



Project Preface

<i>Project name:</i>	Calculations for the retaining walls and timber loadbearing walls with additional beams
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<i>Client name:</i>	Andrea & Mark Jones
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<u><i>Construction site address:</i></u>	
<i>House no, Street:</i>	84 Church Street
<i>City/Town:</i>	Marthyr Tydfil
<i>Postcode:</i>	CF47 9HS

<i>Document prepared by:</i>	Marcin Krawucki BSc (Hons) GMICE ICE Membership: 92007313
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<i>Address:</i>	50 Quarry Row Merthyr Tydfil, CF47 8PS
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<i>Date of preparation:</i>	19/11/2023
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<i>Job reference number:</i>	AUX256
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<i>Revision:</i>	C01
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Project:	Calculations for the retaining walls and timber loadbearing walls with		
Adress:	84 Church Street Marthyr Tydfil		
Job No.	AUX256	Sheet	1
Date:	19/11/2023	Rev.	C1

Design content

1 Introduction

1.1 Instructions

In accordance with instructions received from the client I have carried out a Structural calculations for the steel beams and padstones at the lower ground floor of the house at

**84 Church Street
Marthyr Tydfil
CF47 9HS**

2 Construction works

All the construction works must be done by experienced builder or contractor.

As there is no ground investigation I use the worst case $GBP=75kN/m^2$. The minimum reinforcement cover in the concrete base should be 50mm. The concrete for the Retaining wall is C40. Movement joints must be provided at a maximum of 6m space with a maximum 3m from a corner or change of direction, They must commence at concrete foundation level and continue through the coping courses. The backfill material must be granular type to relieve hydrostatic pressure.

The blocks class is 7.3N.

As there is a opening in the slab at the first floor with only two landings from which there is an access to the first floor rooms therefore the the steel beams were designed to carry the loading from the landings. I have tried to use timber beams but the spans and loadings are too big for timber beams.

The beams are 203x102x23UB and are supported by 100x100x5mm SHS columns. Both beams and columns should be made of min. S275 grade steel. The bease plates and top plates of the columns are 10mm thick with 4no $\varnothing 14$ holes for M12 bolts/anchors. The base plate is 200x200mm and the top plate is 200x100mm.

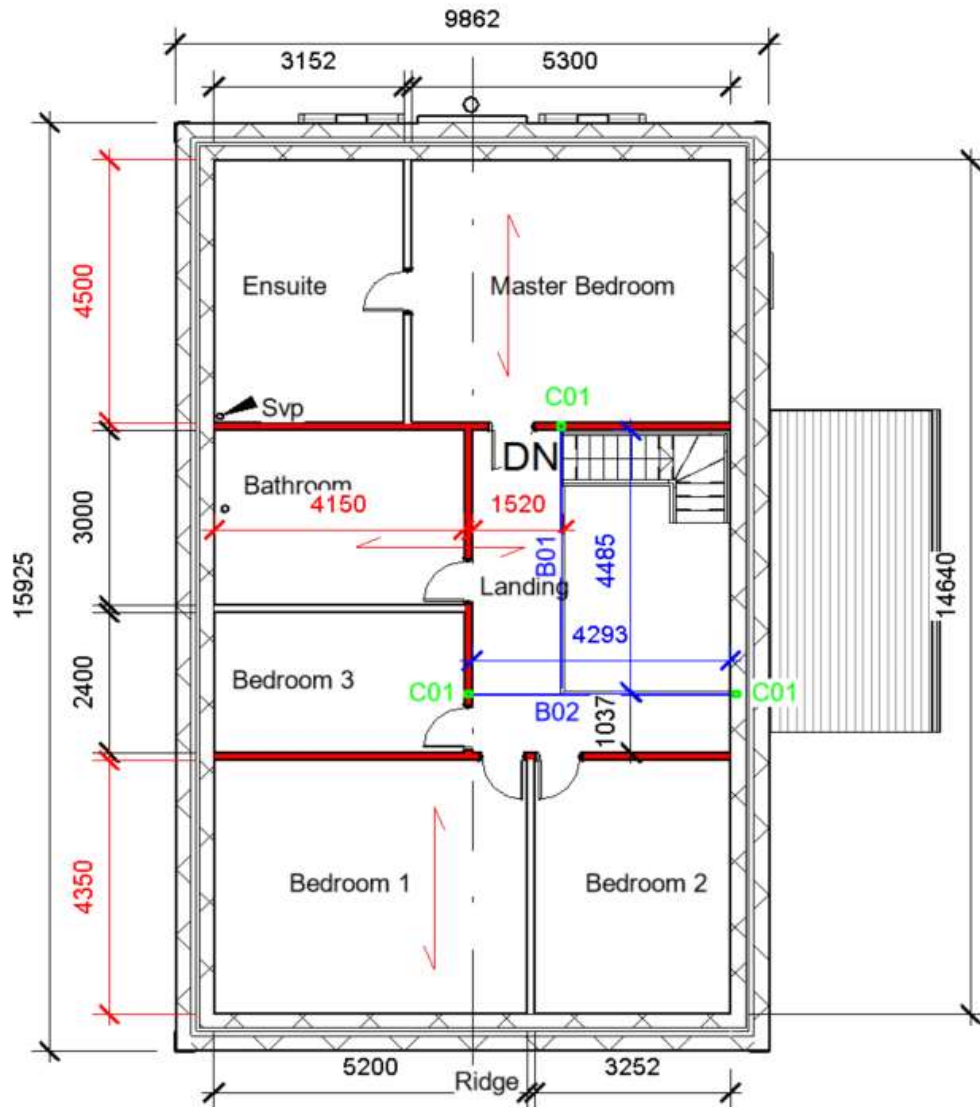
The timber loadbearing walls should be made of 97x47mm C24 timber spaced at 400mm with noggings spaced at 1200mm. The lintels for the door openings up to 1100mm should be made of 2no 195x47mm C24

Marcin Krawucki
BSc (Hons) GMICE
ICE Membership: 92007313



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Floor plan with beams & columns locations



Beam sizes and padstones:

B01 -	1no	203x102x23UB	(S275)	padstones one side	no
B02 -	1no	203x102x23UB	(S275)	padstones one side	no

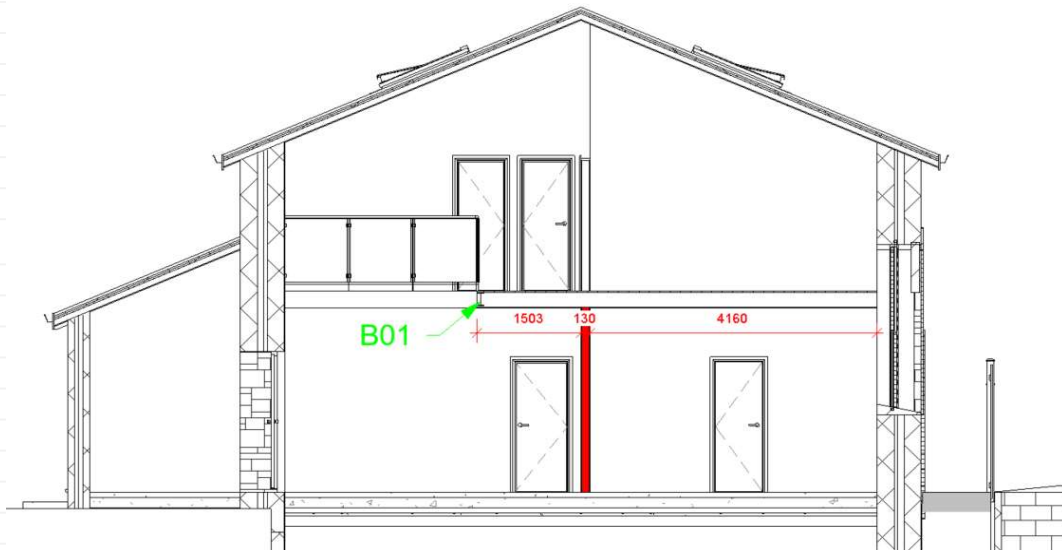
Columns

C01	3no	100x5.0 SHS	(S275)		
base plate:	3no	200x200x10mm	(S275)	with	4no 14mm dia holes for M12 anchors
top plate:	3no	200x100x10mm	(S275)	with	4no 14mm dia holes for M12 bolts

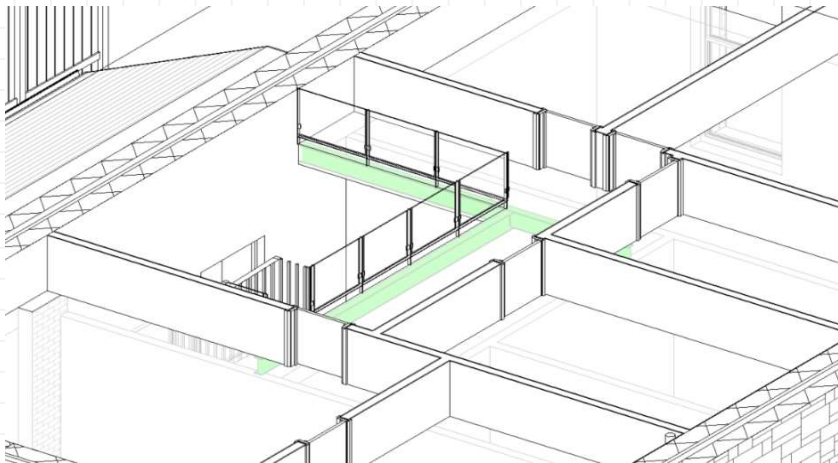


Project:	Calculations for the retaining walls and timber loadbearing walls with additional beams		
Address:	84 Church Street Marthyr Tydfil		
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Loadbearing wall supporting FF joists and trimming beam B01



Section

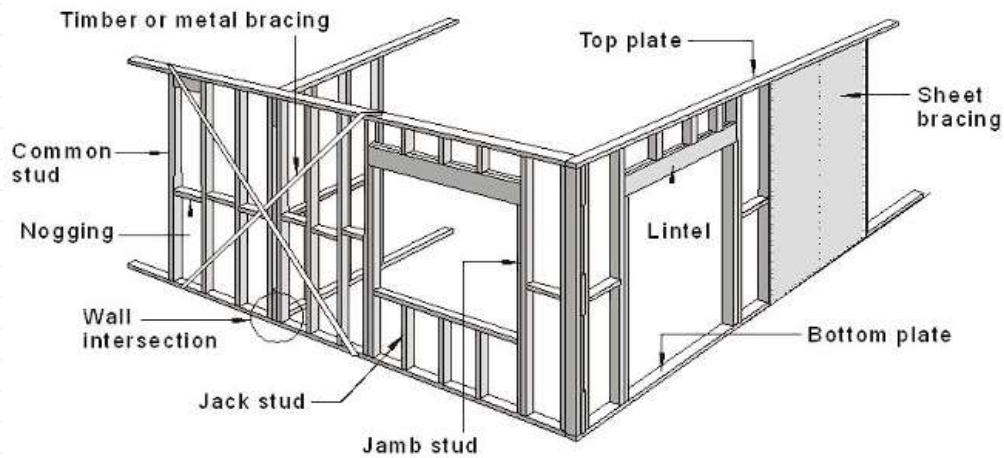


3D View showing beams B01 & B02

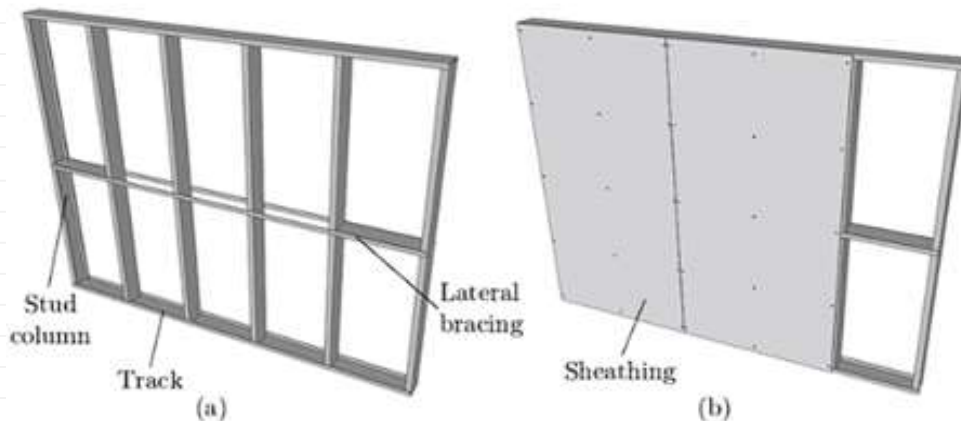


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Address:	84 Church Street Marthyr Tydfil		
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Typical stud wall view with names



The noggins should be installed at max 1200mm spacing.
Bear in mind that in the kitchen and bathroom where are required any hanging cupboards additional noggings might be required.



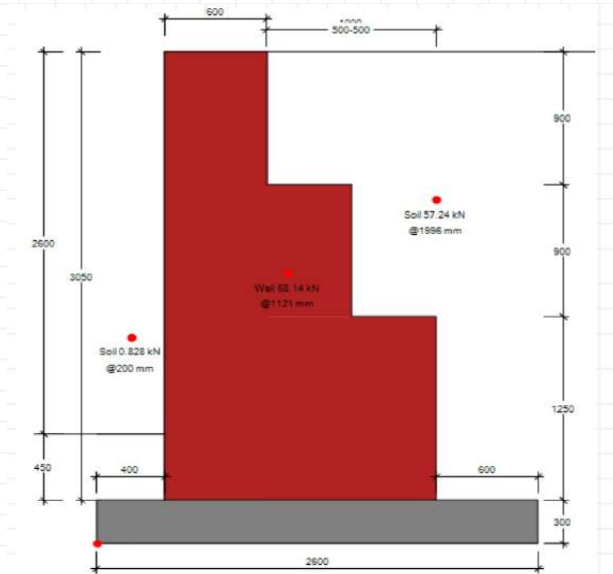
Illustrations of (a) stud wall with lateral bracing (b) stud wall with sheathing



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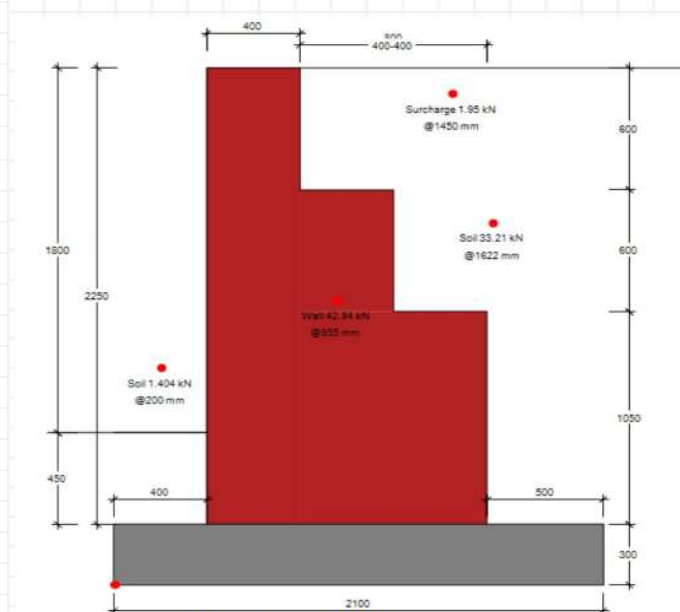
Retaining walls

Internal retaining wall - 2600mm high



Wall - 1 Section

External retaining wall - 1800mm high



Wall - 2 Section

mesh A393 T&B
with 50mm cover
to both retaining walls



Project:	Calculations for the retaining walls and timber loadbearing walls with		
Adress:	84 Church Street Marthyr Tydfil		
Job No.	AUX256	Sheet	4.1
Date:	19/11/2023	Rev.	C1

Calculation for: **Loadings on beam B01**

Loadings on the beam:

Dead load:

PITCH ROOF - NO

				Slope		
Concrete tiles	0.75	kN/m ²	on slope	30	0.866	kN/m ² on plan
Battens+felt	0.05	kN/m ²	on slope	30	0.058	kN/m ² on plan
Insulation					0.10	kN/m ² on plan
Ceiling					0.15	kN/m ² on plan
Rafters self weight					0.10	kN/m ² on plan
Pitch roof total					1.27	kN/m²

Flat roof/Lower roof

0.75 kN/m²

SLAB

				Qty of floors		
timber slab	0.75	kN/m ²	x	1	=	0.75 kN/m ²
partitions	0.50	kN/m ²	x	1	=	0.50 kN/m ²
SLAB Total						1.25 kN/m²

Wall above beam

				Height	Thickness	
none	0	kN/m ³	x	0	x	0 m
						0.00 kN/m *stud part.=0kN/m ³ as it is included above

Imposed load

Residential	1.50	kN/m ²	x	1		1.50 kN/m²
Snow						0.6 kN/m²
Wind (down)	1.10	kN/m ²				1.10 kN/m²
Wind (uplift)	1.60	kN/m ²				1.60 kN/m²

	Joists	Roof	Flat roof
joists length on right side:	1.500 m	0.000 m	0.000 m
joists length on left side:	0.000 m	0.000 m	0.000 m

UDL loading on the beam

Dead G _k						
Pitchroof	0.00	kN/m ²	x	(0.000 m + 0.000 m)/	2 =	0.00 kN/m
Flat roof	0.75	kN/m ²	x	(0.000 m + 0.000 m)/	2 =	0.00 kN/m
Floor slab	1.25	kN/m ²	x	(1.500 m + 0.000 m)/	2 =	0.94 kN/m
Wall					=	0.00 kN/m
Imposed						
Residential	1.50	kN/m ²	x	(1.500 m + 0.000 m)/	2 =	1.13 kN/m
Snow	0.60	kN/m ²	x	(0.000 m + 0.000 m)/	2 =	0.00 kN/m
Wind (down)	1.10	kN/m ²	x	(0.000 m + 0.000 m)/	2 =	0.00 kN/m
Wind (uplift)	1.60	kN/m ²	x	(0.000 m + 0.000 m)/	2 =	0.00 kN/m

G _k =	0.94	kN/m,
Q _k =	1.13	kN/m

When the thickness of the existing wall which is to be removed is greater than 200mm then min. 2 beams required: **1** beams

From the calculations the proposed size of the new beam is:

Beam size: **1no 203x102UB23** Grade: **S275**

Padstones size if req.: **x x mm** fixed to column & beam

Reactions:

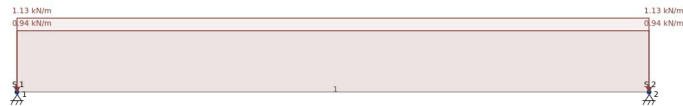
DL= **2.60 kN**

LL= **2.54 kN**



AUX256 Beam B01 SkyCiv Report

Sun 19 Nov 2023, 07:39PM (GMT+00:00)



File Name: AUX256 Beam B01

Software: SkyCiv Structural 3D v6.1.8 (Lic. No.: KDQBmMLFE2zKsN)

Analysis Type: Linear Static & Buckling Analysis

Included in this Report:

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- BILL OF MATERIALS FOR MEMBERS

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 - MEMBER STRESSES

Member Buckling Results

Job Setup

AUX256 Beam B01 SkyCiv Report

SkyCiv Structural 3D v6.1.8
Licence Number: KDQBmMLFE2zKsN
Date: Sun 19 Nov 2023, 07:39PM (GMT+00:00)
Analysis Type: LINEAR STATIC & BUCKLING ANALYSIS

File Name	AUX256 Beam B01
Job Name	AUX256 84 Church Street, Merthyr Tydfil
Designer	Marcin Krawucki BSc (Hons) GMICE
Job Description	Calculations for beam B01

Length Units	m
Section Length Units	mm
Force Units	kN
Moment and Torsion Units	kN-m
Pressure Units	kPa
Material Strength Units	MPa
Material Density Units	kg/m³
Mass Units	kg
Temperature Units	degC
Translation Units	mm
Stress Units	MPa
Nodes	2
Members	1
Plates	0
Meshed Plates	0
Supports	2
Sections	1
Point Loads	0
Distributed Loads	2
Moments	0
Member Prestress Loads	0
Thermal Loads	0
Pressures	0
Area Loads	0
Self Weight	ON
User Defined Nodal Masses	0
Auto Defined Nodal Masses	0
Spectral Loads	0
Member Evaluation Points	9
Extrapolate Plate Results From Gauss Points	YES
General Constraint	RRRRRR
Total Degrees of Freedom	4

NODE COORDINATES (m)

ID	X Coordinate	Y Coordinate	Z Coordinate
1	0.00	0.00	0.00
2	4.49	0.00	0.00

MEMBERS (deg, m, mm, m, kN)

F=Fixed, R=Released, S=Spring

ID	Node A	Node B	Length	Type	Section ID	Rotation Angle	Node A Fixity	Node B Fixity
1	1	2	4.49	Normal	1	0.00	FFFFFF	FFFFFF

ID	Node A Offsets	Node B Offsets	Offset Axis	Node A Rot Stiff Y	Node A Rot Stiff Z	Node B Rot Stiff Y	Node B Rot Stiff Z	Cable Length	T/C Limit	Mirror	Disable Non-Linear
1	0, 0, 0	0, 0, 0	Local	-	-	-	-	-	-	No	No

SUPPORTS (kN/m, kN-m/rad)

F=Fixed, R=Released, S=Spring

B=Both Axes Restraint, N=Negative-Axis Restraint Only, P=Positive-Axis Restraint Only

ID	Node ID	Restraint Code	Direction Code	X Trans Stiffness	Y Trans Stiffness	Z Trans Stiffness	X Rot Stiffness	Y Rot Stiffness	Z Rot Stiffness	Source
1	1	FFFFRR	BBBBBB	-	-	-	-	-	-	User Defined Nodal Support
2	2	FFFFRR	BBBBBB	-	-	-	-	-	-	User Defined Nodal Support

MATERIALS (MPa, kg/m³, 10⁻⁶/degC)

Shear Modulus is used for members only.
Ex, Ey, Gxy, Gxz, Gyz are used for orthotropic plates only.

ID	Name	Young's Modulus	Shear Modulus	Density	Poisson's Ratio	Thermal Exp. Coeff.	Young's Modulus x	Young's Modulus y	Shear Modulus xy	Shear Modulus xz	Shear Modulus yz	Poisson's Ratio xy
9	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.00	Auto	7850.00	0.29	12.00	-	-	-	-	-	Auto

SECTIONS (mm, mm², mm⁴, deg)

ID	Name	Shape	Material ID	Depth	Width	Shear Area z (STRESS)	Shear Area y (STRESS)	Shear Area z (TIMO)	Shear Area y (TIMO)	Torsion Radius
1	203x102 UB 23	203x102 UB 23	9	203.20	101.80	1675.16	1058.97	-	-	13.97

ID	Centroid y	Centroid z	Area (A)	y-Axis Mol (Iy)	z-Axis Mol (Iz)	Torsion Constant (J)	Principal Angle	Non Prismatic
1	101.60	50.90	2940.00	1640000.00	21050000.00	70200.00	0.00	N

ID	Area Red. Factor	Iy Red. Factor	Iz Red. Factor	Torsion Constant Red. Factor	Shear Area Y Red. Factor	Shear Area Z Red. Factor
1	-	-	-	-	-	-

MEMBER DISTRIBUTED LOADS (kN/m)

ID	Load Group	Start Position (%)	End Position (%)	Member	Axes	X Start/End	Y Start/End	Z Start/End
1	DL	0%	100%	1	Global	0.00	-0.94	0.00
						0.00	-0.94	0.00
3	LL	0%	100%	1	Global	0.00	-1.13	0.00
						0.00	-1.13	0.00

SELF WEIGHT (g's)

Load Group	X Gravity	Y Gravity	Z Gravity
SW1	0.00	-1.00	0.00

LOAD COMBINATIONS

ID	Name	Criteria	DL Factor	LL Factor	SW1 Factor
1	ULS: STR (Unfavourable)	Strength	1.35	1.50	1.35
2	SLS: Characteristic	Serviceability	1.00	1.00	1.00

LOAD CASES

Design Code: EN

Load Group	Design Load Case
DL	Dead: Unfavourable
LL	Dead: Unfavourable
SW1	Dead: Unfavourable

Bill of Materials

BILL OF MATERIALS FOR MEMBERS (m, kg)

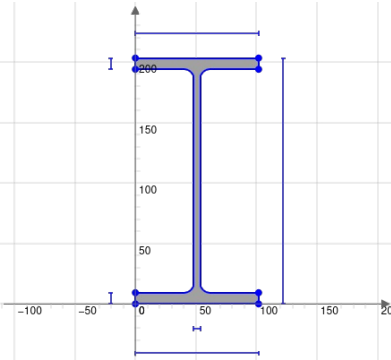
Section	Material	Quantity	Unit Length	Total Length	Unit Mass	Total Mass
1: 203x102 UB 23	9: European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	1	4.49	4.49	103.51	103.51
						103.51

Member 1: LC1 (ULS: STR (Unfavourable))

Member Summary Table	
Member Number	1
Node A	1 (0, 0, 0)
Node B	2 (4.485, 0, 0)
Member Length	4.49 m
Section Name	203x102 UB 23
Section No	1
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Not Buckling
Reaction A (kN,kN-m)	X: 0.00 Y: 7.33 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 0.00
Reaction B (kN,kN-m)	X: 0.00 Y: 7.33 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 0.00

Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	7.56	4.49	-7.56
Shear Stress in Z	0.00	2.54	4.49	-2.54
Shear Stress Total	0.00	7.56	2.24	0.00
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	0.00	0.00	2.24	-39.68
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	2.24	39.68	0.00	0.00
Axial Stress	0.00	0.00	0.00	0.00
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	2.24	39.68	0.00	0.00
Min Combined Normal Stress	0.00	0.00	2.24	-39.68

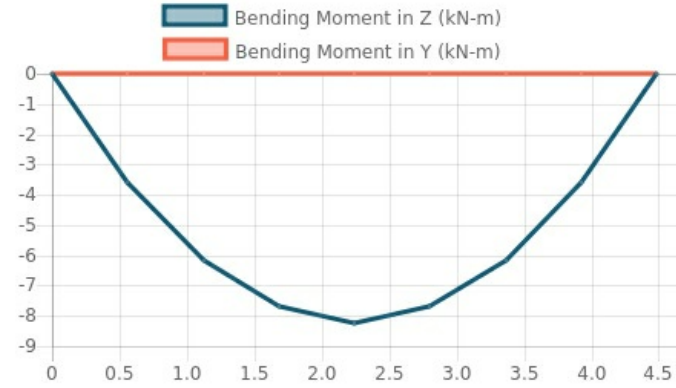
LC1: STR (Unfavourable)



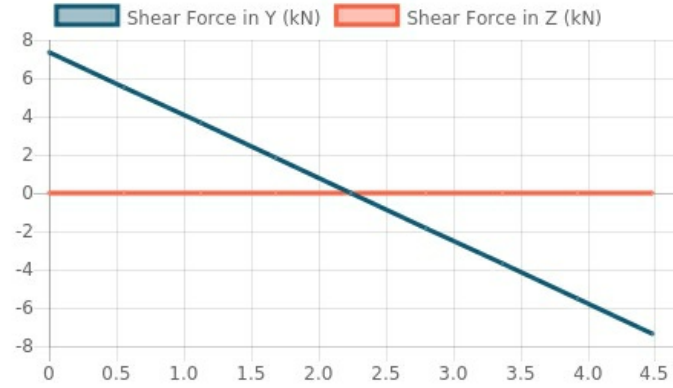
Geometric Properties		
A	2940	mm ²
C _z	50.9	mm
C _y	101.6	mm
Bending Properties		
I _z	21050000	mm ⁴
I _y	1640000	mm ⁴
α	0	°
Shear Properties		
A _z	1675.156	mm ²
A _y	1058.968	mm ²
	mm	
	mm	
Torsion Properties		
J	70200	mm ⁴
r	13.974	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
203x102 UB 23	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850

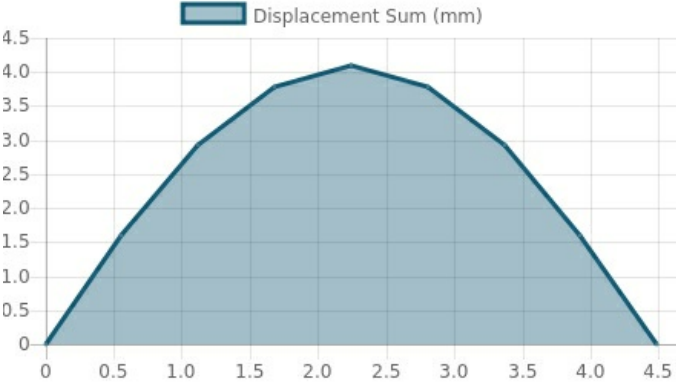
Member 1, ULS: STR (Unfavourable)



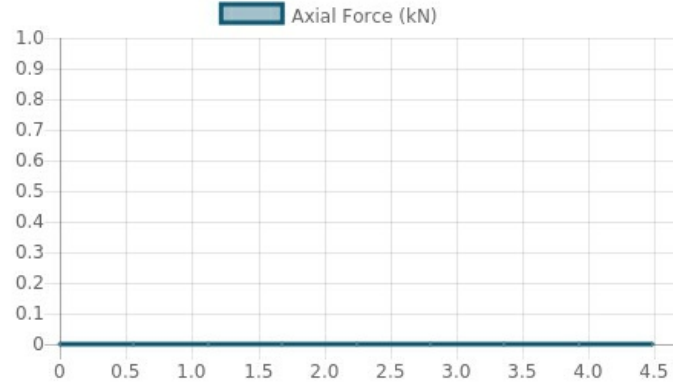
Member 1, ULS: STR (Unfavourable)



Member 1, ULS: STR (Unfavourable)



Member 1, ULS: STR (Unfavourable)

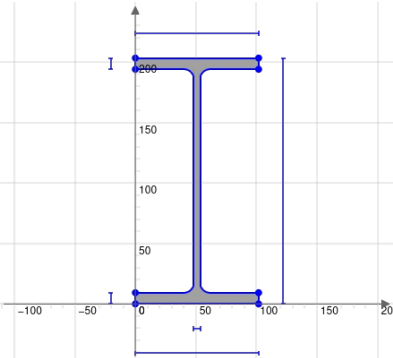


Member 1: LC2 (SLS: Characteristic)

Member Summary Table	
Member Number	1
Node A	1 (0, 0, 0)
Node B	2 (4.485, 0, 0)
Member Length	4.49 m
Section Name	203x102 UB 23
Section No	1
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Not Buckling
Reaction A (kN,kN-m)	X: 0.00 Y: 5.15 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 0.00
Reaction B (kN,kN-m)	X: 0.00 Y: 5.15 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 0.00

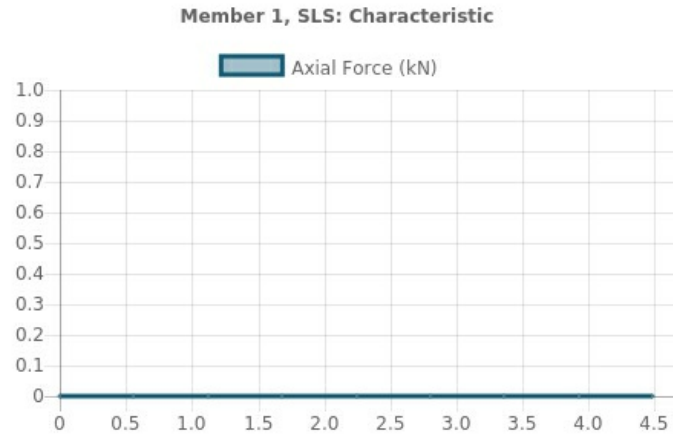
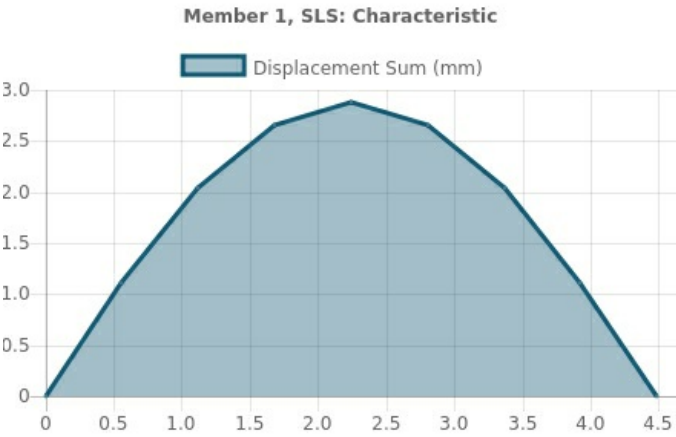
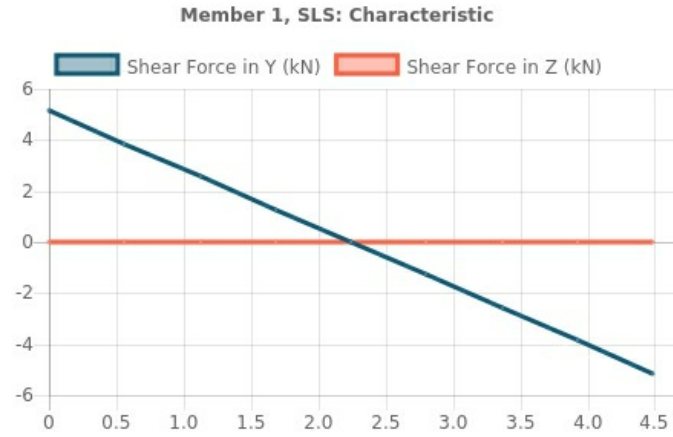
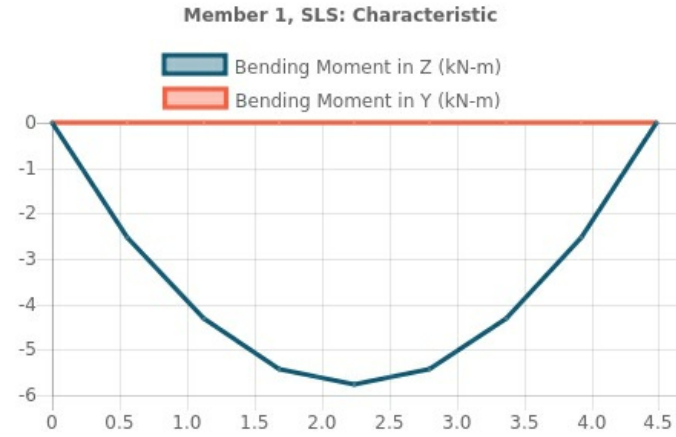
Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	5.31	4.49	-5.31
Shear Stress in Z	0.00	1.78	4.49	-1.78
Shear Stress Total	0.00	5.31	2.24	0.00
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	0.00	0.00	2.24	-27.87
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	2.24	27.87	0.00	0.00
Axial Stress	0.00	0.00	0.00	0.00
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	2.24	27.87	0.00	0.00
Min Combined Normal Stress	0.00	0.00	2.24	-27.87

LC203 1900mmx100mm



Geometric Properties		
A	2940	mm ²
C _z	50.9	mm
C _y	101.6	mm
Bending Properties		
I _z	21050000	mm ⁴
I _y	1640000	mm ⁴
α	0	°
Shear Properties		
A _z	1675.156	mm ²
A _y	1058.968	mm ²
	mm	
	mm	
Torsion Properties		
J	70200	mm ⁴
r	13.974	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
203x102 UB 23	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850



Nodal Results

Load Combination #1: ULS: STR (Unfavourable)
= 1.35×(DL) + 1.5×(LL) + 1.35×(SW1)

NODE REACTIONS (kN, kN-m)

Support ID	Node	X Force	Y Force	Z Force	X Moment	Y Moment	Z Moment
1	1	0.00	7.33	0.00	0.00	0.00	0.00
2	2	0.00	7.33	0.00	0.00	0.00	0.00
	Reaction Sum	0.00	14.66	0.00			
	Load Sum	0.00	-14.66	0.00			
	Equilibrium	0.00	0.00	0.00			

MEMBER END FORCES AND MOMENTS (kN, kN-m)

Member	Node	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	7.33	0.00	0.00	0.00	0.00
	2	0.00	-7.33	0.00	0.00	0.00	0.00

NODAL DISPLACEMENTS (mm)

Node	X Translation	Y Translation	Z Translation	Total Translation
1	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00

Load Combination #2: SLS: Characteristic
= (DL) + (LL) + (SW1)

NODE REACTIONS (kN, kN-m)

Support ID	Node	X Force	Y Force	Z Force	X Moment	Y Moment	Z Moment
1	1	0.00	5.15	0.00	0.00	0.00	0.00
2	2	0.00	5.15	0.00	0.00	0.00	0.00
	Reaction Sum	0.00	10.30	0.00			
	Load Sum	0.00	-10.30	0.00			
	Equilibrium	0.00	0.00	0.00			

MEMBER END FORCES AND MOMENTS (kN, kN-m)

Member	Node	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	5.15	0.00	0.00	0.00	0.00
	2	0.00	-5.15	0.00	0.00	0.00	0.00

NODAL DISPLACEMENTS (mm)

Node	X Translation	Y Translation	Z Translation	Total Translation
1	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00

Member Results

Load Combination #1: ULS: STR (Unfavourable) = 1.35×(DL) + 1.5×(LL) + 1.35×(SW1)

INTERNAL MEMBER FORCES AND MOMENTS (m, kN, kN-m)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	0.00	7.33	0.00	0.00	0.00	0.00
1	1	0.56	0.00	5.50	0.00	0.00	0.00	3.60
1	1	1.12	0.00	3.67	0.00	0.00	0.00	6.17
1	1	1.68	0.00	1.83	0.00	0.00	0.00	7.71
1	1	2.24	0.00	0.00	0.00	0.00	0.00	8.22
1	1	2.80	0.00	-1.83	0.00	0.00	0.00	7.71
1	1	3.36	0.00	-3.67	0.00	0.00	0.00	6.17
1	1	3.92	0.00	-5.50	0.00	0.00	0.00	3.60
1	1	4.49	0.00	-7.33	0.00	0.00	0.00	0.00

GROUPS SUMMARY - INTERNAL MEMBER FORCES AND MOMENTS (kN, kN-m)

Group Name	Type	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
N/A							

MEMBER DISPLACEMENTS (m, mm, rad)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Station Location	Global X Translation	Global Y Translation	Global Z Translation	Total Translation	Global X Rotation	Global Y Rotation	Global Z Rotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.00
1	0.56	0.00	-1.59	0.00	1.59	0.00	0.00	-0.00
1	1.12	0.00	-2.92	0.00	2.92	0.00	0.00	-0.00
1	1.68	0.00	-3.79	0.00	3.79	0.00	0.00	-0.00
1	2.24	0.00	-4.09	0.00	4.09	0.00	0.00	0.00
1	2.80	0.00	-3.79	0.00	3.79	0.00	0.00	0.00
1	3.36	0.00	-2.92	0.00	2.92	0.00	0.00	0.00
1	3.92	0.00	-1.59	0.00	1.59	0.00	0.00	0.00
1	4.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MEMBER LOCAL DISPLACEMENTS (m, mm, rad)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Station Location	Local X Translation	Local Y Translation	Local Z Translation	Local X Rotation	Local Y Rotation	Local Z Rotation
1	0.00	0.00	0.00	0.00	0.00	0.00	-0.00
1	0.56	0.00	-1.59	0.00	0.00	0.00	-0.00
1	1.12	0.00	-2.92	0.00	0.00	0.00	-0.00
1	1.68	0.00	-3.79	0.00	0.00	0.00	-0.00
1	2.24	0.00	-4.09	0.00	0.00	0.00	0.00
1	2.80	0.00	-3.79	0.00	0.00	0.00	0.00
1	3.36	0.00	-2.92	0.00	0.00	0.00	0.00
1	3.92	0.00	-1.59	0.00	0.00	0.00	0.00
1	4.49	0.00	0.00	0.00	0.00	0.00	0.00

MEMBER DISPLACEMENT SPAN CHECK (m, mm)

Member	Length	Max Relative Displacement	Span Method 1	Span Method 2
1	4.49	4.09	L/1096	L/1096

MEMBER STRESSES (m, MPa)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Torsion	Top Mom Z Btm Mom Z	Top Mom Y Btm Mom Y	Max Combined Normal Min Combined Normal	Shear Y Shear Z	Shear Total
1	1	0.00	0.00	0.00	0.00	0.00	7.56	7.56
			0.00	0.00	0.00	0.00	2.54	
1	1	0.56	0.00	17.36	0.00	17.36	5.67	5.67
			0.00	-17.36	0.00	-17.36	1.90	
1	1	1.12	0.00	29.76	0.00	29.76	3.78	3.78
			0.00	-29.76	0.00	-29.76	1.27	
1	1	1.68	0.00	37.20	0.00	37.20	1.89	1.89
			0.00	-37.20	0.00	-37.20	0.63	
1	1	2.24	0.00	39.68	0.00	39.68	0.00	0.00
			0.00	-39.68	0.00	-39.68	0.00	
1	1	2.80	0.00	37.20	0.00	37.20	-1.89	1.89
			0.00	-37.20	0.00	-37.20	-0.63	
1	1	3.36	0.00	29.76	0.00	29.76	-3.78	3.78
			0.00	-29.76	0.00	-29.76	-1.27	
1	1	3.92	0.00	17.36	0.00	17.36	-5.67	5.67
			0.00	-17.36	0.00	-17.36	-1.90	
1	1	4.49	0.00	0.00	0.00	0.00	-7.56	7.56
			0.00	0.00	0.00	0.00	-2.54	

Load Combination #2: SLS: Characteristic = (DL) + (LL) + (SW1)

INTERNAL MEMBER FORCES AND MOMENTS (m, kN, kN-m)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	0.00	5.15	0.00	0.00	0.00	0.00
1	1	0.56	0.00	3.86	0.00	0.00	0.00	2.53
1	1	1.12	0.00	2.57	0.00	0.00	0.00	4.33
1	1	1.68	0.00	1.29	0.00	0.00	0.00	5.41
1	1	2.24	0.00	0.00	0.00	0.00	0.00	5.77
1	1	2.80	0.00	-1.29	0.00	0.00	0.00	5.41
1	1	3.36	0.00	-2.57	0.00	0.00	0.00	4.33
1	1	3.92	0.00	-3.86	0.00	0.00	0.00	2.53
1	1	4.49	0.00	-5.15	0.00	0.00	0.00	0.00

GROUPS SUMMARY - INTERNAL MEMBER FORCES AND MOMENTS (kN, kN-m)

Group Name	Type	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
N/A							

MEMBER DISPLACEMENTS (m, mm, rad)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Station Location	Global X Translation	Global Y Translation	Global Z Translation	Total Translation	Global X Rotation	Global Y Rotation	Global Z Rotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.00
1	0.56	0.00	-1.12	0.00	1.12	0.00	0.00	-0.00
1	1.12	0.00	-2.05	0.00	2.05	0.00	0.00	-0.00
1	1.68	0.00	-2.66	0.00	2.66	0.00	0.00	-0.00
1	2.24	0.00	-2.87	0.00	2.87	0.00	0.00	0.00
1	2.80	0.00	-2.66	0.00	2.66	0.00	0.00	0.00
1	3.36	0.00	-2.05	0.00	2.05	0.00	0.00	0.00
1	3.92	0.00	-1.12	0.00	1.12	0.00	0.00	0.00
1	4.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MEMBER LOCAL DISPLACEMENTS (m, mm, rad)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Station Location	Local X Translation	Local Y Translation	Local Z Translation	Local X Rotation	Local Y Rotation	Local Z Rotation
1	0.00	0.00	0.00	0.00	0.00	0.00	-0.00
1	0.56	0.00	-1.12	0.00	0.00	0.00	-0.00
1	1.12	0.00	-2.05	0.00	0.00	0.00	-0.00
1	1.68	0.00	-2.66	0.00	0.00	0.00	-0.00
1	2.24	0.00	-2.87	0.00	0.00	0.00	0.00
1	2.80	0.00	-2.66	0.00	0.00	0.00	0.00
1	3.36	0.00	-2.05	0.00	0.00	0.00	0.00
1	3.92	0.00	-1.12	0.00	0.00	0.00	0.00
1	4.49	0.00	0.00	0.00	0.00	0.00	0.00

MEMBER DISPLACEMENT SPAN CHECK (m, mm)

Member	Length	Max Relative Displacement	Span Method 1	Span Method 2
1	4.49	2.87	L/1560	L/1560

MEMBER STRESSES (m, MPa)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Torsion	Top Mom Z Btm Mom Z	Top Mom Y Btm Mom Y	Max Combined Normal Min Combined Normal	Shear Y Shear Z	Shear Total
1	1	0.00	0.00	0.00	0.00	0.00	5.31	5.31
			0.00	0.00	0.00	0.00	1.78	
1	1	0.56	0.00	12.19	0.00	12.19	3.98	3.98
			0.00	-12.19	0.00	-12.19	1.34	
1	1	1.12	0.00	20.90	0.00	20.90	2.66	2.66
			0.00	-20.90	0.00	-20.90	0.89	
1	1	1.68	0.00	26.13	0.00	26.13	1.33	1.33
			0.00	-26.13	0.00	-26.13	0.45	
1	1	2.24	0.00	27.87	0.00	27.87	0.00	0.00
			0.00	-27.87	0.00	-27.87	0.00	
1	1	2.80	0.00	26.13	0.00	26.13	-1.33	1.33
			0.00	-26.13	0.00	-26.13	-0.45	
1	1	3.36	0.00	20.90	0.00	20.90	-2.66	2.66
			0.00	-20.90	0.00	-20.90	-0.89	
1	1	3.92	0.00	12.19	0.00	12.19	-3.98	3.98
			0.00	-12.19	0.00	-12.19	-1.34	
1	1	4.49	0.00	0.00	0.00	0.00	-5.31	5.31
			0.00	0.00	0.00	0.00	-1.78	

Member Buckling Results

Simplified Analysis Report

Project Name: AUX256 Beam B01

Date: Sun Nov 19 2023 19:38:30 GMT+0000 (Greenwich Mean Time)

Username: marcinkrawucki@gmail.com

Analysis: Buckling Analysis



Result Summary

Check	Limit ⓘ	Governing Result	Utility ⓘ	Comments
Deflection/Span	L/250	L/1560 Member 1 LC#2 - SLS: Characteristic	0.16	Only checked the Load Combinations with 'Serviceability' criteria.
Custom Stress Limit	250 MPa	39.679 MPa Member 1 LC#1 - ULS: STR (Unfavourable) Min Combined Normal Stress	0.159	Checked member stresses for any stress values above 250 MPa.
Material Yield	275 MPa	39.679 MPa Member 1 LC#1 - ULS: STR (Unfavourable)	0.144	Checked if each individual member exceeds its Material Yield (275 MPa). 1 members checked in 9 Load Combination(s).
Material Strength	485 MPa	39.679 MPa Member 1 LC#1 - ULS: STR (Unfavourable)	0.082	Checked if each individual member exceeds its Material Strength (485 MPa). 1 members checked in 9 Load Combination(s).

Load Summary

Load Combination Name	criteria	DL (Dead: Unfavourable)	LL (Dead: Unfavourable)	SW1 (Dead: Unfavourable)
ULS: STR (Unfavourable)	strength	1.35	1.5	1.35
SLS: Characteristic	serviceability	1	1	1

Note: (Brackets) are the load case names linked to EN standards

Envelope results were also generated, based on the worst result in each member.

Reaction Summary (Envelope Results)

Node ID	Fixity	X (kN)	Y (kN)	Z (kN)	M _x (kN-m)	M _y (kN-m)	M _z (kN-m)
1	FFFFRR	0	7.33195	0	0	0	0
2	FFFFRR	0	7.33195	0	0	0	0

Materials

Name	Database	Density (kg/m ³)	v	F _y (MPa)	F _u (MPa)
European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	Metric, Steel, European Standard (EN), EN 10025, Grade S275JR, S275J0, S275J2G3, S275J2G4, 3mm ≤ Thickness ≤ 16mm	7850	0.29	275	485
BS EN1995-1-1:2004 - Solid timber - C24	Metric, Wood, BS EN1995-1-1:2004, Solid timber, C24	350	0.4		

Member Stresses (Envelope Results)

Mem. ID	Max Stress (MPa)	Min Stress (MPa)	Material	F _y (MPa)	F _u (MPa)	Custom (MPa)	Utility
1	39.67925	-39.67925	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	275	485	false	0.144

Utility calcs are based on Member Stress / Material Strength, where:

Material Strength = min(F_y, F_u, Custom Stress Limit)

Member Stress = $\max(\text{abs}(\min), \text{abs}(\max))$

Project:	Calculations for the retaining walls and timber loadbearing walls with		
Address:	84 Church Street Marthyr Tydfil		
Job No.	AUX256	Sheet	4.1
Date:	19/11/2023	Rev.	C1

Beam size:	1no	203x102UB23	Grade:	S275				
Padstones size if req.:		x	x	mm			columns on both sides	



AUX256 Beam B02 with columns C01 - full Report

Sun 19 Nov 2023, 08:01PM (GMT+00:00)



File Name: AUX256 Beam B02 with columns C01
Software: SkyCiv Structural 3D v6.1.8 (Lic. No.: KDQBmMLFE2zKsN)
Analysis Type: Linear Static & Buckling Analysis

Included in this Report:

- Job Setup
- Bill of Materials
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- Load Combination #1: ULS: STR
 - BUCKLING
- Load Combination #2: SLS: Characteristic
 - BUCKLING

Job Setup

AUX256 Beam B02 with columns C01 - full Report

SkyCiv Structural 3D v6.1.8
Licence Number: KDQBmMLFE2zKsN
Date: Sun 19 Nov 2023, 08:01PM (GMT+00:00)
Analysis Type: LINEAR STATIC & BUCKLING ANALYSIS

File Name	AUX256 Beam B02 with columns C01
Job Name	AUX256 84 Church Street, Merthyr Tydfil
Designer	Marcin Krawucki BSc (Hons) GMICE
Job Description	Calculations for beam B02

Length Units	m
Section Length Units	mm
Force Units	kN
Moment and Torsion Units	kN-m
Pressure Units	kPa
Material Strength Units	MPa
Material Density Units	kg/m³
Mass Units	kg
Temperature Units	degC
Translation Units	mm
Stress Units	MPa
Nodes	4
Members	3
Plates	0
Meshed Plates	0
Supports	2
Sections	2
Point Loads	2
Distributed Loads	2
Moments	0
Member Prestress Loads	0
Thermal Loads	0
Pressures	0
Area Loads	0
Self Weight	ON
User Defined Nodal Masses	0
Auto Defined Nodal Masses	0
Spectral Loads	0
Member Evaluation Points	9
Extrapolate Plate Results From Gauss Points	YES
General Constraint	RRRRRR
Total Degrees of Freedom	12

NODE COORDINATES (m)

ID	X Coordinate	Y Coordinate	Z Coordinate
1	0.00	0.00	0.00
2	4.30	0.00	0.00
3	0.00	-2.80	0.00
4	4.30	-2.80	0.00

MEMBERS (deg, m, mm, m, kN)

F=Fixed, R=Released, S=Spring

ID	Node A	Node B	Length	Type	Section ID	Rotation Angle	Node A Fixity	Node B Fixity
1	1	2	4.30	Normal	1	0.00	FFFFFF	FFFFFF
2	3	1	2.80	Normal	16	0.00	FFFFFF	FFFFFF
3	4	2	2.80	Normal	16	0.00	FFFFFF	FFFFFF

ID	Node A Offsets	Node B Offsets	Offset Axis	Node A Rot Stiff Y	Node A Rot Stiff Z	Node B Rot Stiff Y	Node B Rot Stiff Z	Cable Length	T/C Limit	Mirror	Disable Non-Linear
1	0, 0, 0	0, 0, 0	Local	-	-	-	-	-	-	No	No
2	0, 0, 0	0, 0, 0	Local	-	-	-	-	-	-	No	No
3	0, 0, 0	0, 0, 0	Local	-	-	-	-	-	-	No	No

SUPPORTS (kN/m, kN-m/rad)

F=Fixed, R=Released, S=Spring

B=Both Axes Restraint, N=Negative-Axis Restraint Only, P=Positive-Axis Restraint Only

ID	Node ID	Restraint Code	Direction Code	X Trans Stiffness	Y Trans Stiffness	Z Trans Stiffness	X Rot Stiffness	Y Rot Stiffness	Z Rot Stiffness	Source
1	3	FFFFFF	BBBBBB	-	-	-	-	-	-	User Defined Nodal Support
2	4	FFFFFF	BBBBBB	-	-	-	-	-	-	User Defined Nodal Support

MATERIALS (MPa, kg/m³, 10⁻⁶/degC)

Shear Modulus is used for members only.
Ex, Ey, Gxy, Gxz, Gyz are used for orthotropic plates only.

ID	Name	Young's Modulus	Shear Modulus	Density	Poisson's Ratio	Thermal Exp. Coeff.	Young's Modulus x	Young's Modulus y	Shear Modulus xy	Shear Modulus xz	Shear Modulus yz	Poisson's Ratio xy
9	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.00	Auto	7850.00	0.29	12.00	-	-	-	-	-	Auto

SECTIONS (mm, mm², mm⁴, deg)

ID	Name	Shape	Material ID	Depth	Width	Shear Area z (STRESS)	Shear Area y (STRESS)	Shear Area z (TIMO)	Shear Area y (TIMO)	Torsion Radius
1	203x102 UB 23	203x102 UB 23	9	203.20	101.80	1675.16	1058.97	-	-	13.97
16	100x5.0 SHS	100x5.0 SHS	9	100.00	100.00	814.90	814.90	-	-	56.24

ID	Centroid y	Centroid z	Area (A)	y-Axis Mol (Iy)	z-Axis Mol (Iz)	Torsion Constant (J)	Principal Angle	Non Prismatic
1	101.60	50.90	2940.00	1640000.00	21050000.00	70200.00	0.00	N
16	50.00	50.00	1870.00	2790000.00	2790000.00	4390000.00	0.00	N

ID	Area Red. Factor	Iy Red. Factor	Iz Red. Factor	Torsion Constant Red. Factor	Shear Area Y Red. Factor	Shear Area Z Red. Factor
1	-	-	-	-	-	-
16	-	-	-	-	-	-

POINT LOADS (kN)

ID	Load Group	Node	Member	Position (%)	X Magnitude	Y Magnitude	Z Magnitude
1	DL		1	35%	0.00	-2.60	0.00
2	LL		1	35%	0.00	-2.54	0.00

MEMBER DISTRIBUTED LOADS (kN/m)

ID	Load Group	Start Position (%)	End Position (%)	Member	Axes	X Start/End	Y Start/End	Z Start/End
1	DL	0%	100%	1	Global	0.00	-0.75	0.00
						0.00	-0.75	0.00
3	LL	0%	100%	1	Global	0.00	-0.90	0.00
						0.00	-0.90	0.00

SELF WEIGHT (g's)

Load Group	X Gravity	Y Gravity	Z Gravity
SW1	0.00	-1.00	0.00

LOAD COMBINATIONS

ID	Name	Criteria	DL Factor	LL Factor	SW1 Factor
1	ULS: STR (Unfavourable)	Strength	1.35	1.50	1.35
2	SLS: Characteristic	Serviceability	1.00	1.00	1.00

LOAD CASES

Design Code: EN

Load Group	Design Load Case
DL	Dead: Unfavourable
LL	Dead: Unfavourable
SW1	Dead: Unfavourable

Bill of Materials

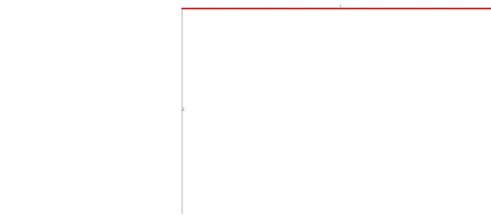
BILL OF MATERIALS FOR MEMBERS (m, kg)

Section	Material	Quantity	Unit Length	Total Length	Unit Mass	Total Mass
1: 203x102 UB 23	9: European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	1	4.30	4.30	99.24	99.24
16: 100x5.0 SHS	9: European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	2	2.80	5.60	41.10	82.21
						181.44

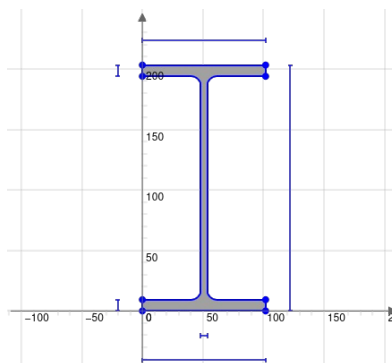
Member 1: LC1 (ULS: STR (Unfavourable))

Member Summary Table	
Member Number	1
Node A	1 (0, 0, 0)
Node B	2 (4.3, 0, 0)
Member Length	4.30 m
Section Name	203x102 UB 23
Section No	1
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Critical Load: 20.57
Reaction A (kN,kN-m)	No Support at this Location
Reaction B (kN,kN-m)	No Support at this Location

LC1: ULS STR (Unfavourable)



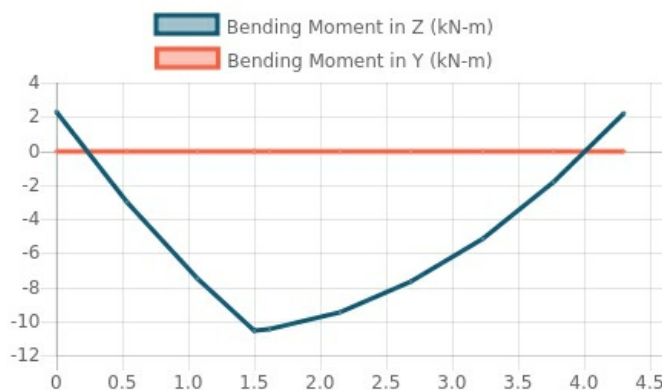
Result	Max Location and Result (m,MPa)	Min Location and Result (m,MPa)
Shear Stress in Y	0.00 10.84	4.30 -8.54
Shear Stress in Z	0.00 3.64	4.30 -2.87
Shear Stress Total	0.00 10.84	1.61 1.15
Bending Stress (Bottom) in Y	0.00 0.00	0.00 0.00
Bending Stress (Bottom) in Z	0.00 10.90	1.50 -50.86
Bending Stress (Top) in Y	0.00 0.00	0.00 0.00
Bending Stress (Top) in Z	1.50 50.86	0.00 -10.90
Axial Stress	0.00 0.41	0.00 0.41
Torsion Stress	0.00 0.00	0.00 0.00
Max Combined Normal Stress	1.50 51.27	3.76 9.46
Min Combined Normal Stress	3.76 -8.65	1.50 -50.46



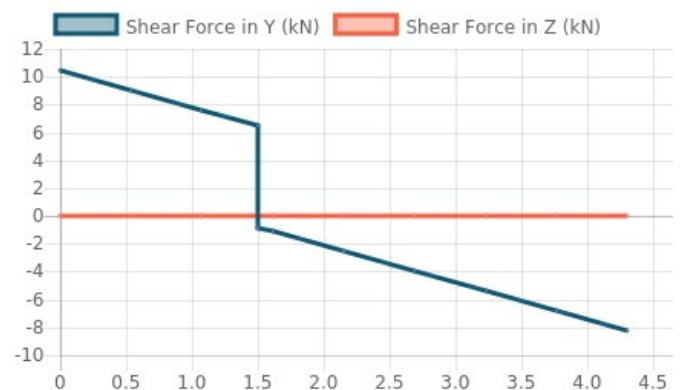
Geometric Properties	
A	2940 mm ²
C _z	50.9 mm
C _y	101.6 mm
Bending Properties	
I _z	21050000 mm ⁴
I _y	1640000 mm ⁴
α	0 °
Shear Properties	
A _z	1675.156 mm ²
A _y	1058.968 mm ²
	mm
	mm
Torsion Properties	
J	70200 mm ⁴
r	13.974 mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
203x102 UB 23	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850

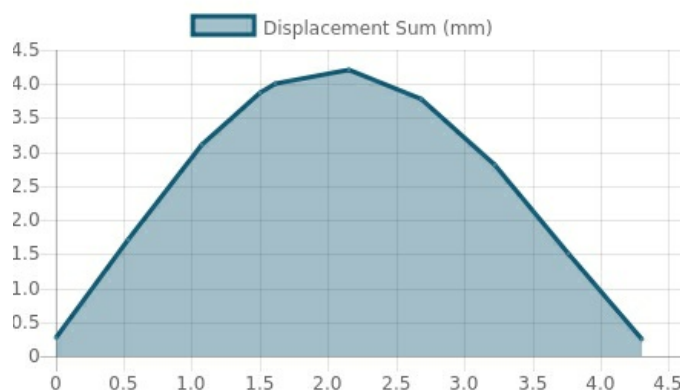
Member 1, ULS: STR (Unfavourable)



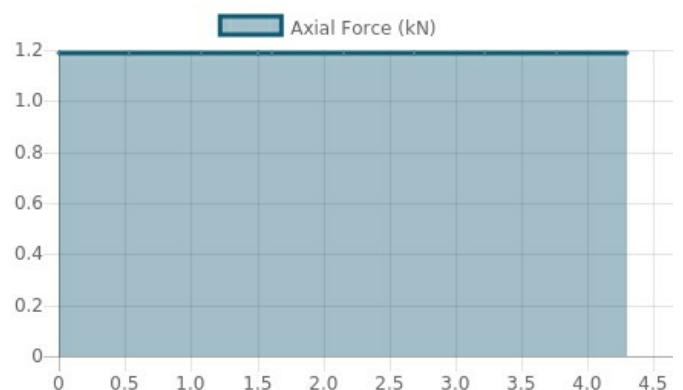
Member 1, ULS: STR (Unfavourable)



Member 1, ULS: STR (Unfavourable)



Member 1, ULS: STR (Unfavourable)



Member 1: LC2 (SLS: Characteristic)

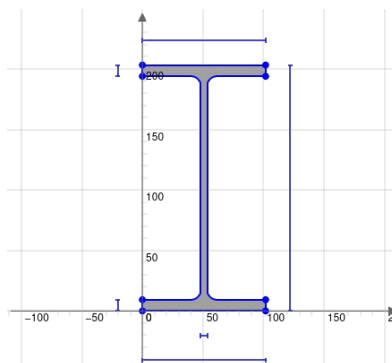
Member Summary Table	
Member Number	1
Node A	1 (0, 0, 0)
Node B	2 (4.3, 0, 0)
Member Length	4.30 m
Section Name	203x102 UB 23
Section No	1
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Critical Load: 20.55
Reaction A (kN,kN-m)	No Support at this Location
Reaction B (kN,kN-m)	No Support at this Location

LC255 1000mmx1000mm



SkyCiv

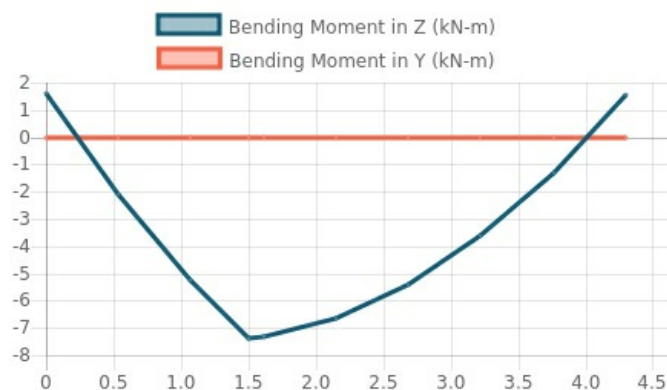
Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	7.62	4.30	-6.00
Shear Stress in Z	0.00	2.56	4.30	-2.02
Shear Stress Total	0.00	7.62	1.61	0.80
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	0.00	7.66	1.50	-35.74
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	1.50	35.74	0.00	-7.66
Axial Stress	0.00	0.28	0.00	0.28
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	1.50	36.02	3.76	6.65
Min Combined Normal Stress	3.76	-6.08	1.50	-35.45



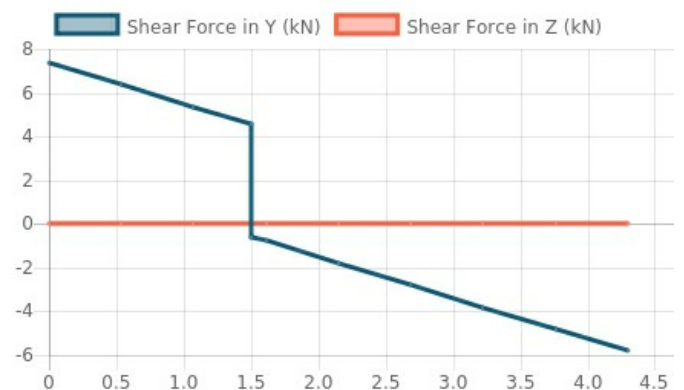
Geometric Properties		
A	2940	mm ²
C _z	50.9	mm
C _y	101.6	mm
Bending Properties		
I _z	21050000	mm ⁴
I _y	1640000	mm ⁴
α	0	°
Shear Properties		
A _z	1675.156	mm ²
A _y	1058.968	mm ²
	mm	
	mm	
Torsion Properties		
J	70200	mm ⁴
r	13.974	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
203x102 UB 23	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850

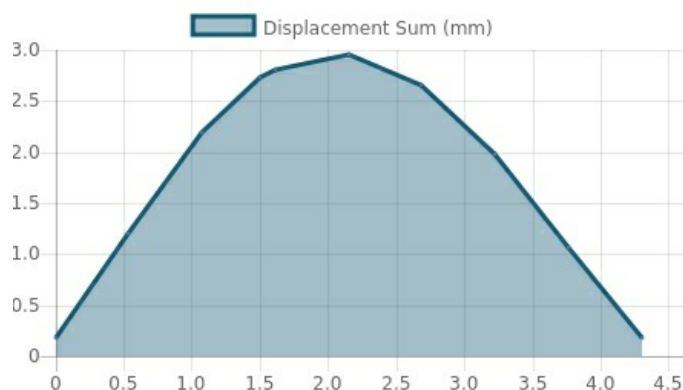
Member 1, SLS: Characteristic



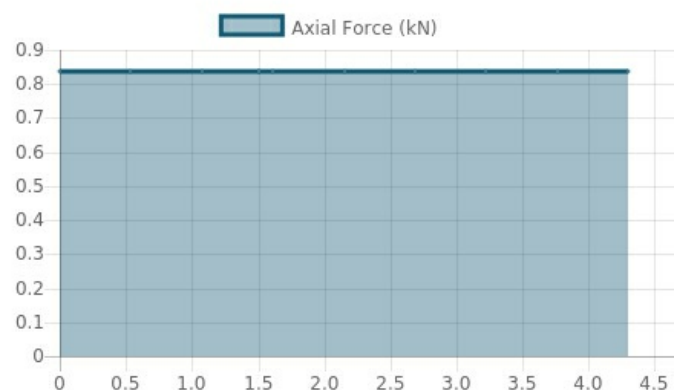
Member 1, SLS: Characteristic



Member 1, SLS: Characteristic

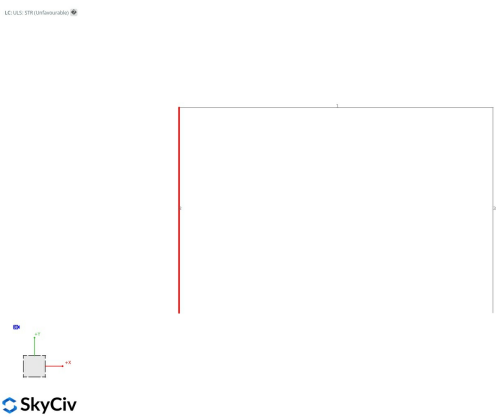


Member 1, SLS: Characteristic

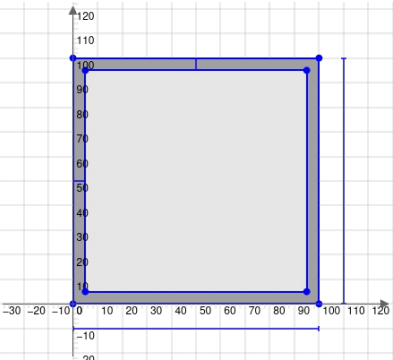


Member 2: LC1 (ULS: STR (Unfavourable))

Member Summary Table	
Member Number	2
Node A	3 (0, -2.8, 0)
Node B	1 (0, 0, 0)
Member Length	2.80 m
Section Name	100x5.0 SHS
Section No	16
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Critical Load: 190.89
Reaction A (kN,kN-m)	X: 1.19 Y: 11.05 Z: 0.00 Mx: 0.00 My: 0.00 Mz: -1.08
Reaction B (kN,kN-m)	No Support at this Location



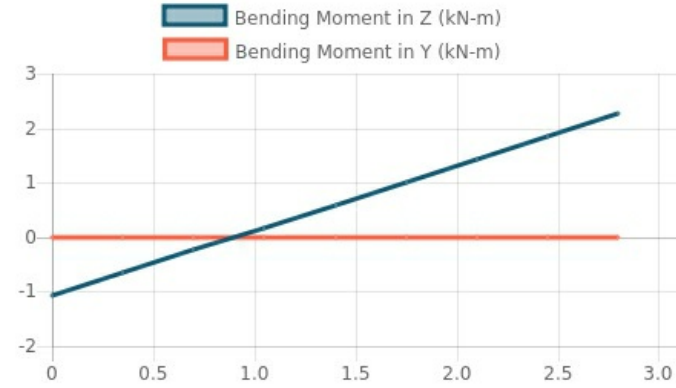
Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	-1.45	0.00	-1.45
Shear Stress in Z	0.00	-1.02	0.00	-1.02
Shear Stress Total	0.00	1.45	0.00	1.45
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	2.80	40.47	0.00	-19.29
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	0.00	19.29	2.80	-40.47
Axial Stress	0.00	5.91	2.80	5.62
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	2.80	46.09	1.05	8.92
Min Combined Normal Stress	1.05	2.68	2.80	-34.85



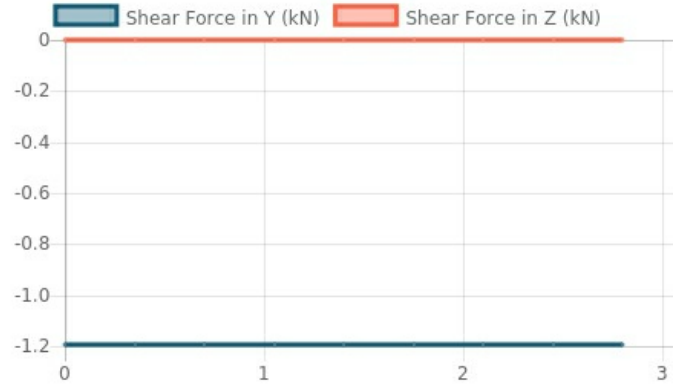
Geometric Properties		
A	1870	mm ²
C _z	50	mm
C _y	50	mm
Bending Properties		
I _z	2790000	mm ⁴
I _y	2790000	mm ⁴
α	0	°
Shear Properties		
A _z	814.902	mm ²
A _y	814.902	mm ²
	mm	
	mm	
Torsion Properties		
J	4390000	mm ⁴
r	56.238	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
100x5.0 SHS	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850

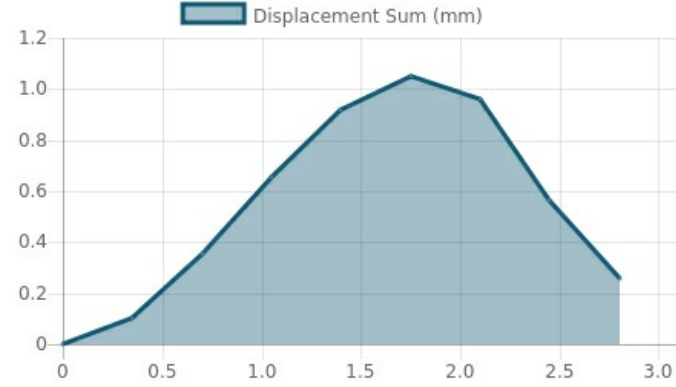
Member 2, ULS: STR (Unfavourable)



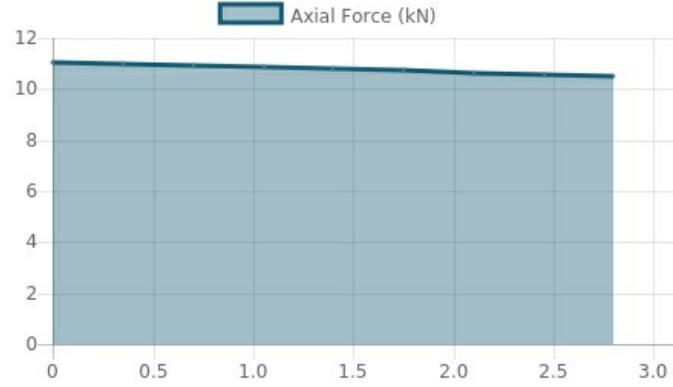
Member 2, ULS: STR (Unfavourable)



Member 2, ULS: STR (Unfavourable)



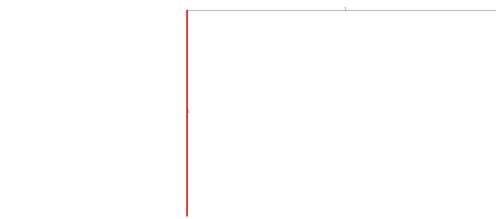
Member 2, ULS: STR (Unfavourable)



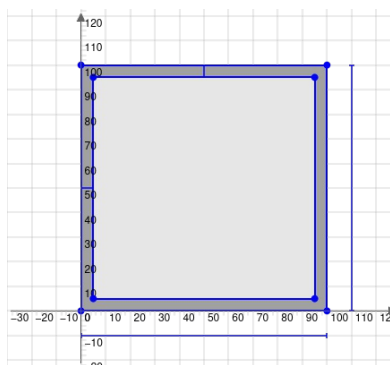
Member 2: LC2 (SLS: Characteristic)

Member Summary Table	
Member Number	2
Node A	3 (0, -2.8, 0)
Node B	1 (0, 0, 0)
Member Length	2.80 m
Section Name	100x5.0 SHS
Section No	16
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Critical Load: 191.21
Reaction A (kN,kN-m)	X: 0.84 Y: 7.79 Z: 0.00 Mx: 0.00 My: 0.00 Mz: -0.76
Reaction B (kN,kN-m)	No Support at this Location

LC2: SLS (Characteristic)



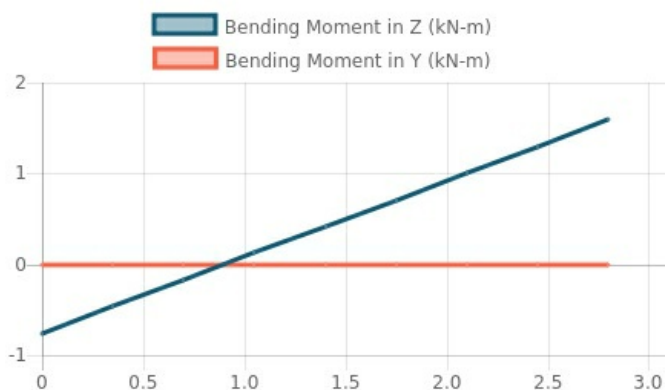
Result	Max Location and Result (m,MPa)	Min Location and Result (m,MPa)
Shear Stress in Y	0.00 -1.02	0.00 -1.02
Shear Stress in Z	0.00 -0.72	0.00 -0.72
Shear Stress Total	0.00 1.02	0.00 1.02
Bending Stress (Bottom) in Y	0.00 0.00	0.00 0.00
Bending Stress (Bottom) in Z	2.80 28.44	0.00 -13.56
Bending Stress (Top) in Y	0.00 0.00	0.00 0.00
Bending Stress (Top) in Z	0.00 13.56	2.80 -28.44
Axial Stress	0.00 4.17	2.80 3.95
Torsion Stress	0.00 0.00	0.00 0.00
Max Combined Normal Stress	2.80 32.39	1.05 6.28
Min Combined Normal Stress	1.05 1.89	2.80 -24.49



Geometric Properties		
A	1870	mm ²
C _z	50	mm
C _y	50	mm
Bending Properties		
I _z	2790000	mm ⁴
I _y	2790000	mm ⁴
α	0	°
Shear Properties		
A _z	814.902	mm ²
A _y	814.902	mm ²
	mm	
	mm	
Torsion Properties		
J	4390000	mm ⁴
r	56.238	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
100x5.0 SHS	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850

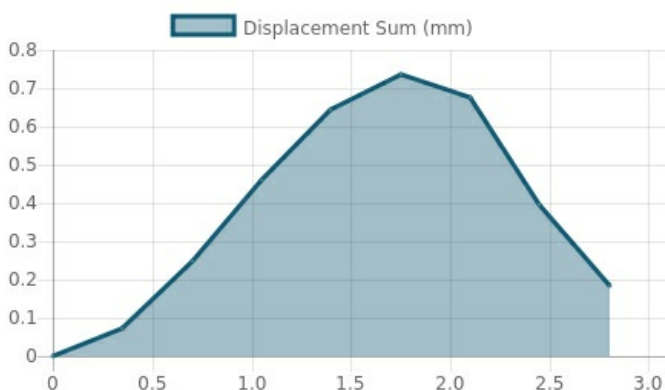
Member 2, SLS: Characteristic



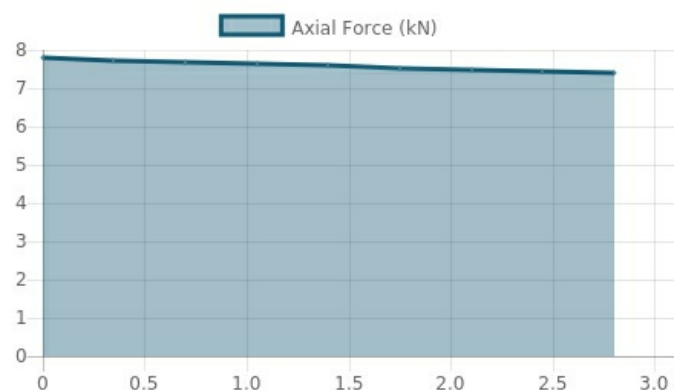
Member 2, SLS: Characteristic



Member 2, SLS: Characteristic



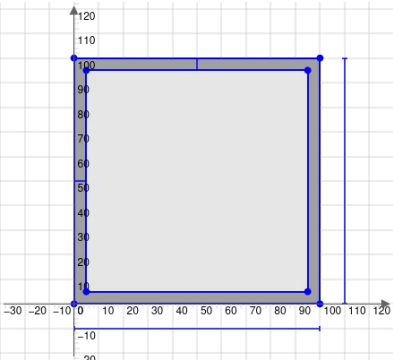
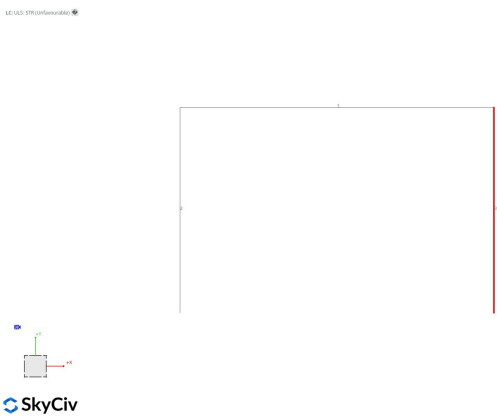
Member 2, SLS: Characteristic



Member 3: LC1 (ULS: STR (Unfavourable))

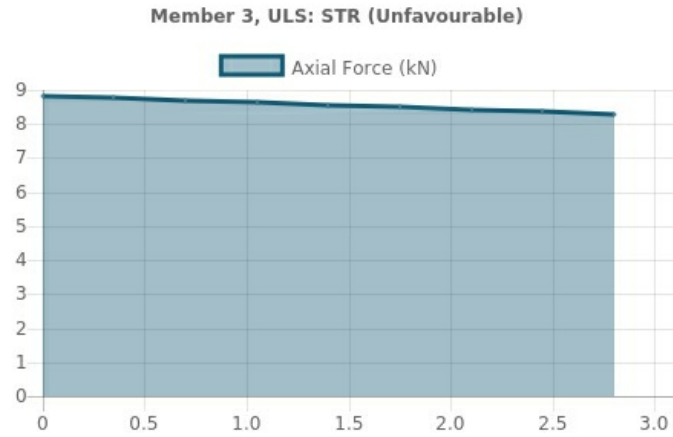
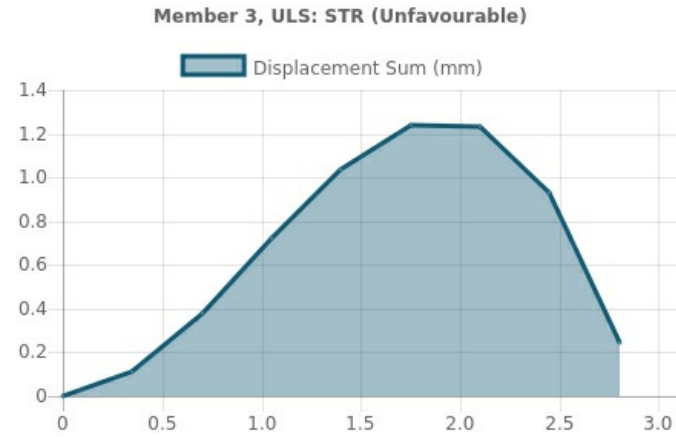
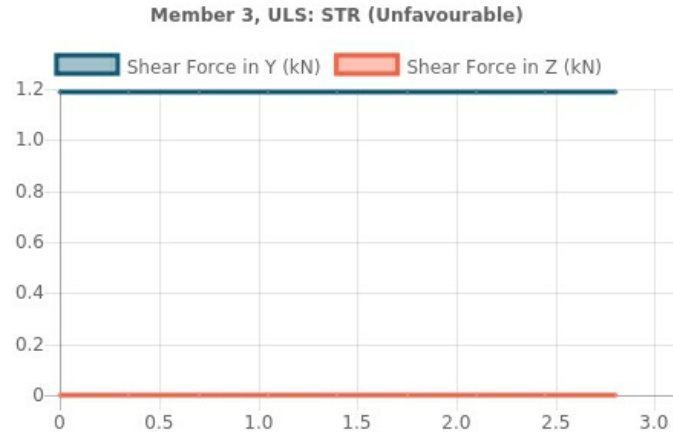
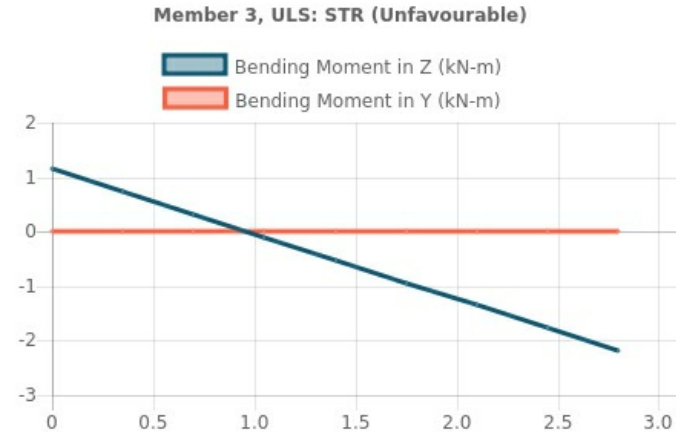
Member Summary Table	
Member Number	3
Node A	4 (4.3, -2.8, 0)
Node B	2 (4.3, 0, 0)
Member Length	2.80 m
Section Name	100x5.0 SHS
Section No	16
Member Rotation	0 degrees
Fixity A	FFFFF
Fixity B	FFFFF
Buckling	Critical Load: 152.42
Reaction A (kN,kN-m)	X: -1.19 Y: 8.83 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 1.15
Reaction B (kN,kN-m)	No Support at this Location

Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	1.45	0.00	1.45
Shear Stress in Z	0.00	1.02	0.00	1.02
Shear Stress Total	0.00	1.45	0.00	1.45
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	0.00	20.53	2.80	-39.24
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	2.80	39.24	0.00	-20.53
Axial Stress	0.00	4.72	2.80	4.43
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	2.80	43.67	1.05	6.49
Min Combined Normal Stress	1.05	2.73	2.80	-34.81



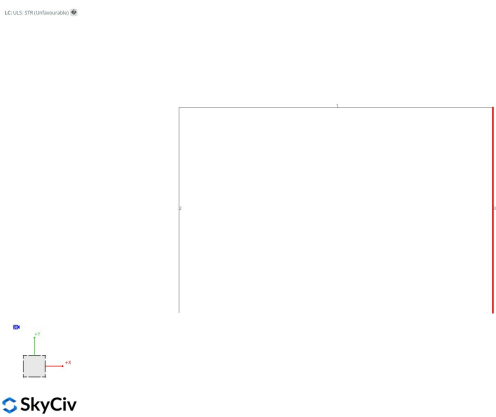
Geometric Properties		
A	1870	mm ²
C _z	50	mm
C _y	50	mm
Bending Properties		
I _z	2790000	mm ⁴
I _y	2790000	mm ⁴
α	0	°
Shear Properties		
A _z	814.902	mm ²
A _y	814.902	mm ²
	mm	
	mm	
Torsion Properties		
J	4390000	mm ⁴
r	56.238	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
100x5.0 SHS	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29	0.29	7850

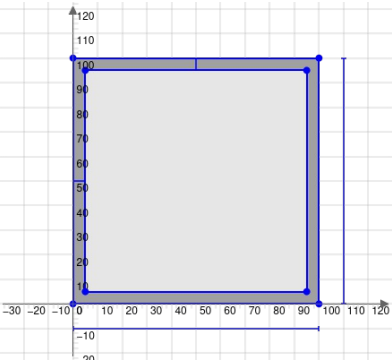


Member 3: LC2 (SLS: Characteristic)

Member Summary Table	
Member Number	3
Node A	4 (4.3, -2.8, 0)
Node B	2 (4.3, 0, 0)
Member Length	2.80 m
Section Name	100x5.0 SHS
Section No	16
Member Rotation	0 degrees
Fixity A	FFFFFF
Fixity B	FFFFFF
Buckling	Critical Load: 152.81
Reaction A (kN,kN-m)	X: -0.84 Y: 6.22 Z: 0.00 Mx: 0.00 My: 0.00 Mz: 0.81
Reaction B (kN,kN-m)	No Support at this Location

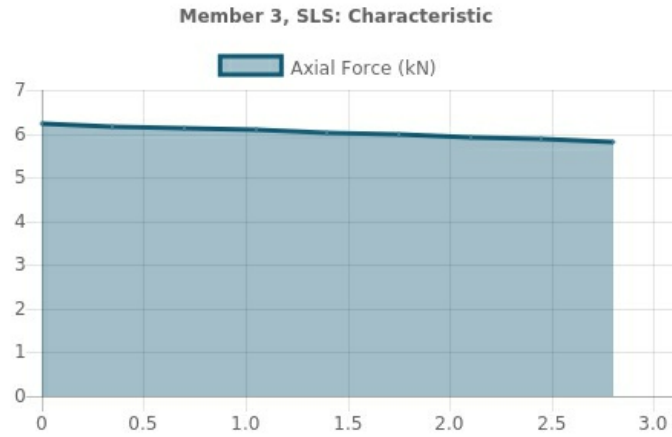
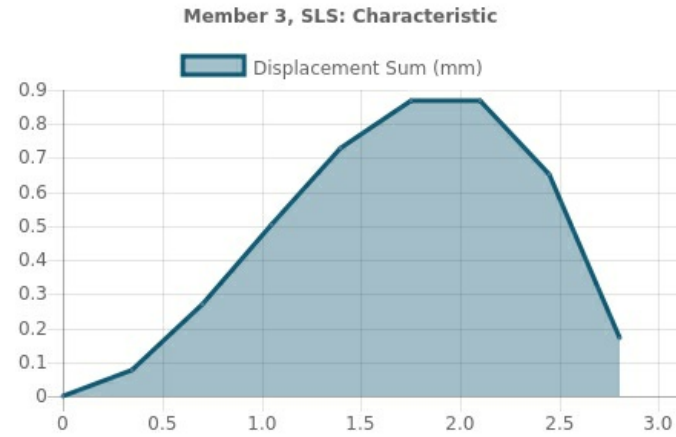
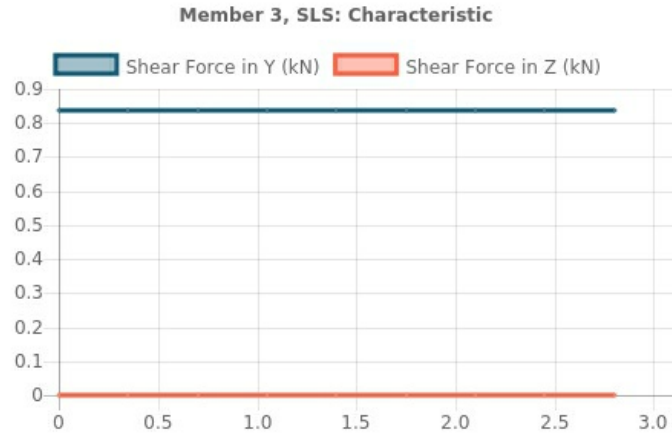


Result	Max Location and Result (m,MPa)		Min Location and Result (m,MPa)	
Shear Stress in Y	0.00	1.02	0.00	1.02
Shear Stress in Z	0.00	0.72	0.00	0.72
Shear Stress Total	0.00	1.02	0.00	1.02
Bending Stress (Bottom) in Y	0.00	0.00	0.00	0.00
Bending Stress (Bottom) in Z	0.00	14.43	2.80	-27.57
Bending Stress (Top) in Y	0.00	0.00	0.00	0.00
Bending Stress (Top) in Z	2.80	27.57	0.00	-14.43
Axial Stress	0.00	3.33	2.80	3.11
Torsion Stress	0.00	0.00	0.00	0.00
Max Combined Normal Stress	2.80	30.69	1.05	4.57
Min Combined Normal Stress	1.05	1.92	2.80	-24.46



Geometric Properties		
A	1870	mm ²
C _z	50	mm
C _y	50	mm
Bending Properties		
I _z	2790000	mm ⁴
I _y	2790000	mm ⁴
α	0	°
Shear Properties		
A _z	814.902	mm ²
A _y	814.902	mm ²
	mm	
	mm	
Torsion Properties		
J	4390000	mm ⁴
r	56.238	mm

Shape	Material	E (MPa)	ν	ρ (kg/m ³)
100x5.0 SHS	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	200000.29		7850



Nodal Results

Load Combination #1: ULS: STR (Unfavourable)
= 1.35×(DL) + 1.5×(LL) + 1.35×(SW1)

NODE REACTIONS (kN, kN-m)

Support ID	Node	X Force	Y Force	Z Force	X Moment	Y Moment	Z Moment
1	3	1.19	11.05	0.00	0.00	0.00	-1.08
2	4	-1.19	8.83	0.00	0.00	0.00	1.15
	Reaction Sum	-0.00	19.88	0.00			
	Load Sum	0.00	-19.88	0.00			
	Equilibrium	-0.00	0.00	0.00			

MEMBER END FORCES AND MOMENTS (kN, kN-m)

Member	Node	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	1.19	10.51	0.00	0.00	0.00	-2.26
	2	1.19	-8.28	0.00	0.00	0.00	-2.19
2	3	11.05	-1.19	0.00	0.00	0.00	1.08
	1	10.51	-1.19	0.00	0.00	0.00	-2.26
3	4	8.83	1.19	0.00	0.00	0.00	-1.15
	2	8.28	1.19	0.00	0.00	0.00	2.19

NODAL DISPLACEMENTS (mm)

Node	X Translation	Y Translation	Z Translation	Total Translation
1	0.25	-0.08	0.00	0.26
2	0.24	-0.06	0.00	0.25
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00

Load Combination #2: SLS: Characteristic
= (DL) + (LL) + (SW1)

NODE REACTIONS (kN, kN-m)

Support ID	Node	X Force	Y Force	Z Force	X Moment	Y Moment	Z Moment
1	3	0.84	7.79	0.00	0.00	0.00	-0.76
2	4	-0.84	6.22	0.00	0.00	0.00	0.81
	Reaction Sum	-0.00	14.01	0.00			
	Load Sum	0.00	-14.01	0.00			
	Equilibrium	-0.00	-0.00	0.00			

MEMBER END FORCES AND MOMENTS (kN, kN-m)

Member	Node	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.84	7.39	0.00	0.00	0.00	-1.59
	2	0.84	-5.82	0.00	0.00	0.00	-1.54
2	3	7.79	-0.84	0.00	0.00	0.00	0.76
	1	7.39	-0.84	0.00	0.00	0.00	-1.59
3	4	6.22	0.84	0.00	0.00	0.00	-0.81
	2	5.82	0.84	0.00	0.00	0.00	1.54

NODAL DISPLACEMENTS (mm)

Node	X Translation	Y Translation	Z Translation	Total Translation
1	0.17	-0.06	0.00	0.18
2	0.17	-0.05	0.00	0.17
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00

Member Results

Load Combination #1: ULS: STR (Unfavourable)
= 1.35×(DL) + 1.5×(LL) + 1.35×(SW1)

INTERNAL MEMBER FORCES AND MOMENTS (m, kN, kN-m)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	1.19	10.51	0.00	0.00	0.00	-2.26
1	1	0.54	1.19	9.08	0.00	0.00	0.00	3.01
1	1	1.07	1.19	7.64	0.00	0.00	0.00	7.50
1	1	1.50	1.19	6.49	0.00	0.00	0.00	10.54
1	1	1.61	1.19	-1.11	0.00	0.00	0.00	10.43
1	1	2.15	1.19	-2.55	0.00	0.00	0.00	9.45
1	1	2.69	1.19	-3.98	0.00	0.00	0.00	7.70
1	1	3.23	1.19	-5.41	0.00	0.00	0.00	5.17
1	1	3.76	1.19	-6.85	0.00	0.00	0.00	1.88
1	1	4.30	1.19	-8.28	0.00	0.00	0.00	-2.19
2	16	0.00	11.05	-1.19	0.00	0.00	0.00	1.08
2	16	0.35	10.99	-1.19	0.00	0.00	0.00	0.66
2	16	0.70	10.92	-1.19	0.00	0.00	0.00	0.24
2	16	1.05	10.85	-1.19	0.00	0.00	0.00	-0.17
2	16	1.40	10.78	-1.19	0.00	0.00	0.00	-0.59
2	16	1.75	10.71	-1.19	0.00	0.00	0.00	-1.01
2	16	2.10	10.65	-1.19	0.00	0.00	0.00	-1.42
2	16	2.45	10.58	-1.19	0.00	0.00	0.00	-1.84
2	16	2.80	10.51	-1.19	0.00	0.00	0.00	-2.26
3	16	0.00	8.83	1.19	0.00	0.00	0.00	-1.15
3	16	0.35	8.76	1.19	0.00	0.00	0.00	-0.73
3	16	0.70	8.69	1.19	0.00	0.00	0.00	-0.31
3	16	1.05	8.62	1.19	0.00	0.00	0.00	0.11
3	16	1.40	8.55	1.19	0.00	0.00	0.00	0.52
3	16	1.75	8.49	1.19	0.00	0.00	0.00	0.94
3	16	2.10	8.42	1.19	0.00	0.00	0.00	1.36
3	16	2.45	8.35	1.19	0.00	0.00	0.00	1.77
3	16	2.80	8.28	1.19	0.00	0.00	0.00	2.19

GROUPS SUMMARY - INTERNAL MEMBER FORCES AND MOMENTS (kN, kN-m)

Group Name	Type	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
N/A							

MEMBER DISPLACEMENTS (m, mm, rad)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Station Location	Global X Translation	Global Y Translation	Global Z Translation	Total Translation	Global X Rotation	Global Y Rotation	Global Z Rotation
1	0.00	0.25	-0.08	0.00	0.26	0.00	0.00	-0.00
1	0.54	0.25	-1.69	0.00	1.71	0.00	0.00	-0.00
1	1.07	0.24	-3.10	0.00	3.11	0.00	0.00	-0.00
1	1.50	0.24	-3.87	0.00	3.88	0.00	0.00	-0.00
1	1.61	0.24	-3.99	0.00	4.00	0.00	0.00	-0.00
1	2.15	0.24	-4.20	0.00	4.21	0.00	0.00	0.00
1	2.69	0.24	-3.77	0.00	3.77	0.00	0.00	0.00
1	3.23	0.24	-2.81	0.00	2.82	0.00	0.00	0.00
1	3.76	0.24	-1.50	0.00	1.52	0.00	0.00	0.00
1	4.30	0.24	-0.06	0.00	0.25	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.35	-0.10	-0.01	0.00	0.10	0.00	0.00	0.00
2	0.70	-0.35	-0.02	0.00	0.35	0.00	0.00	0.00
2	1.05	-0.65	-0.03	0.00	0.65	0.00	0.00	0.00
2	1.40	-0.91	-0.04	0.00	0.92	0.00	0.00	0.00
2	1.75	-1.05	-0.05	0.00	1.05	0.00	0.00	0.00
2	2.10	-0.96	-0.06	0.00	0.96	0.00	0.00	-0.00
2	2.45	-0.56	-0.07	0.00	0.56	0.00	0.00	-0.00
2	2.80	0.25	-0.08	0.00	0.26	0.00	0.00	-0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.35	0.11	-0.01	0.00	0.11	0.00	0.00	-0.00
3	0.70	0.38	-0.02	0.00	0.38	0.00	0.00	-0.00
3	1.05	0.72	-0.02	0.00	0.72	0.00	0.00	-0.00
3	1.40	1.04	-0.03	0.00	1.04	0.00	0.00	-0.00
3	1.75	1.24	-0.04	0.00	1.24	0.00	0.00	-0.00
3	2.10	1.23	-0.05	0.00	1.23	0.00	0.00	0.00
3	2.45	0.93	-0.06	0.00	0.93	0.00	0.00	0.00
3	2.80	0.24	-0.06	0.00	0.25	0.00	0.00	0.00

MEMBER LOCAL DISPLACEMENTS (m, mm, rad)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Station Location	Local X Translation	Local Y Translation	Local Z Translation	Local X Rotation	Local Y Rotation	Local Z Rotation
1	0.00	0.25	-0.08	0.00	0.00	0.00	-0.00
1	0.54	0.25	-1.69	0.00	0.00	0.00	-0.00
1	1.07	0.24	-3.10	0.00	0.00	0.00	-0.00
1	1.50	0.24	-3.87	0.00	0.00	0.00	-0.00
1	1.61	0.24	-3.99	0.00	0.00	0.00	-0.00
1	2.15	0.24	-4.20	0.00	0.00	0.00	0.00
1	2.69	0.24	-3.77	0.00	0.00	0.00	0.00
1	3.23	0.24	-2.81	0.00	0.00	0.00	0.00
1	3.76	0.24	-1.50	0.00	0.00	0.00	0.00
1	4.30	0.24	-0.06	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.35	-0.01	0.10	0.00	0.00	0.00	0.00
2	0.70	-0.02	0.35	0.00	0.00	0.00	0.00
2	1.05	-0.03	0.65	0.00	0.00	0.00	0.00
2	1.40	-0.04	0.91	0.00	0.00	0.00	0.00
2	1.75	-0.05	1.05	0.00	0.00	0.00	0.00
2	2.10	-0.06	0.96	0.00	0.00	0.00	-0.00
2	2.45	-0.07	0.56	0.00	0.00	0.00	-0.00
2	2.80	-0.08	-0.25	0.00	0.00	0.00	-0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.35	-0.01	-0.11	0.00	0.00	0.00	-0.00
3	0.70	-0.02	-0.38	0.00	0.00	0.00	-0.00
3	1.05	-0.02	-0.72	0.00	0.00	0.00	-0.00
3	1.40	-0.03	-1.04	0.00	0.00	0.00	-0.00
3	1.75	-0.04	-1.24	0.00	0.00	0.00	-0.00
3	2.10	-0.05	-1.23	0.00	0.00	0.00	0.00
3	2.45	-0.06	-0.93	0.00	0.00	0.00	0.00
3	2.80	-0.06	-0.24	0.00	0.00	0.00	0.00

MEMBER DISPLACEMENT SPAN CHECK (m, mm)

Member	Length	Max Relative Displacement	Span Method 1	Span Method 2
1	4.30	4.13	L/1041	L/1041
2	2.80	1.20	L/2329	L/2329
3	2.80	1.09	L/2573	L/2573

MEMBER STRESSES (m, MPa)

■ = Maximum value of a result in the member/plate.
■ = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Torsion	Top Mom Z Btm Mom Z	Top Mom Y Btm Mom Y	Max Combined Normal Min Combined Normal	Shear Y Shear Z	Shear Total
1	1	0.00	0.41	-10.90	0.00	11.31	10.84	10.84
			0.00	10.90	0.00	-10.50	3.64	
1	1	0.54	0.41	14.51	0.00	14.91	9.36	9.36
			0.00	-14.51	0.00	-14.10	3.14	
1	1	1.07	0.41	36.19	0.00	36.60	7.88	7.88
			0.00	-36.19	0.00	-35.79	2.65	
1	1	1.50	0.41	50.86	0.00	51.27	6.70	6.70
			0.00	-50.86	0.00	-50.46	2.25	
1	1	1.61	0.41	50.36	0.00	50.77	-1.15	1.15
			0.00	-50.36	0.00	-49.96	-0.38	
1	1	2.15	0.41	45.62	0.00	46.02	-2.63	2.63
			0.00	-45.62	0.00	-45.21	-0.88	
1	1	2.69	0.41	37.15	0.00	37.56	-4.10	4.10
			0.00	-37.15	0.00	-36.75	-1.38	
1	1	3.23	0.41	24.96	0.00	25.37	-5.58	5.58
			0.00	-24.96	0.00	-24.56	-1.87	
1	1	3.76	0.41	9.06	0.00	9.46	-7.06	7.06
			0.00	-9.06	0.00	-8.65	-2.37	
1	1	4.30	0.41	-10.57	0.00	10.97	-8.54	8.54
			0.00	10.57	0.00	-10.16	-2.87	
2	16	0.00	5.91	19.29	0.00	25.20	-1.45	1.45
			0.00	-19.29	0.00	-13.38	-1.02	
2	16	0.35	5.88	11.82	0.00	17.70	-1.45	1.45
			0.00	-11.82	0.00	-5.95	-1.02	
2	16	0.70	5.84	4.35	0.00	10.19	-1.45	1.45
			0.00	-4.35	0.00	1.49	-1.02	
2	16	1.05	5.80	-3.12	0.00	8.92	-1.45	1.45
			0.00	3.12	0.00	2.68	-1.02	
2	16	1.40	5.77	-10.59	0.00	16.36	-1.45	1.45
			0.00	10.59	0.00	-4.82	-1.02	
2	16	1.75	5.73	-18.06	0.00	23.79	-1.45	1.45
			0.00	18.06	0.00	-12.33	-1.02	
2	16	2.10	5.69	-25.53	0.00	31.23	-1.45	1.45
			0.00	25.53	0.00	-19.84	-1.02	
2	16	2.45	5.66	-33.00	0.00	38.66	-1.45	1.45
			0.00	33.00	0.00	-27.35	-1.02	
2	16	2.80	5.62	-40.47	0.00	46.09	-1.45	1.45
			0.00	40.47	0.00	-34.85	-1.02	
3	16	0.00	4.72	-20.53	0.00	25.25	1.45	1.45
			0.00	20.53	0.00	-15.81	1.02	
3	16	0.35	4.68	-13.06	0.00	17.74	1.45	1.45
			0.00	13.06	0.00	-8.37	1.02	
3	16	0.70	4.65	-5.59	0.00	10.23	1.45	1.45
			0.00	5.59	0.00	-0.94	1.02	
3	16	1.05	4.61	1.88	0.00	6.49	1.45	1.45
			0.00	-1.88	0.00	2.73	1.02	
3	16	1.40	4.57	9.35	0.00	13.93	1.45	1.45
			0.00	-9.35	0.00	-4.78	1.02	
3	16	1.75	4.54	16.82	0.00	21.36	1.45	1.45
			0.00	-16.82	0.00	-12.29	1.02	
3	16	2.10	4.50	24.30	0.00	28.80	1.45	1.45
			0.00	-24.30	0.00	-19.79	1.02	
3	16	2.45	4.47	31.77	0.00	36.23	1.45	1.45
			0.00	-31.77	0.00	-27.30	1.02	
3	16	2.80	4.43	39.24	0.00	43.67	1.45	1.45
			0.00	-39.24	0.00	-34.81	1.02	

Load Combination #2: SLS: Characteristic
= (DL) + (LL) + (SW1)

INTERNAL MEMBER FORCES AND MOMENTS (m, kN, kN-m)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
1	1	0.00	0.84	7.39	0.00	0.00	0.00	-1.59
1	1	0.54	0.84	6.38	0.00	0.00	0.00	2.11
1	1	1.07	0.84	5.37	0.00	0.00	0.00	5.27
1	1	1.50	0.84	4.56	0.00	0.00	0.00	7.40
1	1	1.61	0.84	-0.78	0.00	0.00	0.00	7.33
1	1	2.15	0.84	-1.79	0.00	0.00	0.00	6.64
1	1	2.69	0.84	-2.80	0.00	0.00	0.00	5.41
1	1	3.23	0.84	-3.80	0.00	0.00	0.00	3.64
1	1	3.76	0.84	-4.81	0.00	0.00	0.00	1.32
1	1	4.30	0.84	-5.82	0.00	0.00	0.00	-1.54
2	16	0.00	7.79	-0.84	0.00	0.00	0.00	0.76
2	16	0.35	7.74	-0.84	0.00	0.00	0.00	0.46
2	16	0.70	7.69	-0.84	0.00	0.00	0.00	0.17
2	16	1.05	7.64	-0.84	0.00	0.00	0.00	-0.12
2	16	1.40	7.59	-0.84	0.00	0.00	0.00	-0.42
2	16	1.75	7.54	-0.84	0.00	0.00	0.00	-0.71
2	16	2.10	7.49	-0.84	0.00	0.00	0.00	-1.00
2	16	2.45	7.44	-0.84	0.00	0.00	0.00	-1.29
2	16	2.80	7.39	-0.84	0.00	0.00	0.00	-1.59
3	16	0.00	6.22	0.84	0.00	0.00	0.00	-0.81
3	16	0.35	6.17	0.84	0.00	0.00	0.00	-0.51
3	16	0.70	6.12	0.84	0.00	0.00	0.00	-0.22
3	16	1.05	6.07	0.84	0.00	0.00	0.00	0.07
3	16	1.40	6.02	0.84	0.00	0.00	0.00	0.37
3	16	1.75	5.97	0.84	0.00	0.00	0.00	0.66
3	16	2.10	5.92	0.84	0.00	0.00	0.00	0.95
3	16	2.45	5.87	0.84	0.00	0.00	0.00	1.25
3	16	2.80	5.82	0.84	0.00	0.00	0.00	1.54

GROUPS SUMMARY - INTERNAL MEMBER FORCES AND MOMENTS (kN, kN-m)

Group Name	Type	Axial Force	Y Shear	Z Shear	X Torsion	Y Moment	Z Moment
N/A							

MEMBER DISPLACEMENTS (m, mm, rad)

Maximum value of a result in the member/plate.
Minimum value of a result in the member/plate.

Member	Station Location	Global X Translation	Global Y Translation	Global Z Translation	Total Translation	Global X Rotation	Global Y Rotation	Global Z Rotation
1	0.00	0.17	-0.06	0.00	0.18	0.00	0.00	-0.00
1	0.54	0.17	-1.19	0.00	1.20	0.00	0.00	-0.00
1	1.07	0.17	-2.18	0.00	2.18	0.00	0.00	-0.00
1	1.50	0.17	-2.72	0.00	2.72	0.00	0.00	-0.00
1	1.61	0.17	-2.81	0.00	2.81	0.00	0.00	-0.00
1	2.15	0.17	-2.95	0.00	2.96	0.00	0.00	0.00
1	2.69	0.17	-2.65	0.00	2.65	0.00	0.00	0.00
1	3.23	0.17	-1.97	0.00	1.98	0.00	0.00	0.00
1	3.76	0.17	-1.05	0.00	1.07	0.00	0.00	0.00
1	4.30	0.17	-0.05	0.00	0.17	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.35	-0.07	-0.01	0.00	0.07	0.00	0.00	0.00
2	0.70	-0.25	-0.01	0.00	0.25	0.00	0.00	0.00
2	1.05	-0.46	-0.02	0.00	0.46	0.00	0.00	0.00
2	1.40	-0.64	-0.03	0.00	0.64	0.00	0.00	0.00
2	1.75	-0.74	-0.04	0.00	0.74	0.00	0.00	0.00
2	2.10	-0.67	-0.04	0.00	0.68	0.00	0.00	-0.00
2	2.45	-0.39	-0.05	0.00	0.40	0.00	0.00	-0.00
2	2.80	0.17	-0.06	0.00	0.18	0.00	0.00	-0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.35	0.08	-0.01	0.00	0.08	0.00	0.00	-0.00
3	0.70	0.27	-0.01	0.00	0.27	0.00	0.00	-0.00
3	1.05	0.51	-0.02	0.00	0.51	0.00	0.00	-0.00
3	1.40	0.73	-0.02	0.00	0.73	0.00	0.00	-0.00
3	1.75	0.87	-0.03	0.00	0.87	0.00	0.00	-0.00
3	2.10	0.87	-0.03	0.00	0.87	0.00	0.00	0.00
3	2.45	0.65	-0.04	0.00	0.65	0.00	0.00	0.00
3	2.80	0.17	-0.05	0.00	0.17	0.00	0.00	0.00

MEMBER LOCAL DISPLACEMENTS (m, mm, rad)

 = Maximum value of a result in the member/plate.
 = Minimum value of a result in the member/plate.

Member	Station Location	Local X Translation	Local Y Translation	Local Z Translation	Local X Rotation	Local Y Rotation	Local Z Rotation
1	0.00	0.17	-0.06	0.00	0.00	0.00	-0.00
1	0.54	0.17	-1.19	0.00	0.00	0.00	-0.00
1	1.07	0.17	-2.18	0.00	0.00	0.00	-0.00
1	1.50	0.17	-2.72	0.00	0.00	0.00	-0.00
1	1.61	0.17	-2.81	0.00	0.00	0.00	-0.00
1	2.15	0.17	-2.95	0.00	0.00	0.00	0.00
1	2.69	0.17	-2.65	0.00	0.00	0.00	0.00
1	3.23	0.17	-1.97	0.00	0.00	0.00	0.00
1	3.76	0.17	-1.05	0.00	0.00	0.00	0.00
1	4.30	0.17	-0.05	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.35	-0.01	0.07	0.00	0.00	0.00	0.00
2	0.70	-0.01	0.25	0.00	0.00	0.00	0.00
2	1.05	-0.02	0.46	0.00	0.00	0.00	0.00
2	1.40	-0.03	0.64	0.00	0.00	0.00	0.00
2	1.75	-0.04	0.74	0.00	0.00	0.00	0.00
2	2.10	-0.04	0.67	0.00	0.00	0.00	-0.00
2	2.45	-0.05	0.39	0.00	0.00	0.00	-0.00
2	2.80	-0.06	-0.17	0.00	0.00	0.00	-0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.35	-0.01	-0.08	0.00	0.00	0.00	-0.00
3	0.70	-0.01	-0.27	0.00	0.00	0.00	-0.00
3	1.05	-0.02	-0.51	0.00	0.00	0.00	-0.00
3	1.40	-0.02	-0.73	0.00	0.00	0.00	-0.00
3	1.75	-0.03	-0.87	0.00	0.00	0.00	-0.00
3	2.10	-0.03	-0.87	0.00	0.00	0.00	0.00
3	2.45	-0.04	-0.65	0.00	0.00	0.00	0.00
3	2.80	-0.05	-0.17	0.00	0.00	0.00	0.00

MEMBER DISPLACEMENT SPAN CHECK (m, mm)

Member	Length	Max Relative Displacement	Span Method 1	Span Method 2
1	4.30	2.90	L/1481	L/1481
2	2.80	0.84	L/3315	L/3315
3	2.80	0.76	L/3661	L/3661

MEMBER STRESSES (m, MPa)

■ = Maximum value of a result in the member/plate.
■ = Minimum value of a result in the member/plate.

Member	Section	Station Location	Axial Torsion	Top Mom Z Btm Mom Z	Top Mom Y Btm Mom Y	Max Combined Normal Min Combined Normal	Shear Y Shear Z	Shear Total
1	1	0.00	0.28	-7.66	0.00	7.94	7.62	7.62
			0.00	7.66	0.00	-7.38	2.56	
1	1	0.54	0.28	10.19	0.00	10.48	6.58	6.58
			0.00	-10.19	0.00	-9.91	2.21	
1	1	1.07	0.28	25.43	0.00	25.72	5.54	5.54
			0.00	-25.43	0.00	-25.15	1.86	
1	1	1.50	0.28	35.74	0.00	36.02	4.70	4.70
			0.00	-35.74	0.00	-35.45	1.58	
1	1	1.61	0.28	35.39	0.00	35.67	-0.80	0.80
			0.00	-35.39	0.00	-35.10	-0.27	
1	1	2.15	0.28	32.06	0.00	32.34	-1.84	1.84
			0.00	-32.06	0.00	-31.77	-0.62	
1	1	2.69	0.28	26.11	0.00	26.40	-2.88	2.88
			0.00	-26.11	0.00	-25.83	-0.97	
1	1	3.23	0.28	17.55	0.00	17.83	-3.92	3.92
			0.00	-17.55	0.00	-17.26	-1.32	
1	1	3.76	0.28	6.37	0.00	6.65	-4.96	4.96
			0.00	-6.37	0.00	-6.08	-1.67	
1	1	4.30	0.28	-7.43	0.00	7.71	-6.00	6.00
			0.00	7.43	0.00	-7.14	-2.02	
2	16	0.00	4.17	13.56	0.00	17.72	-1.02	1.02
			0.00	-13.56	0.00	-9.39	-0.72	
2	16	0.35	4.14	8.31	0.00	12.45	-1.02	1.02
			0.00	-8.31	0.00	-4.17	-0.72	
2	16	0.70	4.11	3.06	0.00	7.17	-1.02	1.02
			0.00	-3.06	0.00	1.05	-0.72	
2	16	1.05	4.08	-2.19	0.00	6.28	-1.02	1.02
			0.00	2.19	0.00	1.89	-0.72	
2	16	1.40	4.06	-7.44	0.00	11.50	-1.02	1.02
			0.00	7.44	0.00	-3.38	-0.72	
2	16	1.75	4.03	-12.69	0.00	16.72	-1.02	1.02
			0.00	12.69	0.00	-8.66	-0.72	
2	16	2.10	4.00	-17.94	0.00	21.95	-1.02	1.02
			0.00	17.94	0.00	-13.94	-0.72	
2	16	2.45	3.98	-23.19	0.00	27.17	-1.02	1.02
			0.00	23.19	0.00	-19.22	-0.72	
2	16	2.80	3.95	-28.44	0.00	32.39	-1.02	1.02
			0.00	28.44	0.00	-24.49	-0.72	
3	16	0.00	3.33	-14.43	0.00	17.76	1.02	1.02
			0.00	14.43	0.00	-11.10	0.72	
3	16	0.35	3.30	-9.18	0.00	12.48	1.02	1.02
			0.00	9.18	0.00	-5.87	0.72	
3	16	0.70	3.27	-3.93	0.00	7.20	1.02	1.02
			0.00	3.93	0.00	-0.65	0.72	
3	16	1.05	3.25	1.32	0.00	4.57	1.02	1.02
			0.00	-1.32	0.00	1.92	0.72	
3	16	1.40	3.22	6.57	0.00	9.79	1.02	1.02
			0.00	-6.57	0.00	-3.35	0.72	
3	16	1.75	3.19	11.82	0.00	15.02	1.02	1.02
			0.00	-11.82	0.00	-8.63	0.72	
3	16	2.10	3.17	17.07	0.00	20.24	1.02	1.02
			0.00	-17.07	0.00	-13.91	0.72	
3	16	2.45	3.14	22.32	0.00	25.46	1.02	1.02
			0.00	-22.32	0.00	-19.18	0.72	
3	16	2.80	3.11	27.57	0.00	30.69	1.02	1.02
			0.00	-27.57	0.00	-24.46	0.72	

Member Buckling Results

Load Combination #1: ULS: STR (Unfavourable) = 1.35×(DL) + 1.5×(LL) + 1.35×(SW1)

BUCKLING (kN, MPa, m)

Note: A buckling load factor of less than 1 indicates buckling is occurring.

Buckling Load Factor (Mode 1):

17.268

Max Translation at Member ? in the ?-axis.

Max Rotation at Member ? in the ?-axis.

Use Parabolic Johnson Formula for Critical Stress: NO

Member	Critical Load	Critical Stress	Actual Load	Actual Stress	Actual Length	Effective Length z	Effective Length y
1	20.57	7.00	1.19	0.41	4.30	44.95	12.55
2	190.89	102.08	11.05	5.91	2.80	5.37	5.37
3	152.42	81.51	8.83	4.72	2.80	6.01	6.01

Load Combination #2: SLS: Characteristic = (DL) + (LL) + (SW1)

BUCKLING (kN, MPa, m)

Note: A buckling load factor of less than 1 indicates buckling is occurring.

Buckling Load Factor (Mode 1):

24.547

Max Translation at Member ? in the ?-axis.

Max Rotation at Member ? in the ?-axis.

Use Parabolic Johnson Formula for Critical Stress: NO

Member	Critical Load	Critical Stress	Actual Load	Actual Stress	Actual Length	Effective Length z	Effective Length y
1	20.55	6.99	0.84	0.28	4.30	44.97	12.55
2	191.21	102.25	7.79	4.17	2.80	5.37	5.37
3	152.81	81.71	6.22	3.33	2.80	6.00	6.00

Simplified Analysis Report

Project Name: AUX256 Beam B02 with columns C01

Date: Sun Nov 19 2023 20:00:30 GMT+0000 (Greenwich Mean Time)

Username: marcinkrawucki@gmail.com

Analysis: Buckling Analysis



Result Summary

Check	Limit ⓘ	Governing Result	Utility ⓘ	Comments
Deflection/Span	L/250	L/1481 Member 1 LC#2 - SLS: Characteristic	0.169	Only checked the Load Combinations with 'Serviceability' criteria.
Buckling	1	0.058 LC#1 - ULS: STR (Unfavourable)	0.058	-
Custom Stress Limit	250 MPa	51.268 MPa Member 1 LC#1 - ULS: STR (Unfavourable) Max Combined Normal Stress	0.205	Checked member stresses for any stress values above 250 MPa.
Material Yield	275 MPa	51.268 MPa Member 1 LC#1 - ULS: STR (Unfavourable)	0.186	Checked if each individual member exceeds its Material Yield (275 MPa). 3 members checked in 9 Load Combination(s).
Material Strength	485 MPa	51.268 MPa Member 1 LC#1 - ULS: STR (Unfavourable)	0.106	Checked if each individual member exceeds its Material Strength (485 MPa). 3 members checked in 9 Load Combination(s).
Global Governing Displacement	h/300	h/11350.345 ULS: STR (Unfavourable)	0.026	Checked if the displacement perpendicular to the vertical axis for all nodes exceeds the global deflection limit (h/300), where h is the vertical distance from a node to the lowest support on the model.

Load Summary

Load Combination Name	criteria	DL (Dead: Unfavourable)	LL (Dead: Unfavourable)	SW1 (Dead: Unfavourable)
ULS: STR (Unfavourable)	strength	1.35	1.5	1.35
SLS: Characteristic	serviceability	1	1	1

Note: (Brackets) are the load case names linked to EN standards

Envelope results were also generated, based on the worst result in each member.

Reaction Summary (Envelope Results)

Node ID	Fixity	X (kN)	Y (kN)	Z (kN)	M _x (kN-m)	M _y (kN-m)	M _z (kN-m)
3	FFFFFF	1.19105	11.05449	0	0	0	-1.07653
4	FFFFFF	-1.19105	8.8264	0	0	0	1.14552

Materials

Name	Database	Density (kg/m ³)	v	F _y (MPa)	F _u (MPa)
European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	Metric, Steel, European Standard (EN), EN 10025, Grade S275JR, S275J0, S275J2G3, S275J2G4, 3mm ≤ Thickness ≤ 16mm	7850	0.29	275	485
BS EN1995-1-1:2004 - Solid timber - C24	Metric, Wood, BS EN1995-1-1:2004, Solid timber, C24	350	0.4		

Member Stresses (Envelope Results)

Mem. ID	Max Stress (MPa)	Min Stress (MPa)	Material	F _y (MPa)	F _u (MPa)	Custom (MPa)	Utility
1	51.26814	-50.4579	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	275	485	false	0.186
2	46.09375	-34.85275	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	275	485	false	0.168
3	43.66587	-34.80785	European Standard (EN) - EN 10025 - Grade S275JR, S275J0, S275J2G3, S275J2G4 - 3mm ≤ Thickness ≤ 16mm	275	485	false	0.159

Utility calcs are based on Member Stress / Material Strength, where:

Material Strength = min(F_y, F_u, Custom Stress Limit)

Member Stress = max(abs(min), abs(max))



Project:	Calculations for the retaining walls and timber loadbearing walls with		
Adress:	84 Church Street Marthyr Tydfil		
Job No.	AUX256	Sheet	4.1
Date:	19/11/2023	Rev.	C1

Calculation for: Loadings on timber walls

Loadings on the beam:

Dead load:

PITCH ROOF - NO

				Slope		
Concrete tiles	0.75	kN/m ²	on slope	30	0.866	kN/m ² on plan
Battens+felt	0.05	kN/m ²	on slope	30	0.058	kN/m ² on plan
Insulation					0.10	kN/m ² on plan
Ceiling					0.15	kN/m ² on plan
Rafters self weight					0.10	kN/m ² on plan
Pitch roof total					1.27	kN/m²

Flat roof/Lower roof

0.75 kN/m²

SLAB

				Qty of floors		
timber slab	0.75	kN/m ²	x	1	=	0.75 kN/m ²
partitions	0.50	kN/m ²	x	1	=	0.50 kN/m ²
SLAB Total						1.25 kN/m²

Wall above beam

				Height	Thickness	
none	0	kN/m ³	x	0	x	0 m
						0.00 kN/m *stud part.=0kN/m ³ as it is included above

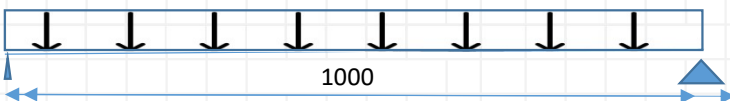
Imposed load

Residential	1.50	kN/m ²	x	1		1.50 kN/m²
Snow						0.6 kN/m²
Wind (down)	1.10	kN/m ²				1.10 kN/m²
Wind (uplift)	1.60	kN/m ²				1.60 kN/m²

	Joists	Roof	Flat roof
joists length on right side:	4.150 m	0.000 m	0.000 m
joists length on left side:	1.520 m	0.000 m	0.000 m

UDL loading on the beam

Dead G _k						
Pitchroof	0.00	kN/m ²	x	(0.000 m + 0.000 m)/ 2	=	0.00 kN/m
Flat roof	0.75	kN/m ²	x	(0.000 m + 0.000 m)/ 2	=	0.00 kN/m
Floor slab	1.25	kN/m ²	x	(4.150 m + 1.520 m)/ 2	=	3.54 kN/m
Wall					=	0.00 kN/m
Imposed						
Residential	1.50	kN/m ²	x	(4.150 m + 1.520 m)/ 2	=	4.25 kN/m
Snow	0.60	kN/m ²	x	(0.000 m + 0.000 m)/ 2	=	0.00 kN/m
Wind (down)	1.10	kN/m ²	x	(0.000 m + 0.000 m)/ 2	=	0.00 kN/m
Wind (uplift)	1.60	kN/m ²	x	(0.000 m + 0.000 m)/ 2	=	0.00 kN/m



G_k= **3.54** kN/m,
Q_k= **4.25** kN/m
Total= **7.80** kN/m

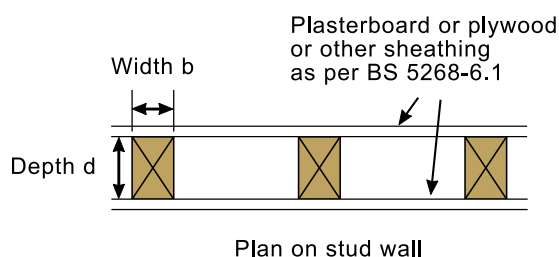
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	Calcs for Loadbearing stud partitions	Date 19 Nov 2023

Internal Timber Stud Wall Design (to BS5268-2:2002)

worst case scenario - wall between utility/store and hall

Timber stud details

Timber strength class	C16
Width	b = 47 mm
Depth	d = 95 mm
Stud spacing	s = 400 mm
Stud wall comprises of 4 or more studs	



Diagrams not to scale

Timber stud wall height details

Stud wall height	$L_{\text{wall}} = \mathbf{2,830 \text{ mm}}$
Stud height	$L = L_{\text{wall}} - (2 \times b) = \mathbf{2,736 \text{ mm}}$
Stud effective height	$L_{\text{eff}} = L \times 0.85 = \mathbf{2,326 \text{ mm}}$
BS 5268-6.1 Clause 4.6.2 recommends $L \times 0.85$ for stud walls restrained by sheathing or plasterboard lining.	

Loading details

Load 1 : Timber floor (domestic dwelling)

Dead load	$F_{d,1} = \mathbf{0.6 \text{ kN/m}^2} \times \mathbf{2.835 \text{ m}} = \mathbf{1.701 \text{ kN/m}}$
Imposed load	$F_{i,1} = \mathbf{1.5 \text{ kN/m}^2} \times \mathbf{2.835 \text{ m}} = \mathbf{4.2525 \text{ kN/m}}$
Total load	$F_{\text{total}} = \mathbf{5.95 \text{ kN/m}}$
Total load per stud	$F = F_{\text{total}} \times s = \mathbf{2.38 \text{ kN}}$

Modification factors

Load duration factor	$K_3 = \mathbf{1.00}$
Bearing modification factor	$K_4 = \mathbf{1.00}$
Load sharing modification factor	$K_8 = \mathbf{1.10}$
Compression member factor (calculated using equation in BS5268-2 Annex B)	$K_{12} = \mathbf{0.48}$

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Section properties

Minimum modulus of elasticity	$E_{min} = 5,800 \text{ N/mm}^2$
Cross sectional area	$A = b \times d = 4,460 \text{ mm}^2$
Second moment of area	$I = b \times d^3 / 12 = 3,360,000 \text{ mm}^4$
Radius of gyration	$i = \sqrt{I / A} = 27.4 \text{ mm}$
Slenderness ratio	$\lambda = L_{eff} / i = 84.80$
	84.8 < 180 therefore OK

Check compression stress parallel to grain on stud

Compression stress parallel to grain	$\sigma_{c,par} = 6.8 \text{ N/mm}^2$
Permissible compression stress	$\sigma_{c,adm} = \sigma_{c,par} \times K_3 \times K_8 \times K_{12} = 3.57 \text{ N/mm}^2$
Applied compression stress	$\sigma_{c,a} = F \times 10^3 / A = 0.533 \text{ N/mm}^2$
	$\sigma_{c,a} \leq \sigma_{c,adm}$ (0.533 N/mm² ≤ 3.573 N/mm²) therefore OK

Check bearing stress perpendicular to grain on rail

Compression stress perpendicular to grain	$\sigma_{t,c,g,perp} = 1.7 \text{ N/mm}^2$
Permissible compression stress perpendicular to grain	$\sigma_{t,c,adm} = \sigma_{t,c,g,perp} \times K_3 \times K_4 = 1.7 \text{ N/mm}^2$
Applied compression stress	$\sigma_{c,a} = F \times 10^3 / A = 0.533 \text{ N/mm}^2$
	$\sigma_{c,a} \leq \sigma_{t,c,adm}$ (0.533 N/mm² ≤ 1.7 N/mm²) therefore OK

Design summary

	Permissible	Applied/Actual	Utilisation	Result
Slenderness ratio	180	84.8	47.1 %	OK
Compression stress parallel to grain on stud (N/mm ²)	3.57	0.53	14.9 %	OK
Bearing stress perpendicular to grain on rail (N/mm ²)	1.7	0.53	31.4 %	OK

Notes

This design is in accordance with BS 5268-2:2002 Structural use of timber – Part 2: Code of practice for permissible stress design, materials and workmanship.

Timber to be covered, this calculation is not to be used for timber which is fully exposed to the elements.

The studs are restrained in the plane of panel by sheathing or plasterboard provided and constructed in accordance with recommendations given in BS 5268-6.1.

The limitations on bow in most strength grading rules are inadequate for the selection of material for columns. Particular attention

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	Calcs for Loadbearing stud partitions	Date 19 Nov 2023

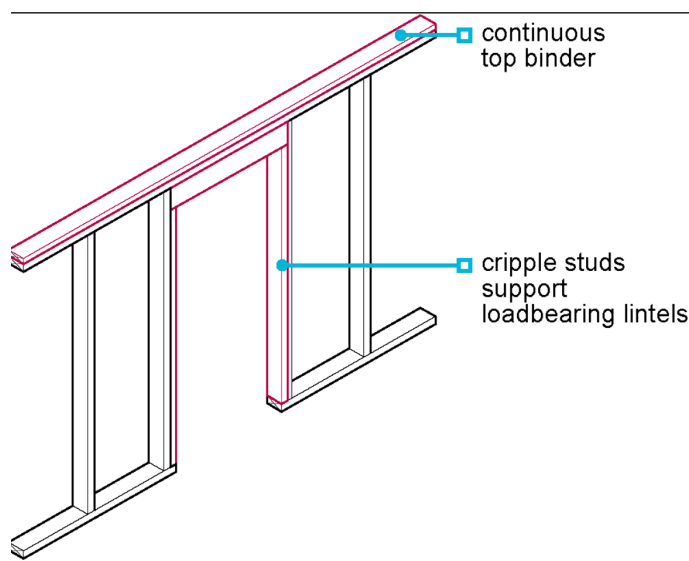
should therefore be paid to the straightness of column, for example, by limiting bow or spring to approximately $1/300$ of the length.

The effect of holes need not be calculated where circular holes with diameters not exceeding 25% of the width of the member are positioned on the neutral axis at between 25% and 40% of the actual length from the end.

These calculations are only applicable for stud walls consisting of four or more studs.

For any door openings in the wall a cripple studs are required on both sides and a lintel

Where internal walls are made up from panels, structural continuity should be maintained, e.g. by the use of a continuous top binder.



Lintels to be 2no 195x47mm C16 for all openings up to 1100mm wide

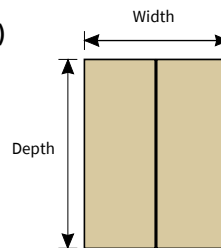
Auxilium Structural Engineering 50 Quarry Row 07465819500 CF47 8PS design@auxiliumse.com	Project 84 Church Street, Merthyr Tydfil	Project ref AUX256
	Calcs for Timber lintel in loadbearing stud partition	Date 19 Nov 2023

Timber Beam Design (BS 5268-2:2002)

this applies for all openings up to 1.1m wide

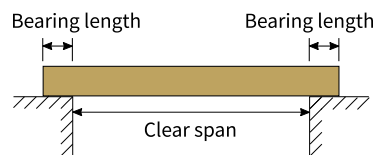
Beam details

Beam	47 x 195 mm (2 x 23.5x195 mm)
Timber strength class	C16
Service class of timber	2
Width	b = 47 mm
Depth	h = 195 mm



Span details

Beam clear span	$L_{cl} = \mathbf{1.1\ m}$
Bearing length	$L_b = \mathbf{50\ mm}$
Beam effective span	$L_{eff} = L_{cl} + (2 \times (L_b / 2)) = \mathbf{1.15\ m}$



Diagrams not to scale

Loading details



Load 1: UDL - Timber floor (domestic dwelling)

Dead load

$$F_{d,1} = 0.6 \text{ kN/m}^2 \times 2.835 \text{ m} = \mathbf{1.701 \text{ kN/m}}$$

Imposed load

$$F_{i,1} = 1.5 \text{ kN/m}^2 \times 2.835 \text{ m} = \mathbf{4.2525 \text{ kN/m}}$$

Reactions (unfactored)

	Dead	Imposed	Total
Left reaction	1.00 kN	2.45 kN	3.44 kN
Right reaction	1.00 kN	2.45 kN	3.44 kN

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Modification factors

Timber service class modification factor K2 as table 16

Bending parallel to grain

$$K_{2,ben} = \mathbf{1.00}$$

Compression perpendicular to grain

$$K_{2,per} = \mathbf{1.00}$$

Shear parallel to grain

$$K_{2,shr} = \mathbf{1.00}$$

Mean & min modulus of elasticity

$$K_{2,mod} = \mathbf{1.00}$$

Load duration factor

$$K_3 = \mathbf{1.00}$$

Bearing modification factor

$$K_4 = \mathbf{1.00}$$

Depth factor (BS5268-2 clause 2.10.6)

$$K_7 = (300 / h)^{0.11} = \mathbf{1.05}$$

Load sharing modification factor (BS5268-2 clause 2.10.11)

$$K_8 = \mathbf{1.10}$$

Modulus of elasticity modification factor (BS5268-2 clause 2.9)

$$K_9 = \mathbf{1.14}$$

Modulus of elasticity

Timber minimum modulus of elasticity

$$E_{min} = \mathbf{5,800 \text{ N/mm}^2}$$

The minimum modulus of elasticity modified by the factor K9 should be used for deflections

$$E = E_{min} \times K_{2,mod} \times K_9 = \mathbf{6,610 \text{ N/mm}^2}$$

Section properties

Area of section

$$\text{Area} = b \times h = \mathbf{9,160 \text{ mm}^2}$$

Inertia of timber about xx axis

$$I_{xx} = b \times h^3 / 12 = \mathbf{29,000,000 \text{ mm}^4}$$

Z to top edge of timber

$$Z = b \times h^2 / 6 = \mathbf{298,000 \text{ mm}^3}$$

Average density for C16 grade timber (BS 5268-2:2002 Table 8)

$$\rho_{mean} = \mathbf{370 \text{ kg/m}^3}$$

Self weight ($g = 9.81 \text{ m/s}^2$)

$$F_{self} = b \times h \times L_{eff} \times \rho_{mean} \times g = \mathbf{38.3 \text{ N}}$$

Section design parameters

Design bending moment

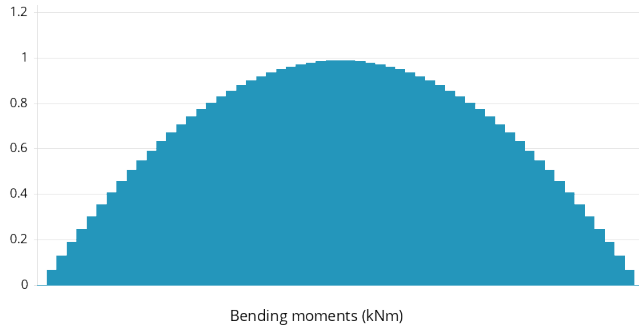
$$M_b = \mathbf{990,000 \text{ Nmm}}$$

Design shear force

$$F_{ve} = \mathbf{3,440 \text{ N}}$$

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	Calcs for Timber lintel in loadbearing stud partition	Date 19 Nov 2023

Check bending stress



Timber grade bending stress parallel to grain (BS5268-2 Table 8)

$$\sigma_{t,m,g,par} = 5.3 \text{ N/mm}^2$$

Permissible timber bending stress (factored)

$$\sigma_{t,m,adm} = \sigma_{t,m,g,par} \times K_{2,ben} \times K_3 \times K_7 \times K_8 = 6.11 \text{ N/mm}^2$$

Maximum bending moment

$$M = 0.99 \text{ kNm}$$

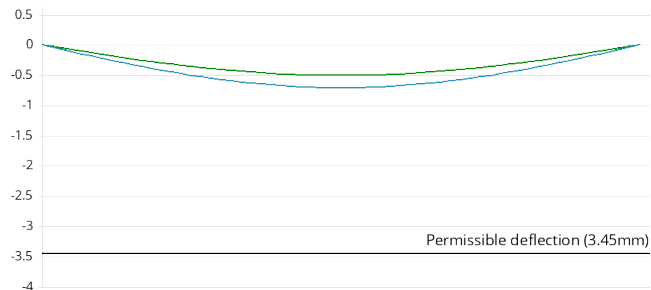
Applied bending stress in timber

$$\sigma_{t,m,max} = M / Z = 3.32 \text{ N/mm}^2$$

Pass $\sigma_{t,m,max} \leq \sigma_{t,m,adm}$ ($3.323 \text{ N/mm}^2 \leq 6.113 \text{ N/mm}^2$) applied bending stress in timber within permissible

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	Calcs for Timber lintel in loadbearing stud partition	Date 19 Nov 2023

Check deflection (including shear deflection as required by clause 2.10.7)



Live load deflection (green) and total load deflection (blue) in mm

Deflection based on $E = 6612 \text{ N/mm}^2$

Dead load deflection without shear

$$\delta_d = \mathbf{0.206 \text{ mm}}$$

Imposed load deflection without shear

$$\delta_i = \mathbf{0.504 \text{ mm}}$$

Total dead & imposed load deflection

$$\delta_t = \mathbf{0.71 \text{ mm}}$$

Modulus of rigidity

$$G = E / 16 = \mathbf{413 \text{ N/mm}^2}$$

Shape factor for rectangular section

$$K_F = \mathbf{1.2}$$

Shear area for beam

$$A_y = EA / K_F = \mathbf{7,640 \text{ mm}^2}$$

Total dead & imposed load

$$WT = \mathbf{6.88 \text{ kN}}$$

If total dead & imposed load applied as a UDL, additional deflection due to shear

$$\delta_{su} = WT \times L_{eff} \times 10^6 / (8 \times A_y \times G) = \mathbf{0.314 \text{ mm}}$$

Shear deflection

$$\delta_{shear} = \delta_{su} \times M / (WT \times L_{eff} / 8) = \mathbf{0.314 \text{ mm}}$$

Permissible deflection

$$\delta_{adm} = 0.003 \times L_{eff} \times 10^3 = \mathbf{3.45 \text{ mm}}$$

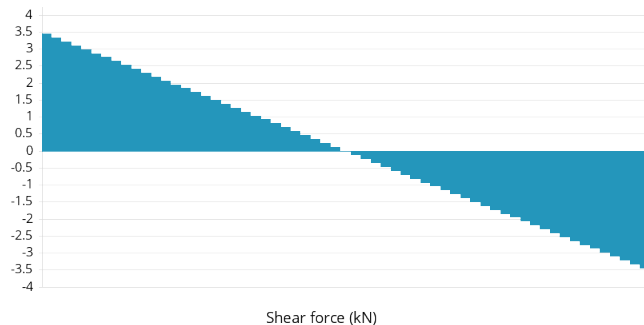
Total deflection inclusive of shear

$$\delta_{max} = \delta_d + \delta_i + \delta_{shear} = \mathbf{1.02 \text{ mm}}$$

Pass $\delta_{max} \leq \delta_{adm}$ ($1.02 \text{ mm} \leq 3.45 \text{ mm}$), therefore OK for deflection

Auxilium Structural Engineering 50 Quarry Row 07465819500 CF47 8PS design@auxiliumse.com	Project 84 Church Street, Merthyr Tydfil	Project ref AUX256
	Calcs for Timber lintel in loadbearing stud partition	Date 19 Nov 2023

Check shear stress



No notches to occur at the critical shear position.

Timber grade shear stress parallel to grain (BS5268-2 Table 8)

$$\tau_{t,g,par} = \mathbf{0.67 \text{ N/mm}^2}$$

Permissible shear parallel to grain (factored)

$$\tau_{t,adm} = \tau_{t,g,par} \times K_{2,shr} \times K_3 \times K_8 = \mathbf{0.737 \text{ N/mm}^2}$$

Permissible shear force on timber

$$F_{t,adm} = 2 \times \tau_{t,adm} \times b \times h / 3 = \mathbf{4,500 \text{ N}}$$

Design shear force

$$F_{ve} = \mathbf{3,440 \text{ N}}$$

Pass $F_{ve} \leq F_{t,adm}$ ($3442 \text{ N} \leq 4503 \text{ N}$) shear capacity of timber is greater than applied shear force, therefore OK

Check bearing stress

Timber grade compressive stress perpendicular to grain (BS5268-2 Table 8)

$$\sigma_{t,c,g,\parallel} = \mathbf{1.7 \text{ N/mm}^2}$$

Permissible compressive stress perpendicular to grain (factored)

$$\sigma_{t,c,adm} = \sigma_{t,c,g,\parallel} \times K_{2,per} \times K_3 \times K_4 \times K_8 = \mathbf{1.87 \text{ N/mm}^2}$$

Timber bearing stress on support

$$\sigma_{t,c,max} = F_{ve} / (L_b \times b) = \mathbf{1.46 \text{ N/mm}^2}$$

Pass $\sigma_{t,c,max} \leq \sigma_{t,c,adm}$ ($1.465 \text{ N/mm}^2 \leq 1.87 \text{ N/mm}^2$) bearing stress is less than permissible timber stress, therefore OK

Design summary

	Permissible	Applied/Actual	Utilisation	Result
Shear force (kN)	4.5	3.44	76.4 %	OK
Bending stress (N/mm ²)	6.11	3.32	54.4 %	OK
Bearing stress (N/mm ²)	1.87	1.46	78.3 %	OK
Deflection (mm)	3.45	1.02	29.7 %	OK

Auxilium Structural Engineering 50 Quarry Row 07465819500 CF47 8PS design@auxiliumse.com	Project 84 Church Street, Merthyr Tydfil	Project ref AUX256
	Calcs for Timber lintel in loadbearing stud partition	Date 19 Nov 2023

Notes

Joists to be bolted together with M12 bolts at 600mm spacings.

This design is in accordance with BS 5268-2:2002 Structural use of timber - Part 2: Code of practice for permissible stress design, materials and workmanship.

The depth to width ratio of the timber does not exceed 5 and as per the requirements of BS 5268-2 Table 19 there is no risk of buckling under design load provided; The ends are held in position and compression edge held in line, as by direct connection of sheathing, deck or joists.

Timber to be covered, this calculation is not to be used for timber which is fully exposed to the elements.

Wane as allowed in BS 4978:2007 + A2:2017 is permitted.



Project:	Calculations for the retaining walls and timber loadbearing walls with		
Adress:	84 Church Street		
	Marthyr Tydfil		
Job No.	AUX256	Sheet	7
Date:	19/11/2023	Rev.	C1

Calculation for: **Loadings on slab under columns C01**

Loadings from beam B02 through columns C01 (worst loading)

Vertical load	DL	4.2	kN	LL	3.6	kN	Vertical design load	11.1	kN
Horizontal load	DL	0.3	kN	LL	0.5	kN	Horizontal design load	1.2	kN
moment	DL	0.4	kN	LL	0.4	kN	Design moment	1.1	kNm

From the calculations the pad foundation or a part of the slab should be as below:

Size:	750x750mm
Depth:	300mm
Reinforcement:	mesh A393 T&B
Cover:	min. 25mm to all sides
Concrete:	C25/30

As in the whole slab will be mesh A393 there is no need to add more mesh under the columns



Project:	Calculations for the retaining walls and timber loadbearing walls with		
Address:	84 Church Street		
	Marthyr Tydfil		
Job No.	AUX256	Sheet	7
Date:	19/11/2023	Rev.	C1

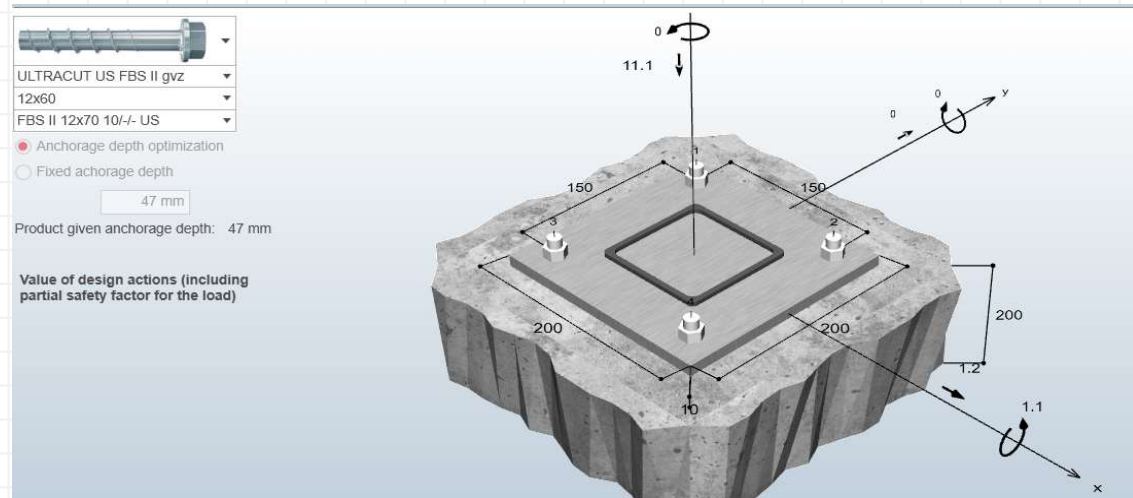
Calculation for: **Loadings on base plate under columns C01**

Loadings from beam B02 through columns C01 (worst loading)

Vertical load	DL	4.2	kN	LL	3.6	kN	Vertical design load	11.1	kN
Horizontal load	DL	0.3	kN	LL	0.5	kN	Horizontal design load	1.2	kN
moment	DL	0.4	kN	LL	0.4	kN	Design moment	1.1	kNm

As per calculations in the Fisher software for the base plate the base plate and the anchors should be as on the below:

Base plate: **200x200x10mm S275**
 Anchors: **4no M12 anchors as shown below**
 Column: **100x100x5mm SHS, grade S275**



as an alternative the below anchors can be used



Base plate details

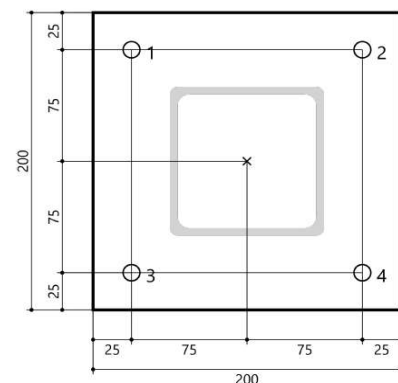
Base plate material S 275
 Base plate thickness $t = 10 \text{ mm}$
 Clearance hole in base plate $d_f = 14 \text{ mm}$

Attachment

Profile type Square tube hot formed (QSH 100x5)

Anchor coordinates

Anchor no.	x mm	y mm
1	-75	75
2	75	75
3	-75	-75
4	75	-75





C-FIX 1.115.0.0
Database version
2023.3.28.8.8
Date
19/11/2023

fischer



AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

Client

Mark Jones

Design Office

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CF47 8PS

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Wallingford; Oxfordshire; OX10 9AT
Phone: 44-(0)-1491 827900
Fax: 44-(0)- 1491 827953
technical@fischer.co.uk
www.fischer.co.uk

Design Specifications

Anchor

Anchor system
Anchor

fischer Bolt anchor FBN II
Bolt anchor FBN II 12/10,
zinc plated steel
65 mm

Calculated anchorage
depth

Design Data

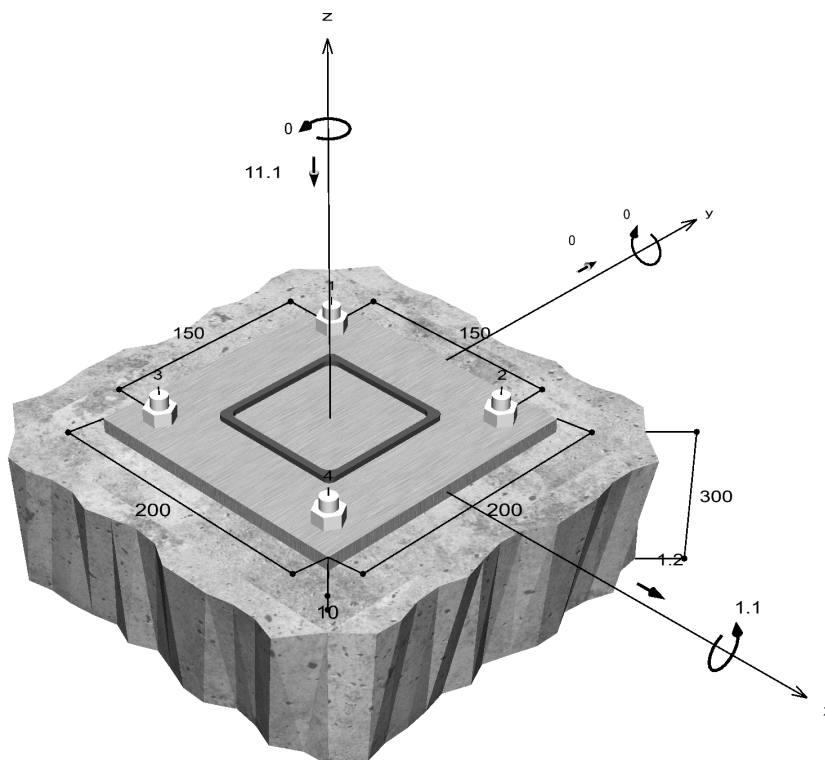
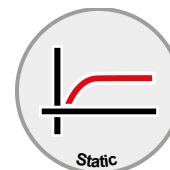
Anchor design in Concrete according European Technical
Assessment ETA-07/0211/ETA-18/0101HDG, Option 7,
Issued 13/07/2020



Geometry / Loads / Scale units

mm, kN, kNm

Value of design actions (including
partial safety factor for the load)



Not drawn to scale

The input values and the design results should be checked against local valid standards and approvals. Please respect the disclaimer of warranty in the license agreement of the Software.



AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

Input data

Design method	EN 1992-4:2018 mechanical fastener
Base material	C25/30, EN 206
Concrete condition	Non-cracked, dry hole
Reinforcement	Normal or no reinforcement. No edge reinforcement
Drilling method	Hammer drilling
Installation type	Push-through installation
Annular gap	Annular gap not filled
Type of loading	Permanent-Transient/Static
Base plate location	Base plate flush installed on base material
Base plate geometry	200 mm x 200 mm x 10 mm
Profile type	Square tube hot formed (QSH 100x5)

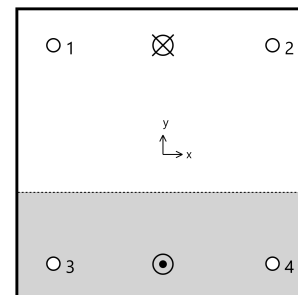
Design actions *)

#	N _{Ed} kN	V _{Ed,x} kN	V _{Ed,y} kN	M _{Ed,x} kNm	M _{Ed,y} kNm	M _{T,Ed} kNm	Type of loading
1	-11.10	1.20	0.00	1.10	0.00	0.00	Permanent-Transient/Static

*) The required partial safety factors for actions are included

Resulting anchor forces

Anchor no.	Tensile action kN	Shear Action kN	Shear Action x kN	Shear Action y kN
1	0.88	0.30	0.30	0.00
2	0.88	0.30	0.30	0.00
3	0.00	0.30	0.30	0.00
4	0.00	0.30	0.30	0.00



max. concrete compressive strain :	0.06 ‰
max. concrete compressive stress :	1.7 N/mm ²
Resulting tensile actions :	1.75 kN , X/Y position (0 / 75)
Resulting compression actions :	12.85 kN , X/Y position (0 / -75)

Resistance to tension loads

Proof	Action kN	Capacity kN	Utilisation β _N %
Steel failure *	0.88	29.71	3.0
Pullout failure *	0.88	19.26	4.6
Concrete cone failure	1.75	34.00	5.2

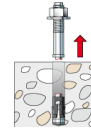
* Most unfavourable anchor



AUX256 84 CHURCH STREET, Merthyr Tydfil, 84 CHURCH STREET, , Merthyr Tydfil, CF47 9HS

Steel failure

$$N_{Ed} \leq \frac{N_{Rk,s}}{\gamma_{Ms}} \quad (N_{Rd,s})$$

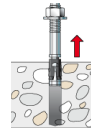


$N_{Rk,s}$ kN	γ_{Ms}	$N_{Rd,s}$ kN	N_{Ed} kN	$\beta_{N,s}$ %
41.60	1.40	29.71	0.88	3.0

Anchor no.	$\beta_{N,s}$ %	Group N°	Decisive Beta
1	3.0	1	$\beta_{N,s;1}$
2	3.0	2	$\beta_{N,s;2}$
3	0.0	3	$\beta_{N,s;3}$
4	0.0	4	$\beta_{N,s;4}$

Pullout failure

$$N_{Ed} \leq \frac{N_{Rk,p}}{\gamma_{Mp}} \quad (N_{Rd,p})$$



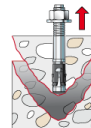
$N_{Rk,p}$ kN	Ψ_c	γ_{Mp}	$N_{Rd,p}$ kN	N_{Ed} kN	$\beta_{N,p}$ %
28.90	1.120	1.50	19.26	0.88	4.6

The given Psi,c-factor may has been determined by interpolation.

Anchor no.	$\beta_{N,p}$ %	Group N°	Decisive Beta
1, 2	4.6	1	$\beta_{N,p;1}$

Concrete cone failure

$$N_{Ed} \leq \frac{N_{Rk,c}}{\gamma_{Mc}} \quad (N_{Rd,c})$$



$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N} \quad \text{Eq. (7.1)}$$

$$N_{Rk,c} = 28.82kN \cdot \frac{67,275mm^2}{38,025mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 50.99kN$$

$$N_{Rk,c}^0 = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 11.0 \cdot \sqrt{25.0N/mm^2} \cdot (65mm)^{1.5} = 28.82kN \quad \text{Eq. (7.2)}$$

$$\Psi_{s,N} = \min\left(1; 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = \min\left(1; 0.7 + 0.3 \cdot \frac{\infty}{98mm}\right) = 1.000 \leq 1 \quad \text{Eq. (7.4)}$$

$$\Psi_{re,N} = 1.000 \quad \text{Eq. (7.5)}$$



AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_p}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1 \quad \text{Eq. (7.6)}$$

$$\Psi_{ec,Nx} = \frac{1}{1 + \frac{2 \cdot 0mm}{195mm}} = 1.000 \leq 1 \quad \Psi_{ec,Ny} = \frac{1}{1 + \frac{2 \cdot 0mm}{195mm}} = 1.000 \leq 1$$

$$\Psi_{M,N} = 1.00 \geq 1 \quad \text{Eq. (7.7)}$$

N_{Rk,c} kN	γ_{Mc}	N_{Rd,c} kN	N_{Ed} kN	β_{N,c} %
50.99	1.50	34.00	1.75	5.2

Anchor no.	β_{N,c} %	Group N°	Decisive Beta
1, 2	5.2	1	β _{N,c;1}

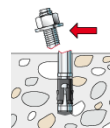
Resistance to shear loads

Proof	Action kN	Capacity kN	Utilisation β_v %
Steel failure without lever arm *	0.30	25.04	1.2
Concrete pry-out failure	1.20	138.34	0.9

* Most unfavourable anchor

Steel failure without lever arm

$$V_{Ed} \leq \frac{V_{Rk,s}}{\gamma_{Ms}} \quad (V_{Rd,s})$$



$$V_{Rk,s} = k_7 \cdot V_{Rk,s}^0 = 1.00 \cdot 31.30kN = 31.30kN \quad \text{Eq. (7.35)/ (7.36)}$$

V_{Rk,s} kN	γ_{Ms}	V_{Rd,s} kN	V_{Ed} kN	β_{Vs} %
31.30	1.25	25.04	0.30	1.2

Anchor no.	β_{Vs} %	Group N°	Decisive Beta
1	1.2	1	β _{Vs;1}
2	1.2	2	β _{Vs;2}
3	1.2	3	β _{Vs;3}
4	1.2	4	β _{Vs;4}



AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

Concrete pry-out failure

$$V_{Ed} \leq \frac{V_{Rk,cp}}{\gamma_{Mc}} \quad (V_{Rd,cp})$$



$$V_{Rk,cp} = k_8 \cdot N_{Rk,c} = 2.3 \cdot 90.22kN = 207.51kN$$

Eq. (7.39a)

$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$

Eq. (7.1)

$$N_{Rk,c} = 28.82kN \cdot \frac{119,025mm^2}{38,025mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 90.22kN$$

$$N_{Rk,c}^0 = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 11 \cdot \sqrt{25.0N/mm^2} \cdot (65mm)^{1.5} = 28.82kN$$

Eq. (7.2)

$$\Psi_{s,N} = \min\left(1; 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = \min\left(1; 0.7 + 0.3 \cdot \frac{\infty}{98mm}\right) = 1.000 \leq 1$$

Eq. (7.4)

$$\Psi_{re,N} = 1.000$$

Eq. (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_p}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$

Eq. (7.6)

$$\Psi_{M,N} = 1.00 \geq 1$$

Eq. (7.7)

$V_{Rk,cp}$ kN	γ_{Mc}	$V_{Rd,cp}$ kN	V_{Ed} kN	$\beta_{V,cp}$ %
207.51	1.50	138.34	1.20	0.9

Anchor no.	$\beta_{V,cp}$ %	Group N°	Decisive Beta
1, 2, 3, 4	0.9	1	$\beta_{V,cp;1}$

Utilization of tension and shear loads

Tension loads	Utilisation β_N %
Steel failure *	3.0
Pullout failure *	4.6
Concrete cone failure	5.2

* Most unfavourable anchor

Shear Loads	Utilisation β_V %
Steel failure without lever arm *	1.2
Concrete pry-out failure	0.9



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Resistance to combined tensile and shear loads

Utilisation steel

$$\begin{aligned}\beta_{N,s} &= \beta_{N,s;1} = 0.03 \leq 1 \\ \beta_{V,s} &= \beta_{V,s;1} = 0.01 \leq 1 \\ \beta_N^2 + \beta_V^2 &= \beta_{N,s;1}^2 + \beta_{V,s;1}^2 = 0.00 \leq 1\end{aligned}$$

Eq. (7.55)



Proof successful

Utilisation concrete

$$\begin{aligned}\beta_{N,c} &= \beta_{N,c;1} = 0.05 \leq 1 \\ \beta_{V,cp} &= \beta_{V,cp;1} = 0.01 \leq 1 \\ \beta_N^{1.5} + \beta_V^{1.5} &= \beta_{N,c;1}^{1.5} + \beta_{V,cp;1}^{1.5} = 0.01 \leq 1\end{aligned}$$

Eq. (7.56)

Information concerning the anchor plate

Base plate details

Plate thickness specified by user without proof

t = 10 mm

Profile type

Square tube hot formed (QSH 100x5)

Technical remarks

The transmission of the anchor loads to the supports of the concrete member shall be shown for the ultimate limit state and the serviceability limit state; for this purpose, the normal verifications shall be carried out under due consideration of the actions introduced by the anchors. For these verifications the additional provisions given in the current design method shall be taken into account.

As a pre-condition the anchor plate is assumed to be flat when subjected to the actions. Therefore, the plate (if present) must be sufficiently stiff. The C-Fix anchor plate design is based on a proof of stresses and does not allow a statement about the stiffness of the plate. The proof of the necessary stiffness is not carried out by C-Fix.



C-FIX 1.115.0.0
Database version
2023.3.28.8.8
Date
19/11/2023

AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

Installation data

Anchor

Anchor system

Anchor

fischer Bolt anchor FBN II

Bolt anchor FBN II 12/10,
zinc plated steel

Art.-No. 40950



Accessories

Blow-out pump ABG big
SDS Plus-V II 12/110/160
or alternatively
FHD 12/200/330
Hammer drilling with or without
suction

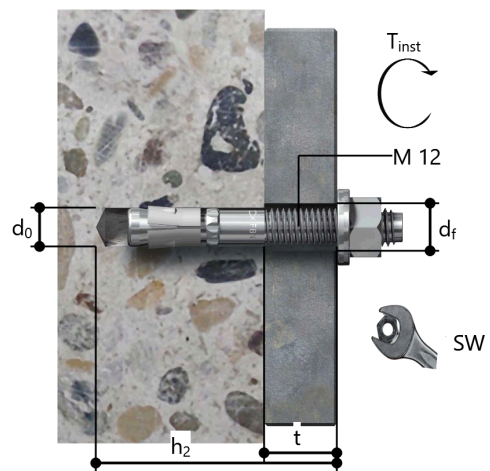
Art.-No. 567792

Art.-No. 531803

Art.-No. 546597

Installation details

Thread diameter	M 12
Drill hole diameter	$d_0 = 12 \text{ mm}$
Drill hole depth	$h_2 = 95 \text{ mm}$
Calculated anchorage depth	$h_{ef} = 65 \text{ mm}$
Installation depth	$h_{nom} = 65 \text{ mm}$
Drilling method	Hammer drilling
Drill hole cleaning	Only blow out by hand No borehole cleaning required in case of using a hollow drill bit, e.g. fischer FHD.
Installation type	Push-through installation
Annular gap	Annular gap not filled
Installation torque	$T_{inst} = 50.0 \text{ Nm}$
Socket size	19 mm
Base plate thickness	$t = 10 \text{ mm}$
Total fixing thickness	$t_{fix} = 10 \text{ mm}$
$T_{fix,max}$	$t_{fix,max} = 10 \text{ mm}$





AUX256 84 CHurch Street, Merthyr Tydfil, 84 CHurch Street, , Merthyr Tydfil, CF47 9HS

Base plate details

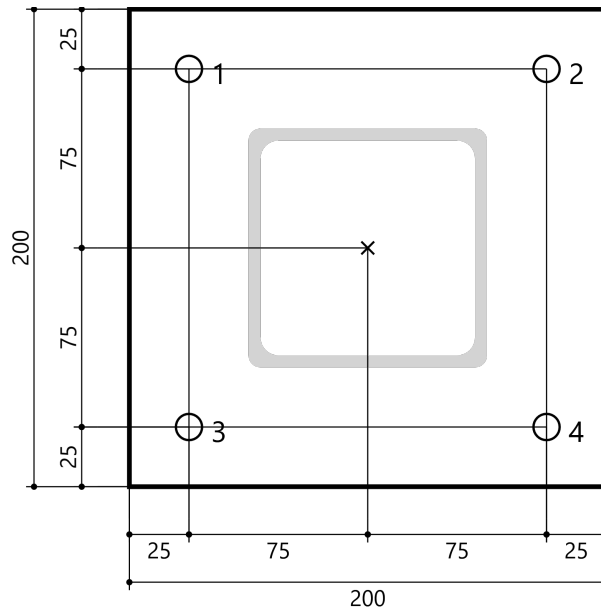
Base plate material S 275
Base plate thickness $t = 10 \text{ mm}$
Clearance hole in base plate $d_i = 14 \text{ mm}$

Attachment

Profile type Square tube hot formed (QSH 100x5)

Anchor coordinates

Anchor no.	x mm	y mm
1	-75	75
2	75	75
3	-75	-75
4	75	-75



Your Logo / Company Details Here	Project:	84 Church Street , Merthyr Tydfil		By:	MK
	Calculation:	Single Pad Foundation Design under column C01		Approved:	
		BS 8004 & BS 8110			
	Sheet Number:	1	Date:	19/11/2023	

<u>Soil Data</u>					
Bearing Capacity of Soil	50	kN/m ²			
Angle of Internal Soil Friction	20	degrees			
Soil Density	18	kN/m ³			
Cohesion	0	kN/m ²			
<u>Loading Data</u>					
Factor of Safety					
Factor of Safety (Dead)	1.40				
Factor of Safety (Imposed)	1.60				
Axial Load 1 (Dead)	4.2	kN	C01		
Axial Load 2 (Dead)	0	kN			
Axial Load 3 (Dead)	0	kN			
Axial Load 1 (Imposed)	3.6	kN	C01		
Axial Load 2 (Imposed)	0	kN			
Axial Load 3 (Imposed)	0	kN			
Moment 1 (Dead)	0.4	kNm	C01		
Moment 2 (Dead)	0	kNm			
Moment 3 (Dead)	0	kNm			
Moment 1 (Imposed)	0.5	kNm	C01		
Moment 2 (Imposed)	0	kNm			
Moment 3 (Imposed)	0	kNm			
Horizontal Load 1 (Dead)	0.3	kN	C01		
Horizontal Load 2 (Dead)	0	kN			
Horizontal Load 3 (Dead)	0	kN			
Horizontal Load 1 (Imposed)	0.5	kN	C01		
Horizontal Load 2 (Imposed)	0	kN			
Horizontal Load 3 (Imposed)	0	kN			

Your Logo / Company Details Here	Project:	84 Church Street , Merthyr Tydfil		By:	MK																																				
	Calculation:	Single Pad Foundation Design		Approved:																																					
		BS 8004 & BS 8110																																							
	Sheet Number:	2	Date:	19/11/2023																																					
Pad Dimensions <table border="1"> <tr> <td>Column Dimensions (X)</td> <td>100</td> <td>mm</td> </tr> <tr> <td>Column Dimensions (Y)</td> <td>100</td> <td>mm</td> </tr> <tr> <td>Depth to Top of Pad</td> <td>0.30</td> <td>m</td> </tr> <tr> <td>Pad Dimensions (X)</td> <td>0.75</td> <td>m</td> </tr> <tr> <td>Pad Dimensions (Y)</td> <td>0.75</td> <td>m</td> </tr> <tr> <td>Pad Dimensions (Z)</td> <td>0.30</td> <td>m</td> </tr> </table> <table> <tr> <td>Eccentricity:</td> <td>72</td> <td>mm</td> <td></td> <td></td> <td>Acceptable</td> </tr> <tr> <td>Bearing Capacity:</td> <td>50</td> <td>kN/m²</td> <td>Max Bearing Pressure:</td> <td>44.5</td> <td>kN/m² Acceptable</td> </tr> <tr> <td>Horizontal Force:</td> <td>1.22</td> <td>kN/m²</td> <td>Sliding Resistance:</td> <td>6.7</td> <td>kN/m² Acceptable</td> </tr> </table>						Column Dimensions (X)	100	mm	Column Dimensions (Y)	100	mm	Depth to Top of Pad	0.30	m	Pad Dimensions (X)	0.75	m	Pad Dimensions (Y)	0.75	m	Pad Dimensions (Z)	0.30	m	Eccentricity:	72	mm			Acceptable	Bearing Capacity:	50	kN/m ²	Max Bearing Pressure:	44.5	kN/m ² Acceptable	Horizontal Force:	1.22	kN/m ²	Sliding Resistance:	6.7	kN/m ² Acceptable
Column Dimensions (X)	100	mm																																							
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Horizontal Force:	1.22	kN/m ²	Sliding Resistance:	6.7	kN/m ² Acceptable																																				
Plan View			Elevation																																						

Your Logo / Company Details Here	Project:	84 Church Street , Merthyr Tydfil		By:	
	Calculation:	Single Pad Foundation Design		MK	
		BS 8004 & BS 8110		Approved:	
	Sheet Number:	3	Date:	19/11/2023	

Reinforcement Design

Concrete Grade	30	N/mm ²
Steel Grade	500	N/mm ²
Factor of Safety (Steel)	1.15	
Cover	40	mm

Bending Reinforcement (X Direction)

Reinforcement Required	17	mm ²
Reinforcement Diameter	10	mm
Number of Bars	5	
Spacing	165	mm
Area Chosen	393	mm ²

Bending Reinforcement (Y Direction)

Reinforcement Required	9	mm ²
Reinforcement Diameter	10	mm
Number of Bars	5	
Spacing	165	mm
Area Chosen	393	mm ²

Shear Reinforcement Checks

Design Shear Stress (X)	0.039	N/mm ²
Shear Resistance (X)	0.436	N/mm ²
Design Shear Stress (Y)	0.034	N/mm ²
Shear Resistance (Y)	0.436	N/mm ²
Design Shear Stress (X)	0.000	N/mm ²

Acceptable
Acceptable

Acceptable
Acceptable

Acceptable
Acceptable

Acceptable

Your Logo / Company Details Here	Project:			By:	
	Calculation:	Single Pad Foundation Design			Approved:
		BS 8004 & BS 8110			
	Sheet Number:	4	Date:		

Summary & Details

Eccentricity:

Pad Size for Bearing:

Pad Size for Sliding:

Bending Reinforcement (X):

Bending Reinforcement (Y):

Shear Reinforcement (X):

Shear Reinforcement (Y):

Punching Shear:

Acceptable

Acceptable

Acceptable

Acceptable

Acceptable

Acceptable

Acceptable

0.75m

0.75m

5H10-02-165

5H10-01-165

0.3m

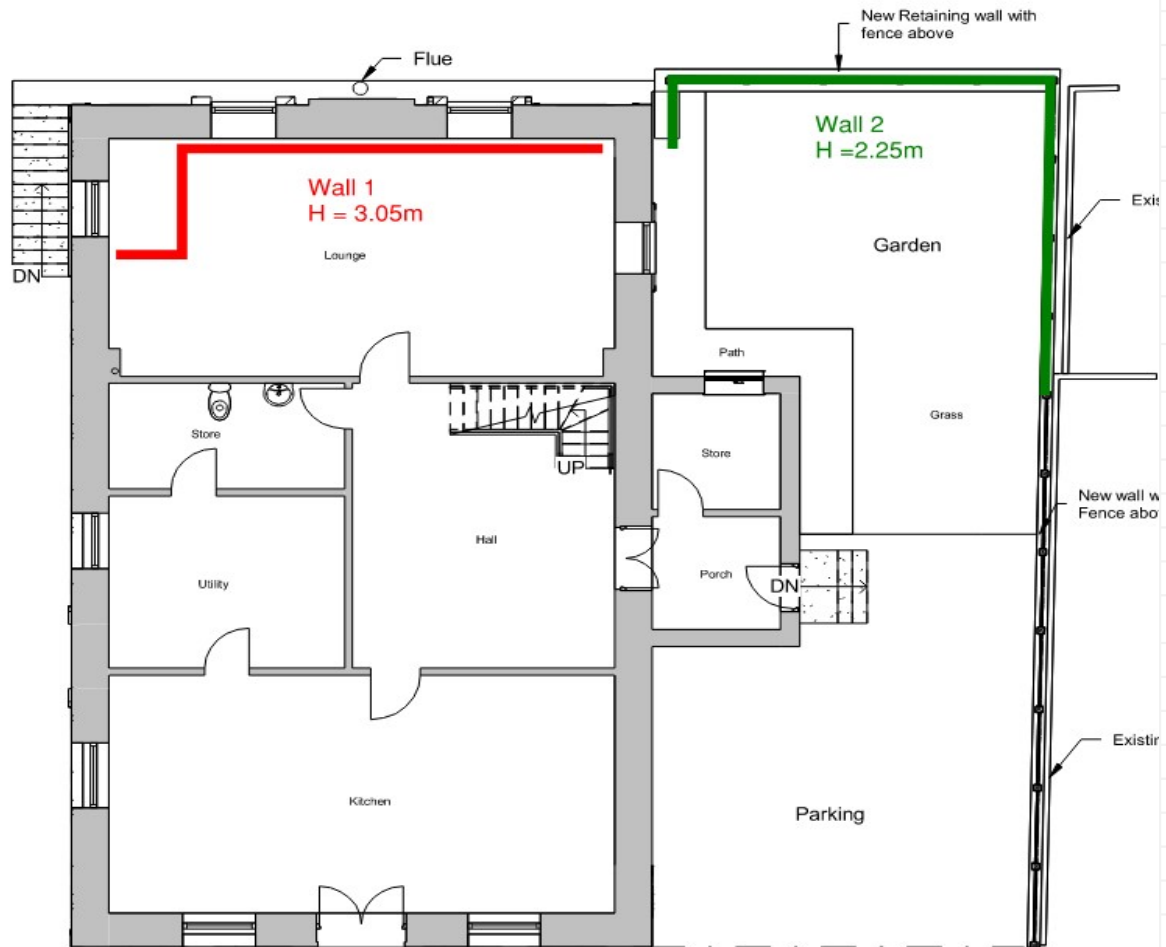
0.75m

5H10-01-165

5H10-02-165

Project:	Calculation package for the Retaining wall		
Address:	84 Church Street, Penydarren Merthyr, Tydfil		
Job No.	AUX256	Sheet	2
Date:	16-11-2023	Rev.	C00

Plan



Plan view

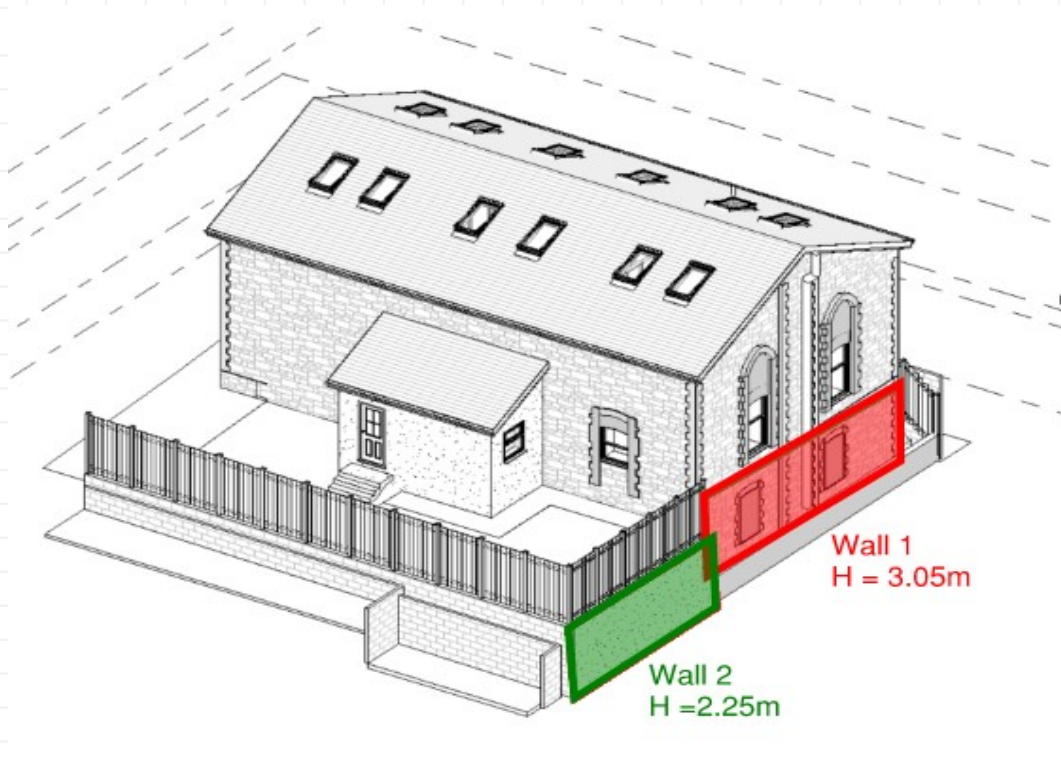


AUXILIUM
STRUCTURAL ENGINEERING

Mobile: +44 7465819500
Email: design@auxiliumse.com

Project:	Calculation package for the Retaining wall		
Address:	84 Church Street, Penydarren Merthyr, Tydfil		
Job No.	AUX256	Sheet	3
Date:	16-11-2023	Rev.	C00

Plan



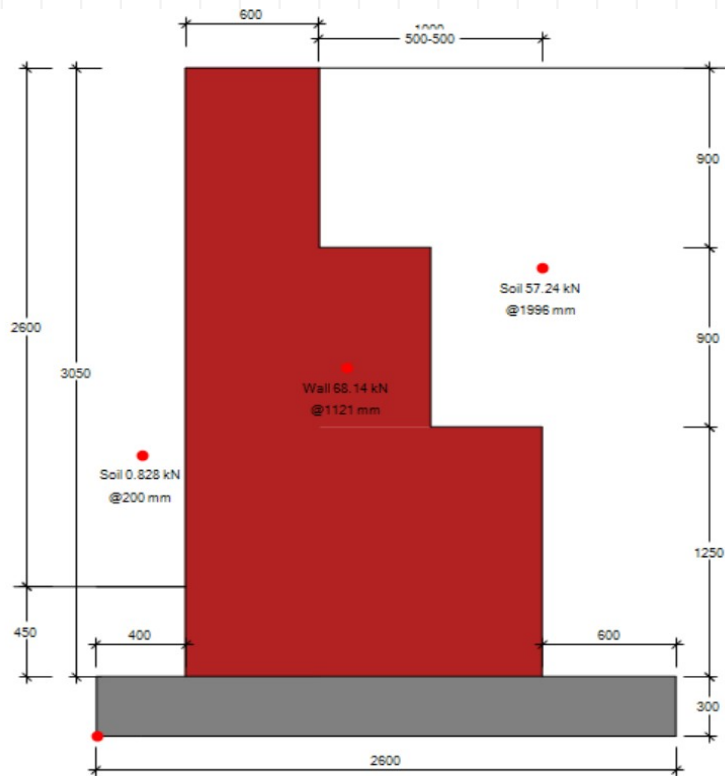


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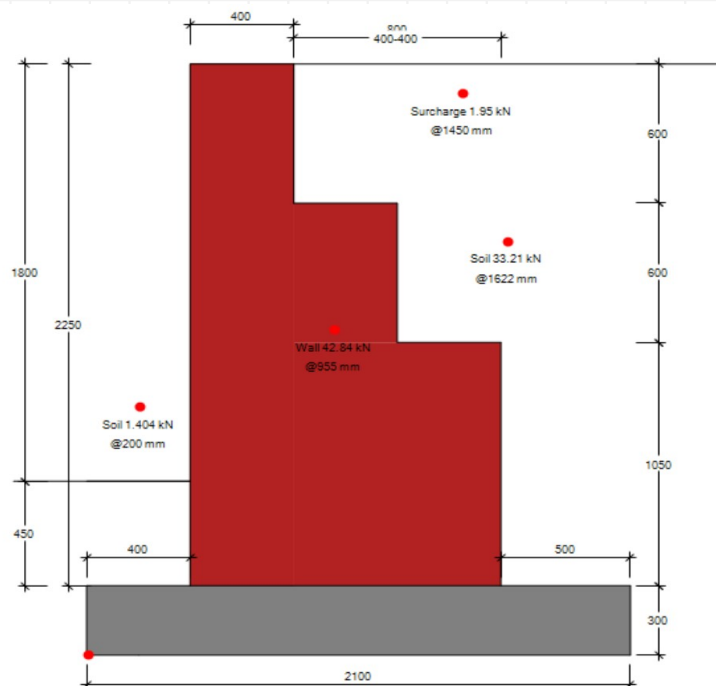
Mobile: +44 7465819500
Email: design@auxiliumse.com

Project:	Calculation package for the Retaining wall		
Address:	84 Church Street, Penydarren		
	Merthyr, Tydfil		
Job No.	AUX256	Sheet	4
Date:	16-11-2023	Rev.	C00

Plan



Wall - 1 Section



Wall - 2 Section

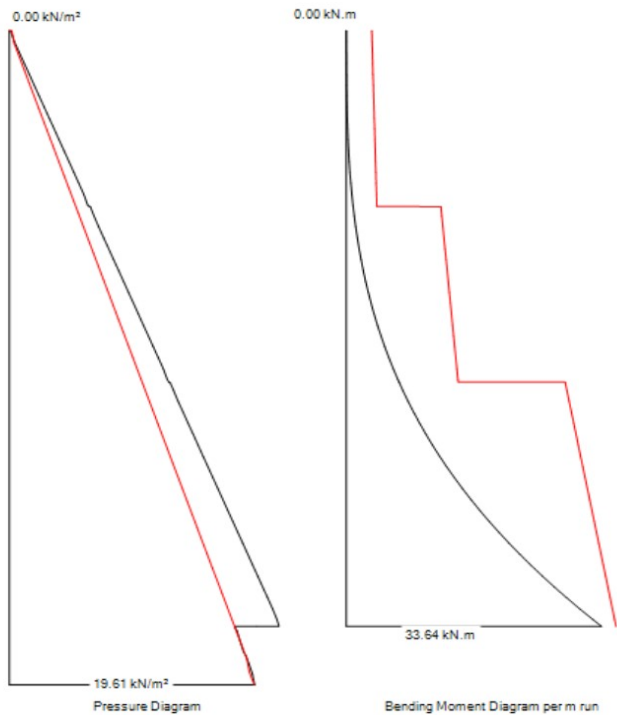


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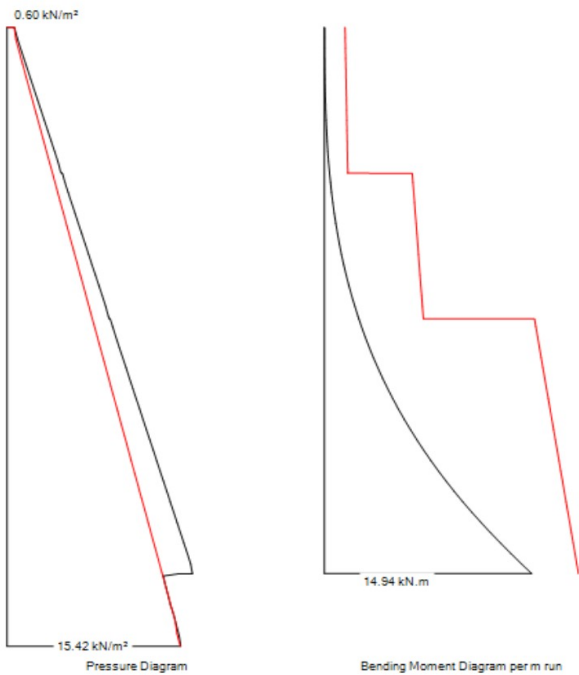
Mobile: +44 7465819500
Email: design@auxiliumse.com

Project:	Calculation package for the Retaining wall		
Address:	84 Church Street, Penydarren Merthyr, Tydfil		
Job No.	AUX256	Sheet	5
Date:	16-11-2023	Rev.	C00

Plan



Wall - 1 Pressure applied



Wall - 2 Pressure applied

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Date	:
Checked	:
Approved	:

STRUCTURAL CALCULATIONS

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STRUCTURAL ENGINEERS CALCULATIONS

PROJECT No: AUX256

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**MasterKey : Retaining Wall Design to BS 8002 : 1994,
 BS EN 1996-1-1:2005+A1:2012 and BS 8110 : 1997**

Basic RC Retaining Wall

Gravity Masonry Retaining Wall with Reinforced Concrete Base

Summary of Design Data

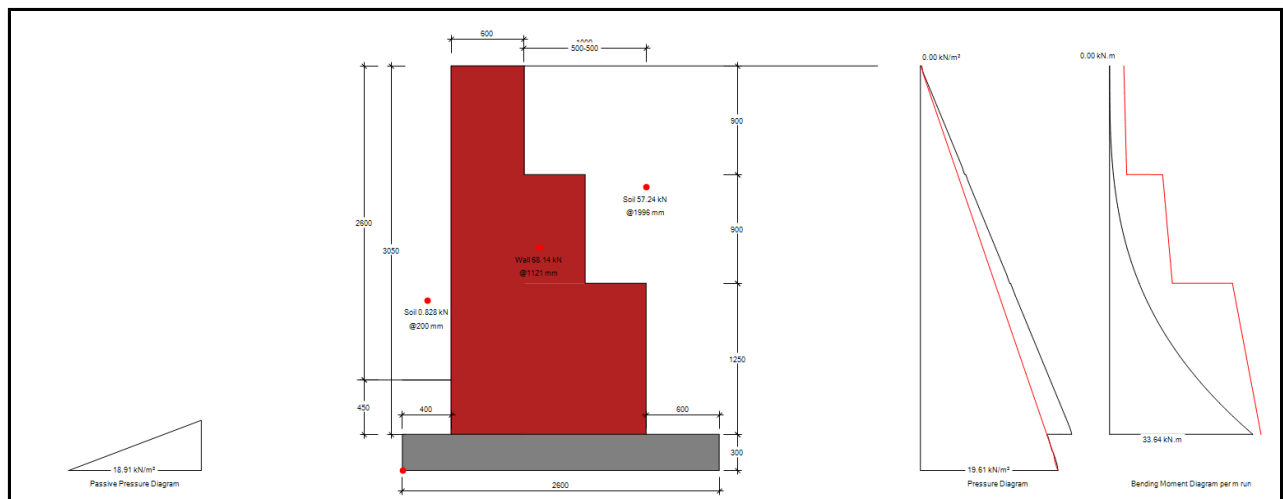
EC6 National Annex	UK
Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m ³)	Soil 18.00, Concrete 24.00, Masonry 14.00
Concrete grade	fcu 40 N/mm ² , Permissible tensile stress 0.250 N/mm ²
Concrete covers (mm)	Base cover 50 mm
Reinforcement design	fy 500 N/mm ² , fyt 500 N/mm ² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 0.00 kN/m ² , Fully drained
Unplanned excavation depth	Front of wall 335 mm
† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice	

Soil Properties

Bearing pressure	Premissable service pressure @ front 75.00 kN/m ² , @ back 75.00 kN/m ²
Back Soil Friction and Cohesion	$\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$
Base Friction and Cohesion	$\delta = \text{Atn}(0.75 \times \text{Tan}(\text{Atn}(\text{Tan}(30)/1.2))) = 19.84^\circ$
Front Soil Friction and Cohesion	$\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$

Loading Cases

G _{Soil} - Soil Self Weight, G _{Wall} - Wall & Base Self Weight, P _a - Active Earth Pressure, P _p - Passive Earth Pressure	
Case 1: Geotechnical Design	1.00 G _{Soil} + 1.00 G _{Wall} + 1.00 P _a + 1.00 P _p
Case 2: Structural Ultimate Design	1.40 G _{Soil} + 1.40 G _{Wall} + 1.00 P _a + 1.00 P _p



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 Sheet :
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 Date :
 Checked :
 Approved :

Geotechnical Design**Wall Stability - Virtual Back Pressure**

Case 1 Overturning/Stabilising 37.104/190.797 0.194 OK

Wall Sliding - Virtual Back Pressure

$F_x/(R_x F_{\text{Friction}} + R_x F_{\text{Passive}})$ 33.125/(45.541+3.932) 0.670 OK

Soil Pressure

Virtual Back (No uplift) Max(57.752/75, 39.331/75) kN/m² 0.770 OK

Wall Back (No uplift) Max(63.740/75, 33.344/75) kN/m² 0.850 OK

Structural Design**Masonry Wall Details**

Partial Safety Factor (γ_{mc}/γ_{mf}) Units Category II, Execution Control Class 2 3/2.7 Table NA.1

Material Concrete blocks, $\gamma = 14$ kN/m³

Units and Mortar Strength 7.3 N/mm², Mortar designation M12(i)

Blocks Ratio Unit height=215, Least horizontal dimensions=102.5 2.10

Compressive Strength (f_k) Group 1 5.48 N/mm² Table NA.4

Wall Design (Inner Face Tension)

Critical Section Critical @ 0 mm from base, Case 2

Section Properties @ Base $t=1600$ mm, Area=16000 cm², $Z_b=426667$ cm³

Flexural Strength f_{yk1} $f_{yk1}=0.15$, $g_d=0.031$ N/mm², $f_{yk1}=f_{yk1}+0.9g_d/\gamma_{mf}$ 0.225 N/mm² Table NA.6

$M_r=f_{yk1}.Z_b/\gamma_{mf}$ 0.225x426667/2.7 35.56 kN.m

Moment Capacity Check (M/Mr) M 33.6 kN.m, Mr 35.6 kN.m 0.946 OK

Shear Capacity Check F 32.7 kN, $f_{vk}0.212$ N/mm², F_{vr} 135.9 kN 0.24 OK

Base Top Steel Design

Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm² OK

Compression Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm²

Leverarm $z=fn(d,b,As,f_y,F_{cu})$ 245 mm, 1000 mm, 393 mm², 500 N/mm², 40 N/mm² 233 mm

$M_r=fn(\text{above}, As', d', x, x/d)$ 393 mm², 55 mm, 11 mm, 0.04 39.8 kN.m

Moment Capacity Check (M/Mr) M 4.3 kN.m, Mr 39.8 kN.m 0.108 OK

Shear Capacity Check F 14.0 kN, v_c 0.454 N/mm², F_{vr} 111.2 kN 0.13 OK

Base Bottom Steel Design

Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm² OK

Compression Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm²

Leverarm $z=fn(d,b,As,f_y,F_{cu})$ 245 mm, 1000 mm, 393 mm², 500 N/mm², 40 N/mm² 233 mm

$M_r=fn(\text{above}, As', d', x, x/d)$ 393 mm², 55 mm, 11 mm, 0.04 39.8 kN.m

Moment Capacity Check (M/Mr) M 4.8 kN.m, Mr 39.8 kN.m 0.121 OK

Shear Capacity Check F 23.9 kN, v_c 0.454 N/mm², F_{vr} 111.2 kN 0.22 OK

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STRUCTURAL CALCULATIONS

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PROJECT No: AUX256

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**MasterKey : Retaining Wall Design to BS 8002 : 1994,
 BS EN 1996-1-1:2005+A1:2012 and BS 8110 : 1997
 Basic RC Retaining Wall
 Gravity Masonry Retaining Wall with Reinforced Concrete Base**

Summary of Design Data

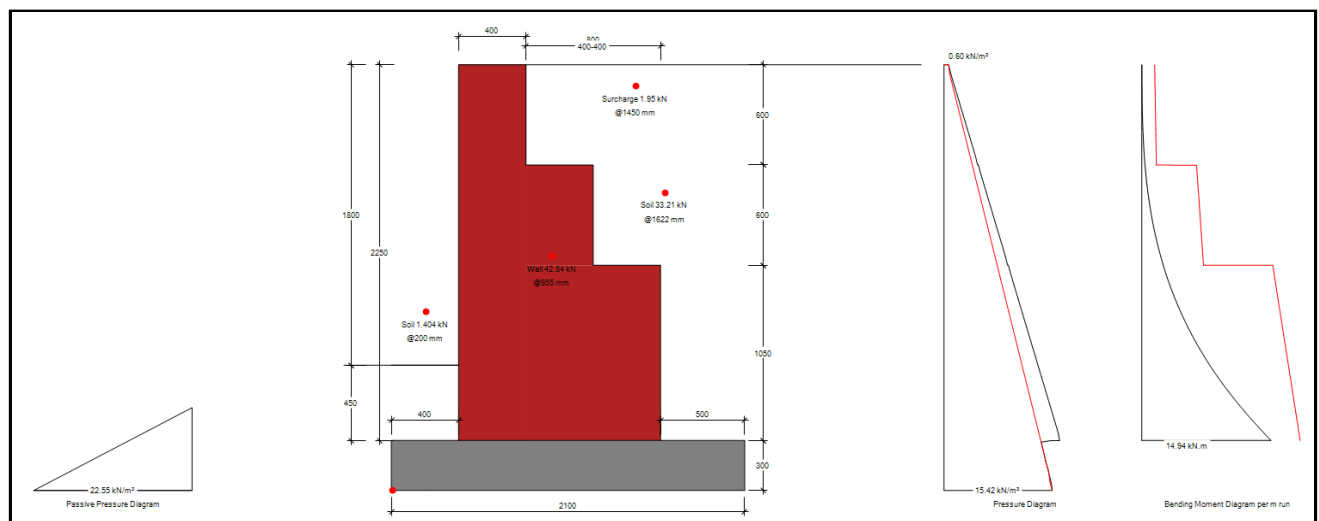
EC6 National Annex	UK
Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m ³)	Soil 18.00, Concrete 24.00, Masonry 14.00
Concrete grade	fcu 40 N/mm ² , Permissible tensile stress 0.250 N/mm ²
Concrete covers (mm)	Base cover 50 mm
Reinforcement design	fy 500 N/mm ² , fyb 500 N/mm ² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 1.50 kN/m ² , Fully drained
Unplanned excavation depth	Front of wall 255 mm
† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice	

Soil Properties

Bearing pressure	Premissable service pressure @ front 75.00 kN/m ² , @ back 75.00 kN/m ²
Back Soil Friction and Cohesion	$\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$
Base Friction and Cohesion	$\delta = \text{Atn}(0.75 \times \text{Tan}(\text{Atn}(\text{Tan}(30)/1.2))) = 19.84^\circ$
Front Soil Friction and Cohesion	$\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$

Loading Cases

G _{Soil} - Soil Self Weight, G _{Wall} - Wall & Base Self Weight, F _{VHeel} - Vertical Loads over Heel,	
P _a - Active Earth Pressure, P _{surcharge} - Earth pressure from surcharge, P _p - Passive Earth Pressure	
Case 1: Geotechnical Design	1.00G _{Soil} +1.00G _{Wall} +1.00F _{VHeel} +1.00P _a +1.00P _{surcharge} +1.00P _p
Case 2: Structural Ultimate Design	1.40G _{Soil} +1.40G _{Wall} +1.60F _{VHeel} +1.00P _a +1.00P _{surcharge} +1.00P _p



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Job ref :
 Sheet :
 Made By :
 Date :
 Checked :
 Approved :

Geotechnical Design**Wall Stability - Virtual Back Pressure**

Case 1 Overturning/Stabilising 17.959/96.455 0.186 OK

Wall Sliding - Virtual Back Pressure

$F_x/(R_x \text{Friction} + R_x \text{Passive})$ 20.443/(28.219+5.593) 0.605 OK

Soil Pressure

Virtual Back (No uplift) Max(42.163/75, 32.317/75) kN/m² 0.562 OK

Wall Back (No uplift) Max(45.629/75, 28.851/75) kN/m² 0.608 OK

Structural Design**Masonry Wall Details**

Partial Safety Factor (γ_{mc}/γ_{mf}) Units Category II, Execution Control Class 2 3/2.7 Table NA.1

Material Concrete blocks, $\gamma = 14$ kN/m³

Units and Mortar Strength 7.3 N/mm², Mortar designation M12(i)

Blocks Ratio Unit height=215, Least horizontal dimensions=102.5 2.10

Compressive Strength (f_k) Group 1 5.48 N/mm² Table NA.4

Wall Design (Inner Face Tension)

Critical Section Critical @ 0 mm from base, Case 2

Section Properties @ Base $t=1200$ mm, Area=12000 cm², $Z_b=240000$ cm³

Flexural Strength f_{xk1} $f_{xk1}=0.15$, $g_d=0.023$ N/mm², $f_{xk1}=f_{xk1}+0.9g_d \cdot \gamma_{mf}$ 0.206 N/mm² Table NA.6

$M_r=f_{xk1} \cdot Z_b / \gamma_{mf}$ 0.206x240000/2.7 18.32 kN.m

Moment Capacity Check (M/M_r) M 14.9 kN.m, M_r 18.3 kN.m 0.816 OK

Shear Capacity Check F 18.4 kN, f_{vk} 0.209 N/mm², F_{vr} 100.4 kN 0.18 OK

Base Top Steel Design

Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm² OK

Compression Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm²

Leverarm $z=fn(d,b,As,f_y,F_{cu})$ 245 mm, 1000 mm, 393 mm², 500 N/mm², 40 N/mm² 233 mm

$M_r=fn(\text{above}, As', d', x, x/d)$ 393 mm², 55 mm, 11 mm, 0.04 39.8 kN.m

Moment Capacity Check (M/M_r) M 2.2 kN.m, M_r 39.8 kN.m 0.054 OK

Shear Capacity Check F 8.6 kN, v_c 0.454 N/mm², F_{vr} 111.2 kN 0.08 OK

Base Bottom Steel Design

Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm² OK

Compression Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm²

Leverarm $z=fn(d,b,As,f_y,F_{cu})$ 245 mm, 1000 mm, 393 mm², 500 N/mm², 40 N/mm² 233 mm

$M_r=fn(\text{above}, As', d', x, x/d)$ 393 mm², 55 mm, 11 mm, 0.04 39.8 kN.m

Moment Capacity Check (M/M_r) M 3.0 kN.m, M_r 39.8 kN.m 0.076 OK

Shear Capacity Check F 15.0 kN, v_c 0.454 N/mm², F_{vr} 111.2 kN 0.14 OK