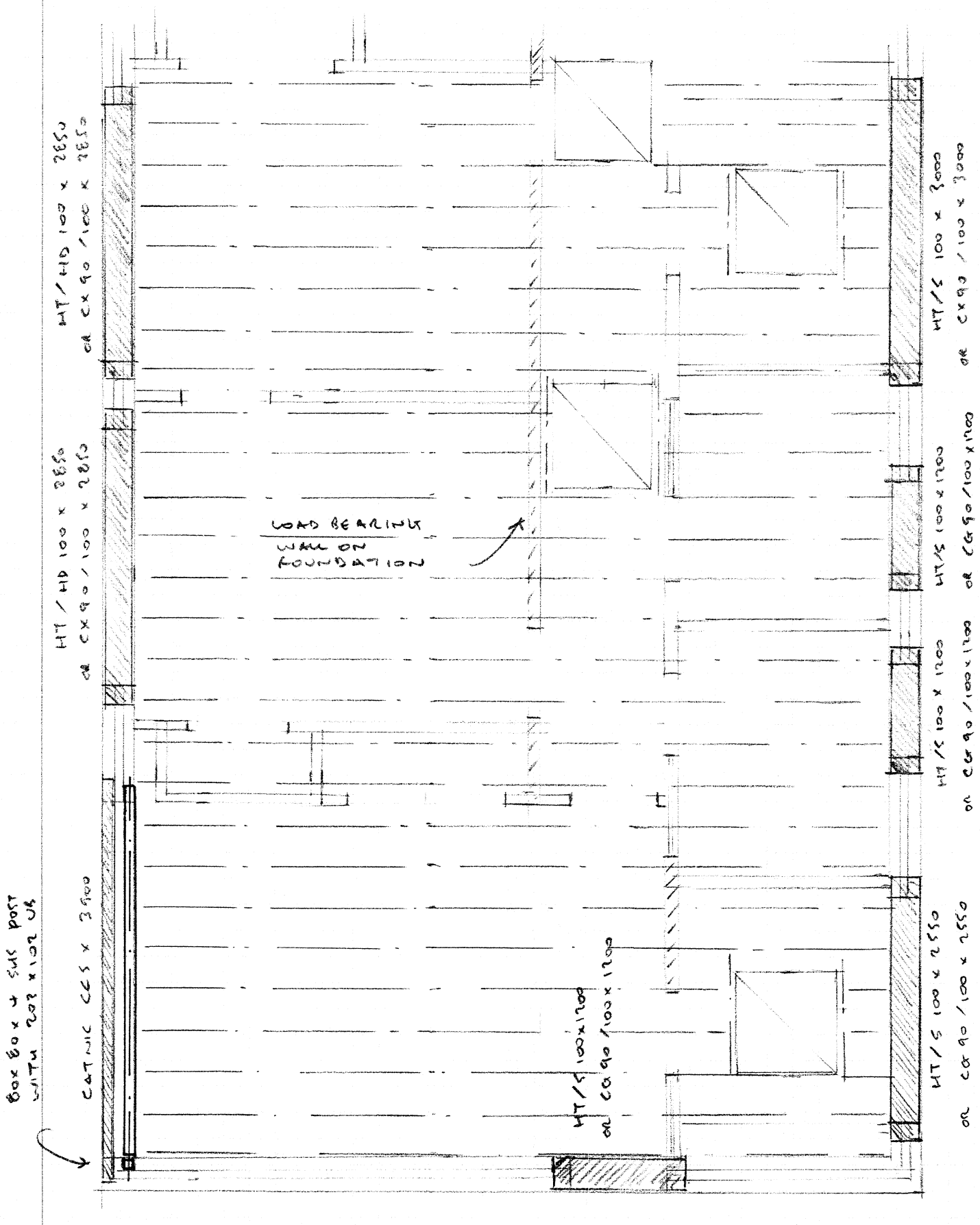
REPLACEMENT DWELLING

Date: FEB 18

Calc By: KDAY



ROOF PLAN SHT 3 OF 7 (SCALE 1:50)

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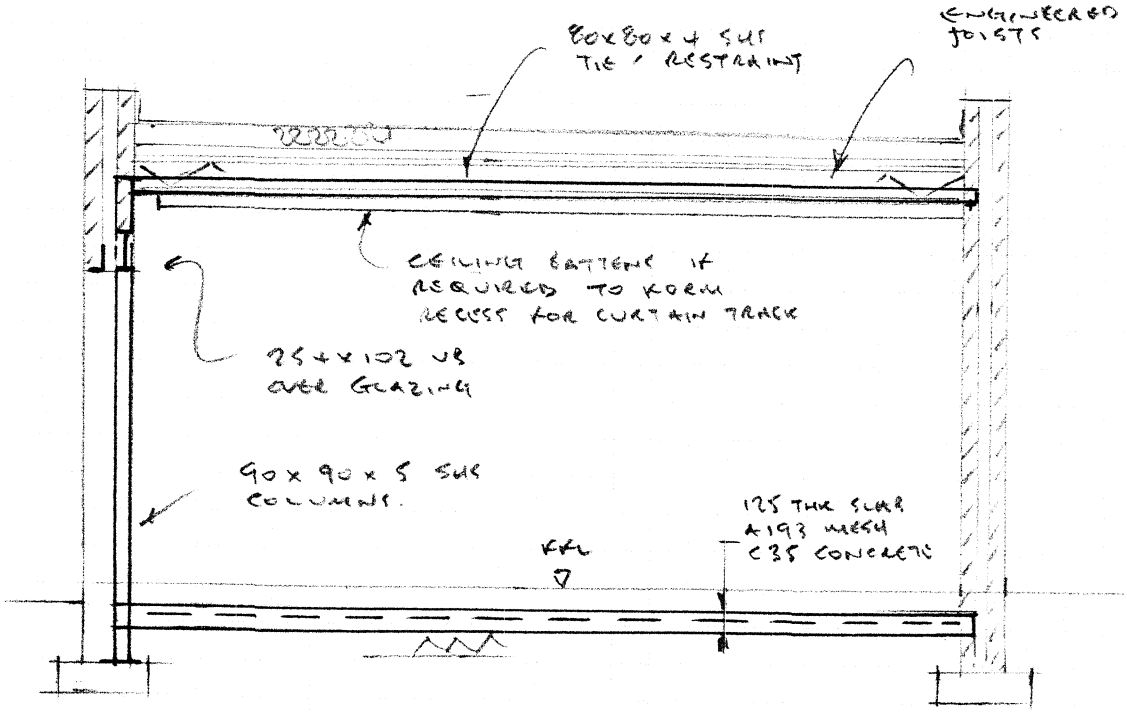
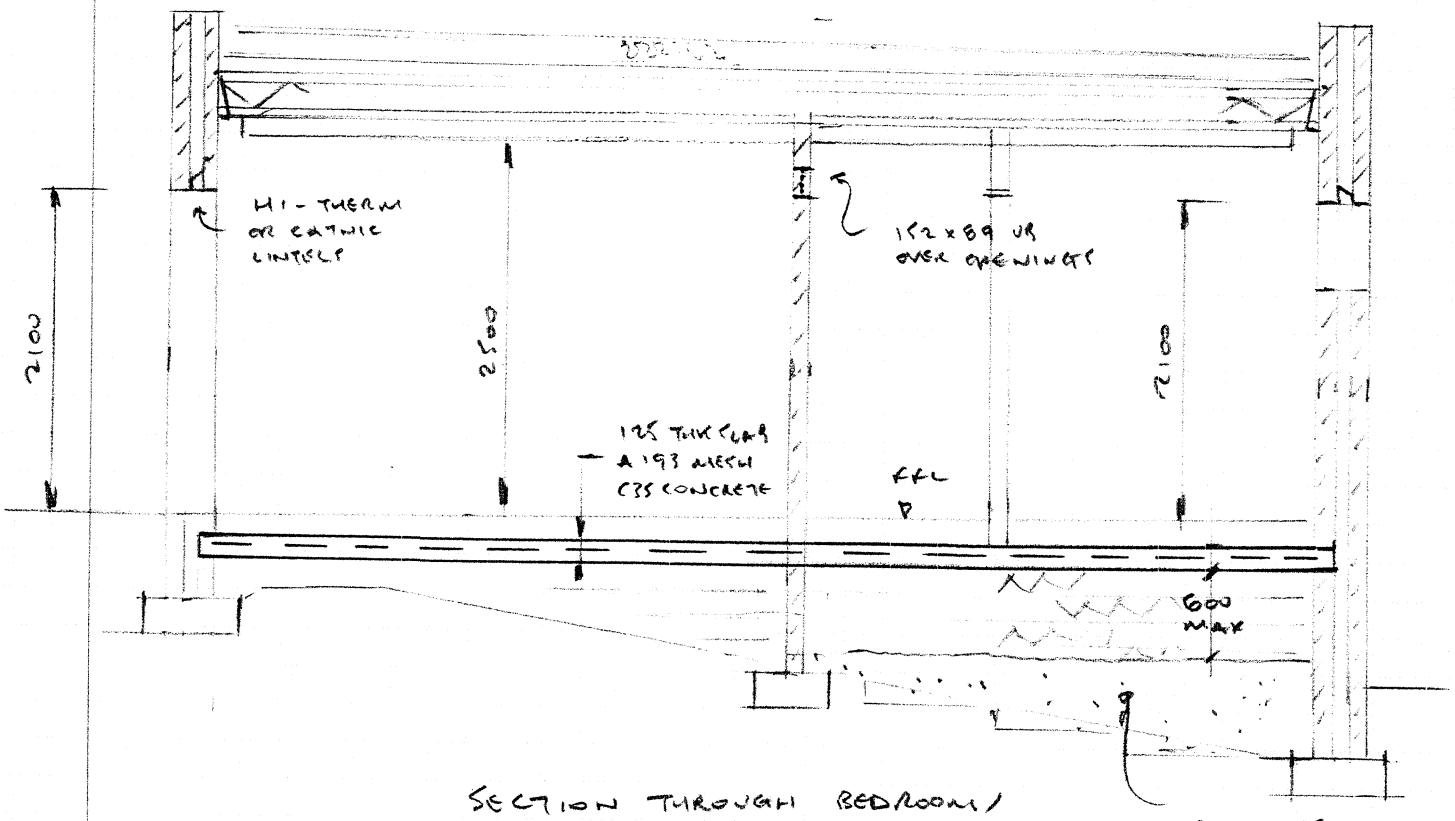
Calc By:	DAT

Project: AUCKLANDS
ST IVES ROAD, CARBIS BAY TR26 2DG
REPLACEMENT DWELLING



SECTION THROUGH LIVING / KITCHEN - SCALE 1:50



SECTION THROUGH BEDROOM / OFFICE - SCALE 1:50