rev A

mba structures ltd

50 High Street, Brampton, Cambs

Structural Calculations Package



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INTRODUCTION

These calculations have been prepared in accordance with instructions received from J K Architecture

The calculations are to provide information in respect to Building Regulation approval as shown on detailed drawings in connection with the proposed works.

Any inspection of the work has not been undertaken in accordance with our instructions.

Calculations to comply with and with reference to the following Codes of Practice:-

BS 6399	Design Loading for Buildings
BS 5268	Structural Use of Timber
BS 5628	Use of Masonry
BS 8110	Structural Use of Concrete
BS 5950	Structural Use of Steelwork

The current Building Regulations

PREAMBLE

It is proposed to convert the existing coach house and stables into a dwelling.

The following calculations are to justify the existing structure and recommend strengthening and repairs as considered necessary.

Our brief is limited to these items only.

This project contains no known items which we consider to be of a greater risk than an experienced builder would expect to find on a similar project.

The existing structure is to be fully exposed and checked to confirm structure prior to commencing work and ordering materials

Full Building Regulations approval should be obtained prior to commencement of works on site and any works carried out prior to approval is done so at the contractors risk. The works are to be carried out to the approval and satisfaction of the Building Inspector and to accepted good building practice and in full compliance with all relevant British Standards and Codes of Practice. These calculations are for building regulation purpose and do not constitute full working drawings/details for the project. All beam lengths used in these calculations are design lengths. For ordering all beams/joists lengths are to be taken to suit site dimensions.

A Party Wall award may be required, specialist advice should be obtained.

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LOADING DATA:

		kN/m2
Pitched Roof:-		
	Tiles	0.55
	Battens/felt	0.05
	Rafters	0.1
	Insulation	0.03
	Ceiling	0.18
	Imposed	0.75
		1.66
Loft:-	Allow	1.05
Flat Roof:-		
	Chips and Bitumen	0.2
	3 Layers felt	0.1
	Boarding	0.15
	Joists	0.14
	Insulation	0.03
	Ceiling	0.18
	Imposed	0.75
		1.55
Floor:-		
	Finishes	0.06
	Boarding	0.15
	Joists	0.17
	Ceiling	0.18
	Imposed	1.5
		2.06
Stud Wall:		
	Studs/noggins	0.09
	Plasterboard	0.36
		0.45
Blockwall:		
	100mm block	0.7
	Plaster x 2	0.7
		1.4

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Brickwall:-

215mm brick	4.3
Plaster/render	0.7
	5.00

Cavity Wall:

105mm Brick	2.15
100 block	0.7
Plaster	0.35
	3.20

External Stud Wall:

Timber Boarding	0.18
Battens/felt	0.1
Insulation	0.05
Studs	0.2
Plasterboard	0.36
	0.89

Wind:-

V	40
S1	1
S2	0.6
S3	1
Vs	0.35

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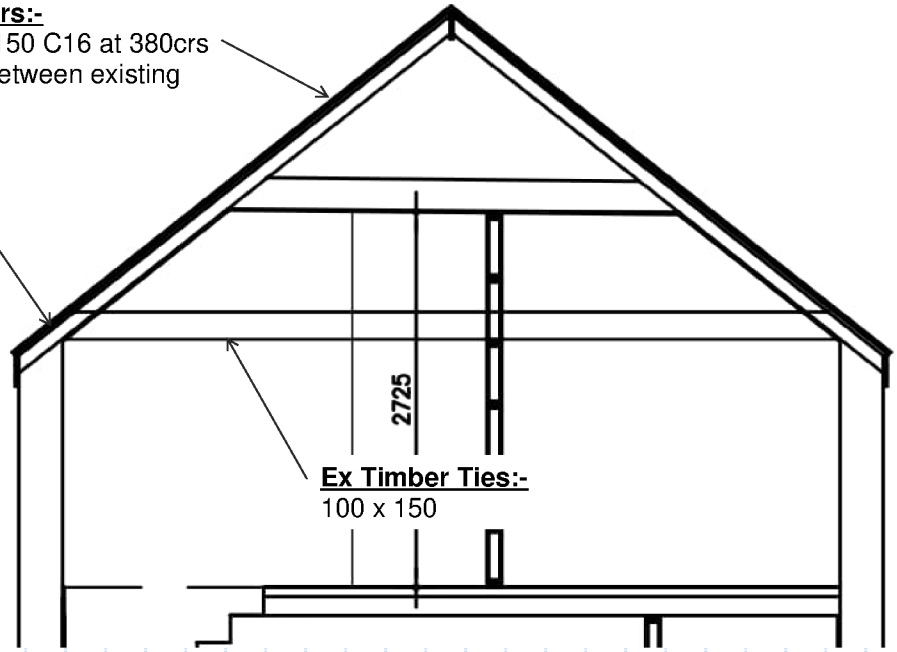
Roof Section:-

Rafters:-
50 x 150 C16 at 380crs
laid between existing

Ex Wall Plate:-
75x 175 timber



Ex Timber Ties:-
100 x 150

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Rafters:- Span 3250

Loading		Roof		1.66

Ex Timber Wall Plate:- Span 1750

Loading		Roof	1.66 x 6.0 / 2	4.98

Ex Timber Tie Beam:- Span 6000

Loading	(p09)	Wall Plate	2 [2.43 + 1.97]	8.8

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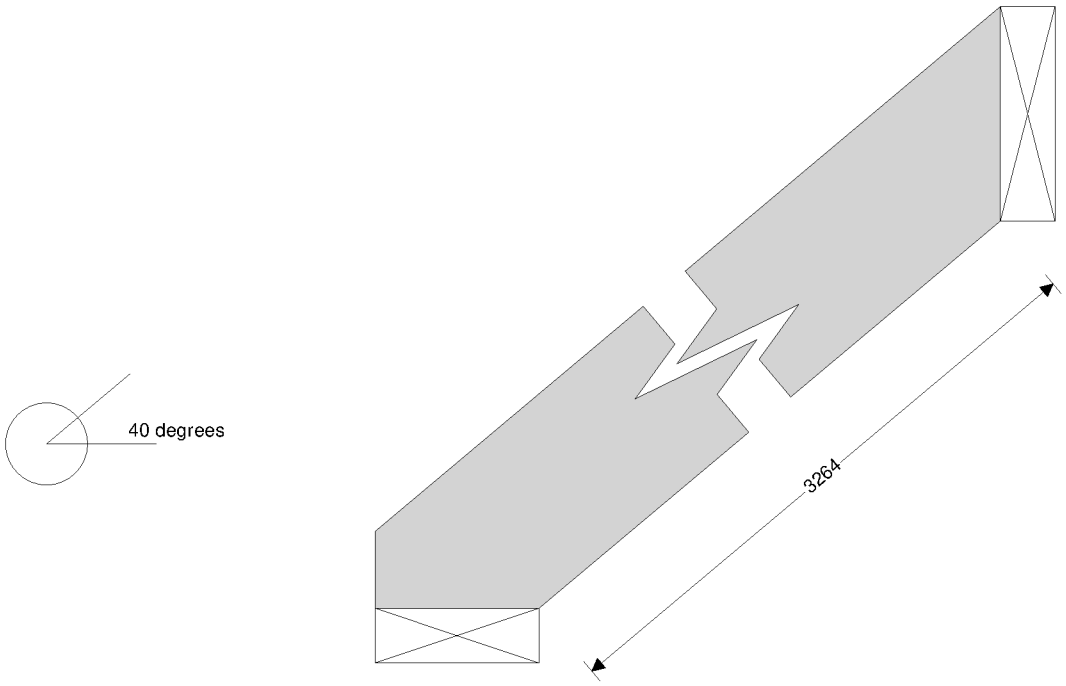
Timber Rafters:-

TIMBER RAFTER DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.03



Rafter details

Breadth of timber sections	b = **50** mm	Depth of timber sections	h = **150** mm
Rafter spacing	s = **380** mm	Rafter span	**Single span**
Clear length of span on slope	L_{cl} = **3264** mm	Rafter slope	α = **40.0** deg
Timber strength class	**C16**		

Section properties

Cross sectional area of rafter	A = **7500** mm^2	Section modulus	Z = **187500** mm^3
Radius of gyration	r = **43** mm	Second moment of area	I = **14062500** mm^4

Loading details

Rafter self weight	F_j = **0.02** kN/m	Dead load on slope	F_d = **0.75** kN/m^2
Imposed snow load on plan	F_u = **0.75** kN/m^2	Imposed point load	F_p = **0.90** kN

Modification factors

Section depth factor	K_7 = **1.08**	Load sharing factor	K_8 = **1.10**

Consider long term load condition

Load duration factor	K_3 = **1.00**	Total UDL perp. to rafter	F = **0.236** kN/m
Notional bearing length	L_b = **3** mm	Effective span	L_{eff} = **3267** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **6.292** N/mm^2	Applied bending stress	σ_{m_max} = **1.677** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress	σ_{c_adm} = **4.065** N/mm^2	Applied compressive stress	σ_{c_max} = **0.190** N/mm^2

PASS - Applied compressive stress within permissible limits

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Timber Rafters:-

Check combined bending and compressive stress parallel to grain

Combined loading check **0.318 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.737** N/mm^2 Applied shear stress τ_{max} = **0.077** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.800** mm Total deflection δ_{max} = **2.917** mm

PASS - Total deflection within permissible limits

Consider medium term load condition

Load duration factor K_3 = **1.25** Total UDL perp. to rafter F = **0.403** kN/m

Notional bearing length L_b = **5** mm Effective span L_{eff} = **3269** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **7.865** N/mm^2 Applied bending stress σ_{m_max} = **2.871** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.634** N/mm^2 Applied compressive stress σ_{c_max} = **0.326** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.444 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Applied shear stress τ_{max} = **0.132** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.807** mm Total deflection δ_{max} = **4.999** mm

PASS - Total deflection within permissible limits

Consider short term load condition

Load duration factor K_3 = **1.50** Total UDL perp. to rafter F = **0.236** kN/m

Notional bearing length L_b = **6** mm Effective span L_{eff} = **3270** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **9.438** N/mm^2 Applied bending stress σ_{m_max} = **4.686** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **5.071** N/mm^2 Applied compressive stress σ_{c_max} = **0.268** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.558 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.106** N/mm^2 Applied shear stress τ_{max} = **0.215** N/mm^2

PASS - Applied shear stress within permissible limits

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Timber Rafters:-

Check deflection

Permissible deflection δ_{adm} = **9.809** mm Total deflection δ_{max} = **7.147** mm

PASS - Total deflection within permissible limits

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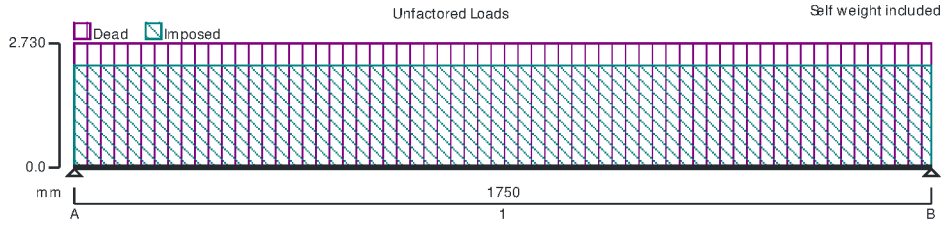
Ex Timber Wall Plate:-

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03



Applied loading

Beam loads

Dead self weight of beam × 1

Dead full UDL 2.730 kN/m

Imposed full UDL 2.250 kN/m

Analysis results

Design moment	M = **1.925** kNm	Design shear	F = **4.399** kN
Total load on beam	W_{tot} = **8.798** kN		
Reactions at support A	R_{A_max} = **4.399** kN	R_{A_min} = **4.399** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **2.430** kN		
Unfactored imposed load reaction at support A	$R_{A_Imposed}$ = **1.969** kN		
Reactions at support B	R_{B_max} = **4.399** kN	R_{B_min} = **4.399** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **2.430** kN		
Unfactored imposed load reaction at support B	$R_{B_Imposed}$ = **1.969** kN		

Timber section details

Breadth of section	b = **75** mm	Depth of section	h = **175** mm
Number of sections	N = **1**	Breadth of beam	b_b = **75** mm
Timber strength class	**C16**		

Member details

Service class of timber	**2**	Load duration	**Long term**
Length of span	L_{s1} = **1750** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	**3.00**	Actual depth-to-breadth ratio	**2.33**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **2.200** N/mm²	Applied bearing stress	σ_{c_a} = **0.587** N/mm²

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress	σ_{m_adm} = **5.624** N/mm²	Applied bending stress	σ_{m_a} = **5.028** N/mm²

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress	τ_{adm} = **0.670** N/mm²	Applied shear stress	τ_a = **0.503** N/mm²

PASS - Applied shear stress is less than permissible shear stress

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Ex Timber Wall Plate:-

Deflection

Permissible deflection δ_{adm} = **5.250** mm

Total deflection δ_a = **3.646** mm

PASS - Total deflection is less than permissible deflection

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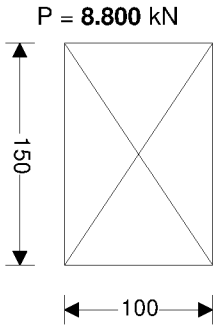
Ex Timber Tie Beam:-

TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03

Analysis results

Design axial tension



Timber section details

Breadth of section	b = **100** mm	Depth of section	h = **150** mm
Number of sections	N = **1**	Breadth of beam	b_b = **100** mm
Timber strength class	**C16**		

Member details

Service class of timber	**2**	Load duration	**Long term**

Tension parallel to grain

Permissible tensile stress	σ_{t_adm} = **3.454** N/mm^2	Applied tensile stress	σ_{t_a} = **0.587** N/mm^2

PASS - Applied tensile stress is less than permissible tensile stress

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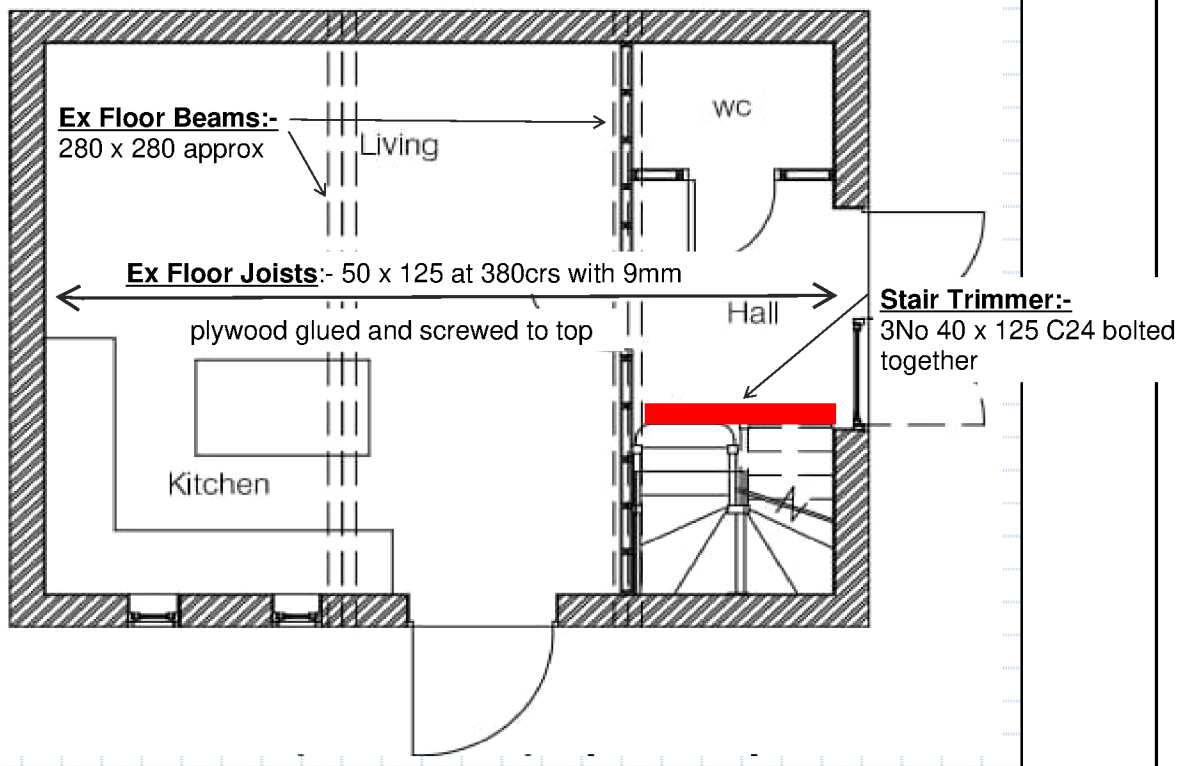
First Floor Framing Plan:-



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Floor Joists:- Span 2500

Loading	Floor		2.06

Stairwell Trimmer:- Span 2250

Loading	Floor	2.06 x 2.0 / 2	2.06

Ex Main Floor Beams:- Span 5000

Loading	Floor	2.06 x 5.0 / 2	5.15

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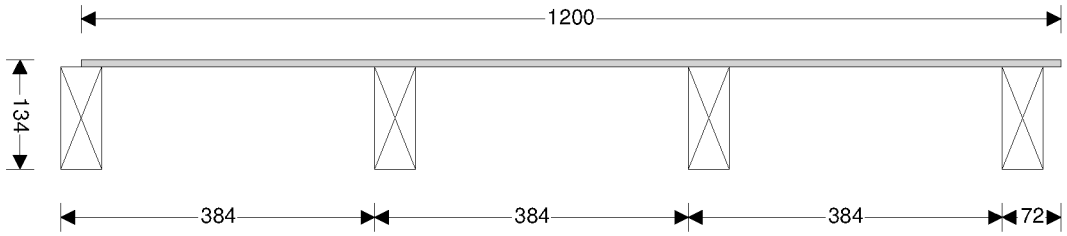
Ex Timber Floor Joists:-

STRESS SKIN PANEL DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.03

Single-skin panel details

Effective span of panel	L_{ef} = **2500** mm	Panel width	b_{panel} = **1200** mm
Web member depth	h = **125** mm	Web member breadth	b = **50** mm
Web member spacing	s = **384** mm	No.of web members per panel	N = **4**
Timber strength class	**C16**	Panel depth	t_{panel} = **134** mm
Top skin	9 mm x 7 ply Finnish conifer plywood 1.4 mm veneer:Sanded		
Minimum thickness	t_{mins_top} = **8.6** mm		



Section properties

EA for top skin	EA_{top} = **24982.140** kN	EA for web member	EA = **220000.000** kN
Summation of EA for panel	ΣEA = **244982** kN		
Neutral axis depth	$\bar{y}$ = **64.3** mm	Bending rigidity of panel	EI = **387** kN/m^{-2}

Loading details

Joist self weight	F_{swt} = **0.15** kN/m	Dead load	F_{d_udl} = **0.75** kN/m^2
Imposed UDL	F_{i_udl} = **1.50** kN/m^2	Imposed point load	F_{i_pt} = **1.40** kN

Modification factors

Section depth factor	K_7 = **1.10**	Load sharing factor	K_8 = **1.10**
Stress concentration factor	K_{37} = **0.50**	Nail glue factor	K_{70} = **0.90**

Consider long term loads

Load duration factor (timber)	K_3 = **1.00**	Load duration factor (plywood)	K_{36} = **1.00**

Check bending stresses

Maximum bending moment	M = **2.229** kNm		
Permiss.comp.stress top skin	$\sigma_{ms_top_adm}$ = **8.130** N/mm^2	Compressive stress top skin	σ_{ms_top} = **1.279** N/mm^2

PASS - Compressive stress at extreme fibre of top skin is less than permissible stress

Permiss.bend stress in web	σ_{mw_adm} = **6.419** N/mm^2	Bending stress top of web	σ_{mw_top} = **2.826** N/mm^2

PASS - Bending stress at upper extreme fibre of web is less than permissible stress

Bending stress bottom of web σ_{mw_bot} = **3.517** N/mm^2

PASS - Bending stress at lower extreme fibre of web is less than permissible stress

Check horizontal shear stresses in web members

Maximum shear force	V = **3.566** kN		
Permissible shear stress	τ_{adm} = **0.737** N/mm^2	Max.horizontal shear stress	τ_{max} = **0.193** N/mm^2

PASS - Maximum horizontal shear stress is less than permissible shear stress

Check rolling shear stress between top skin and web members

Perm.roll shear stress top	$\tau_{r_top_adm}$ = **0.356** N/mm^2	Max.rolling shear stress	$\tau_{r_top_max}$ = **0.079** N/mm^2

PASS - Maximum rolling shear stress at top skin is less than permissible rolling shear stress

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Ex Timber Floor Joists:-

Check deflection

Permissible deflection δ_{adm} = **7.500** mm Total deflection δ_{max} = **3.929** mm

PASS - Total deflection is less than permissible deflection

Consider medium term loads

Load duration factor (timber) K_3 = **1.25** Load duration factor (plywood) K_{36} = **1.33**

Check bending stresses

Maximum bending moment M = **1.698** kNm

Permiss.comp.stress top skin $\sigma_{ms_top_adm}$ = **10.813** N/mm^2 Compressive stress top skin σ_{ms_top} = **0.974** N/mm^2

PASS - Compressive stress at extreme fibre of top skin is less than permissible stress

Permiss.bend stress in web σ_{mw_adm} = **8.024** N/mm^2 Bending stress top of web σ_{mw_top} = **2.152** N/mm^2

PASS - Bending stress at upper extreme fibre of web is less than permissible stress

Bending stress bottom of web σ_{mw_bot} = **2.679** N/mm^2

PASS - Bending stress at lower extreme fibre of web is less than permissible stress

Check horizontal shear stresses in web members

Maximum shear force V = **2.016** kN

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Max.horizontal shear stress τ_{max} = **0.109** N/mm^2

PASS - Maximum horizontal shear stress is less than permissible shear stress

Check rolling shear stress between top skin and web members

Perm.roll shear stress top $\tau_{r_top_adm}$ = **0.473** N/mm^2 Max.rolling shear stress $\tau_{r_top_max}$ = **0.045** N/mm^2

PASS - Maximum rolling shear stress at top skin is less than permissible rolling shear stress

Check deflection

Permissible deflection δ_{adm} = **7.500** mm Total deflection δ_{max} = **2.698** mm

PASS - Total deflection is less than permissible deflection

Splice plate design

Min.length splice plate top L_{top_splice} = **31** mm

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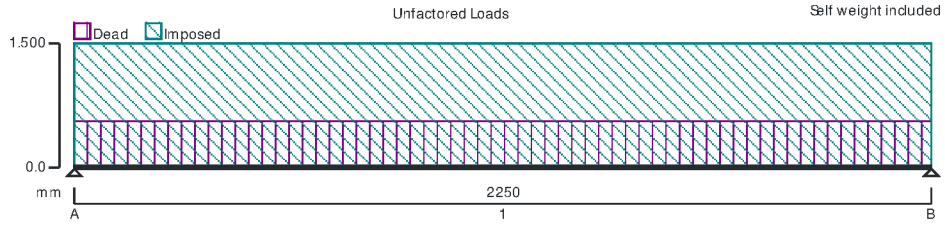
Timber Stairwell Trimmer:-

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03



Applied loading

Beam loads

Dead self weight of beam × 1

Dead full UDL 0.560 kN/m

Imposed full UDL 1.500 kN/m

Analysis results

Design moment	M = **1.347** kNm	Design shear	F = **2.394** kN
Total load on beam	W_{tot} = **4.788** kN		
Reactions at support A	R_{A_max} = **2.394** kN	R_{A_min} = **2.394** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **0.707** kN		
Unfactored imposed load reaction at support A	$R_{A_Imposed}$ = **1.688** kN		
Reactions at support B	R_{B_max} = **2.394** kN	R_{B_min} = **2.394** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **0.707** kN		
Unfactored imposed load reaction at support B	$R_{B_Imposed}$ = **1.688** kN		

Timber section details

Breadth of section	b = **50** mm	Depth of section	h = **125** mm
Number of sections	N = **3**	Breadth of beam	b_b = **150** mm
Timber strength class	**C16**		

Member details

Service class of timber	**2**	Load duration	**Long term**
Length of span	L_{s1} = **2250** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio **3.00** Actual depth-to-breadth ratio **0.83**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress σ_{c_adm} = **2.420** N/mm² Applied bearing stress σ_{c_a} = **0.160** N/mm²

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress σ_{m_adm} = **6.419** N/mm² Applied bending stress σ_{m_a} = **3.447** N/mm²

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress τ_{adm} = **0.737** N/mm² Applied shear stress τ_a = **0.192** N/mm²

PASS - Applied shear stress is less than permissible shear stress

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Timber Stairwell Trimmer:-

Deflection

Permissible deflection δ_{adm} = **6.750** mm Total deflection δ_a = **4.341** mm

PASS - Total deflection is less than permissible deflection

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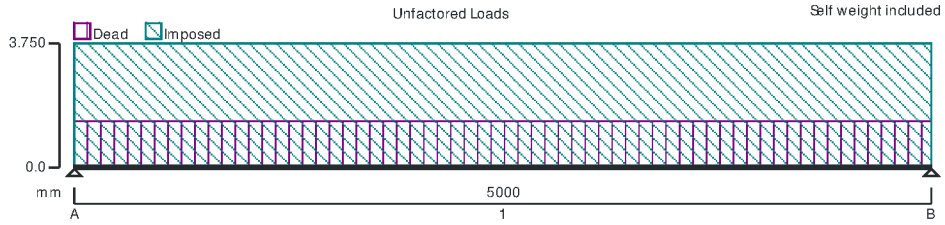
Ex Main Timber Floor Beams:-

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03



Applied loading

Beam loads

Dead self weight of beam × 1

Dead full UDL 1.400 kN/m

Imposed full UDL 3.750 kN/m

Analysis results

Design moment	M = **17.103** kNm	Design shear	F = **13.682** kN
Total load on beam	W_{tot} = **27.365** kN		
Reactions at support A	R_{A_max} = **13.682** kN	R_{A_min} = **13.682** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **4.307** kN		
Unfactored imposed load reaction at support A	$R_{A_Imposed}$ = **9.375** kN		
Reactions at support B	R_{B_max} = **13.682** kN	R_{B_min} = **13.682** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **4.307** kN		
Unfactored imposed load reaction at support B	$R_{B_Imposed}$ = **9.375** kN		

Timber section details

Breadth of section	b = **280** mm	Depth of section	h = **280** mm
Number of sections	N = **1**	Breadth of beam	b_b = **280** mm
Timber strength class	**C24**		

Member details

Service class of timber	**2**	Load duration	**Long term**
Length of span	L_{s1} = **5000** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	**3.00**	Actual depth-to-breadth ratio	**1.00**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **2.400** N/mm²	Applied bearing stress	σ_{c_a} = **0.489** N/mm²

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress	σ_{m_adm} = **7.557** N/mm²	Applied bending stress	σ_{m_a} = **4.675** N/mm²

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress	τ_{adm} = **0.710** N/mm²	Applied shear stress	τ_a = **0.262** N/mm²

PASS - Applied shear stress is less than permissible shear stress

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Ex Main Timber Floor Beams:-

Deflection

Permissible deflection δ_{adm} = **13.995** mm

Total deflection δ_a = **12.659** mm

PASS - Total deflection is less than permissible deflection

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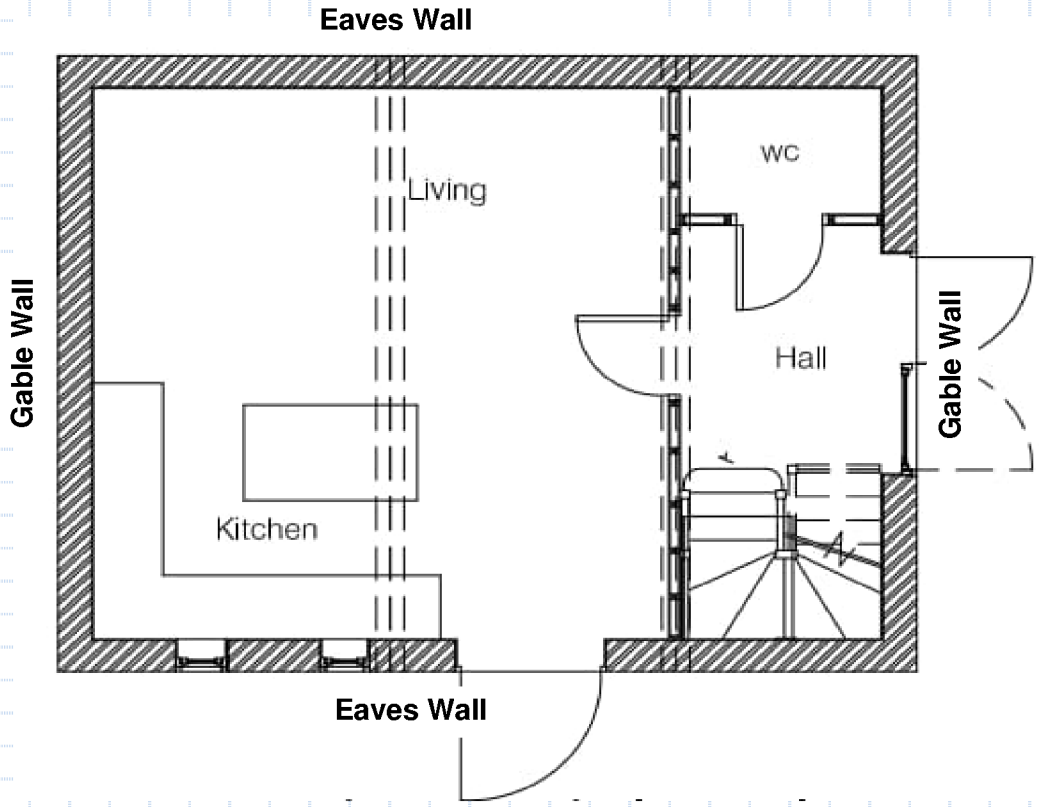
Ground Floor Plan:-



Consider Existing Foundations:-

Assumed allowable ground bearing pressure = 100 kN/m2

From Geological Maps sub soil is expected to be sand and gravel over Oxford clay. Boreholes some 275m to the north west and 250m to the south confirm sandy gravel to some 4.0m below ground level.

Gable Wall Loading

Roof	1.66 x 0.5 = 0.83	
Floor	2.06 x 2.5/2 = 2.58	42.71
Wall	7.15 x 5.5 = 39.3	

Min width = 42.71/100 = 0.43m

Eaves Wall Loading

Roof	1.66 x 6.0/2 = 4.98	
Floor	2.06 x 5.0/2 = 5.15	42.33
Wall	7.15 x 4.5 = 32.2	

Min width = 42.33/100 = 0.42m

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Ground Bearing Floor Slab:-

CONCRETE INDUSTRIAL GROUND FLOOR SLAB DESIGN

In accordance with TR34, 4th Edition 2013

Tedds calculation version 2.0.04

Design summary

Load 1 -Single internal 100 x 100 point load

Description	Unit	Provided	Required	Utilisation	Result
Slab capacity in flexure	kN	136.3	2.1	0.015	PASS
Shear at face	kN	187.0	2.1	0.011	PASS
Shear at 2d	kN	77.9	2.0	0.026	PASS

Load 2 -UDL 2 kN/m²

Description	Unit	Provided	Required	Utilisation	Result
Slab capacity in flexure	kN/m²	54.2	1.5	0.028	PASS

Slab details

Reinforcement type	Fabric	Concrete class	C28/35
Slab thickness	h = **150** mm		
Fabric reinforcement type	A142	Char. strength of reinf.	f_{yk} = **500** N/mm²
Area of bottom steel provided	$A_{s,prov}$ = **142** mm²/m	Diameter of reinforcement	ϕ_s = **6** mm
Nominal cover	c_{nom_b} = **50** mm		
Eff. depth of reinforcement	d = **94** mm		

Partial safety factors

Concrete (with or without fibre)	γ_c = **1.50**	Reinforcement (bar or fabric)	γ_s = **1.15**
Permanent	γ_G = **1.20**	Variable	γ_Q = **1.50**
Dynamic loads	γ_D = **1.60**		

Subgrade reaction

Modulus of subgrade reaction k = **0.030** N/mm³

Concrete details - Table 6.1. Strength properties for concrete

Char. comp. cylinder strength	f_{ck} = **28** N/mm²	Char. comp. cube strength	f_{cu} = **35** N/mm²
Mean comp cylinder strength	f_{cm} = **36** N/mm²	Mean axial tensile strength	f_{ctm} = **2.8** N/mm²
Flexural tensile strength	$f_{ctd,fl}$ = **2.7** N/mm²	Design conc. comp strength	f_{cd} = **18.7** N/mm²
Secant modulus of concrete	E_{cm} = **32** kN/mm²		
Poisons ratio	ν = **0.2**	Radius of relative stiffness	l = **749** mm
Characteristic of system	λ = **0.953** m⁻¹		

Moment capacity

Negative moment capacity	M_n = M_{un} = **10.0** kNm/m	Positive moment capacity	M_p = M_{pfab} = **5.5** kNm/m

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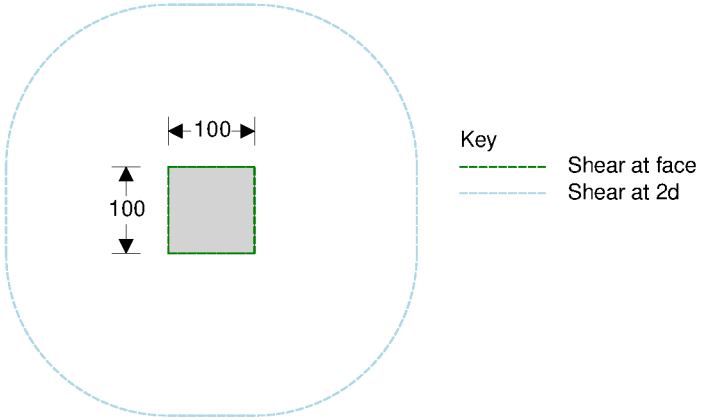
Ground Bearing Floor Slab:-

Load 1 - Single internal 100 x 100 point load



Single internal load

Loading length	l_l = **100**mm	Loading width	l_w = **100**mm
Permanent load	G_k = **0.0** kN	Variable load	Q_k = **1.4** kN
Dynamic load	D_k = **0.0** kN		

Contact radius ratio

Equivalent contact radius ratio	a = **56.4** mm	Radius ratio	a / l = **0.075**

Ultimate capacity under single internal concentrated loads

For a/l equal to 0	P_{u_0} = **97.6** kN	For a/l equal to 0.2	$P_{u_0.2}$ = **200.3** kN
Thus for a / l equal to 0.075	P_u = **136.3** kN		

Check ultimate load capacity of slab

Number of loads	N = **1**	Loading applied to slab	F_{uls} = **2.1** kN
Utilisation	F_{uls} / P_u = **0.015**		

PASS - Total slab capacity exceeds applied load

Punching shear at the face of the loaded area

Shear factor	k_2 = **0.53**		
Perimeter - face loaded area	u_0 = **400** mm	Shear stress	v_{max} = **4.973** N/mm^2
Max load capacity - punching	$P_{p,max}$ = **187.0** kN		
Utilisation	F_{uls} / $P_{p,max}$ = **0.011**		

PASS - Total slab capacity in punching at face of loaded area exceeds applied load

Punching shear at the critical perimeter

Shear factor	k_s = **2.00**	Min shear stress at 2d	$v_{Rd,c,min}$ = **0.524** N/mm^2
Ratio of reinf. in x-direction	ρ_x = **0.00151**	Ratio of reinf. in y-direction	ρ_y = **0.00151**
Reinforcement ratio	ρ_1 = **0.00151**	Max shear stress at 2d	$v_{Rd,c}$ = **0.524** N/mm^2
Perimeter at 2d from face	u_1 = **1581** mm	Max. load capacity at 2d	P_p = **77.9** kN
Ground reaction (cl.7.10.2)	R_p = **0.1** kN	Total imposed shear load	F_{uls_total} = **2.0** kN
Utilisation	F_{uls_total} / P_p = **0.026**		

PASS - Total slab capacity in punching at 2d from face of loaded area exceeds applied load

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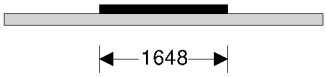
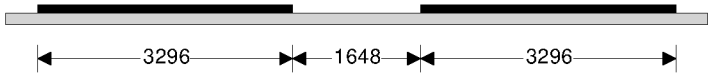
Ground Bearing Floor Slab:-

Load 2 - UDL 2 kN/m²



Maximum positive bending moment loading pattern



Maximum negative bending moment loading pattern

Working load capacity of UDL

UDL	U_k = **1.5** kN/m²		
Critical aisle width	l_{crit} = **1648** mm	Loaded width of single UDL	l_{load_p} = **1648** mm
Loaded width of dual UDL	l_{load_n} = **3296** mm	Working load capcity of slab	q = **54.2** kN/m²
Utilisation	U_k / q = **0.028**		

PASS - Total slab capacity exceeds applied load

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Notes:-

The structural worthiness of the existing and/or proposed foundations should be assessed on site after careful consideration of the prevailing ground conditions and, if considered relevant, the intensity and size of any trees and/or shrubs presently in existence, and/or to be planted, within the zone of influence of the proposed works.

In the case of existing buildings the structural worthiness of the existing load carrying elements, such as walls and lintels etc. in respect to their capability to accept any additional loads should be carefully assessed on site.

The main contractor is to design supply and remain responsible for all temporary works required to ensure the complete safety and structural stability of the property and all surrounding buildings for the duration of the contract works.

Structural concrete to be grade C35. Blinding concrete to be grade 20. All concrete below ground to be grade C35/SRC.

Mass concrete padstones to be strength class C25 to BS 5328 with a minimum cement content of 250kg/m3 and a maximum water/cement ratio of 0.70.

Steel to be grade S355, typically class EX2 complying with all current British Standards.

Steelwork to be shot blasted to SA 2.5 of BS 7079:Part 1 and painted one coat of Leighs Paint Epigrip C400 Epoxy Zinc Phosphate Primer 75 microns DFT.

Steelwork encased in concrete or masonary to receive an additional coat of brush applied bitumastic paint.

All timber to be grade C16/C24 as noted to BS 5268 and to be double vacuum treated. Sawn ends are to be treated with a compatible preservative.

All joist hangers are to be galvanised mild steel with a minimum thickness of 2.5mm.

Joists to be doubled under baths and partitions.

For joist spans greater than 2.5m herringbone strutting is to be installed in accordance with the Building Regulations.

Provide solid strutting under all partitions running at right angles to joists under.

All doubled up joists to be bolted together using M12 (4.6) bolts and 51mm dia toothed plate connectors at 500mm crs.

Solid blocking is to be installed between joists where notched into steel beams or supported on joist hangers.

The client's attention is drawn to the current Construction (Design & Management) Regulations 2015 which relate to any Building works involving more than 500 man hours or longer than thirty days in duration. It is the clients responsibility to appoint CDM coordinator on all relevant projects which require compliance with CDM regulations.