NOTE.
Confirm direction of floor joists.

TITLE:
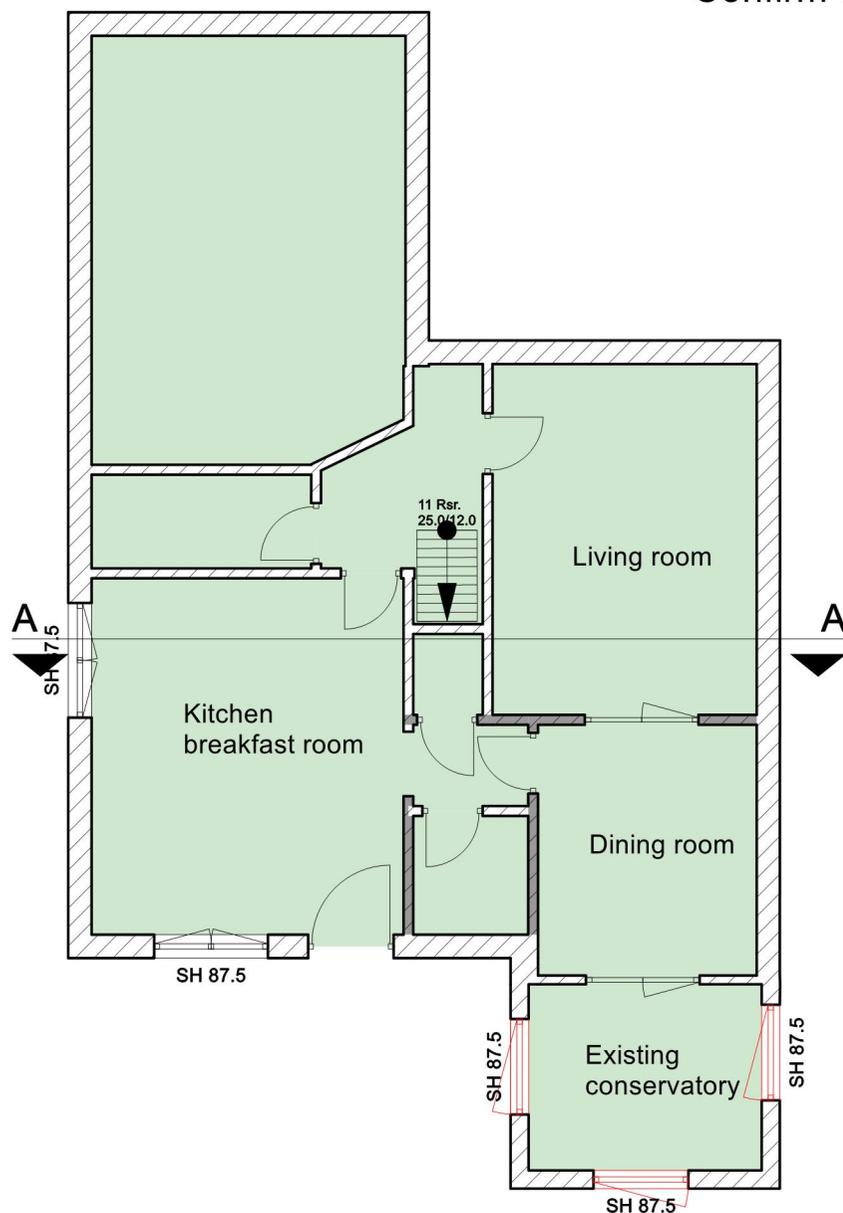
CLIENT:

SCALE: 1: 100@A4

DATE:

DRG No 001-01-1

ISSUE   A

Living room

11 Rsr.
25.0/12.0

Kitchen
breakfast room

A
SH 7.5

A

Dining room

SH 87.5

Existing
conservatory

SH 87.5

SH 87.5

SH 87.5

Existing ground floor

Solid wall 130mm thk (Confirm)

WE HAVE ASSUMED EXTERNAL WALLS   315mm THK
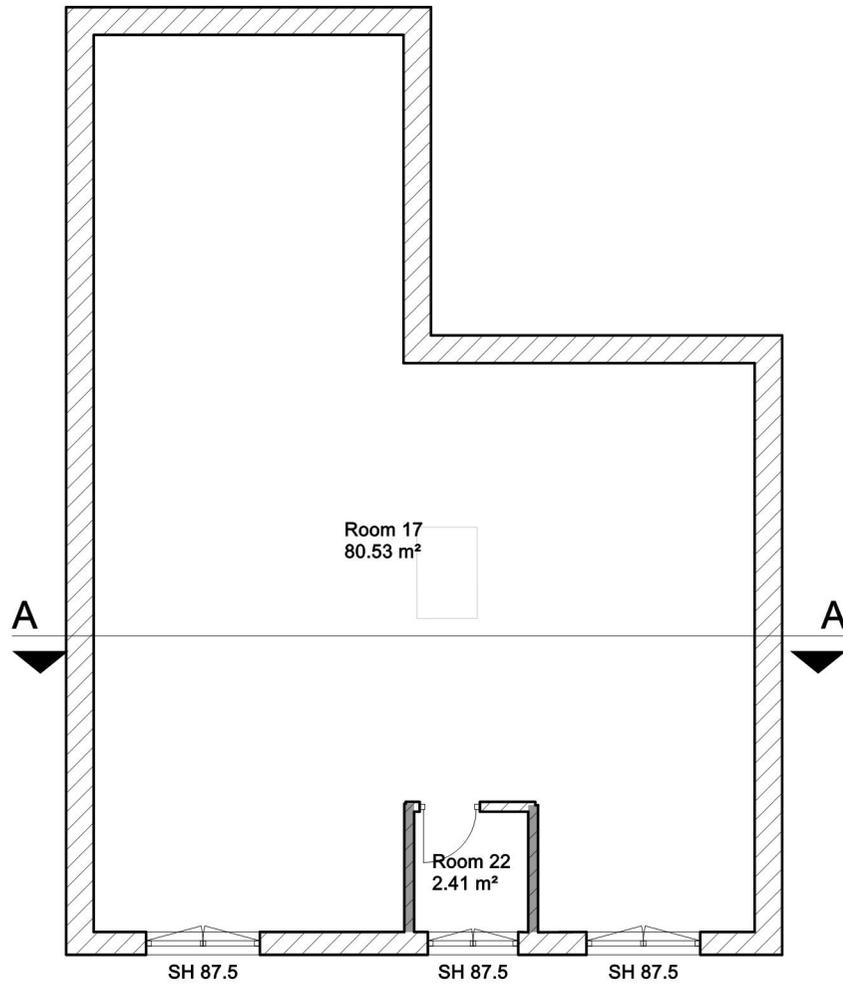INTERNAL WALLS   130mm THK

0   1m   2m   3m   4m

SCALE BAR IN MTRS

Room 17
80.53 m²

A — A

Room 22
2.41 m²

SH 87.5   SH 87.5   SH 87.5

Existing first floor

A ———————————————— A

Existing roof details

Existing side elevation

Existing front elevation.

Existing side elevation
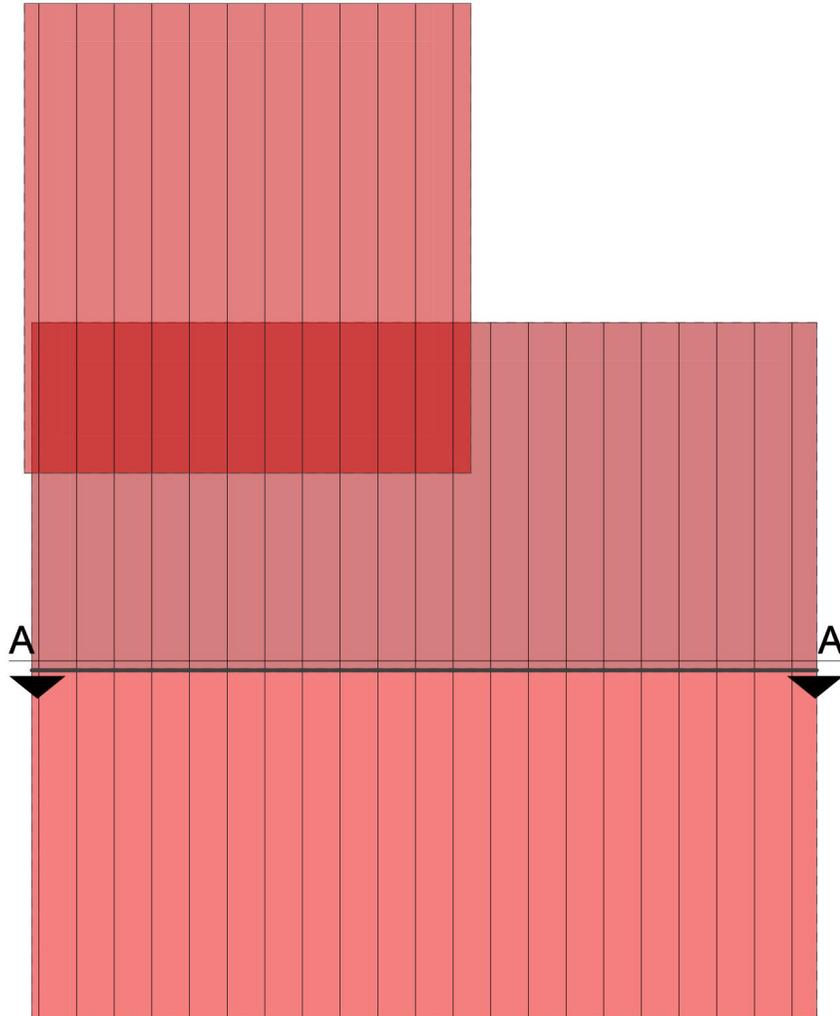
Existing rear elevation
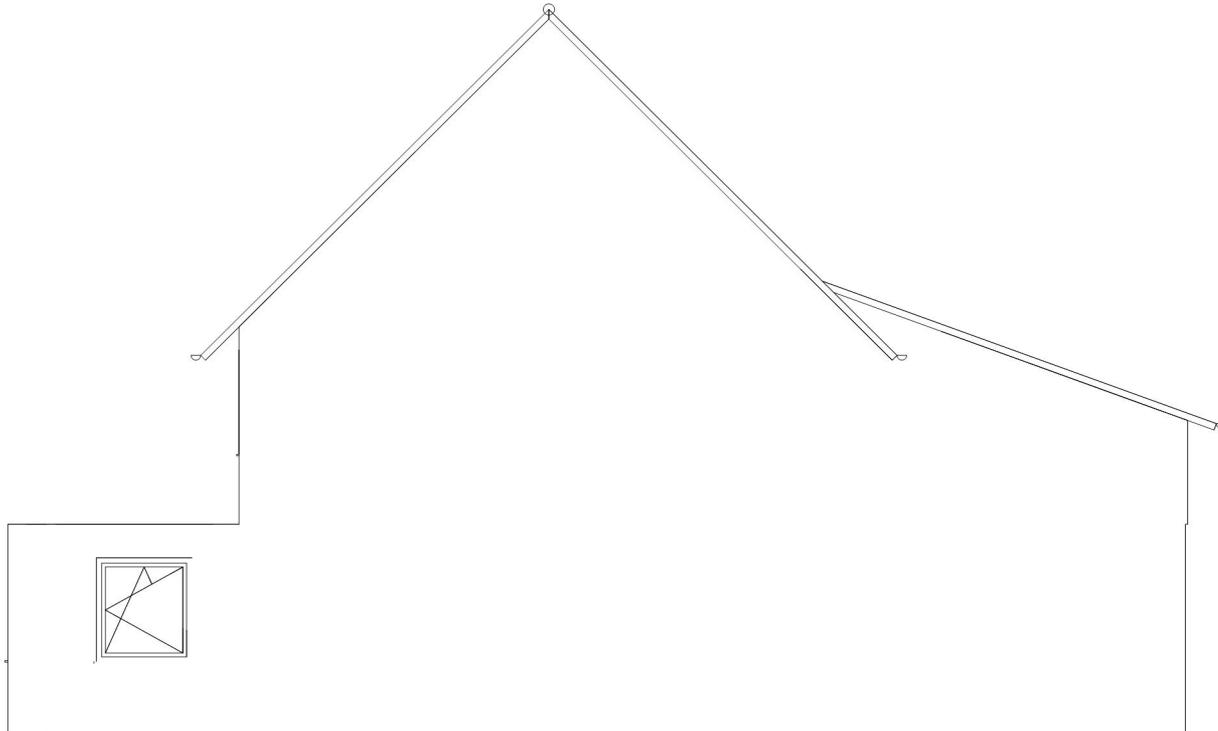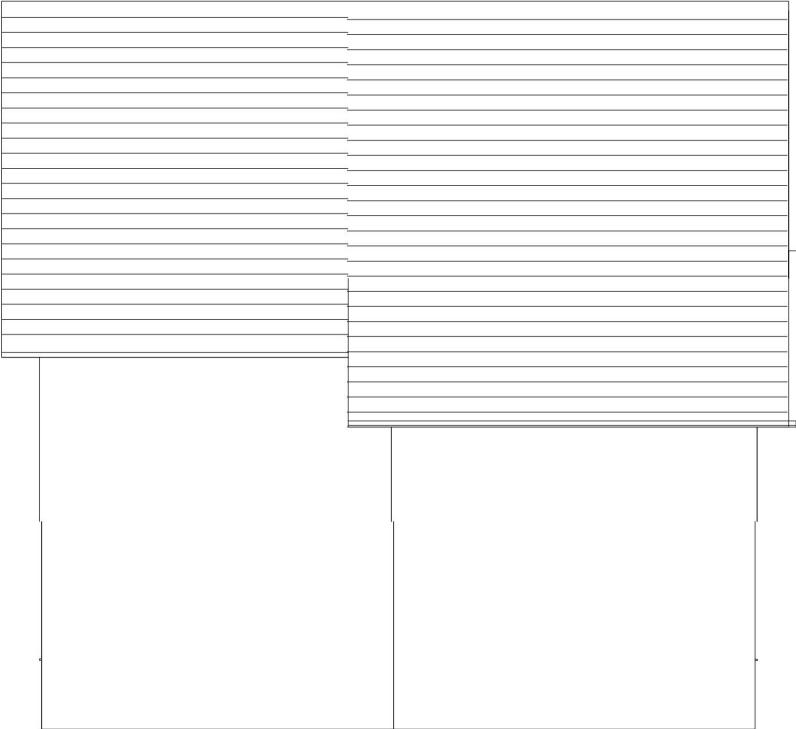
TITLE:

CLIENT:

SCALE: 1: 100@A4

DATE:

DRG No   001-01-8

ISSUE   A
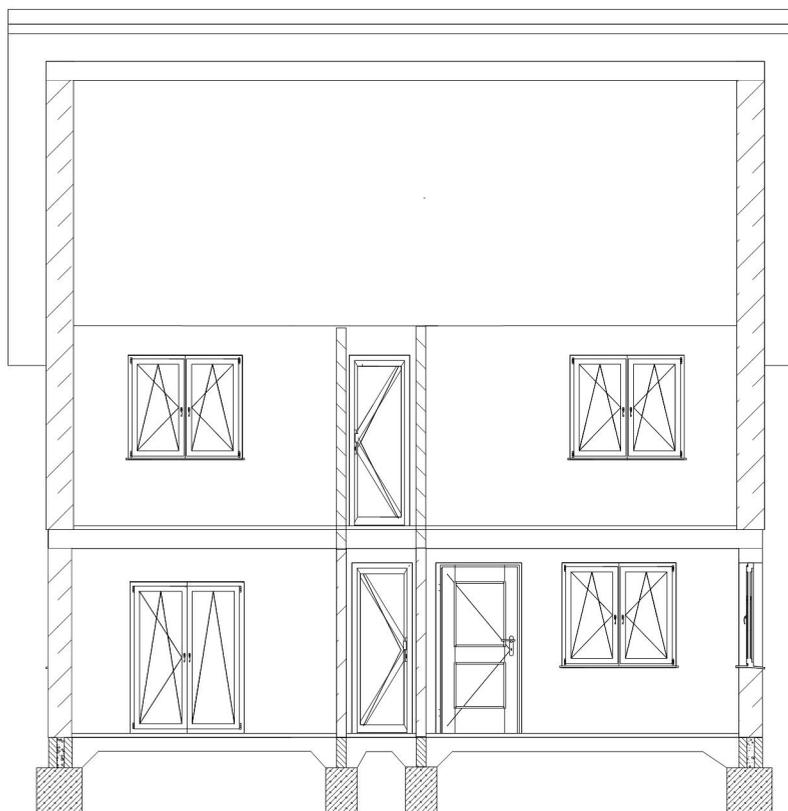
Existing section AA

Interdiy

TITLE:

CLIENT:

SCALE: 1: 100@A4

DATE:

DRG No   002-01-1

ISSUE   A

New door in
place of window

Kitchen
breakfast room

11 Rsr.
25.0/12.0

Living room

Confirm wall
thickness

A ◤   A ◤

Dining room

New 3m window

50   50

New extension

2.700

3.78
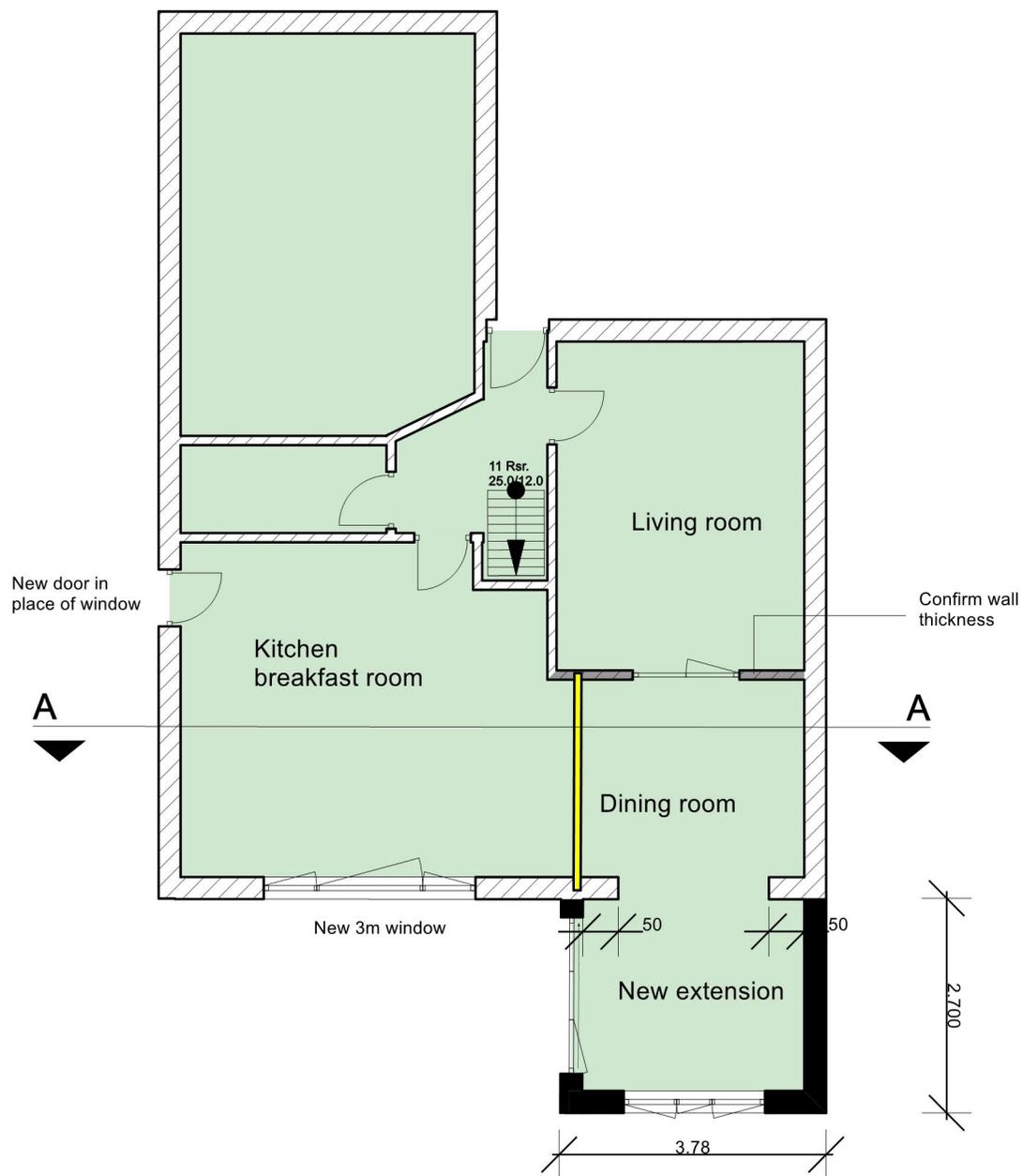
Proposed ground floor

▭ Solid wall

▬ Existing steel beam

WE HAVE ASSUMED EXTERNAL WALLS 315mm THK
INTERNAL WALLS   130mm THK

0   1m   2m   3m   4m

SCALE BAR IN MTRS

Room 17
83.56 m²

A ————————————————— A

SH 87.5   SH 87.5   SH 87.5

Proposed first floor

Existing roof details

Proposed side elevation

Proposed front elevation.

2.600

0.000

2.20

Proposed side elevation

10 Degs

2.60

0.875

0.875 To the sill

0.00

3.000

2.000

Existing rear elevation

PITCHED MONO/PENT ROOF

FULL FILL CAVITY WALL
U-value 0.18 W/m2K

103 Facing brick

Stainless steel retaining wall ties built
in at 750 mm ctrs horizontally, 450 mm
vertically and 225mm ctrs at reveals and
corners in staggered rows.

Horizontal strip polymer (Hyload) damp
proof course to both leafs, minimum 150mm
above external ground level.

100mm PIR insulation eg. Celotex CW400
full fill cavity.

Cavity wall skin 100mm lightweight block
Aircrete 0,15 W/mK

Internal finish to be 12.5mm plasterboard
on daps

315mm

SOLID GROUND FLOOR SLAB
U Value 0.18W/m2K

Tongue and groove board or chipboard.

A. VCA should be laid over and under the insulation.

Min 100mm PIR insulation eg. Celotex GA4000

150mm thick concrete slab

1200g damp proof membrane

150mm sand blinded hardcore

TRENCH FOUNDATIONS

50mm residual cavity

DPC 150mm above ground level

50mm Celotex insulation

Masonry wall as detailed by architect

Lean mix ready fill 225mm below DPC

750mm * 600mm concrete trench
foundation. Concrete mix to conform
to BS EN 206-1 and BS 8500-2

Depth to be 1000mm deep depending on
ground conditions take agreed with BCO.

100mm thick concrete slab

1200g damp proof membrane

150mm sand blinded hardcore

Section AA

NOTES:

On site examination. SB2 maynot be required.
This can be confirmed between builder
and SE.

Span   5.600

Bearing space   100mm

overall length   5.700

305*165*46 UB

Span   2.400

Bearing space   0.250

overall length   2.650

152*152*37UC

315mm

Stitch weld 10mm plate
50 hit * 152miss

7.49

Living room

11 Rsr.
25.0/12.0

SB2   Refer to notes.   SB2

**Kitchen
breakfast room**

5.49⁵

Dining room

SB1

0.500   0.500

New extension
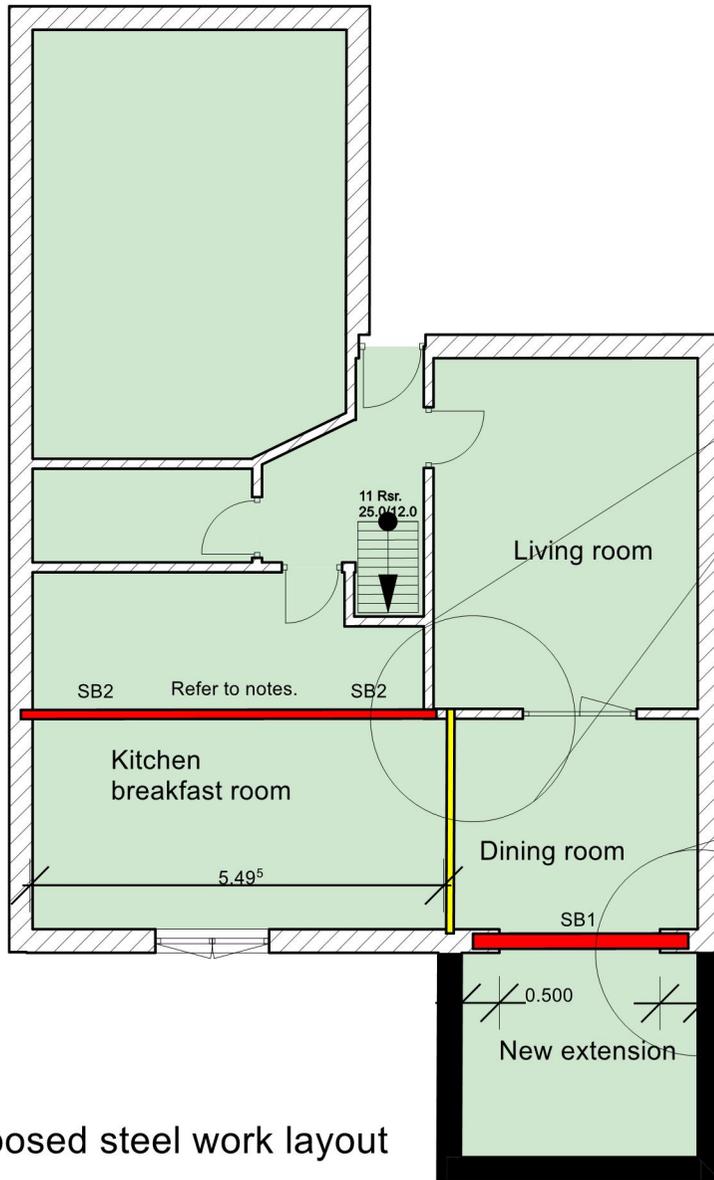
Proposed steel work layout

2.150

3.150

3.78
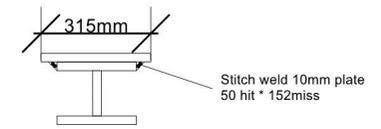
Existing steel beam

New steel beam

WE HAVE ASSUMED EXTERNAL WALLS   315mm THK
INTERNAL WALLS   130mm THK

0   1m   2m   3m   4m

SCALE BAR IN MTRS

Steel Beam Design

To Eurocode BS EN 1993-1-1/NA:2008

Design summary

	Resistance / Limit	Applied / Actual	Utilisation	
Shear	**226** kN	**108** kN	**48 %**	**OK**
Bending moment	**85** kNm	**64.8** kNm	**76 %**	**OK**
Buckling	**79.6** kNm	**64.8** kNm	**81 %**	**OK**
Total deflection	**12** mm	**6** mm	**50 %**	**OK**
Deflection due to variable actions	**6.7** mm	**2.2** mm	**33 %**	**OK**

Section details

Type	**Universal column**
Section	**152 x 152 x 37 UC**
Steel grade	**S275**

Width	$b =$ **154** mm
Depth	$h =$ **162** mm
Web thickness	$t_w =$ **8** mm
Flange thickness	$t_f =$ **11.5** mm
Root radius	$r =$ **7.6** mm
Mass per metre	$w =$ **37** kg/m

11.5mm

161.8mm

8mm

154.4mm
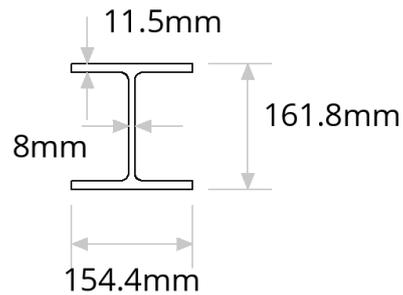
Span and restraints

Effective span	$L =$ **2,400** mm
Buckling length	$L_{cr} =$ **2,400** mm

Deflection limits

Variable action deflection limit	$\Delta_Q = L / 360 =$ **6.67** mm
Total deflection limit	$\Delta_{G+Q} = L / 200 =$ **12** mm

Safety factors

Partial factor for permanent actions	$\gamma_G =$ **1.35**
Partial factor for variable actions	$\gamma_Q =$ **1.5**

Loading details

Self weight

Permanent action

$SW = w \times 9.81 / 1000 = \mathbf{0.363}$ kN/m

Load 1: UDL - Sloping roof, 30° to 45°

Permanent action

$G_1 = \mathbf{1.41}$ kN/m² × **7.5** m = **10.6** kN/m

Variable action

$Q_1 = \mathbf{0.75}$ kN/m² × **7.5** m = **5.62** kN/m

Load 2: UDL - Ceiling beneath sloping roof

Permanent action

$G_2 = \mathbf{0.3}$ kN/m² × **7.5** m = **2.25** kN/m

Variable action

$Q_2 = \mathbf{0.25}$ kN/m² × **7.5** m = **1.88** kN/m

Load 3: UDL - Lightweight timber stud partitions, on floor plan

Permanent action

$G_3 = \mathbf{0}$ kN/m² × **7.5** m = **0** kN/m

Variable action

$Q_3 = \mathbf{0.25}$ kN/m² × **7.5** m = **1.88** kN/m

Load 4: UDL - Timber floor (domestic dwelling)

Permanent action

$G_4 = \mathbf{0.6}$ kN/m² × **7.5** m = **4.5** kN/m

Variable action

$Q_4 = \mathbf{1.5}$ kN/m² × **7.5** m = **11.2** kN/m

Load 5: UDL - 225mm Brickwork + Plaster or render on ONE side

Permanent action

$G_5 = \mathbf{4.7}$ kN/m² × **4** m = **18.8** kN/m

Variable action

$Q_5 = \mathbf{0}$ kN/m² × **4** m = **0** kN/m

Load 6: UDL - Flat roof, with no permanent access

Permanent action

$G_6 = \mathbf{1}$ kN/m² × **3** m = **3** kN/m

Variable action

$Q_6 = \mathbf{0.75}$ kN/m² × **3** m = **2.25** kN/m

Load 7: UDL - Ceiling beneath sloping roof

Permanent action

$G_7 = \mathbf{0.3}$ kN/m² × **3** m = **0.9** kN/m

Variable action

$Q_7 = \mathbf{0.25}$ kN/m² × **3** m = **0.75** kN/m

Reactions

	Permanent (unfactored)	Variable (unfactored)	Total (unfactored)	Total (factored)
Left reaction	**48.5** kN	**28.3** kN	**76.8** kN	**108** kN
Right reaction	**48.5** kN	**28.3** kN	**76.8** kN	**108** kN

Design shear force
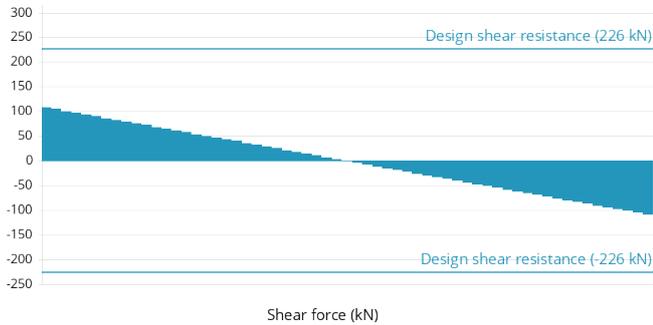
Shear force (kN)

Design shear force	V_{Ed} = **108** kN	
Design shear resistance	$V_{c,Rd}$ = **226** kN	
Utilisation	V_{Ed} / $V_{c,Rd}$ = **48** %	**OK**

Design bending moment

Bending moments (kNm)
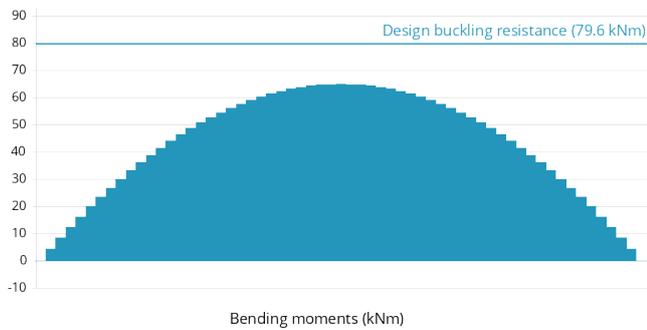
Design bending moment, major axis	M_{Ed} = **64.8** kNm	
Design resistance for bending	$M_{c,Rd}$ = **85** kNm	
Bending utilisation	M_{Ed} / $M_{c,Rd}$ = **76** %	**OK**
Design resistance for buckling	$M_{b,Rd}$ = **79.6** kNm	
Buckling utilisation	M_{Ed} / $M_{b,Rd}$ = **81** %	**OK**

Deflection

Live load deflection (green) and total load deflection (blue) in mm
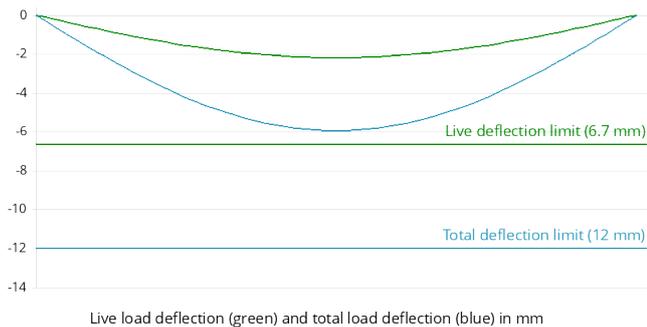
Variable action deflection limit	Δ_Q = **6.7** mm	
Variable action deflection	δ_Q = **2.2** mm	**OK**
Total deflection limit	Δ_{G+Q} = **12** mm	
Total deflection	δ_{G+Q} = **6** mm	**OK**

Section properties

Elastic modulus - major axis, yy	W_{el} = **273** cm^3
Plastic modulus - major axis, yy	W_{pl} = **309** cm^3
Second moment of area - major axis, yy	I_y = **2,210** cm^4
Second moment of area - minor axis, zz	I_z = **706** cm^4
Warping constant	I_w = **0.04** dm^6
Torsional constant	I_T = **19.2** cm^4
Area of section	A = **4,710** mm^2

Factors and design values of material coefficients (EN 1993-1-1:2005 and National Annex)

Young's modulus of elasticity	$E = $ **210,000** N/mm^2	cl.3.2.6
Poisson's ratio in elastic stage	$v = $ **0.3**	cl.3.2.6
Shear modulus	$G_s = $ **81,000** N/mm^2	cl.3.2.6
Partial factor for resistance of cross-sections	$\gamma_{M0} = $ **1**	cl.6.1(1)B / BS-EN NA
Partial factor for resistance to instability	$\gamma_{M1} = $ **1**	cl.6.1(1)B / BS-EN NA
Factor for shear area	$\eta = $ **1**	EN 1993-1-5:2006 cl.5.1(2) / BS-EN NA
Limiting non dimensional slenderness ratio	$\overline{\lambda}_{LT,0} = $ **0.4**	cl.6.3.2.3(1) / BS-EN NA
Beta factor for buckling reduction factor calculation	$\beta = $ **0.75**	cl.6.3.2.3(1) / BS-EN NA

Yield strength

Nominal yield strength for S275 grade and nominal section thickness 11.50 mm	$f_y = $ **275** N/mm^2	Tata blue book

Section classification (EN 1993-1-1:2005 cl.5.5)

Epsilon	$\varepsilon = $ **0.924**	EN 1993-1-1:2005 Table 5.2
Flange ratio for local buckling	$c_f / t_f = $ **5.7**	
Flange ratio limit for class 1	$9\,\varepsilon = $ **8.32**	Table 5.2 (sheet 2 of 3)
Flange class	$Class_f = $ **1**	
Web ratio for local buckling	$c_w / t_w = $ **15.5**	
Web ratio limit for class 1	$72\,\varepsilon = $ **66.6**	Table 5.2 (sheet 1 of 3)
Web class	$Class_w = $ **1**	
Section class	$Class = $ **1**	

Shear resistance (EN 1993-1-1:2005 cl.6.2.6)

Height of web	$h_w = $ **139** mm	
Shear area for I and H sections	$A_v = $ **1,430** mm^2	cl.6.2.6 (3)
Design shear resistance	$V_{pl,Rd} = $ **226** kN	eq (6.18)

Shear buckling (EN 1993-1-5:2006 cl.5)

The shear buckling resistance for webs should be verified according to Section 5 of EN 1993-1-5 if $(h_w / t_w) > (72\,\varepsilon / \eta)$

Web ratio for shear buckling	$h_w / t_w = $ **17.4**	EN 1993-1-5:2006 cl.5.1 (2)
Shear buckling limit	$72\,\varepsilon / \eta = $ **66.6**	EN 1993-1-5:2006 cl.5.1 (2)

$(h_w / t_w) <= (72\,\varepsilon / \eta)$ therefore shear buckling calculation not required

Bending resistance (EN 1993-1-1:2005 cl.6.2.5)

The shear force (108 kN) is less than half of the plastic shear resistance (226 kN / 2 = 113 kN), therefore its effect on moment resistance may be neglected.

Class 1 section, therefore use plastic modulus	$W_{pl} = $ **309,000** mm^3	
Design bending resistance	$M_{c,Rd} = $ **85** kNm	eq (6.13)

Design buckling resistance (EN 1993-1-1:2005 cl.6.3.2)

C1 factor	$C1 = $ **1**	
Shear modulus of elasticity	$G_s = $ **81,000** N/mm^2	cl.3.2.6 (1)
Buckling length	$L_{cr} = $ **2,400** mm	
Critical buckling moment	$M_{CR} = $ **276** kNm	NCCI SN003b-EN-EU

Class 1 section, therefore use plastic modulus	W_{pl} = **309,000** mm^3	cl.6.3.2.1(3)
Non-dimensional slenderness ratio	$\overline{\lambda}_{LT}$ = **0.555**	cl.6.3.2.2 (1)
Depth to width ratio for buckling curve	h / b = **1.05**	
Buckling curve for h / b ratio	Buckling curve = **b**	Table 6.5 / BS-EN NA
Imperfection factor for buckling curve b	α_{LT} = **0.34**	Table 6.3 / BS-EN NA
Intermediate factor for reduction factor calculation	ϕ_{LT} = **0.642**	cl.6.3.2.3 (1)
Buckling reduction factor	χ_{LT} = **0.937**	eq (6.57)
Correction factor for moment distribution	k_c = **1**	Table 6.6
Moment distribution modification factor	f = **1**	cl.6.3.2.3 (2)
Modified buckling reduction factor	$\chi_{LT,mod}$ = **0.937**	eq (6.58)
Design buckling resistance	$M_{b,Rd}$ = **79.6** kNm	eq (6.55)

Notes

C1 value conservatively taken as 1.0

Ends of beam are to be laterally restrained. Ends of beams can be laterally restrained using one of the following methods;

1) End of beam built into masonry wall.
2) End of beam fixed to a masonry wall.
3) End of beam fixed to a column or a beam.

The designer is to ensure that the proposed detail adequately ensures that the end of the beam is laterally restrained.

No allowance has been made for destabilising loads which are outside the scope of these calculations (Destabilising loads would not normally occur in a traditional masonry structure)

Steel Beam Design

To Eurocode BS EN 1993-1-1/NA:2008

Design summary

	Resistance / Limit	Applied / Actual	Utilisation	
Shear	**357** kN	**66** kN	**18 %**	**OK**
Bending moment	**198** kNm	**92.4** kNm	**47 %**	**OK**
Buckling	**114** kNm	**92.4** kNm	**81 %**	**OK**
Total deflection	**28** mm	**10** mm	**36 %**	**OK**
Deflection due to variable actions	**15.6** mm	**6.9** mm	**45 %**	**OK**

Section details

Type	**Universal beam**
Section	**305 x 165 x 46 UB**
Steel grade	**S275**

11.8mm

306.6mm

6.7mm

165.7mm

Width	b = **166** mm
Depth	h = **307** mm
Web thickness	t_w = **6.7** mm
Flange thickness	t_f = **11.8** mm
Root radius	r = **8.9** mm
Mass per metre	w = **46.1** kg/m
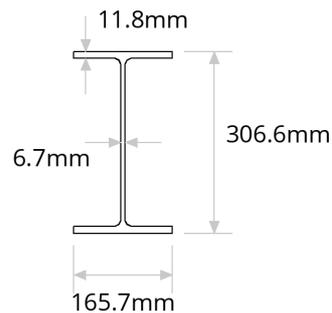
Span and restraints

Effective span	L = **5,600** mm
Buckling length	L_{cr} = **5,600** mm

Deflection limits

Variable action deflection limit	Δ_Q = L / 360 = **15.6** mm
Total deflection limit	Δ_{G+Q} = L / 200 = **28** mm

Safety factors

Partial factor for permanent actions	γ_G = **1.35**
Partial factor for variable actions	γ_Q = **1.5**

Loading details

Self weight

Permanent action

$SW = w \times 9.81 / 1000 = \mathbf{0.452}$ kN/m

Load 1: UDL - Timber floor (domestic dwelling)

Permanent action

$G_1 = \mathbf{0.6}$ kN/m² $\times$ $\mathbf{3.75}$ m = $\mathbf{2.25}$ kN/m

Variable action

$Q_1 = \mathbf{1.5}$ kN/m² $\times$ $\mathbf{3.75}$ m = $\mathbf{5.62}$ kN/m

Load 2: UDL - Timber floor (domestic dwelling)

Permanent action

$G_2 = \mathbf{0.6}$ kN/m² $\times$ $\mathbf{3.75}$ m = $\mathbf{2.25}$ kN/m

Variable action

$Q_2 = \mathbf{1.5}$ kN/m² $\times$ $\mathbf{3.75}$ m = $\mathbf{5.62}$ kN/m

Reactions

	Permanent (unfactored)	Variable (unfactored)	Total (unfactored)	Total (factored)
Left reaction	**13.9** kN	**31.5** kN	**45.4** kN	**66** kN
Right reaction	**13.9** kN	**31.5** kN	**45.4** kN	**66** kN

Design shear force
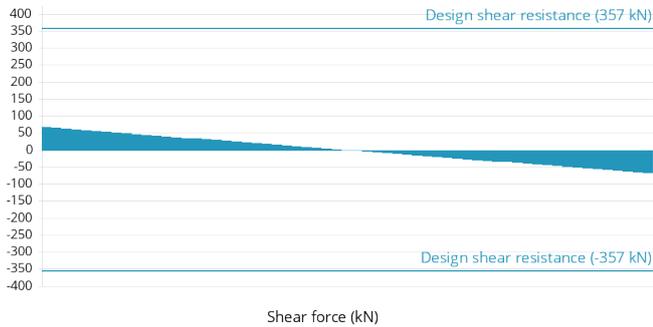
Design shear force	$V_{Ed} = \mathbf{66}$ kN	
Design shear resistance	$V_{c,Rd} = \mathbf{357}$ kN	
Utilisation	$V_{Ed} / V_{c,Rd} = \mathbf{18}$ %	**OK**

Design bending moment
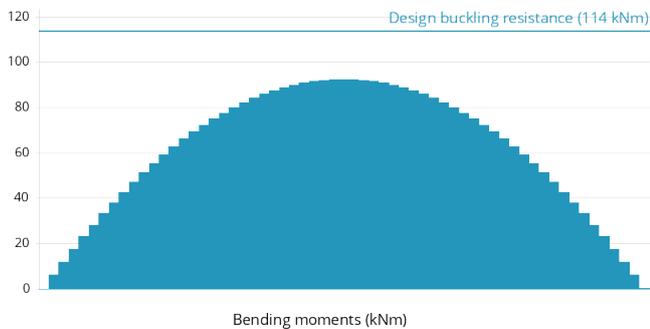
Design bending moment, major axis	$M_{Ed} = \mathbf{92.4}$ kNm	
Design resistance for bending	$M_{c,Rd} = \mathbf{198}$ kNm	
Bending utilisation	$M_{Ed} / M_{c,Rd} = \mathbf{47}$ %	**OK**
Design resistance for buckling	$M_{b,Rd} = \mathbf{114}$ kNm	
Buckling utilisation	$M_{Ed} / M_{b,Rd} = \mathbf{81}$ %	**OK**

Deflection

Live load deflection (green) and total load deflection (blue) in mm
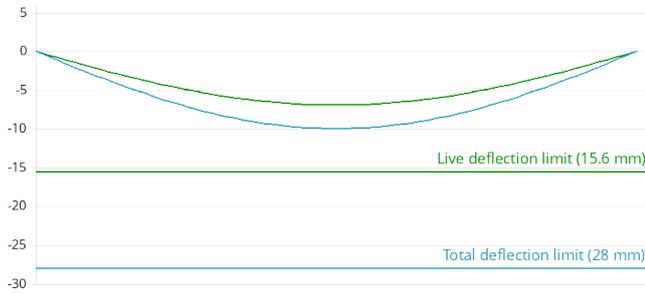
Variable action deflection limit	Δ_Q = **15.6** mm	
Variable action deflection	δ_Q = **6.9** mm	**OK**
Total deflection limit	Δ_{G+Q} = **28** mm	
Total deflection	δ_{G+Q} = **10** mm	**OK**

Section properties

Elastic modulus - major axis, yy	W_{el} = **646** cm^3	
Plastic modulus - major axis, yy	W_{pl} = **720** cm^3	
Second moment of area - major axis, yy	I_y = **9,900** cm^4	
Second moment of area - minor axis, zz	I_z = **896** cm^4	
Warping constant	I_w = **0.195** dm^6	
Torsional constant	I_T = **22.2** cm^4	
Area of section	A = **5,870** mm^2	

Factors and design values of material coefficients (EN 1993-1-1:2005 and National Annex)

Young's modulus of elasticity	E = **210,000** N/mm²	cl.3.2.6
Poisson's ratio in elastic stage	v = **0.3**	cl.3.2.6
Shear modulus	G_s = **81,000** N/mm²	cl.3.2.6
Partial factor for resistance of cross-sections	γ_{M0} = **1**	cl.6.1(1)B / BS-EN NA
Partial factor for resistance to instability	γ_{M1} = **1**	cl.6.1(1)B / BS-EN NA
Factor for shear area	η = **1**	EN 1993-1-5:2006 cl.5.1(2) / BS-EN NA
Limiting non dimensional slenderness ratio	$\overline{\lambda}_{LT,0}$ = **0.4**	cl.6.3.2.3(1) / BS-EN NA
Beta factor for buckling reduction factor calculation	β = **0.75**	cl.6.3.2.3(1) / BS-EN NA

Yield strength

Nominal yield strength for S275 grade and nominal section thickness 11.80 mm	f_y = **275** N/mm²	Tata blue book

Section classification (EN 1993-1-1:2005 cl.5.5)

Epsilon	ε = **0.924**	EN 1993-1-1:2005 Table 5.2
Flange ratio for local buckling	c_f / t_f = **5.98**	
Flange ratio limit for class 1	$9\,\varepsilon$ = **8.32**	Table 5.2 (sheet 2 of 3)
Flange class	Class$_f$ = **1**	
Web ratio for local buckling	c_w / t_w = **39.6**	
Web ratio limit for class 1	$72\,\varepsilon$ = **66.6**	Table 5.2 (sheet 1 of 3)
Web class	Class$_w$ = **1**	
Section class	Class = **1**	

Shear resistance (EN 1993-1-1:2005 cl.6.2.6)

Height of web	$h_w = \mathbf{283}$ mm	
Shear area for I and H sections	$A_v = \mathbf{2{,}250}$ mm^2	cl.6.2.6 (3)
Design shear resistance	$V_{pl,Rd} = \mathbf{357}$ kN	eq (6.18)

Shear buckling (EN 1993-1-5:2006 cl.5)

The shear buckling resistance for webs should be verified according to Section 5 of EN 1993-1-5 if $(h_w / t_w) > (72\ \varepsilon / \eta)$

Web ratio for shear buckling	$h_w / t_w = \mathbf{42.2}$	EN 1993-1-5:2006 cl.5.1 (2)
Shear buckling limit	$72\ \varepsilon / \eta = \mathbf{66.6}$	EN 1993-1-5:2006 cl.5.1 (2)

$(h_w / t_w) <= (72\ \varepsilon / \eta)$ therefore shear buckling calculation not required

Bending resistance (EN 1993-1-1:2005 cl.6.2.5)

The shear force (66 kN) is less than half of the plastic shear resistance (357 kN / 2 = 179 kN), therefore its effect on moment resistance may be neglected.

Class 1 section, therefore use plastic modulus	$W_{pl} = \mathbf{720{,}000}$ mm^3	
Design bending resistance	$M_{c,Rd} = \mathbf{198}$ kNm	eq (6.13)

Design buckling resistance (EN 1993-1-1:2005 cl.6.3.2)

C1 factor	$C1 = \mathbf{1}$	
Shear modulus of elasticity	$G_s = \mathbf{81{,}000}$ N/mm^2	cl.3.2.6 (1)
Buckling length	$L_{cr} = \mathbf{5{,}600}$ mm	
Critical buckling moment	$M_{CR} = \mathbf{135}$ kNm	NCCI SN003b-EN-EU
Class 1 section, therefore use plastic modulus	$W_{pl} = \mathbf{720{,}000}$ mm^3	cl.6.3.2.1(3)
Non-dimensional slenderness ratio	$\bar{\lambda}_{LT} = \mathbf{1.21}$	cl.6.3.2.2 (1)
Depth to width ratio for buckling curve	$h / b = \mathbf{1.85}$	
Buckling curve for h / b ratio	Buckling curve = $\mathbf{b}$	Table 6.5 / BS-EN NA
Imperfection factor for buckling curve b	$\alpha_{LT} = \mathbf{0.34}$	Table 6.3 / BS-EN NA
Intermediate factor for reduction factor calculation	$\phi_{LT} = \mathbf{1.19}$	cl.6.3.2.3 (1)
Buckling reduction factor	$\chi_{LT} = \mathbf{0.573}$	eq (6.57)
Correction factor for moment distribution	$k_c = \mathbf{1}$	Table 6.6
Moment distribution modification factor	$f = \mathbf{1}$	cl.6.3.2.3 (2)
Modified buckling reduction factor	$\chi_{LT,mod} = \mathbf{0.573}$	eq (6.58)
Design buckling resistance	$M_{b,Rd} = \mathbf{114}$ kNm	eq (6.55)

Notes

C1 value conservatively taken as 1.0

Ends of beam are to be laterally restrained. Ends of beams can be laterally restrained using one of the following methods;

1) End of beam built into masonry wall.
2) End of beam fixed to a masonry wall.
3) End of beam fixed to a column or a beam.

The designer is to ensure that the proposed detail adequately ensures that the end of the beam is laterally restrained.

No allowance has been made for destabilising loads which are outside the scope of these calculations (Destabilising loads would not normally occur in a traditional masonry structure)