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23 PIERSON ROAD
WINDSOR
BERKSHIRE
SL4 5RJ

PROPOSED EXTENSION AND ALTERATIONS

STRUCTURAL CALCULATIONS

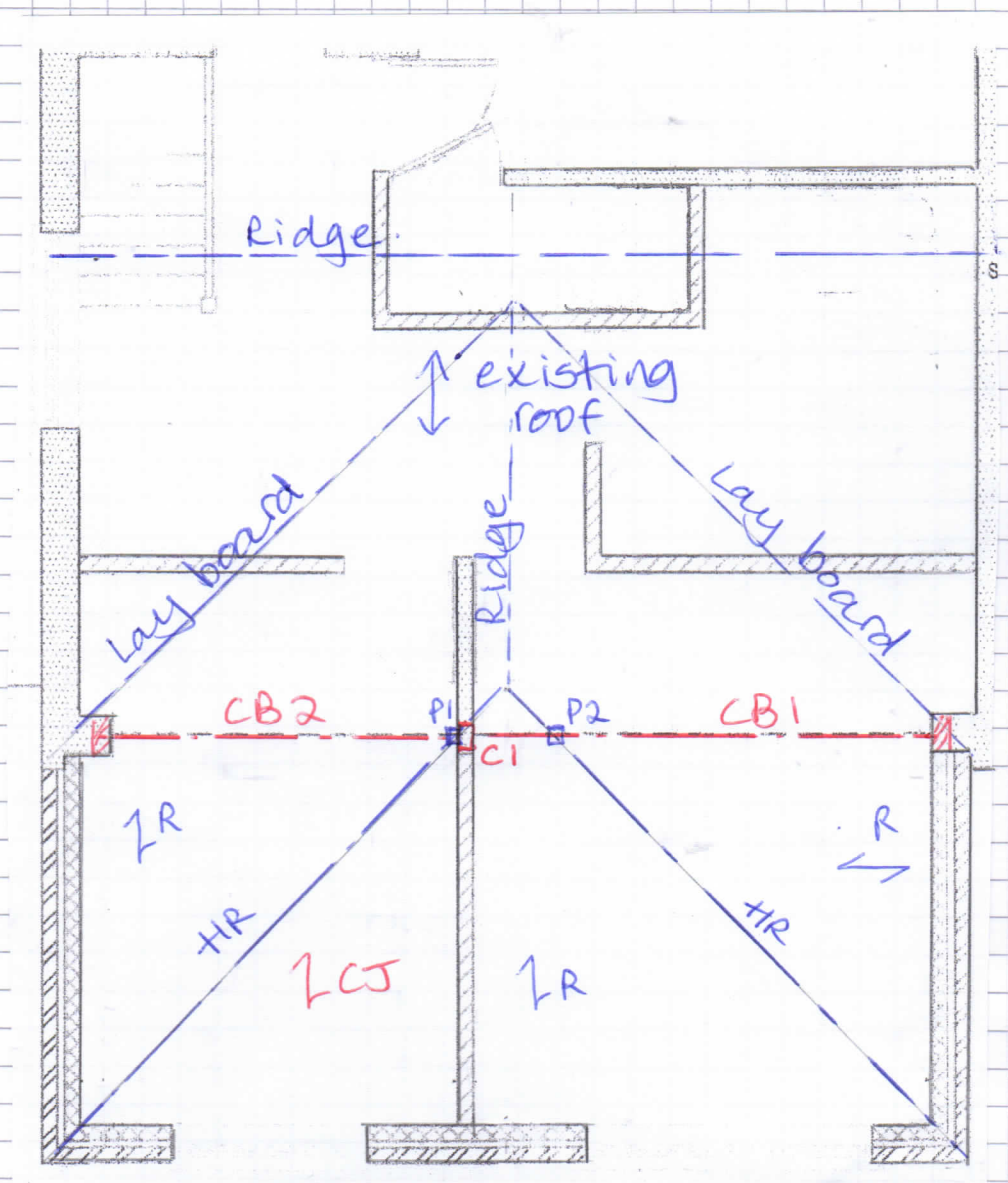
May 2022

It is proposed to extend above an existing single-storey extension at this 2-storey property. Also to carry out some internal alterations.

LOADS

		SLS (KN/m²)	ULS
Roof			
	tiles, battens, felt	= 0.75	
	rafters, insulation	= 0.20	
	pitch ≤ 37° =>	1.19	1.67
	snow	= 0.60	0.96
		1.79	2.63
attic	DL	= 0.25	0.35
	LL	= 0.25	0.40
		0.50	0.75
first floor	DL	= 0.60	0.84
	LL	= 1.50	2.40
		2.10	3.24
internal masonry wall		= 2.50	3.50
cavity wall		= 3.90	5.46
external timber wall		= 1.40	1.96

ROOF


Ridge
existing roof
Ridge
Lay board
Lay board
CB2
P1
P2
CB1
C1
2R
R
HR
HR
2CJ
2R

Rafters

l = 2.85m.

C24 47x147 at 400 crs - pages 4 + 5

Hip rafter

w_{min} = 0

w_{max} = 1.79 x 2.6 = 4.65 kN/m

l = 3.65m

C24 47x195. - page 6

prop at midspan off CB1 + CB2 also. support on P1 + P2

ceiling joists

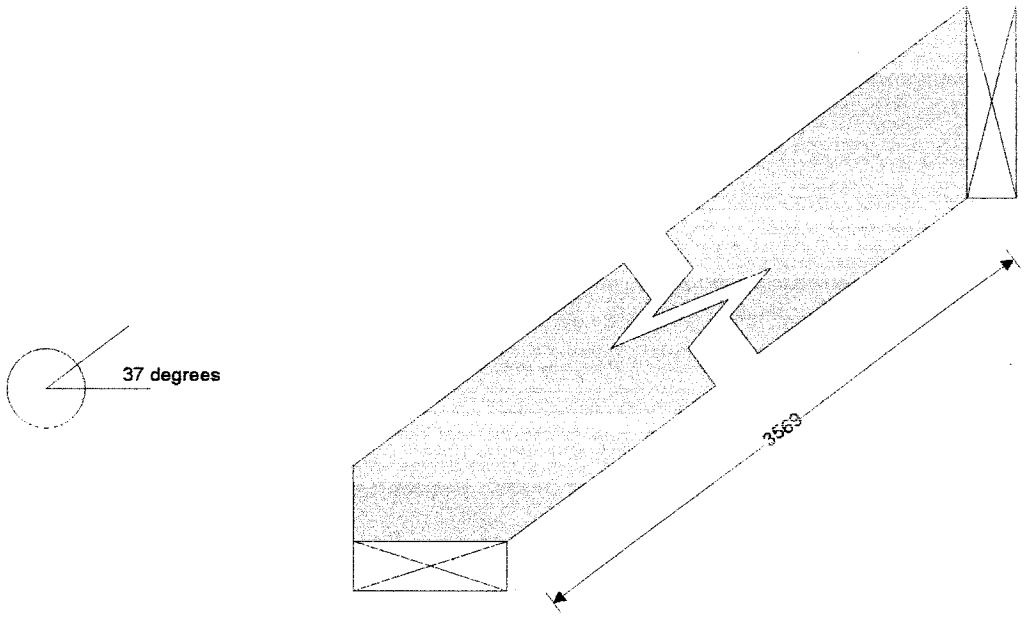
l = 2.6m

47x122 at 400 crs - pages 7 + 8

Tekla Tedds	Project				Job no.	
Tamara Maw Structures 3 Shelley Close Wooburn Moor HP10 0NW	23 Pierson Road					
	Calcs for				Start page no./Revision	
	Rafters				4	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	TM	17/05/2022				

TIMBER RAFTER DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.03



Rafter details

Breadth of timber sections	b = **47** mm	Depth of timber sections	h = **147** mm
Rafter spacing	s = **400** mm	Rafter span	**Single span**
Clear length of span on slope	L_{cl} = **3569** mm	Rafter slope	α = **37.0** deg
Timber strength class	**C24**		

Section properties

Cross sectional area of rafter	A = **6909** mm^2	Section modulus	Z = **169270** mm^3
Radius of gyration	r = **42** mm	Second moment of area	I = **12441382** mm^4

Loading details

Rafter self weight	F_j = **0.02** kN/m	Dead load on slope	F_d = **0.85** kN/m^2
Imposed snow load on plan	F_u = **0.60** 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 = **0.290** kN/m
Notional bearing length	L_b = **4** mm	Effective span	L_{eff} = **3573** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **8.923** N/mm^2	Applied bending stress	σ_{m_max} = **2.738** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress	σ_{c_adm} = **4.308** N/mm^2	Applied compressive stress	σ_{c_max} = **0.269** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.376 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.781** N/mm² Applied shear stress τ_{max} = **0.113** N/mm²

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **10.718** mm Total deflection δ_{max} = **4.706** 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 = **0.444** kN/m

Notional bearing length L_b = **6** mm Effective span L_{eff} = **3575** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **11.154** N/mm² Applied bending stress σ_{m_max} = **4.186** N/mm²

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.849** N/mm² Applied compressive stress σ_{c_max} = **0.412** N/mm²

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.471 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.976** N/mm² Applied shear stress τ_{max} = **0.172** N/mm²

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **10.725** mm Total deflection δ_{max} = **7.203** 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 = **0.290** kN/m

Notional bearing length L_b = **7** mm Effective span L_{eff} = **3576** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **13.385** N/mm² Applied bending stress σ_{m_max} = **6.538** N/mm²

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **5.253** N/mm² Applied compressive stress σ_{c_max} = **0.348** N/mm²

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.565 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.172** N/mm² Applied shear stress τ_{max} = **0.269** N/mm²

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **10.727** mm Total deflection δ_{max} = **9.981** mm

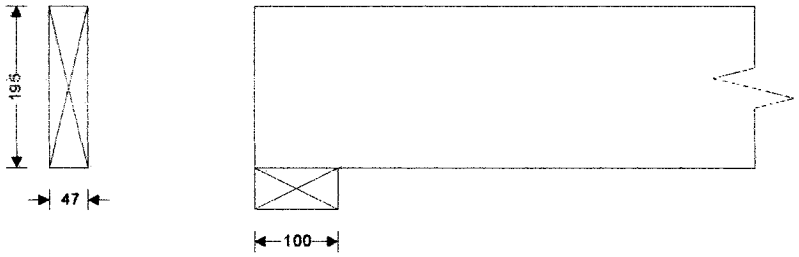
PASS - Total deflection within permissible limits

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.01

Analysis results

Design moment	M = **1.047** kNm	Design shear	F = **3.402** kN
Total load on beam	W_{tot} = **8.624** kN		
Reactions at support A	R_{A_max} = **0.203** kN	R_{A_min} = **0.203** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **0.203** kN		
Reactions at support B	R_{B_max} = **5.390** kN	R_{B_min} = **5.390** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **5.390** kN		
Reactions at support C	R_{C_max} = **3.031** kN	R_{C_min} = **3.031** kN	
Unfactored dead load reaction at support C	R_{C_Dead} = **3.031** kN		



Timber section details

Breadth of section	b = **47** mm	Depth of section	h = **195** mm
Number of sections	N = **1**	Breadth of beam	b_b = **47** mm
Timber strength class	**C24**		

Member details

Service class of timber	**1**	Load duration	**Long term**
Length of span 1	L_{s1} = **1825** mm		
Length of span 2	L_{s2} = **1825** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	**5.00**	Actual depth-to-breadth ratio	**4.15**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **2.640** N/mm²	Applied bearing stress	σ_{c_a} = **1.147** N/mm²

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

Bending parallel to grain

Permissible bending stress	σ_{m_adm} = **7.864** N/mm²	Applied bending stress	σ_{m_a} = **3.514** 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 = **0.557** N/mm²

PASS - Applied shear stress is less than permissible shear stress

Deflection

Permissible deflection	δ_{adm} = **5.475** mm	Total deflection	δ_a = **1.781** mm

PASS - Total deflection is less than permissible deflection

TIMBER JOIST DESIGN (BS5268-2:2002)

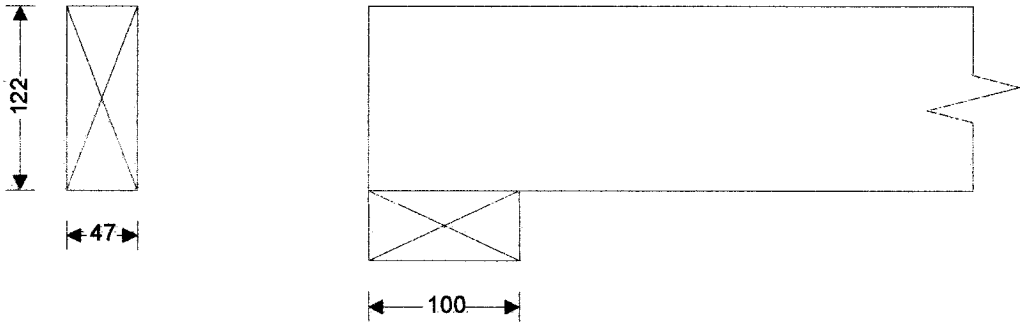
Tedds calculation version 1.1.04

Joist details

Joist breadth	b = **47** mm	Joist depth	h = **122** mm
Joist spacing	s = **400** mm	Service class of timber	**1**
Timber strength class	**C16**		

Span details

Number of spans	N_{span} = **1**	Length of bearing	L_b = **100** mm
Clear length of span	L_{s1} = **2600** mm		



Section properties

Second moment of area	I = **7112071** mm^4	Section modulus	Z = **116591** mm^3

Loading details

Joist self weight	F_{swt} = **0.02** kN/m	Dead load	F_{d_udl} = **0.25** kN/m^2
Imposed UDL(Long term)	F_{i_udl} = **0.25** kN/m^2		
Imposed point load (Medium)	F_{i_pt} = **0.90** kN		

Consider long term loads

Design bending moment	M = **0.184** kNm	Design shear force	V = **0.283** kN
Design support reaction	R = **0.283** kN	Design deflection	δ = **2.137** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **6.437** N/mm^2	Applied bending stress	σ_{m_max} = **1.576** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress	τ_{adm} = **0.737** N/mm^2	Applied shear stress	τ_{max} = **0.074** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **2.420** N/mm^2	Applied bearing stress	σ_{c_max} = **0.060** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection	δ_{adm} = **7.800** mm	Actual deflection	δ = **2.137** mm

PASS - Actual deflection within permissible limits

Consider medium term loads

Design bending moment	M = **0.684** kNm	Design shear force	V = **1.053** kN
Design support reaction	R = **1.053** kN	Design deflection	δ = **6.642** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **8.046** N/mm^2 Applied bending stress σ_{m_max} = **5.869** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Applied shear stress τ_{max} = **0.275** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.025** N/mm^2 Applied bearing stress σ_{c_max} = **0.224** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

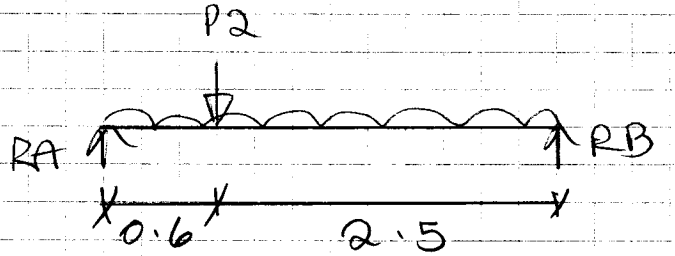
Permissible deflection δ_{adm} = **7.800** mm Actual deflection δ = **6.642** mm

PASS - Actual deflection within permissible limits

Beam CB1

		SLS (kN/m)	ULS
Existing roof	1.79×3.25	5.82	
	2.63×3.25		8.55
" attic	0.5×3.25	1.63	
	0.75×3.25		2.44
New ceiling	0.5×1.3	0.65	
	0.75×1.3		0.98
		8.10	11.97

P2: $5.39 + 3.03 = 8.42$ kN 12.4kN



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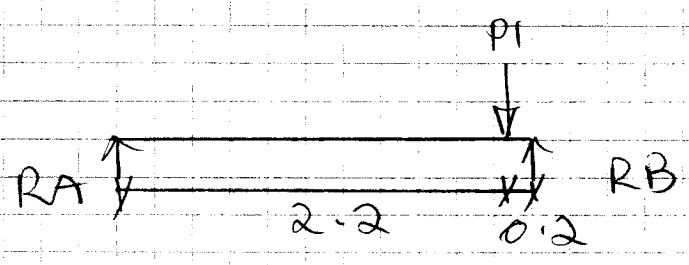
RA : 29 kN => C1

RB : 21.4kN => padstone

Beam CB2



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RA : 15.8 kN => padstone

RB : 26.1 kN => Bolt to end of CB1 with end plates + 4M16

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **18.7** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **29** kN	V_{min} = **-21.4** kN
Deflection	δ_{max} = **7.4** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **29** kN	R_{A_min} = **29** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **29** kN	
Maximum reaction at support B	R_{B_max} = **21.4** kN	R_{B_min} = **21.4** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **21.4** kN	

Section details

Section type	**UC 152x152x23 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.00**	Section classification	**Semi-compact**

Shear capacity - Section 4.2.3

Design shear force	F_v = **29** kN	Design shear resistance	P_v = **145.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **18.7** kNm	Moment capacity low shear	M_c = **48.5** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **32.2** kNm	M_b / m_{LT} = **34.6** kNm	

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **8.611** mm	Maximum deflection	δ = **7.43** mm

PASS - Maximum deflection does not exceed deflection limit

Tekla Tedds	Project				Job no.	
Tamara Maw Structures 3 Shelley Close Wooburn Moor HP10 0NW	23 Pierson Road					
	Calcs for				Start page no./Revision	
	Beam CB2				11	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	TM	17/05/2022				

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **10.1** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **15.8** kN	V_{min} = **-26.1** kN
Deflection	δ_{max} = **2.4** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **15.8** kN	R_{A_min} = **15.8** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **15.8** kN	
Maximum reaction at support B	R_{B_max} = **26.1** kN	R_{B_min} = **26.1** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **26.1** kN	

Section details

Section type	**UC 152x152x23 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.00**	Section classification	**Semi-compact**

Shear capacity - Section 4.2.3

Design shear force	F_v = **26.1** kN	Design shear resistance	P_v = **145.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **10.1** kNm	Moment capacity low shear	M_c = **48.5** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **37.2** kNm	M_b / m_{LT} = **39.9** kNm	

PASS - Buckling resistance moment exceeds design bending moment

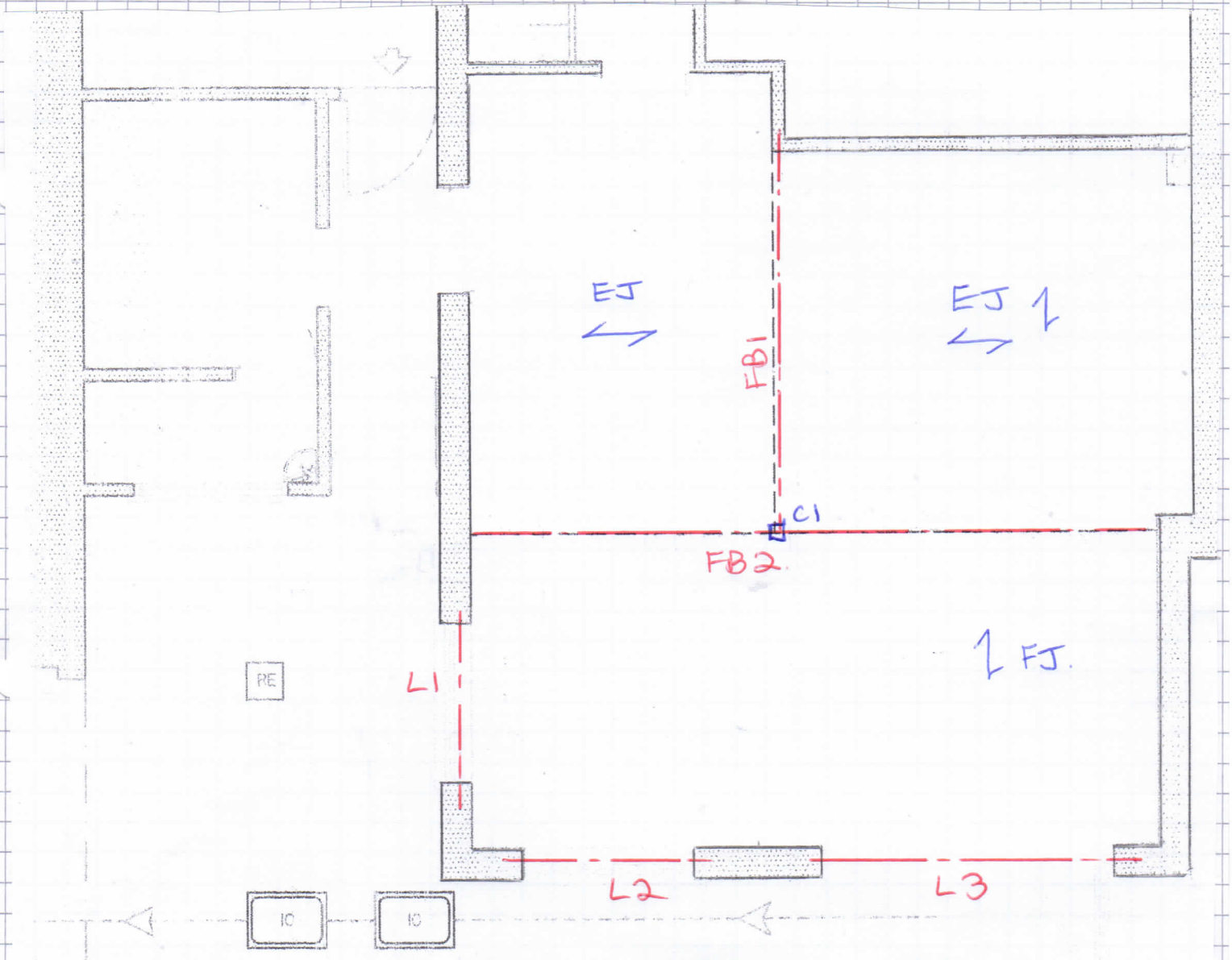
Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **6.667** mm	Maximum deflection	δ = **2.418** mm

PASS - Maximum deflection does not exceed deflection limit

FIRST FLOOR STRUCTURE



floor Joists

$t = 2.6m$

min 47 x 147 at 400 crs but increase depth to suit existing joists if preferred - pages 14 + 15.

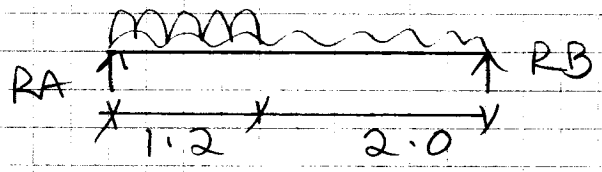
Beam FB1 SLS (KN/m) ULS

first floor: $2.1 \times 3 = 6.30$

$3.24 \times 3 =$ 9.72

partial UDL:

wall = $2.5 \times 2.4 = 6.00$ 8.40



152 UC 23 - page 16

or 178 x 102 UB - page 17

RA : 24.2 KN => FB2

RB : 17.9 KN => padstone on wall. found in under TBC

TIMBER JOIST DESIGN (BS5268-2:2002)

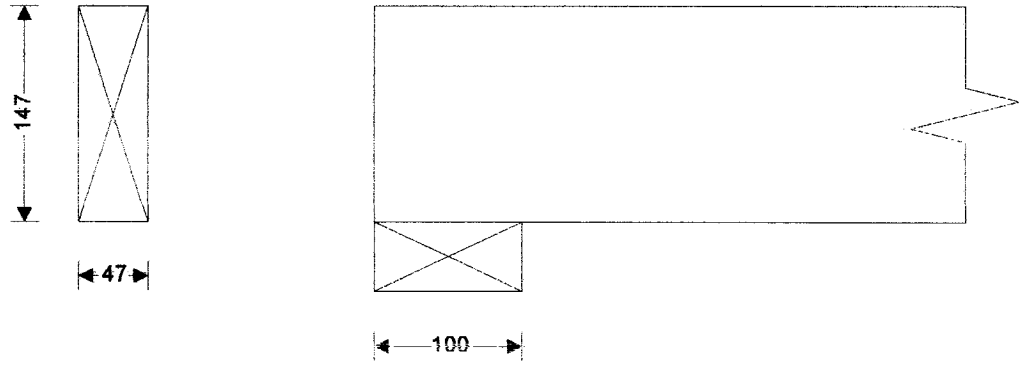
Tedds calculation version 1.1.04

Joist details

Joist breadth	b = **47** mm	Joist depth	h = **147** mm
Joist spacing	s = **400** mm	Service class of timber	**1**
Timber strength class	**C16**		

Span details

Number of spans	N_{span} = **1**	Length of bearing	L_b = **100** mm
Clear length of span	L_{s1} = **2600** mm		



Section properties

Second moment of area	I = **12441382** mm^4	Section modulus	Z = **169270** mm^3

Loading details

Joist self weight	F_{swt} = **0.02** kN/m	Dead load	F_{d_udl} = **0.60** kN/m^2
Imposed UDL(Long term)	F_{l_udl} = **1.50** kN/m^2		
Imposed point load (Medium)	F_{l_pt} = **1.40** kN		

Consider long term loads

Design bending moment	M = **0.728** kNm	Design shear force	V = **1.119** kN
Design support reaction	R = **1.119** kN	Design deflection	δ = **4.909** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **6.306** N/mm^2	Applied bending stress	σ_{m_max} = **4.298** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress	τ_{adm} = **0.737** N/mm^2	Applied shear stress	τ_{max} = **0.243** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **2.420** N/mm^2	Applied bearing stress	σ_{c_max} = **0.238** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection	δ_{adm} = **7.800** mm	Actual deflection	δ = **4.909** mm

PASS - Actual deflection within permissible limits

Consider medium term loads

Design bending moment	M = **1.131** kNm	Design shear force	V = **1.739** kN
Design support reaction	R = **1.739** kN	Design deflection	δ = **6.458** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **7.882** N/mm²

Applied bending stress σ_{m_max} = **6.679** N/mm²

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm²

Applied shear stress τ_{max} = **0.378** N/mm²

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.025** N/mm²

Applied bearing stress σ_{c_max} = **0.370** N/mm²

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **7.800** mm

Actual deflection δ = **6.458** mm

PASS - Actual deflection within permissible limits

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **16** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **24.2** kN	V_{min} = **-17.9** kN
Deflection	δ_{max} = **6.7** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **24.2** kN	R_{A_min} = **24.2** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **24.2** kN	
Maximum reaction at support B	R_{B_max} = **17.9** kN	R_{B_min} = **17.9** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **17.9** kN	

Section details

Section type	**UC 152x152x23 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.00**	Section classification	**Semi-compact**

Shear capacity - Section 4.2.3

Design shear force	F_v = **24.2** kN	Design shear resistance	P_v = **145.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **16** kNm	Moment capacity low shear	M_c = **48.5** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **31.5** kNm	M_b / m_{LT} = **34.1** kNm	

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **8.889** mm	Maximum deflection	δ = **6.721** mm

PASS - Maximum deflection does not exceed deflection limit

Tekla Tedds	Project				Job no.	
Tamara Maw Structures 3 Shelley Close Wooburn Moor HP10 0NW	23 Pierson Road					
	Calcs for				Start page no./Revision	
	Beam FB1				17	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	TM	17/05/2022				

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **16** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **24.2** kN	V_{min} = **-17.9** kN
Deflection	δ_{max} = **6.2** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **24.2** kN	R_{A_min} = **24.2** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **24.2** kN	
Maximum reaction at support B	R_{B_max} = **17.9** kN	R_{B_min} = **17.9** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **17.9** kN	

Section details

Section type	**UB 178x102x19 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.00**	Section classification	**Plastic**

Shear capacity - Section 4.2.3

Design shear force	F_v = **24.2** kN	Design shear resistance	P_v = **140.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **16** kNm	Moment capacity low shear	M_c = **47.1** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **18.6** kNm	M_b / m_{LT} = **20.1** kNm	

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **8.889** mm	Maximum deflection	δ = **6.168** mm

PASS - Maximum deflection does not exceed deflection limit

Beam fB2 SLS (KN/m) ULS

P_{cB2} = End A = 15.8KN

P_{C1} = 26.1 + 29 = 55.1KN

P_{fB1} (with 1st flr) = 24.2KN

(w/o 1st flr) = 8.6KN

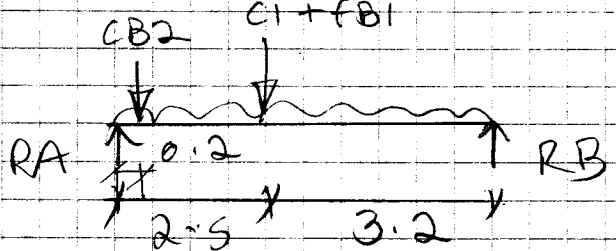
New first = 2.1 x 1.3 = 2.73

3.24 x 1.3 = 4.21

Existing first = 2.1 x 1.75 = 3.68

3.24 x 1.75 = 5.67

Loadcase 1 : first supported on fB1



203 UC 71
- page 19

Loadcase 2 : first supported on fB2

203 UC 71 - page 20

RA max = 81.9 KN

RB max = 59.4 KN

support on piers or posts
foundn. under TBC +
strengthened if necessary

Tekla Tedds	Project				Job no.	
Tamara Maw Structures 3 Shelley Close Wooburn Moor HP10 0NW	23 Pierson Road					
	Calcs for				Start page no./Revision	
	Beam FB2 - load case 1				19	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	TM	17/05/2022				

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **133.8** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **74.5** kN	V_{min} = **-50.1** kN
Deflection	δ_{max} = **24.2** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **74.5** kN	R_{A_min} = **74.5** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **74.5** kN	
Maximum reaction at support B	R_{B_max} = **50.1** kN	R_{B_min} = **50.1** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **50.1** kN	

Section details

Section type	**UC 203x203x71 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.02**	Section classification	**Plastic**

Shear capacity - Section 4.2.3

Design shear force	F_v = **74.5** kN	Design shear resistance	P_v = **343.1** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **133.8** kNm	Moment capacity low shear	M_c = **211.7** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **146** kNm	M_b / m_{LT} = **177.9** kNm	

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

ULS loads

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **22.8** mm	Maximum deflection	↳ δ = **24.174** mm

~~FAIL~~ - ***Deflection exceeds deflection limit***

δ_{SLS} = 16.7mm

⇒ OK

Tekla Tedds Tamara Maw Structures 3 Shelley Close Wooburn Moor HP10 0NW	Project 23 Pierson Road			Job no.	
	Calcs for Beam FB2 - load case 2			Start page no./Revision 20	
	Calcs by TM	Calcs date 17/05/2022	Checked by	Checked date	Approved by	Approved date

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.05

Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Analysis results

Maximum moment	M_{max} = **134.6** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **81.9** kN	V_{min} = **-59.4** kN
Deflection	δ_{max} = **25.4** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **81.9** kN	R_{A_min} = **81.9** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **81.9** kN	
Maximum reaction at support B	R_{B_max} = **59.4** kN	R_{B_min} = **59.4** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **59.4** kN	

Section details

Section type	**UC 203x203x71 (BS4-1)**	Steel grade	**S275**

Classification of cross sections - Section 3.5

Tensile strain coefficient	ε = **1.02**	Section classification	**Plastic**

Shear capacity - Section 4.2.3

Design shear force	F_v = **81.9** kN	Design shear resistance	P_v = **343.1** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment	M = **134.6** kNm	Moment capacity low shear	M_c = **211.7** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	M_b = **146** kNm	M_b / m_{LT} = **173** kNm	

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection	δ_{lim} = **22.8** mm	Maximum deflection	δ = **25.382** mm

FAIL - Deflection exceeds deflection limit

ULS loads

δ_{SLS} : 17.5mm

=> OK

Lintel L1

SLS (KN/m)

Roof : 1.79 x 1.5 = 2.69.

External wall :

cavity wall = 3.9 x 2.6 = 10.14

timber wall = 1.4 x 2.6 = 3.64.

if cavity wall W = 12.83 KN/m

if stud wall W = 6.33 KN/m

l_o = 1.3m

Existing lintel details TBC

IGL1/5 or equivalent reqd.

Lintel L2.

		SLS	
Roof =	1.79 x 1.0	= 1.79	KN/m
attic =	0.5 x 1.3	= 0.65	
1st =	2.1 x 1.3	= 2.73	
		5.17	

cavity wall = 3.9 x 2.6 x 0.8 = 8.11

timber wall = 1.4 x 2.6 x 0.8 = 2.91

if cavity wall W = 13.28 KN/m

if stud wall W = 6.08 KN/m

l_o = 1.3m IGL1/5

Lintel L3

Loads as for L2.

l_o = 2.9m IGL1/HD.

foundations

under support of FB2:

End A : P = 81.9 KN ULS
: 56 KN SLS

0.75 x 0.75m pad foundn may be reqd.

End B : P : 59.4 KN ULS
= 41 KN SLS

0.65 x 0.65m pad foundn may be reqd.

under Left side elevation of extension:

Existing W = 3.9 x 3 x 0.85 = 9.95 KN/m

additional W = 12.83
or = 6.33

=> total W = 22.78 KN/m
or = 16.28 KN/m

foundn expected to be approx min 450 wide

=> $P_{max} = \frac{22.78}{0.45}$ = 50.6 KN/m²

expected to be acceptable

under Right side elevation

Existing W = 3.9 x 3 = 11.7 KN/m

additional W = 12.83
or 6.33

=> $P_{max} = \frac{24.53}{0.45}$ = 54.5 KN/m²

expected to be acceptable.

Under Rear elevation

SLS (kN/m)

Existing roof = 1.75 x 1.3 = 2.28
wall = 3.9 x 3 x 0.7 = 8.19
10.47

additional W = 13.28
or = 8.08

=> Total W = 23.75
or = 18.55

$P_{max} = \frac{23.75}{0.45}$ = 53 kN/m² expected to be acceptable.