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Consulting Structural Engineers		Rev.	A
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Project Title	0		
Work Section	Structural Calculations		

Structural Calculations Sample - SME Ltd

The following calculations have been undertaken for the proposed alterations at the above address.

All the dimensions for beams included within the calculations are to be site checked, by the building contractor prior to commencing or ordering materials. All works are to be carried out to the calculations enclosed.

If any changes are made on site, then these calculations must be checked and adjusted to suit new layouts.

The contractor is to ensure adequate temporary supports and propping is provided when the beams and structural elements are installed or removed. The contractor is to ensure overall stability of the structure is continuously maintained during the alteration works and if in doubt consult relevant parties.

If any of the assumptions used for the calculations are discovered to be incorrect once work commences on site then the calculations must be amended to suit.

NOTE: CALCULATIONS ARE SUBJECT TO BUILDING CONTROL APPROVAL. ANY WORKS CARRIED OUT PRIOR TO APPROVAL OF CALCULATIONS BY BUILDING CONTROL ARE AT OWN RISK. STRONGLY SUGGEST NO MATERIALS ARE ORDERED OR WORK ARE CARRIED OUT UNTIL APPROVAL IS RECEIVED FROM BUILDING CONTROL.

The design has been carried out in accordance with the following standards:

- **Loading BS 6399**
- **Steel BS 5950**
- **Concrete BS 8110**
- **Masonry BS 5628**
- **Timber BS 5268**

General Loadings:

Dead Loads:

Walls:

Timber stud wall:	0.3 kN/m (per metre high) - Line Load
	0.25 kN/m^2 – Typical Blanket Load
100mm solid wall:	2.2 kN/m (per metre high)
	0.75 kN/m^2 – Typical Blanket Load
215mm solid wall:	4.3 kN/m (per metre high)

Floors:

Timber Floor:	0.5 kN/m^2
Precast Floor (150mm):	2.5 kN/m^2
Precast Floor (200mm):	3 kN/m^2
Sand/cement screed:	2.4 kN/m^2 (per 100mm deep)
Finishes:	0.2 kN/m^2 (U.N.O.)

Roof:

Pitched Roof Carcass:	P'board:	0.1 kN/m^2
	Insulation:	0.1 kN/m^2
	Rafters/ties:	0.2 kN/m^2
	Felt & Battens:	0.1 kN/m^2
	Total:	**0.5 kN/m^2**
Pitched Roof Finish:	Concrete Tiles:	0.75 kN/m^2
	Natural Slates:	0.74 kN/m^2
	Fibre-cement slates:	0.25 kN/m^2
Flat Roof:	P'board:	0.1 kN/m^2
	Insulation:	0.1 kN/m^2
	Joists:	0.2 kN/m^2
	Felt & Battens:	0.1 kN/m^2
	Built-up roofing	0.5 kN/m^2
	Total:	**1.0 kN/m^2**

Live Loads:

Floors:

Domestic floor:	1.5 kN/m^2
Attic Storage floor:	0.5 kN/m^2

Roofs:

Pitched Roof:	0.60 kN/m^2
Flat Roof:	0.75 kN/m^2

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BEAM NUMBER = **B1**

SPAN	4.00 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Roof	0.00	4.00	1.00 kN/m2	x 1.75 m	1.75 kN/m	1.4	2.45 kN/m
	Flat Roof	0.00	4.00	1.00 kN/m2	x 1.50 m	1.50 kN/m	1.4	2.10 kN/m
	Type 3	0.00	4.00	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Type 4	0.00	4.00	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.4	0.00 kN/m
Imposed Load	Roof	0.00	4.00	0.60 kN/m2	x 1.75 m	1.05 kN/m	1.6	1.68 kN/m
	Flat Roof	0.00	4.00	0.75 kN/m2	x 1.50 m	1.13 kN/m	1.6	1.80 kN/m
	Type 3	0.00	4.00	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Type 4	0.00	4.00	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.6	0.00 kN/m
Self weight	Yes						**UDL =**	**8.03 kN/m**

POINT LOADS

Point Load 1	x= 0.00 m	From :		**Point Load 2**	x= 0.00 m	From :	
Dead Load	0.00 kN	1.4	0.00 kN	Dead Load	0.00 kN	1.4	0.00 kN
Imposed Load	0.00 kN	1.6	0.00 kN	Imposed Load	0.00 kN	1.6	0.00 kN
		P1	**0.00 kN**			**P2**	**0.00 kN**

DESIGN OF BEAM B1 — CHOSEN SECTION UC 152x152x23

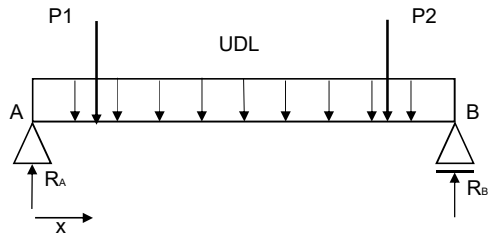
Forces in Beam	
Moment	**16.68 kNm**
Shear Force	**16.68 kN**

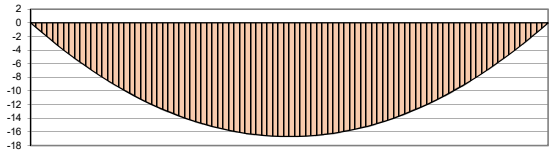
Reactions	Charact DL	Charact IL	
Ra	6.94	4.35	**16.68 kN**
Rb	6.94	4.35	**16.68 kN**

Design Parameters		
Steel Grade		**275 N/mm²**
Modulus of Elasticity E		**205000 N/mm²**
Section Depth		**152.4 mm**
Section Width		**152.2 mm**
Section Area		**29 cm²**
Section 2nd moment of area Ix		**1250.0 cm⁴**
Section modulus Zx		**164.0 cm³**
Section plastic modulus Sx		**182.0 cm³**
Section shear area Av		**8.8 cm²**
Section radius of gyration ry		**3.7 cm**
Section torsional index x		**20.7**
Section buckling parameter u		**0.84**
Section Class		**Class 3 (Flange)**
Effective Section plastic modulus Sx,eff		**175.49 cm3**
LTB Parameters		
Restraint Condition Coefficient		1.20 (Table 13)
Effective Length	Le	480.00 cm
Slenderness	λ	129.7
Slenderness Factor	v	0.762
Correction Factor	m or n	1.00 (Table 18)
Equivalent slenderness	λLT	81.55
Bending Stength	pb	161.36 (B)

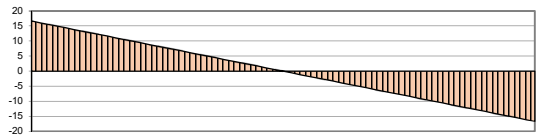
Design Status		
Moment Capacity	**48.3 kNm**	Pass
Buckling Resistance	**28.3 kNm**	Pass
Shear Capacity	**145.8 kN**	Pass

Deflection	Limits	Allowable	Max actual deflection	
Imposed Loads	360	11.1	**2.83 mm**	Pass
Total Loads	360	11.1	**7.35 mm**	Pass

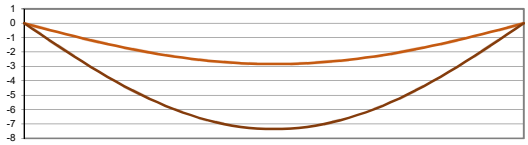




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

PADSTONE DESIGN

	LHS	RHS
Masonry Type		3.5N Block
Characteristic strength of masonry =		3.50 N/mm2
Maximum Allowable Bearing Stress =		1.25 N/mm2
End Reaction from		B1 16.68 kN
End Reaction from		No 0.00 kN
		∑ 16.68 kN
Actual Bearing Stress =		2.19 N/mm2
		Padstone Required
Padstone provided=		440 x 100 mm
Eccentricity=		0 mm
Stress under padstone =		0.38 N/mm2
		Padstone Pass

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BEAM NUMBER = **FLAT ROOF JOIST 1** SPAN 3.50 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Flat Roof	0.00	3.50	1.00 kN/m2	x 0.40 m	0.40 kN/m	1.0	0.40 kN/m
	Type 2	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 3	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 4	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
Imposed Load	Flat Roof	0.00	3.50	0.75 kN/m2	x 0.40 m	0.30 kN/m	1.0	0.30 kN/m
	Type 2	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 3	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 4	0.00	3.50	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m

Self weight Yes

UDL = 0.70 kN/m

POINT LOADS

Point Load 1	x=	0.00 m	From :		Point Load 2	x=	0.00 m	From :
Dead Load		0.00 kN	1.0	0.00 kN	Dead Load		0.00 kN	1.0	0.00 kN
Imposed Load		0.00 kN	1.0	0.00 kN	Imposed Load		0.00 kN	1.0	0.00 kN
			P1	0.00 kN				P2	0.00 kN

DESIGN OF FLAT ROOF JOIST 1 CHOSEN SECTION 1No 150x50 C24 Timber

Forces in Beam	
Moment	**1.12 kNm**
Shear Force	**1.28 kN**

Reactions	Charact DL	Charact IL	
Ra	0.75	0.53	**1.28 kN**
Rb	0.75	0.53	**1.28 kN**

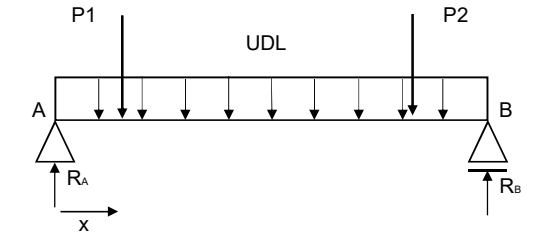
Design Parameters	
Timber Grade	**C24**
Modulus of Elasticity (mean)	**10800 N/mm²**
Modulus of Elasticity (min)	**7200 N/mm²**
Section Depth	**150 mm**
Section Width	**50 mm**
Section Area	**75 cm²**
Section 2nd moment of area Ix	**1406.3 cm⁴**
Section 2nd moment of area Iy	**156.3 cm⁴**
Section modulus Zx	**187.5 cm³**
Section radius of gyration rx	**4.3 cm**
Section radius of gyration ry	**1.4 cm**

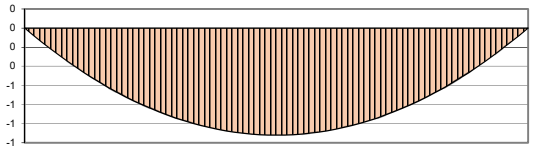
Additional Parameters	
End Bearing Length	100 mm
Bottom Notch Depth	0 mm
Part of Load Sharing System	yes
Extend 75mm beyond bearing	no

Modification Factors	
Class Factor K2 - Bending & Tension	1.00
Class Factor K2 - Compression	1.00
Class Factor K2 - Shear	1.00
Class Factor K2 - mean/min. E	1.00
Load Duration Factor K3	1.25
Bearing Stress Factor K4	1.00
Shear at Notched End K5	1.00
Total Depth Factor K7	1.08
Loadshare Factor K8	1.10
Trimmer Joists/Lintels K9	1.00

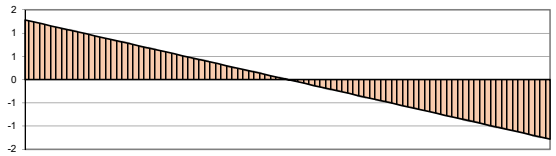
Element Parameters/ Internal Stresses			
Effective Length x-x	Lex	350 cm	
Effective Length y-y	Ley	350 cm	
Slenderness x-x	λx	80.8	Pass
Slenderness y-y	λy	242.5	Pass
Bending Stress		5.97 N/mm²	
Bearing Stress		0.26 N/mm²	
Shear Stress		0.26 N/mm²	

Design Status		
Allowable Bending Stress	**11.13 N/mm²**	Pass
Allowable Bearing Stress	**2.6 N/mm²**	Pass
Allowable Shear Stress	**0.98 N/mm²**	Pass

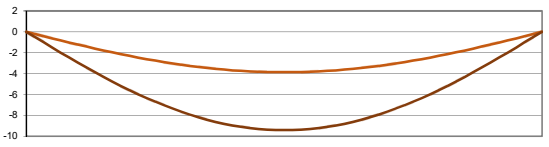




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

Deflection		
Imposed Loads	3.86 mm	
Dead Loads	5.54 mm	
Shear	0.27 mm	
Total Loads	**9.67 mm**	
Limiting Deflection	**10.5 mm**	Pass

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BEAM NUMBER = TB1

SPAN	2.70 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Flat Roof	0.00	2.70	1.00 kN/m2	x 2.81 m	2.81 kN/m	1.0	2.81 kN/m
	Type 2	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 3	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 4	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
Imposed Load	Flat Roof	0.00	2.70	0.75 kN/m2	x 2.81 m	2.11 kN/m	1.0	2.11 kN/m
	Type 2	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 3	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
	Type 4	0.00	2.70	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.0	0.00 kN/m
Self weight	Yes						**UDL =**	**4.92 kN/m**

POINT LOADS

Point Load 1	x= 0.00 m	From :		Point Load 2	x= 0.00 m	From :	
Dead Load	0.00 kN	1.0	0.00 kN	Dead Load	0.00 kN	1.0	0.00 kN
Imposed Load	0.00 kN	1.0	0.00 kN	Imposed Load	0.00 kN	1.0	0.00 kN
		P1	0.00 kN			P2	0.00 kN

DESIGN OF TB1 — CHOSEN SECTION 4No 150x50 C24 Timber — bolted together @400mm c/c using M12 bolts

Forces in Beam	
Moment	**4.59 kNm**
Shear Force	**6.81 kN**

Reactions	Charact DL	Charact IL	
Ra	3.96	2.85	**6.81 kN**
Rb	3.96	2.85	**6.81 kN**

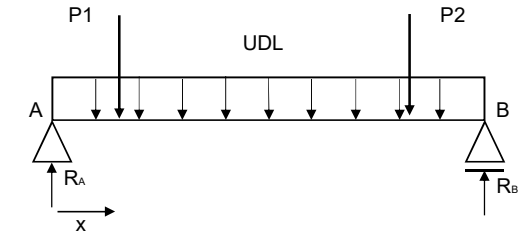
Design Parameters	
Timber Grade	**C24**
Modulus of Elasticity (mean)	**10800 N/mm²**
Modulus of Elasticity (min)	**7200 N/mm²**
Section Depth	**150 mm**
Section Width	**200 mm**
Section Area	**300 cm²**
Section 2nd moment of area Ix	**5625.0 cm⁴**
Section 2nd moment of area Iy	**10000.0 cm⁴**
Section modulus Zx	**750.0 cm³**
Section radius of gyration rx	**4.3 cm**
Section radius of gyration ry	**5.8 cm**

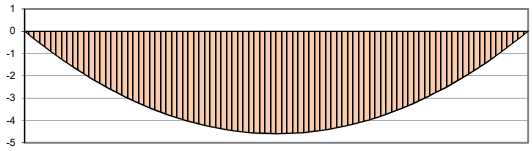
Additional Parameters	
End Bearing Length	100 mm
Bottom Notch Depth	0 mm
Part of Load Sharing System	no
Extend 75mm beyond bearing	no

Modification Factors	
Class Factor K2 - Bending & Tension	1.00
Class Factor K2 - Compression	1.00
Class Factor K2 - Shear	1.00
Class Factor K2 - mean/min. E	1.00
Load Duration Factor K3	1.25
Bearing Stress Factor K4	1.00
Shear at Notched End K5	1.00
Total Depth Factor K7	1.08
Loadshare Factor K8	1.00
Trimmer Joists/Lintels K9	1.24

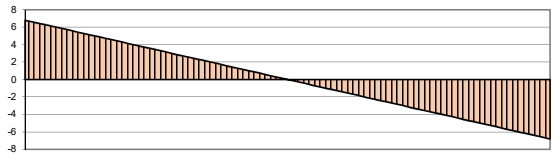
Element Parameters/ Internal Stresses			
Effective Length x-x	Lex	270 cm	
Effective Length y-y	Ley	270 cm	
Slenderness x-x	λx	62.4	Pass
Slenderness y-y	λy	46.8	Pass
Bending Stress		6.12 N/mm²	
Bearing Stress		0.34 N/mm²	
Shear Stress		0.34 N/mm²	

Design Status		
Allowable Bending Stress	**10.12 N/mm²**	Pass
Allowable Bearing Stress	**2.4 N/mm²**	Pass
Allowable Shear Stress	**0.89 N/mm²**	Pass

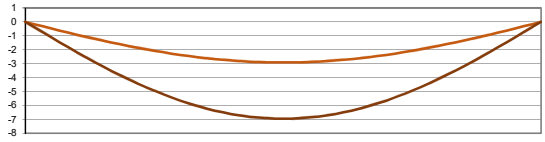




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

Deflection		
Imposed Loads	2.90 mm	
Dead Loads	4.04 mm	
Shear	0.33 mm	
Total Loads	**7.28 mm**	
Limiting Deflection	**8.1 mm**	Pass

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BEAM NUMBER = **B2**

SPAN	4.40 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Loft Floor	0.00	4.40	0.95 kN/m2	x	1.70 m	1.62 kN/m	1.4	2.26 kN/m
	Str.Fl.Joist	0.00	4.40	0.90 kN	/	0.40 m	2.24 kN/m	1.4	3.14 kN/m
	Type 3	0.00	4.40	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Type 4	0.00	4.40	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
Imposed Load	Loft Floor	0.00	4.40	1.50 kN/m2	x	1.70 m	2.55 kN/m	1.6	4.08 kN/m
	Str.Fl.Joist	0.00	4.40	1.02 kN	/	0.40 m	2.56 kN/m	1.6	4.09 kN/m
	Type 3	0.00	4.40	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Type 4	0.00	4.40	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.6	0.00 kN/m
Self weight	Yes							**UDL =**	**13.57 kN/m**

POINT LOADS

Point Load 1	**x=**	0.40 m	From :	B1	**Point Load 2**	**x=**	0.20 m	From :	Chimney beam
Dead Load		6.94 kN	1.4	9.72 kN	Dead Load		12.00 kN	1.4	16.80 kN
Imposed Load		4.35 kN	1.6	6.96 kN	Imposed Load		0.00 kN	1.6	0.00 kN
			P1	**16.68 kN**				**P2**	**16.80 kN**

DESIGN OF BEAM B2 — CHOSEN SECTION UC 152x152x37

Forces in Beam	
Moment	**39.26 kNm**
Shear Force	**62.16 kN**

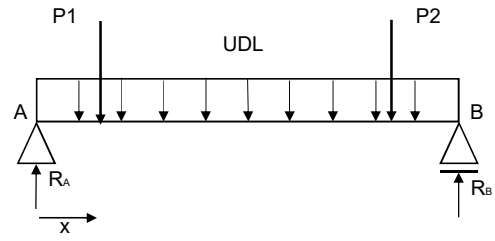
Reactions	Charact DL	Charact IL	
Ra	27.04	15.19	**62.16 kN**
Rb	10.45	11.63	**33.24 kN**

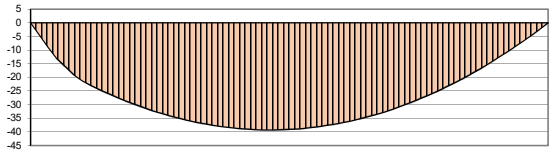
Design Parameters	
Steel Grade	**275 N/mm²**
Modulus of Elasticity E	**205000 N/mm²**
Section Depth	**161.8 mm**
Section Width	**154.4 mm**
Section Area	**47 cm²**
Section 2nd moment of area Ix	**2210.0 cm⁴**
Section modulus Zx	**273.2 cm³**
Section plastic modulus Sx	**309.0 cm³**
Section shear area Av	**12.9 cm²**
Section radius of gyration ry	**3.9 cm**
Section torsional index x	**13.3**
Section buckling parameter u	**0.85**
Section Class	**Class 1**

LTB Parameters		
Restraint Condition Coefficient		1.20 (Table 13)
Effective Length	Le	528.00 cm
Slenderness	λ	135.4
Slenderness Factor	v	0.634
Correction Factor	m or n	1.00 (Table 18)
Equivalent slenderness	λLT	72.81
Bending Stength	pb	181.61 (B)

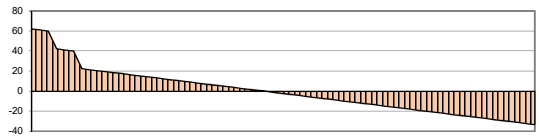
Design Status		
Moment Capacity	**85.0 kNm**	Pass
Buckling Resistance	**56.1 kNm**	Pass
Shear Capacity	**213.6 kN**	Pass

Deflection	Limits	Allowable	Max actual deflection	
Imposed Loads	360	12.2	**5.96 mm**	Pass
Total Loads	360	12.2	**11.88 mm**	Pass

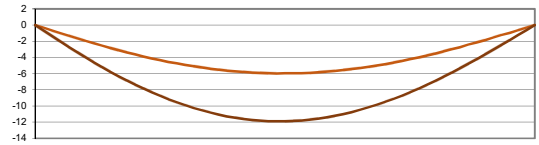




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

PADSTONE DESIGN

	LHS	RHS
Masonry Type	3.5N Block	3.5N Block
Characteristic strength of masonry =	3.50 N/mm2	3.50 N/mm2
Maximum Allowable Bearing Stress =	1.25 N/mm2	1.25 N/mm2
End Reaction from	B2 62.16 kN	B2 33.24 kN
End Reaction from	No 0.00 kN	No 0.00 kN
	∑ 62.16 kN	∑ 33.24 kN
Actual Bearing Stress =	4.03 N/mm2	2.15 N/mm2
	Padstone Required	**Padstone Required**
Padstone provided=	900 x 100 mm	600 x 100 mm
Eccentricity=	0 mm	0 mm
Stress under padstone =	0.69 N/mm2	0.55 N/mm2
	Padstone Pass	Padstone Pass

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Project Title	0		
Work Section	Structural Calculations		

BEAM NUMBER = B3

SPAN	2.20 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Dormer Wall	0.00	2.20	1.00 kN/m2	x 2.70 m	2.70 kN/m	1.4	3.78 kN/m
	Loft Floor	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Flat Roof	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Type 4	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.4	0.00 kN/m
Imposed Load	Dormer Wall	0.00	2.20	0.00 kN/m2	x 2.70 m	0.00 kN/m	1.6	0.00 kN/m
	Loft Floor	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Flat Roof	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Type 4	0.00	2.20	0.00 kN/m2	x 0.00 m	0.00 kN/m	1.6	0.00 kN/m
Self weight	Yes						UDL =	3.78 kN/m

POINT LOADS

Point Load 1 x=	0.00 m	From :		Point Load 2 x=	0.00 m	From :	
Dead Load	0.00 kN	1.4	0.00 kN	Dead Load	0.00 kN	1.4	0.00 kN
Imposed Load	0.00 kN	1.6	0.00 kN	Imposed Load	0.00 kN	1.6	0.00 kN
		P1	0.00 kN			P2	0.00 kN

DESIGN OF BEAM B3 — CHOSEN SECTION UC 152x152x23

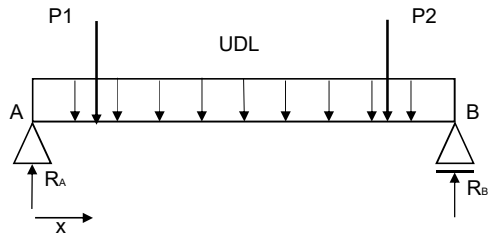
Forces in Beam	
Moment	2.47 kNm
Shear Force	4.50 kN

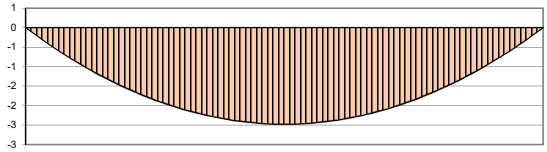
Reactions	Charact DL	Charact IL	
Ra	3.21	0.00	4.50 kN
Rb	3.21	0.00	4.50 kN

Design Parameters		
Steel Grade		275 N/mm²
Modulus of Elasticity E		205000 N/mm²
Section Depth		152.4 mm
Section Width		152.2 mm
Section Area		29 cm²
Section 2nd moment of area Ix		1250.0 cm⁴
Section modulus Zx		164.0 cm³
Section plastic modulus Sx		182.0 cm³
Section shear area Av		8.8 cm²
Section radius of gyration ry		3.7 cm
Section torsional index x		20.7
Section buckling parameter u		0.84
Section Class		Class 3 (Flange)
Effective Section plastic modulus Sx,eff		175.49 cm3
LTB Parameters		
Restraint Condition Coefficient		1.20 (Table 13)
Effective Length	Le	264.00 cm
Slenderness	λ	71.4
Slenderness Factor	v	0.890
Correction Factor	m or n	1.00 (Table 18)
Equivalent slenderness	λLT	52.38
Bending Stength	pb	232.15 (B)

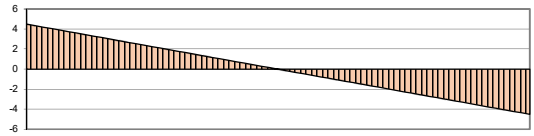
Design Status		
Moment Capacity	48.3 kNm	Pass
Buckling Resistance	40.7 kNm	Pass
Shear Capacity	145.8 kN	Pass

Deflection	Limits	Allowable	Max actual deflection	
Imposed Loads	360	6.1	0.00 mm	Pass
Total Loads	360	6.1	0.35 mm	Pass

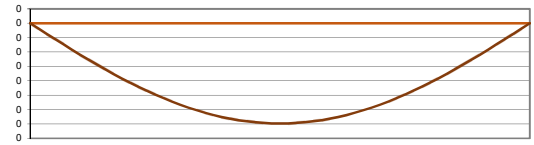




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

PADSTONE DESIGN

	LHS	RHS
Masonry Type	3.5N Block	
Characteristic strength of masonry =	3.50 N/mm2	
Maximum Allowable Bearing Stress =	1.25 N/mm2	
End Reaction from	B3 4.50 kN	
End Reaction from	No 0.00 kN	
	∑ 4.50 kN	
Actual Bearing Stress =	0.59 N/mm2	
	Padstone not required	
Padstone provided=		
Eccentricity=		
Stress under padstone =		

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Work Section	Structural Calculations		

BEAM NUMBER = B4

SPAN	2.90 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Dormer Wall	0.00	2.90	1.00 kN/m2	x	2.70 m	2.70 kN/m	1.4	3.78 kN/m
	Loft Floor	0.00	2.90	0.95 kN/m2	x	1.05 m	1.00 kN/m	1.4	1.40 kN/m
	Flat Roof	0.00	2.90	1.00 kN/m2	x	1.05 m	1.05 kN/m	1.4	1.47 kN/m
	Type 4	0.00	2.90	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
Imposed Load	Dormer Wall	0.00	2.90	0.00 kN/m2	x	2.70 m	0.00 kN/m	1.6	0.00 kN/m
	Loft Floor	0.00	2.90	1.50 kN/m2	x	1.05 m	1.58 kN/m	1.6	2.52 kN/m
	Flat Roof	0.00	2.90	0.75 kN/m2	x	1.05 m	0.79 kN/m	1.6	1.26 kN/m
	Type 4	0.00	2.90	0.00 kN/m2	x	0.00 m	0.00 kN/m	1.6	0.00 kN/m

Self weight Yes

UDL = 10.43 kN/m

POINT LOADS

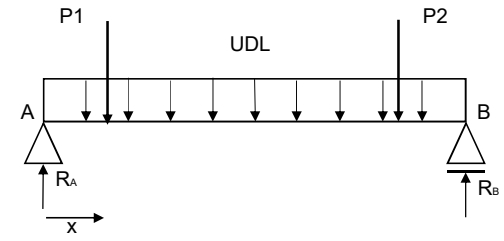
Point Load 1 x=	0.30 m	From :	B3	**Point Load 2 x=**	0.00 m	From :	
Dead Load	3.21 kN	1.4	4.50 kN	Dead Load	0.00 kN	1.4	0.00 kN
Imposed Load	0.00 kN	1.6	0.00 kN	Imposed Load	0.00 kN	1.6	0.00 kN
		P1	**4.50 kN**			P2	0.00 kN

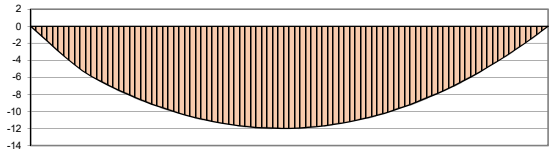
DESIGN OF BEAM B4 — CHOSEN SECTION UC 152x152x23

Forces in Beam	
Moment	**11.97 kNm**
Shear Force	**19.60 kN**

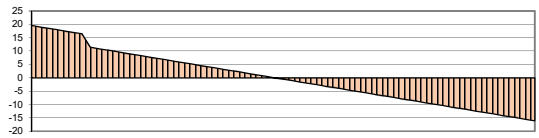
Reactions	Charact DL	Charact IL	
Ra	10.09	3.43	**19.60 kN**
Rb	7.54	3.43	**16.03 kN**

Design Parameters		
Steel Grade		**275 N/mm²**
Modulus of Elasticity E		**205000 N/mm²**
Section Depth		**152.4 mm**
Section Width		**152.2 mm**
Section Area		**29 cm²**
Section 2nd moment of area Ix		**1250.0 cm⁴**
Section modulus Zx		**164.0 cm³**
Section plastic modulus Sx		**182.0 cm³**
Section shear area Av		**8.8 cm²**
Section radius of gyration ry		**3.7 cm**
Section torsional index x		**20.7**
Section buckling parameter u		**0.84**
Section Class		**Class 3 (Flange)**
Effective Section plastic modulus Sx,eff		**175.49 cm3**
LTB Parameters		
Restraint Condition Coefficient		1.20 (Table 13)
Effective Length	Le	348.00 cm
Slenderness	λ	94.1
Slenderness Factor	v	0.838
Correction Factor	m or n	1.00 (Table 18)
Equivalent slenderness	λLT	64.98
Bending Stength	pb	200.81 (B)

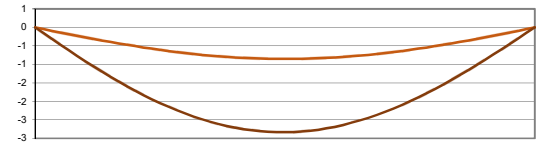




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

Design Status			
Moment Capacity		**48.3 kNm**	Pass
Buckling Resistance		**35.2 kNm**	Pass
Shear Capacity		**145.8 kN**	Pass

Deflection	Limits	Allowable	Max actual deflection	
Imposed Loads	360	8.1	**0.85 mm**	Pass
Total Loads	360	8.1	**2.83 mm**	Pass

PADSTONE DESIGN

	LHS	**RHS**
Masonry Type	3.5N Block	3.5N Block
Characteristic strength of masonry =	3.50 N/mm2	3.50 N/mm2
Maximum Allowable Bearing Stress =	1.25 N/mm2	1.25 N/mm2
End Reaction from	B4 19.60 kN	B4 16.03 kN
End Reaction from	No 0.00 kN	No 0.00 kN
	∑ 19.60 kN	∑ 16.03 kN
Actual Bearing Stress =	2.58 N/mm2	10.54 N/mm2
	Padstone Required	**Padstone Required**
Padstone provided=	300 x 100 mm	300 x 100 mm
Eccentricity=	0 mm	0 mm
Stress under padstone =	0.65 N/mm2	0.53 N/mm2
	Padstone Pass	Padstone Pass

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Project Title	0		
Work Section	Structural Calculations		

BEAM NUMBER = B5

SPAN	4.40 m

LOADING

UDL

	Load Type	Load location		Load value				
Dead Load	Type 1	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Str.Fl.Joist	0.00	4.40	1.43 kN /	0.40 m	3.57 kN/m	1.4	5.00 kN/m
	Type 3	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
	Type 4	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.4	0.00 kN/m
Imposed Load	Type 1	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Str.Fl.Joist	0.00	4.40	1.30 kN /	0.40 m	3.26 kN/m	1.6	5.22 kN/m
	Type 3	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.6	0.00 kN/m
	Type 4	0.00	4.40	0.00 kN/m2 x	0.00 m	0.00 kN/m	1.6	0.00 kN/m
Self weight	Yes							

UDL = 10.22 kN/m

POINT LOADS

Point Load 1 x=	0.00 m	From :	0	Point Load 2 x=	0.00 m	From :	
Dead Load	0.00 kN	1.4	0.00 kN	Dead Load	0.00 kN	1.4	0.00 kN
Imposed Load	0.00 kN	1.6	0.00 kN	Imposed Load	0.00 kN	1.6	0.00 kN
		P1	0.00 kN			P2	0.00 kN

DESIGN OF BEAM B5 — CHOSEN SECTION UC 152x152x30

Forces in Beam	
Moment	**25.73 kNm**
Shear Force	**23.39 kN**

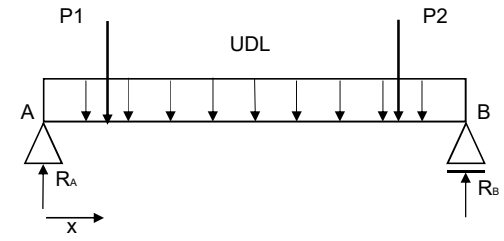
Reactions	Charact DL	Charact IL	
Ra	8.51	7.18	**23.39 kN**
Rb	8.51	7.18	**23.39 kN**

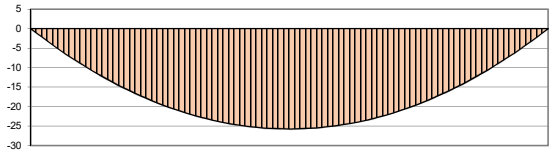
Design Parameters	
Steel Grade	**275 N/mm²**
Modulus of Elasticity E	**205000 N/mm²**
Section Depth	**157.6 mm**
Section Width	**152.9 mm**
Section Area	**38.3 cm²**
Section 2nd moment of area Ix	**1748.0 cm⁴**
Section modulus Zx	**221.8 cm³**
Section plastic modulus Sx	**248.0 cm³**
Section shear area Av	**10.2 cm²**
Section radius of gyration ry	**3.8 cm**
Section torsional index x	**16.0**
Section buckling parameter u	**0.85**
Section Class	**Class 1**

LTB Parameters		
Restraint Condition Coefficient		1.20 (Table 13)
Effective Length	Le	528.00 cm
Slenderness	λ	137.9
Slenderness Factor	v	0.679
Correction Factor	m or n	1.00 (Table 18)
Equivalent slenderness	λLT	79.44
Bending Stength	pb	166.11 (B)

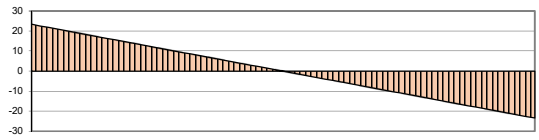
Design Status		
Moment Capacity	**68.2 kNm**	Pass
Buckling Resistance	**41.2 kNm**	Pass
Shear Capacity	**169.0 kN**	Pass

Deflection	Limits	Allowable	Max actual deflection	
Imposed Loads	360	12.2	**4.44 mm**	Pass
Total Loads	360	12.2	**9.71 mm**	Pass

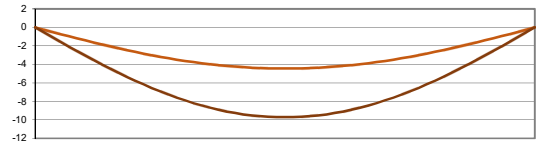




Bending Moment Diagram [kNm]



Shear Force Diagram [kN]



Deflection Diagram [mm]

PADSTONE DESIGN

	LHS	RHS
Masonry Type	3.5N Block	3.5N Block
Characteristic strength of masonry =	3.50 N/mm2	3.50 N/mm2
Maximum Allowable Bearing Stress =	1.25 N/mm2	1.25 N/mm2
End Reaction from	B5 23.39 kN	B5 23.39 kN
End Reaction from	No 0.00 kN	No 0.00 kN
	∑ 23.39 kN	∑ 23.39 kN
Actual Bearing Stress =	1.53 N/mm2	1.53 N/mm2
	Padstone Required	**Padstone Required**
Padstone provided=	350 x 100 mm	350 x 100 mm
Eccentricity=	0 mm	0 mm
Stress under padstone =	0.67 N/mm2	0.67 N/mm2
	Padstone Pass	Padstone Pass