From: Brian Senior
Sent: 11 November 2019 18:46
To: Ailsa Teasdale
Cc: Waring Building
Subject: Fwd: 76 Main Rd Aislaby

Hi Ailsa,
I hope you are well.
Please find attached the non-material amendment application form for the narrowed rear windows at 76 Main Rd, Aislaby. Also find attached the engineer's email, calcs and report for the rear elevation. We intend to proceed with Option 1 detailed in the report should NYMNP agree. Ill telephone tomorrow to pay the application fee.
Kind regards,
Brian

Hi Brian

Please find attached copy of my calculations re the masonry at the rear of your property.

I have detailed proposals that incorporate 900mm piers at each end of the long wall. The 1st option that I have proposed requires 300mm piers each side of the bi-fold doors. With this option it would then be possible to utilise standard catnic lintels for all the openings on the rear wall (except the one for the bi-fold doors which will require a heavy duty catnic lintel). - see sketch sk.02

Because of all the openings it will also be advisable to stiffen the sides of the bi-fold doors with ancon windposts installed in the cavities.

All the items for the option 1 are standard so it is definitely my preferred option.

If you did want to reduce the piers each side of the bi-fold doors further, then it would not be possible to obtain minimum bearing each end for the lintels. In this case (option 2) then the beam over the bi-fold doors would need to span over the side opening as well in one continuous length. A steel box-section beam with a shelf plate would be required for this option. It would be advisable to have the beam galvanised as the location is quite a corrosive environment.

My own view is that option 1 is simpler to achieve.

I have also included design (sizes) for the 2 sets of lintels each end of the kitchen that we discussed.

I have assumed you will install pre-fabricated timber trusses over the garage area. If not you will need a steel ridge beam and possible 2 purlins to support the roof.

I also assume foundation design has been others.

My account also attached.

Trust you will find all in order (I suggest you send calcs to building inspector and check he is ok before proceeding too far).
If you do want to discuss anything further I am hoping to be out all day tomorrow but should be at my desk all day Friday.

Regards

Richard

Ref 3.632

October 2019

ALTERATIONS / EXTENSION

AT

76 MAIN ROAD

AISLABY, WHITBY

FOR

MR B SENIOR

STRUCTURAL CALCULATIONS

Prepared by

Richard Agar
Associates Limited
Consulting Civil & Structural Engineers
Established 1988

Ivy House Farm, 8 Main Road, Aislaby, WHITBY, North Yorkshire, YO21 1SW

www.richardagarassociates.co.uk

Ref: 3.632
Project: Extension at 76 Main Road, Aislaby, Whitby
Client: Mr B Senior
Architect / Surveyor: t.b.a.

CALCULATION RESULTS / SIZE SUMMARY

(see sketches on following pages for general locations)

OPTION 1 (min 300mm piers each side of bi-fold doors)

BEAM(S)

Location:	Size
B.01 (lintel)	Catnic cx 90/100
B.02	2 no. 178 x 102 x 19 kg UB (alternatively use 2 no. Catnic BHD 100)
B.03	2 no. 178 x 102 x 19 kg UB (alternatively use 2 no. Catnic BHD 100)

MASONRY PIERS

Min masonry piers to be as shown on drg 3.632-sk.02

STEEL WINDPOSTS ADJACENT BI-FOLD DOOR OPENING

Ancon type WP3 – 85 x 60 x 5mm thk.

GENERAL NOTES:

All steel beams/ lintels to have min 150mm bearing each end

OPTION 2 (piers each side of bi-fold doors less than 300mm)
(see sketch 3.632-sk.03)

BEAM(S)

Location:	**Size**
B.01 (lintel)	150 x 100 x 5 thk RHS

with 6 mm shelf plate – see sketch 3.632-sk.04
This beam (& plate) should be galvanised.
(this beam is to be continuous across 3 openings; i.e. the bifold doors & 2 side windows – max span 5500mm)

B.02	2 no. 178 x 102 x 19 kg UB (alternatively use 2 no. Catnic BHD 100)
B.03	2 no. 178 x 102 x 19 kg UB (alternatively use 2 no. Catnic BHD 100)

MASONRY PIERS

Min masonry piers to be as shown on drg 3.632-sk.03

STEEL WINDPOSTS ADJACENT BI-FOLD DOOR OPENING

Ancon type WP3 – 85 x 60 x 5mm thk.

GENERAL NOTES:

All steel beams/ lintels to have min 150mm bearing each end

DESIGN NOTES

Proposals are for rear extension to dwelling.

These proposals include a single storey rear elevation with a large number of window openings. These calculations specifically refer to requirements for minimum piers along this rear elevation.

Drawing nos 3.632-sk.02 & 03 summarise our requirements for 2 options.

Foundation design and garage roof are assumed to have been designed by others.

Where construction of existing floors & direction of floor joists has not been fully investigated, then a worst case has been assumed e.g floors assumed to span onto beam. This may result in some floor loads being taken twice i.e. resulting in a simple conservative assessment of loadings.

General stability is to be provided by attaching to main building.

Normal good practice and compliance with Building Regulations assumed
e.g use of mild steel restraint straps at eaves & verge on roof.
adequate propping during installation of new steel beams.
fire protection to steelwork (2 layers plasterboard).

Design standards used.

EN 1993-1-1: 2005	Steel
EN 1993-1-8: 2005	Steel connections
EN 1996-1-1:2005	Masonry
EN 1991-1-1: 2002	Actions on Structures

Where European Standards have been used, reference will also have been made to the relevant UK National Annexe.

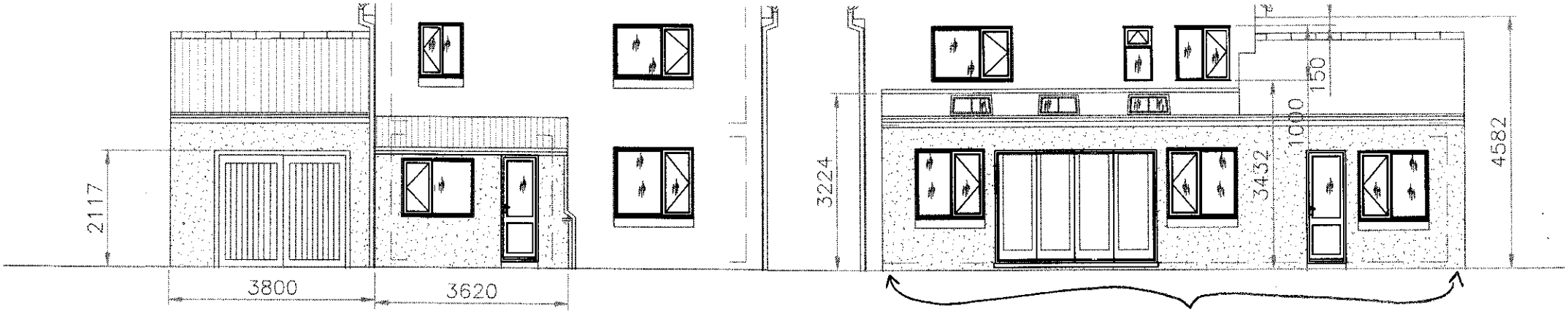
GENERAL

The site has been inspected by the engineer.

Structural design is based on information/dimensions taken on site by the engineer.

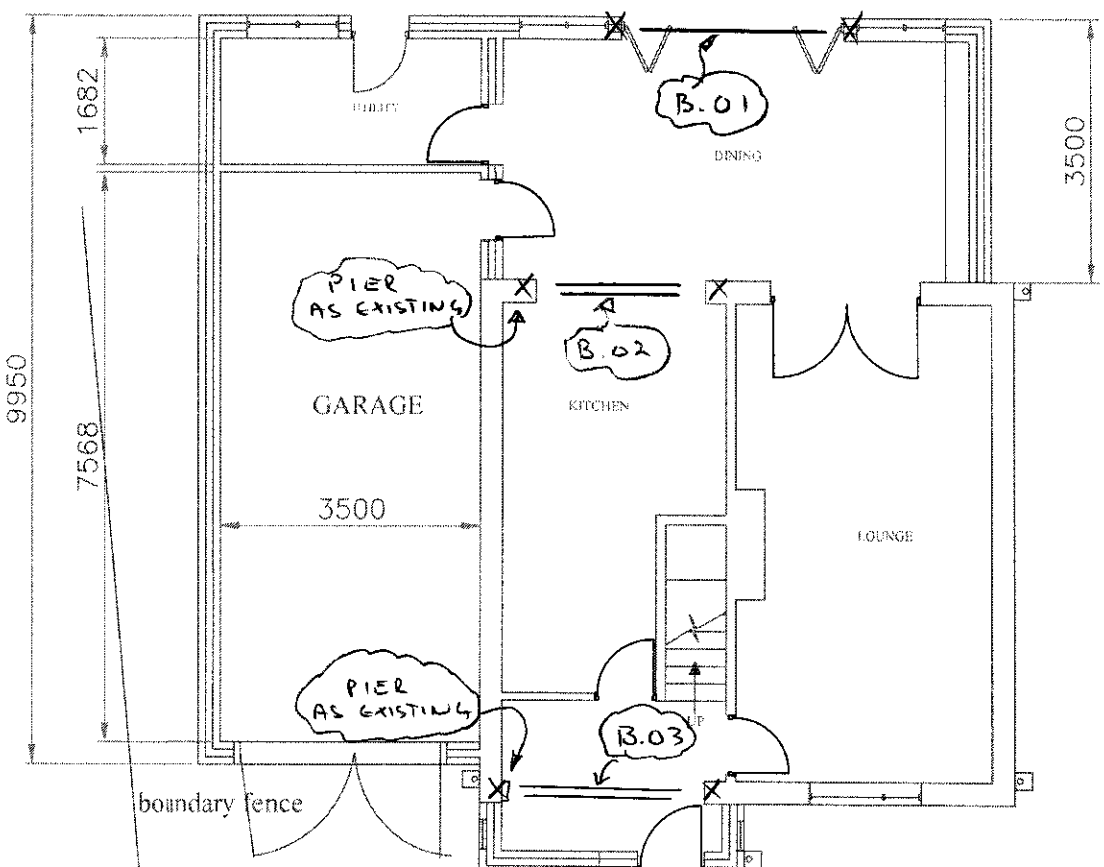
These calculations are subject to approval by the relevant statutory bodies and authorities before construction work begins.

If in doubt, ASK!

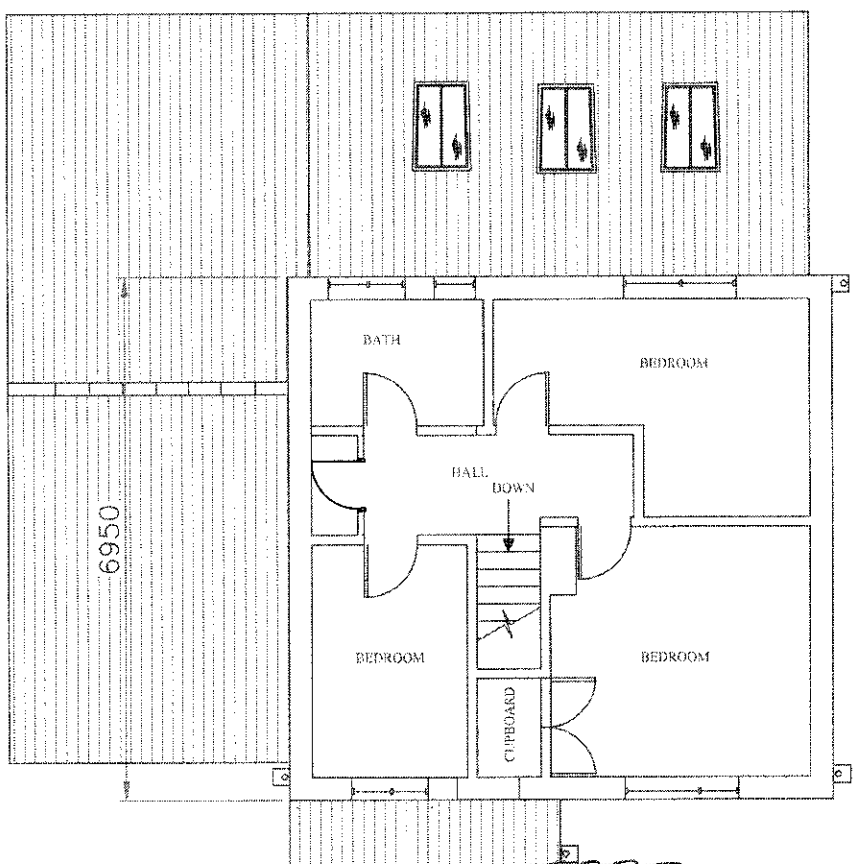


FRONT ELEVATION

* SEE SKETCH 3.632-SK.02 FOR AMENDED ELEVATION

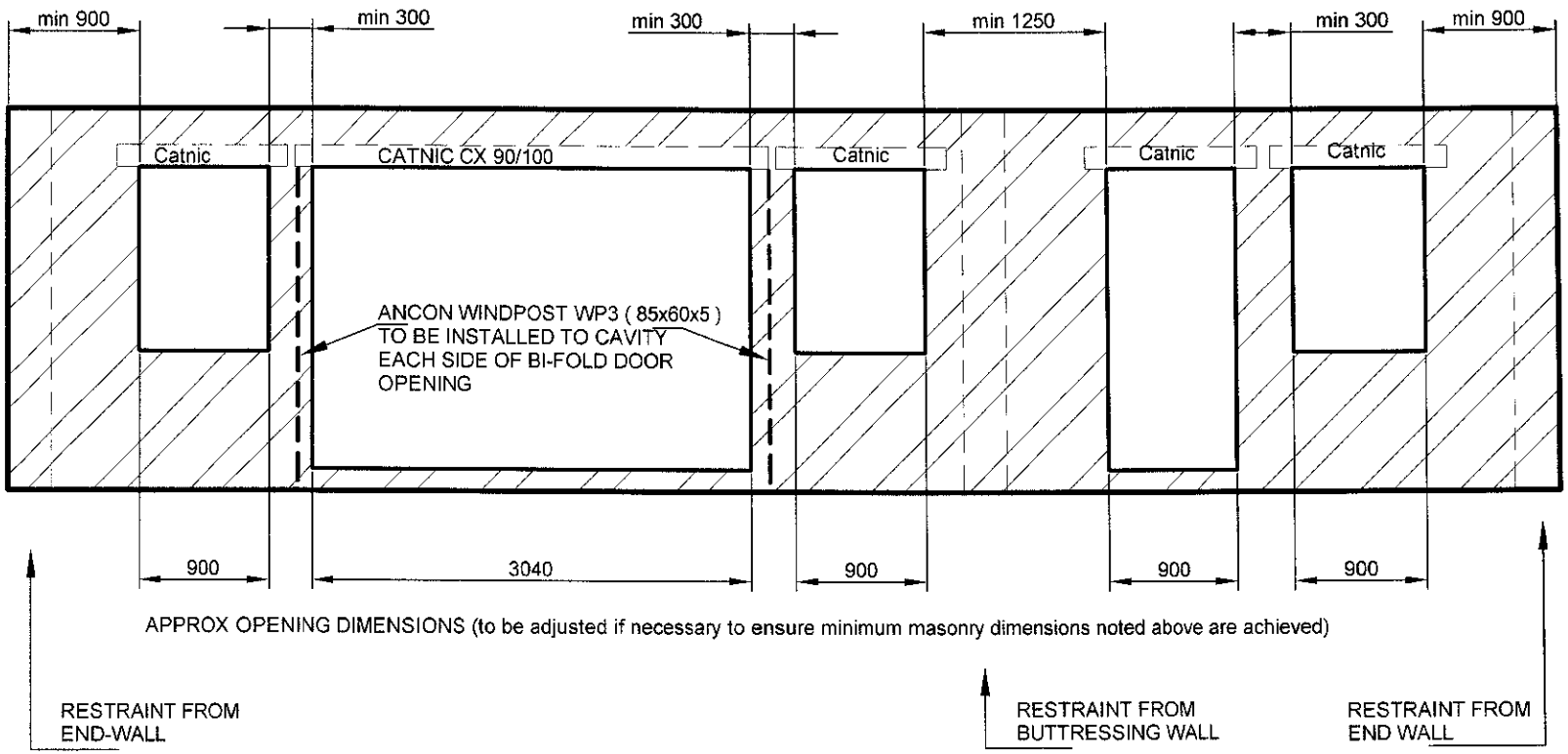


GROUND FLOOR



3.632-SK.01

MINIMUM MASONRY PIER DIMENSIONS

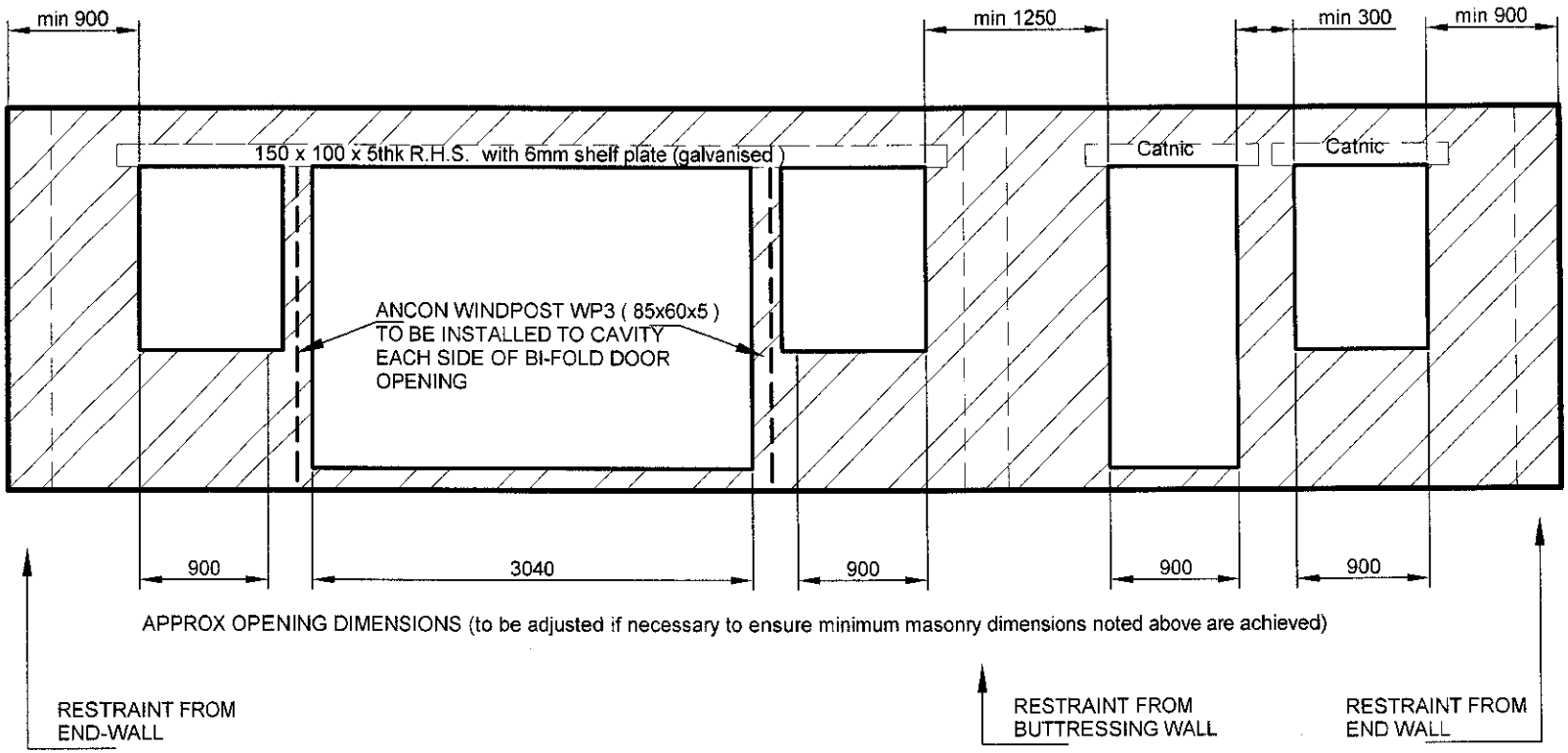


SCHEMATIC REAR ELEVATION

Richard Agar
Associates Limited
Consulting Civil & Structural Engineers
8 MAIN RD, AISLABY
WHITBY
NORTH YORKSHIRE
YO21 1SW

Client	MR B SENIOR
Project	76 MAIN ROAD
Title	REAR ELEVATION MIN MASONRY DIMENSIONS
Drawn	RA
Date	Oct' 19
Scales	N.T.S.
Drg No.	3.632-sk.02
Rev	

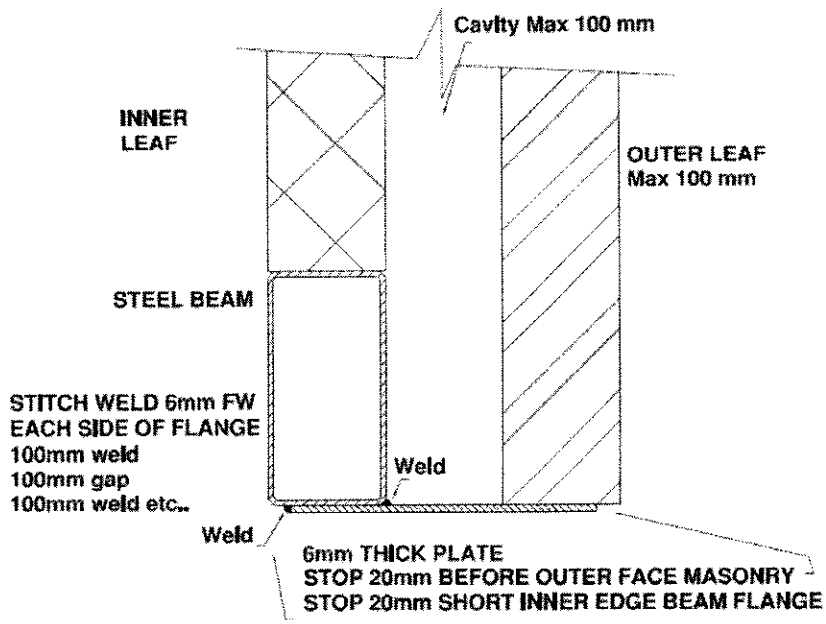
MINIMUM MASONRY PIER DIMENSIONS



SCHEMATIC REAR ELEVATION (Option 2)

Richard Agar
Associates Limited
Consulting Civil & Structural Engineers
8 MAIN RD, AISLABY
WHITBY
NORTH YORKSHIRE
YO21 1SW

Client	MR B SENIOR
Project	76 MAIN ROAD
Title	REAR ELEVATION - OPTION 2 MIN MASONRY DIMENSIONS
Drawn	RA
Date	Oct' 19
Scales	N.T.S.
Drg No.	3.632-sk.03
Rev	



BEAM WITH SHELF PLATE DETAIL

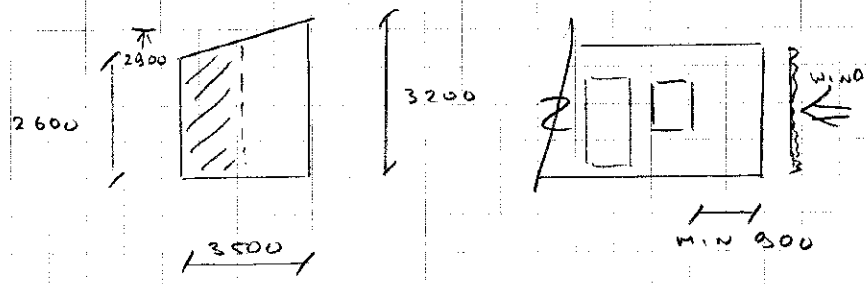
WARNING !
CAVITY MUST NOT EXCEED 100mm
EXTERNAL LEAF MUST NOT EXCEED 100 mm THICKNESS

Drg no. 3.632-sk.04

Ref	Calculations	Output

1/ END PIERS

CHECK CAPACITY TO ACT AS WIND-POSTS



TYP - WORST CASE

Max area for wind load on rear gables
$= \frac{(2.9+2.6)}{2} \times \frac{3.5}{2} = 4.81$ say 5 sq.m.

Allow characteristic wind load = 1 kN/m² (conservative)

∴ DESIGN WIND LOAD ON END GABLE

$= 1.5 \times 1 \times 5 = 7.50$ kN.

MAX BM ON END PIER
(Very conservative as ignores pier at opposite end and also reduced span due to windows)

$M_{Ed} = 7.5 \times \frac{2.6}{8} = 2.44$ kN m (Conservative)

SGC RESULTS NEXT PAGE

Provide min 400mm pier each end.

3.632
10.01

Richard Agar Assc. Ltd Consulting Engineers
MOMENT OF RESISTANCE OF PLAIN MASONRY COLUMNS / PIERS
TO EN 1996-1-1: 2005 and UK National Annexe

Job Reference:- 76 Main Road Job No. : 3.632
Col/Pier Ref:- End Pier - New Extn

Simple conservative design check; any outer leaf and
any adjoining outstand flanges are ignored
i.e. Pier/Col treated as isolated column

GEOMETRY:

o/a Depth - incl adjoining leaf (major axis)	D =900 mm
o/a Width (minor axis)	B =300 mm
Cavity Depth (major axis)	d2 =700 mm
Cavity Width (minor axis)	b2 =100 mm
Nett area of section	Area =200,000 sq.mm
Section Modulus	Z =32 x 10^6 mm^3

MATERIALS:

Mortar type :M4 (iii)	
Masonry type :aggregate concrete - group 1	
Masonry Normalised comp. strength	fb = 17.5 N/sq.mm
Partial safety factor material (T.NA.1)	gm = 2.7
Masonry characteristic strength (cl.3.6.1.2)	fk = 6.2 N/sq.mm
Masonry flexural strength (T.NA.6)	fxk1 = 0.3 N/sq.mm

APPLIED VERTICAL LOAD cl. 6.3.1.(4)

Axial load (1.0.Gk)	Ned = 0 kN
Upper limit for axial. stress (0.2.fk/gm)	= 0.46 N/sq.mm
Applied Axial stress	sd = 0.00 N/sq.mm

SHEAR STRENGTH (simple check ignoring benefit vertical load)
Initial shear strength masonry (T.NA.5) fvko = 0.15 N/sq.mm
Partial factor of safety (T.NA.1) gms = 2.5

RESULTS:

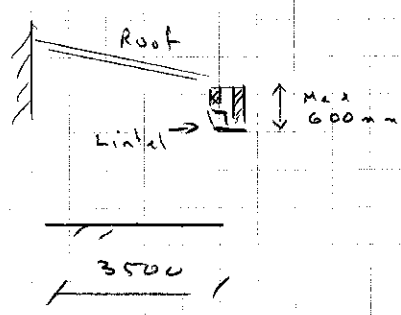
Shear Strength of section (A.fvko/gms)	Fvd = 12.00 kN ← > 7.50 kN ∴ OK
Moment of Resistance (fxk1/gm+sd).Z)	MoR = 3.59 kN.m ← > 2.44 kN.m ∴ OK

Moment Capacity Masonry Column/Pier Date:- 22/Oct/2019 Time:- 1:45 PM

CONSERVATIVE DESIGN.
900mm END PIER HAS CAPACITY FOR
SHEAR + BM FROM WIND WITHOUT
INCLUDING REST OF WALL.

Ref	Calculations	Output

LOADINGS



LOADINGS

	G_k	Q_k
Roof		
DL = $\frac{3.5}{2}$ × 1.50 =	2.63	
LL = $\frac{3.5}{2}$ × 0.75 =		1.31
Masonry (allow 600mm)		
DL = 2 × 0.1 × 0.6 × 24 =	3.00	
say	6.00	1.31
	KN/m	

(equiv total load = 3 × (6 + 1.31) = 22 KN

Options

(i) Provided min 150 bearing available

(ii) If piers each side bifold doors < 300 then use RHS & plate to span 5.50m.

SEE OPTIONS RE PIER SIZES

(i) CATNIC CX 90/100 (min 150 bearing each end)

(ii) 150 x 100 x 5 RHS + 6mm plate

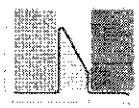
OPEN BACK LINTELS

70-85mm Cavity
100-115mm Inner Leaf

All ratios are shown inner to outer

Standard Duty

Standard lengthsare available in 150mm increments up to1800mm, 300mm at lengths from 2100 to 3600mm.

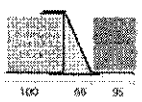


CG70/100

Standard lengths (mm)	750-1500	1650-1800	2100	2400	2700	3000-3600
SWL 1:1/3:1 (kN)	15	18	20	22	26	26
Weight (kg/m)	6.0	7.5	8.1	8.7	10.0	12.5
Nominal height 'h' (mm)	140	140	160	180	220	220

Heavy Duty

Standard lengths are available in 150mm increments.

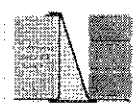


CH70/100

Standard lengths (mm)	900-1800	1950-2100	2250-2400
SWL 1:1/19:1 (kN)	32	48	45
Weight (kg/m)	10.9	13.6	13.6
Nominal height 'h' (mm)	157	157	157

Extra Heavy Duty

Standard lengthsare available in 150mm increments up to3000mm, 300mm at lengths 3000mm to 4800mm (including 4575mm, but excluding 4500mm).



CX70/100

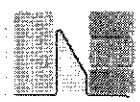
Standard lengths (mm)	900-2700	2850-3000	3300-3900	4200-4800
SWL 1:1/19:1 (kN)	60	55	50	32
Weight (kg/m)	16.4	16.4	19.9	19.9
Nominal height 'h' (mm)	232	232	232	232

70-85mm Cavity
125-140*mm Wide Inner Leaf

* For **CG** lintels used with 140mm dense blocks please refer to 'Cavity Wall Lintel Installation Guide' on pages 10-11.

Standard Duty

Standard lengths are available in 150mm increments up to 1800mm, 300mm at lengths from 2100mm to 3000mm.

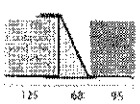


CG70/140

Standard lengths (mm)	750-1200	1350-1800	2100-2400	2700-3000
SWL 1:1/3:1 (kN)	12	17	20	26
Weight (kg/m)	6.3	8.0	9.2	13.1
Nominal height 'h' (mm)	140	140	180	220

Heavy Duty

Standard lengths are available in 150mm increments.

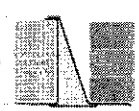


CH70/140

Standard lengths (mm)	900-1800	1950-2100	2250-2400
SWL 1:1/19:1 (kN)	32	48	45
Weight (kg/m)	11.1	13.9	13.9
Nominal height 'h' (mm)	157	157	157

Extra Heavy Duty

Standard lengths are available in 150mm increments up to 3000mm, 300mm at lengths 3000mm to 4800mm (including 4575mm, but excluding 4500mm).



CX70/140

Standard lengths (mm)	900-2700	2850-3000	3300-3900	4200-4800
SWL 1:1/19:1 (kN)	60	55	50	32
Weight (kg/m)	16.7	16.7	20.3	20.3
Nominal height 'h' (mm)	232	232	232	232

The SWL (safe working load) is based on the total UDL (uniformdistributed load) over maximum span using 150mmend bearings.

Concrete Floor Loads

When using the Catnic **CH** and **CX** open back ranges with concrete floors, always ensure that the blockwork is built tight against the inner vertical face of the lintel and that a mortar joint is added to the top of the blockwork so that the floor units have an even spread over the inner flange of the lintel. For guidance on installation refer to page 11.

Note: To achieve the '**CH** and **CX**' loading figures indicated, lintels must be built-in as illustrated, ensuring that the blockwork infill is well-jointed during construction and compatible with the strength of the masonry above.

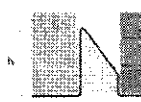
OPEN BACK LINTELS

90-105mm Cavity
100-115mm Inner Leaf

All ratios are shown inner to outer

Standard Duty

Standard lengths are available in 150mm increments up to 3000mm, 300mm at lengths from 3000mm to 3600mm.

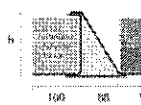


CG90/100

Standard lengths (mm)	750-1500	1650-1800	1950-2100	2250-2400	2550-2700	2850-3600
SWL 1:1/3:1 (kN)	15	18	20	22	26	26
Weight (kg/m)	6.1	7.6	8.3	8.9	10.2	13.0
Nominal height 'h' (mm)	140	140	160	180	220	220

Heavy Duty

Standard lengths are available in 150mm increments.

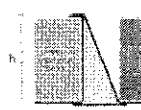


CH90/100

Standard lengths (mm)	900-1800	1950-2100	2250-2400
SWL 1:1/19:1 (kN)	32	48	45
Weight (kg/m)	11.2	14.0	14.0
Nominal height 'h' (mm)	157	157	157

Extra Heavy Duty

Standard lengths are available in 150mm increments up to 3000mm, 300mm at lengths 3000mm to 4800mm (including 4575mm, but excluding 4500mm).



CX90/100

Standard lengths (mm)	900-2700	2850-3000	3300-3900	4200-4800
SWL 1:1/19:1 (kN)	60	55	50	32
Weight (kg/m)	16.9	16.9	20.5	20.5
Nominal height 'h' (mm)	232	232	232	232

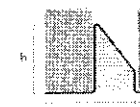
Where **CH** and **CX** lintels are required to support greater loads or different wall constructions than the figures published, please contact our **Technical Services Department on**

90-105mm Cavity
125-140*mm Wide Inner Leaf

* For **CG** lintels used with 140mm dense blocks please refer to 'Cavity Wall Lintel Installation Guide' on pages 10-11.

Standard Duty

Standard lengths are available in 150mm increments up to 1800mm, 300mm at lengths from 2100mm to 3000mm.

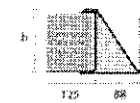


CG90/140

Standard lengths (mm)	750-1200	1350-1800	2100-2400	2700-3000
SWL 1:1/3:1 (kN)	12	17	20	26
Weight (kg/m)	6.5	8.1	9.4	13.3
Nominal height 'h' (mm)	140	140	180	220

Heavy Duty

Standard lengths are available in 150mm increments.

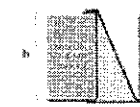


CH90/140

Standard lengths (mm)	900-1800	1950-2100	2250-2400
SWL 1:1/19:1 (kN)	32	48	45
Weight (kg/m)	11.5	14.3	14.3
Nominal height 'h' (mm)	157	157	157

Extra Heavy Duty

Standard lengths are available in 150mm increments up to 3000mm, 300mm at lengths 3000mm to 4800mm (including 4575mm, but excluding 4500mm).



CX90/140

Standard lengths (mm)	900-2700	2850-3000	3300-3900	4200-4800
SWL 1:1/19:1 (kN)	60	55	50	32
Weight (kg/m)	17.2	17.2	20.9	20.9
Nominal height 'h' (mm)	232	232	232	232

Richard Agar Assc. Ltd Consulting Engineers
DESIGN OF SINGLE SPAN RHS & SHS SECTIONS TO EN 1993-1-1: 2005

3.632
11.02

Job Reference:- 76 Main Road Job No. : 3.632
Beam Reference:- Lintel B.01

Following dimensions for design purposes only
Contractor should check all dimensions on site before ordering materials
This sheet is brief summary of computed results. Full details are available if required. Program adopts conservative approach for the strength checks

SPAN DATA:
Span Ls = 5.5 m
Effective length Le = 5.5 m
Load factors :- Variable Actions (imposed) = 1.50 Permanent Actions (Dead) = 1.35

TRIAL SECTION SIZE :-150x100x5.0 RHS
Material is grade S355 Section classification is 2

Section Properties
Depth of section h = 150 mm
Width of section b = 100 mm
Wall thickness t = 5 mm
2nd Moment Area (major y-axis) Iy = 739 cm^4
Plastic modulus (major y-axis) Wply = 119 cm^3
Cross-sectional area A = 23.7 cm^2

Shear buckling check - cl. 6.2.6(6):
The shear buckling resistance for webs should be checked according to section 5 of EN 1993-1-5 if: hw/t > 72e/n (eqn 6.22)
hw/t = 28.00
72e/n = 58.58
shear buckling ok

Shear capacity check - cl 6.2.6(1) & eqns 6.17, 6.18:
Shear area Av=Ah/(b+h) = Av = 1,422 sq.mm
Shear strength Vcrd=Av(fy/sqr(3)) = Vcrd = 291.45 kN (eqn 6.18)
Applied shear force = Ved = 27.68 kN
shear capacity ok

Moment capacity check - cl 6.2.5(1) & eqns 6.12, 6.13:
Moment capacity Mcrd = Wply.fy/gm0 Mcrd = 42.25 kN.m (eqn 6.13)
Applied design moment = Med = 38.06 kN.m
moment capacity ok

Member buckling check - cl 6.3.2.1; 6.3.2.2(4); 6.3.2.3
For slenderness LamdaLT < LamdaLTo, then L.T.B. buckling effects may be ignored
cl. 6.3.2.3 LamdaLTo = 0.4
Access steel doc sn003a:
Mcrd = 471.55 kN.m
LamdaLT = sqr(Wy.fy/Mcr) LamdaLT = 0.30
member buckling ok

DEFLECTION CHECK
NA.2.23 :-floors, roofs -brittle finishes
Deflection due to imposed loads = di = 10.06 mm
Allowable Imposed load deflection = d2 = 15.28 mm
deflection ok

3.632
11.03

Richard Agar Assc. Ltd Consulting Engineers
ADDITIONAL STRENGTH CHECKS FOR RHS & SHS SECTIONS
SUBJECT TO COMBINED BENDING AND TORSION

Job Reference:- 76 Main Road Job No. : 3.632
Beam Reference:- Lintel B.01

TRIAL SECTION SIZE :-150x100x5.0 RHS
Material is grade S355 Section classification is 2

TORSION ACTIONS

Total characteristic Variable action causing torsion	Pqt = 0.00 kN
Total characteristic Permanent action causing torsion	Pgt = 8.25 kN
Total Design action causing torsion	F.1d = 11.14 kN
Eccentricity of load to centre line of beam	e = 200.0 mm
Design value of Torsion (at support)=	T.ed = 1.11 kN.m

Torsional moment capacity - cl. 6.2.7(1); 6.2.7(8); eqn 6.13
For hollow sections only Saint-Venant torsion needs be considered

Design value of Torsion (at support)=	T.ed = 1.11 kN.m
Torsional capacity Trd = Wt.fy/sqr(3)	T.rd = 26.03 kN.m

torsional moment capacity ok

Serviceability check - Rotational twist
SCI doc p.057 recommends limiting rotation to 2 degrees

Characteristic torsional moment	= 0.83 kN.m
Rotational twist (unfactored torsion)	phi = 0.40 degrees

Rotational twist ok

Richard Agar Associates Limited
Consulting Civil & Structural Engineers

Project: 76 MAIN RD	Job ref: 3.632
Structure: BI-FOLD DOORS	Page: 12.00
Member: WIND POSTS TO SIDES	Date: OCT 15

Ref	Calculations	Output

PROVIDE WIND POSTS TO SIDES OF BI-FOLD DOORS

AREA ACTING ON LONG VERTICAL EDGE

= 2.5 x 2.6 = 6.50 sq.m

WIND LOAD = 6.50 x 1.00 = 6.50 kN

SEE ANCON DATA SHEET PAGE.

WP3 - 85 x 60 x 5 => 7.30 kN

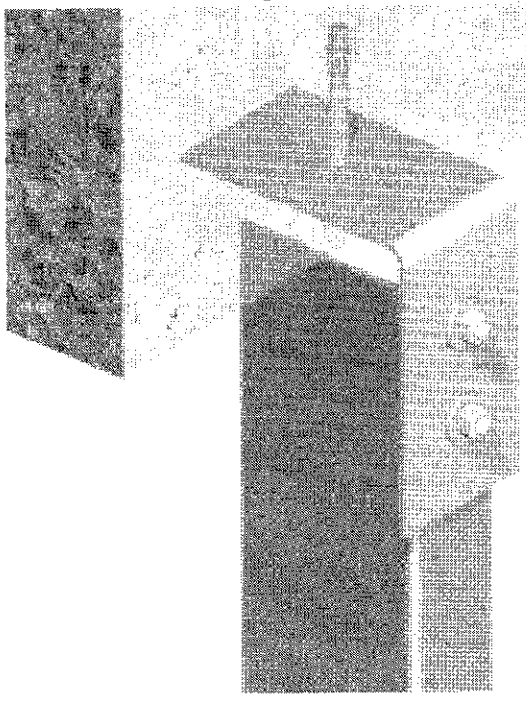
Ancon
WP3
85 x 60 x 5

prepared by

checked by

Masonry Support, Windposts & Lintels

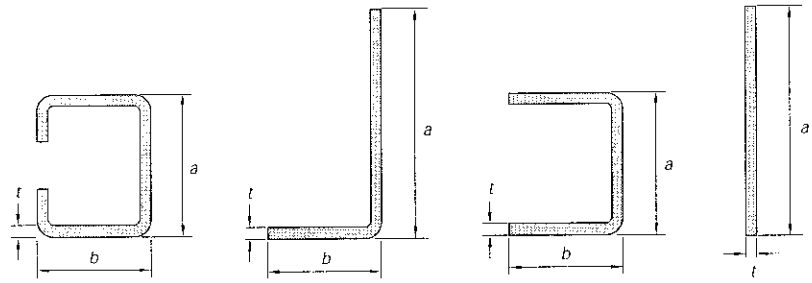
3 632
12.01



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

Richard Agar Associates Limited Consulting Civil & Structural Engineers	Project 76 MAIN RD	Job ref 3.632
	Structure EXTN + ALTS	Page 14.00
	Member LINTELS B.02 & B.03	Date OCT 19

Ref	Calculations	Output
	- DESIGN FOR WORST CASE - ASSUME 2no ELEVN TO SUIT CAVITY WALL OVER - ASSUME WORST CASE = INNER LEAF	
	LOADINGS (inner leaf) Masonry DL = 2.5 x 0.1 x 2.4 = 6.00 Ish. floor DL = $\frac{7}{2}$ x 0.50 = 1.75 LL = $\frac{7}{2}$ x 1.50 = 5.25 7.75 / 5.25 kN/m (G_k / Q_k)	
	SEE RESULTS NEXT PAGE →	E.M. 2no CAT N.C BHD 100 OR 2no 178 x 102 x 19 UB

prepared by MV

checked by

INTERNAL WALLS
INTERNAL PARTITION AND LOADBEARING WALL LINTELS

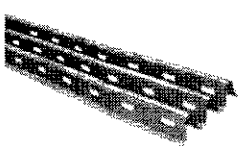
For use in internal partition and loadbearing walls 75mm, 100mm and 140mm.

Internal wall lintels

Catnic lintels for internal partitions and loadbearing walls are available in either 'corrugated', 'channel' or 'box section' to accommodate different loads and openings.

1 Corrugated

For use in solid or block walls.



CN92 and CN102

Offers a cost effective solution for extra light duty loads.

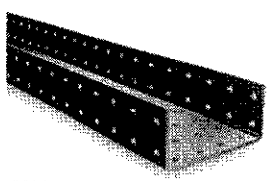
Suitable for normal domestic loading.

Benefits

Integral plaster key
Formed shaped staggered holes to provide a key for plaster finish

2 Channel

For use in solid or block walls.



CN100

Offers a cost effective solution for light duty loads.

As corrugated lintel plus:
Suitable for masonry/timber floor loads.

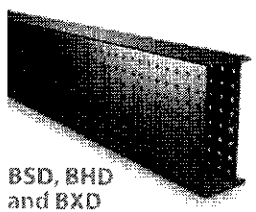
Benefits

Duplex Corrosion Protection System
Ensures optimum durability and longevity

Integral plaster key
With holes at 300c/c to provide a plaster key

3 Classic Box

For use in solid or block walls.



BSD, BHD and BXD

Offers a cost effective solution for standard duty and heavy duty loads.

Universal application caters for all loading conditions:
- Direct floor or roof load
- Supports concrete floor loads
- Supports point loads e.g. steel beams

BSD, BHD and BXD
As previous plus:
- Suitable for 140mm blockwork

Benefits

Duplex Corrosion Protection System
Ensures optimum durability and longevity

Integral plaster key
With staggered holes to those on the box profile

The SWL (safe working load) is based on the total UDL (uniform distributed load) over maximum span using 75mm end bearings for CN92 and CN102.

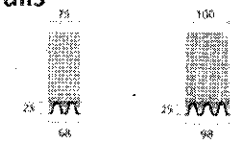
INTERNAL WALL LINTELS

TOTAL LOAD = 2·8(7·75 + 5·25) = 36·40 KN

75mm and 100mm Interior Solid Walls

Extra Light Duty

Standard lengths are available in increments of 150mm.



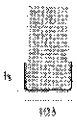
CN92		CN102
Standard lengths (mm)	1050-1200	1050-1200
SWL (kN)	7	7
Weight (kg/m)	1.2	1.8
Nominal height 'h' (mm)	25	25

Note: When using **CN92** and **CN102** lintels normal building practice should be observed, in that one course of blockwork should be laid on the lintel and the mortar allowed to harden for at least 24 hours before additional loads are applied.

100mm Interior Solid Walls

Light Duty

Standard lengths are available in increments of 150mm.



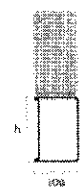
CN100	
Standard lengths (mm)	1050-1200
SWL (kN)	10
Weight (kg/m)	3.7
Nominal height 'h' (mm)	50

* Not suitable for floor loads

100mm Interior Solid Walls

Standard Duty

Standard lengths are available in increments of 150mm at lengths up to 3000mm, 300mm at lengths from 3000mm to 4800mm (including 4575mm, but excluding 4500mm).



BSD100					
Standard lengths (mm)	750-2100	2250-2700	2850-3600	3900-4575	4800
SWL (kN)	19	20	29	29	27
Weight (kg/m)	6.0	7.5	12.4	15.7	15.7
Nominal height 'h' (mm)	143	143	219	219	219

Heavy Duty

BHD100					
Standard lengths (mm)	750-1500	1650-2100	2250-2700	2850-3600	3900-4800
SWL (kN)	29	39	39	51	51
Weight (kg/m)	7.5	9.4	12.4	15.7	18.8
Nominal height 'h' (mm)	143	143	219	219	295

Extra Heavy Duty

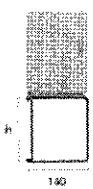
BXD100		
Standard lengths (mm)	750-1500	1650-2700
SWL (kN)	47	59
Weight (kg/m)	9.4	15.7
Nominal height 'h' (mm)	143	219

51 > 36.40 ∴ ok.

140mm Interior Solid Walls

Standard Duty

Standard lengths are available in increments of 150mm at lengths up to 3000mm, 300mm at lengths from 3000mm – 4800mm (including 4575mm, but excluding 4500mm).



BSD140					
Standard lengths (mm)	1050-2100	2250-2700	2850-3600	3900-4575	4800
SWL (kN)	19	20	29	29	27
Weight (kg/m)	6.9	8.7	13.1	16.2	16.2
Nominal height 'h' (mm)	143	143	219	219	219

Heavy Duty

BHD140					
Standard lengths (mm)	1050-1500	1650-2100	2250-2700	2850-3600	3900-4800
SWL (kN)	29	39	39	51	51
Weight (kg/m)	8.7	10.9	13.1	16.2	20.5
Nominal height 'h' (mm)	143	143	219	219	295

Extra Heavy Duty

BXD140		
Standard lengths (mm)	1050-1500	1650-2700
SWL (kN)	47	59
Weight (kg/m)	10.9	16.2
Nominal height 'h' (mm)	143	219

3.632
14.01

3.632
14.02

Richard Agar Assc. Ltd Consulting Engineers
ANALYSIS & DESIGN OF SINGLE SPAN STEEL BEAMS TO EN 1993-1-1: 2005

Job Reference:- 76 Main Road Job No. : 3.632
Beam Reference:- Lintel B.02 & B.03
Following dimensions for design calculation purposes only.
Contractor should check all dimensions on site before ordering materials.

SPAN DATA
Span Ls = 2.8 metres
Effective length Le = 2.8 metres

LOADING DATA (characteristic loads)

Load Type	Variable	Permanent	Start Dist.	Cover Dist.
Patch load (kN/m)	5.25	7.75	0.00	2.79

Load factors: Variable actions = 1.50 ; Permanent actions = 1.35

TRIAL SECTION SIZE: 178*102*19kg UB
Material grade is S 275 and section classification is: PLASTIC (EN 1993-1-1 table 5.2 & cl. 5.5.2 (6)

SHEAR CAPACITY cl.6.2.6(2)
Ultimate shear capacity of beam Vpl.Rd = 154.31 kN
Applied max shear on beam V.Ed = 25.67 kN
SHEAR CHECK OK

MOMENT CAPACITY cl.6.2.5 & 6.2.8
(includes reduction for high shear if applicable)
Limiting Shear value 0.5*Vpl.Rd = 77.16 kN
Applied shear at max moment Fvbm = 0.51 kN
Moment capacity Mv.Rd = 47.03 kN.m
Applied moment M.Ed = 17.97 kN.m
MOMENT CHECK OK

LATERAL TORSIONAL BUCKLING (LTB) cl.6.3.2.3
Buckling Moment of resistance Mb.Rd = 35.40 kN.m
Applied moment M.Ed = 17.97 kN.m
LTB CHECK OK

WEB BEARING CHECKS
1. Web Crushing
Stiff bearing length ss = 50.00 mm
Web crushing capacity Ry.Rd = 86.49 kN
2. Web Crippling
Web crippling capacity Ra.Rd = 159.84 kN
Max applied end reaction Rmax = 25.67 kN
WEB BEARING CHECKS OK

DEFLECTION CHECK (at mid-span)
NA.2.23 :-floors, roofs -brittle finishes
Deflection due to Variable actions d.i = 1.47 mm
Allowable deflection due to Variable actions d.2 = 7.78 mm
DEFLECTION CHECK OK

Richard Agar Associates Ltd
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Ivy House Farm, 8 Main Road, Aislaby, Whitby, YO21 1SW
Tel
Email:
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Our ref 3.632/4145

23rd October 2019

Mr Brian Senior
76 Main Road
Aislaby
WHITBY
North Yorkshire

INVOICE No 4145

76 MAIN ROAD, AISLABY
MASONRY CHECKS

Professional Services To 23rd October 2019 Visit site and discuss proposals with client. Prepare structural calculations for masonry checks to rear elevation of new extension. Include 2 no. sets of internal lintels. Provide copy of above to Mr B Senior by email.	325.00
Site Visits 11-10-19 as noted above	included above
Disbursements Photocopying, telephone etc	included above
VAT Not VAT registered	nil
AMOUNT DUE TOTAL	**£ 325.00**

Total amount due £ 325.00 **PAYMENT REQUIRED WITHIN 14 DAYS.**
Please make remittance payable to " **Richard Agar Associates Ltd** "

Prompt payment discount: ***You may deduct £ 16.00 from the above total (ie pay £ 309.00) if we receive your payment by 29th October 2019.***

Interest will be charged at 2.5% per month cumulative from date of invoice on all overdue amounts.
If a receipt is required please return this invoice with payment