

17th December 20
Job No: 10961BSW3

Structural Calculations

**Moxham House
17 Woolley Street
Bradford on Avon
Wiltshire**

Project	Moxham House, 17 Woolley Street, Bradford on Avon, Wiltshire	Sheet no./rev.	BSW3/ 1
Introduction, Assumptions & Loading		By/Date	MM / Dec-25
<u>Introduction</u> The proposed works to Moxham House relate to problems with the existing floor joists of a first floor bathroom caused by water damage. An area of timber joists below a shower tray have decayed and need to be replaced. However, to keep the amount of replacement to a minimum, limited sections of the floor joists will be cut out and removed and new joists and trimmers introduced. These calculations will consider the design of the replacement joists and trimmers. <u>Assumptions</u> Location of the site is Bradford on Avon in an urban location. Codes to be used include but not limited to: BS EN 1991 – Eurocode 1 - Actions on Structures BS EN 1995 – Eurocode 3 – Design of Timber Structures <u>Loads</u> Floors Dead: 0.95 kN/m² incl. joists, boarding & finishes (First Floor) Live: 1.50 kN/m² (residential)			

Project

Moxham House, 17 Woodway Street, Bedford on Ave

Sheet no./rev2

BSW?

TRIMMER JOISTS

By/Date

MM 1/12/8

CONSIDER NEW TRIMMER JOIST TO SUPPORT NEW JOISTS
REPLACING THOSE THAT ARE GOTTEN

SPAN 1600

$$\text{DEAD} \quad 0.95 \text{ kN/m}^2 \times 2.7 \frac{1}{2} = 1.78 \text{ kN/m}$$

$$\text{LIVE} \quad 1.50 \text{ kN/m}^2 \times 2.7 \frac{1}{2} = 2.03 \text{ kN/m}$$

1 NO 50 x 200 CIS JOIST

END REAGIN D 1.05 kN

L 1.62 kN

TRIMMER WILL BE SUPPORTED BY ONE OF THE EXISTING
JOISTS OF SPACED WITH AN ADDITIONAL JOIST

SPAN 2700

$$\text{KINGPIN DEAD} \quad 0.95 \text{ kN/m}^2 \times 0.375 = 0.36 \text{ kN/m}$$

$$\text{L} \quad 1.5 \text{ kN/m}^2 \times 0.375 = 0.56 \text{ kN/m}$$

$$\text{PT LD} \quad \left. \begin{array}{l} \text{D} \quad 1.05 \text{ kN} \\ \text{L} \quad 1.62 \text{ kN} \end{array} \right\} @ 1350$$

ADD 50 x 200 CIS TO EXISTING & ALLOW FOR
NOTION FOR PIPE WORK - MAY SO DEEP

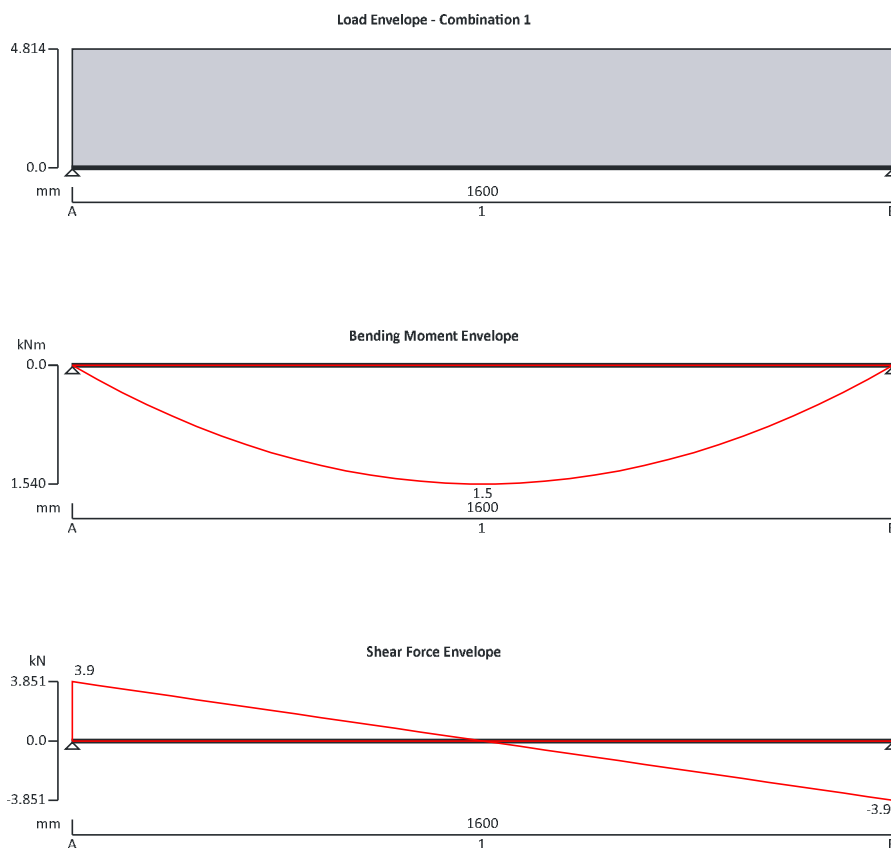
Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 3
Trimmer Joist		By/Date	MM / Dec-25

TIMBER BEAM ANALYSIS & DESIGN (EN1995)

TIMBER BEAM ANALYSIS & DESIGN TO EN1995-1-1:2004

In accordance with EN1995-1-1:2004 + A2:2014 and Corrigendum No.1 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version
1.7.05



Applied loading

Beam loads

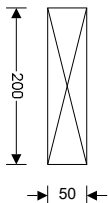
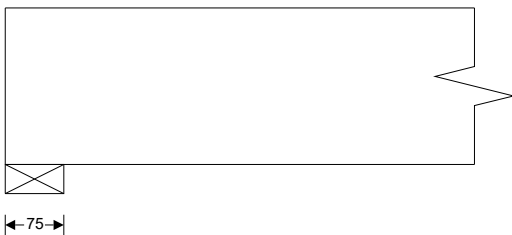
Permanent self weight of beam $\times 1$

Permanent full UDL 1.280 kN/m

Variable full UDL 2.030 kN/m

Load combinations

Load combination 1 Support A Permanent $\times 1.35$
Variable $\times 1.50$

Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 4
Trimmer Joist		By/Date	MM / Dec-25
Span 1 Permanent $\times 1.35$ Variable $\times 1.50$ Support B Permanent $\times 1.35$ Variable $\times 1.50$ Analysis results Maximum moment $M_{\max} = 1.540 \text{ kNm}$ $M_{\min} = 0.000 \text{ kNm}$ Design moment $M = \max(\text{abs}(M_{\max}), \text{abs}(M_{\min})) = 1.540 \text{ kNm}$ Maximum shear $F_{\max} = 3.851 \text{ kN}$ $F_{\min} = -3.851 \text{ kN}$ Design shear $F = \max(\text{abs}(F_{\max}), \text{abs}(F_{\min})) = 3.851 \text{ kN}$ Total load on beam $W_{\text{tot}} = 7.702 \text{ kN}$ Reactions at support A $R_{A_{\max}} = 3.851 \text{ kN}$ $R_{A_{\min}} = 3.851 \text{ kN}$ Unfactored permanent load reaction at support A $R_{A_{\text{Permanent}}} = 1.048 \text{ kN}$ Unfactored variable load reaction at support A $R_{A_{\text{Variable}}} = 1.624 \text{ kN}$ Reactions at support B $R_{B_{\max}} = 3.851 \text{ kN}$ $R_{B_{\min}} = 3.851 \text{ kN}$ Unfactored permanent load reaction at support B $R_{B_{\text{Permanent}}} = 1.048 \text{ kN}$ Unfactored variable load reaction at support B $R_{B_{\text{Variable}}} = 1.624 \text{ kN}$   Timber section details Breadth of timber sections $b = 50 \text{ mm}$ Depth of timber sections $h = 200 \text{ mm}$ Number of timber sections in member $N = 1$ Overall breadth of timber member $b_b = N \times b = 50 \text{ mm}$ Timber strength class - EN 338:2016 Table 1 C16 Member details Load duration - cl.2.3.1.2 Long-term Service class of timber - cl.2.3.1.3 1 Length of span $L_{s1} = 1600 \text{ mm}$ Length of bearing $L_b = 75 \text{ mm}$			

Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 5
	Trimmer Joist	By/Date	MM / Dec-25
Section properties Cross sectional area of member $A = N \times b \times h = 10000 \text{ mm}^2$ Section modulus $W_y = N \times b \times h^2 / 6 = 333333 \text{ mm}^3$ $W_z = h \times (N \times b)^2 / 6 = 83333 \text{ mm}^3$ Second moment of area $I_y = N \times b \times h^3 / 12 = 33333333 \text{ mm}^4$ $I_z = h \times (N \times b)^3 / 12 = 2083333 \text{ mm}^4$ Radius of gyration $r_y = \sqrt{I_y / A} = 57.7 \text{ mm}$ $r_z = \sqrt{I_z / A} = 14.4 \text{ mm}$ Partial factor for material properties and resistances Partial factor for material properties - Table 2.3 $\gamma_M = 1.300$ Modification factors Modification factor for load duration and moisture content - Table 3.1 $k_{mod} = 0.700$ Deformation factor for service classes - Table 3.2 $k_{def} = 0.600$ Depth factor for bending - exp.3.1 $k_{h,m} = 1.000$ Depth factor for tension - exp.3.1 $k_{h,t} = 1.000$ Bending stress re-distribution factor - cl.6.1.6(2) $k_m = 0.700$ Crack factor for shear resistance - cl.6.1.7(2) $k_{cr} = 0.670$ Load configuration factor - exp.6.4 $k_{c,90} = 1.500$ System strength factor - cl.6.6 $k_{sys} = 1.000$ Lateral buckling factor - cl.6.3.3(5) $k_{crit} = 1.000$ Compression perpendicular to the grain - cl.6.1.5 Design compressive stress $\sigma_{c,90,d} = R_{A,max} / (N \times b \times (L_b + \min(L_b, 30 \text{ mm}))) = 0.734 \text{ N/mm}^2$ Design compressive strength $f_{c,90,d} = k_{mod} \times k_{sys} \times k_{c,90} \times f_{c,90,k} / \gamma_M = 1.777 \text{ N/mm}^2$ $\sigma_{c,90,d} / f_{c,90,d} = 0.413$ Bending - cl 6.1.6 Design bending stress $\sigma_{m,d} = M / W_y = 4.621 \text{ N/mm}^2$ PASS - Design compressive strength exceeds design compressive stress at bearing			

Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 6
Trimmer Joist		By/Date	MM / Dec-25
Design bending strength $f_{m,d} = k_{h,m} \times k_{mod} \times k_{sys} \times k_{crit} \times f_{m,k} / \gamma_M = 8.615 \text{ N/mm}^2$ $\sigma_{m,d} / f_{m,d} = 0.536$ PASS - Design bending strength exceeds design bending stress			
Shear - cl.6.1.7 Applied shear stress $\tau_d = 3 \times F / (2 \times k_{cr} \times A) = 0.862 \text{ N/mm}^2$ Permissible shear stress $f_{v,d} = k_{mod} \times k_{sys} \times f_{v,k} / \gamma_M = 1.723 \text{ N/mm}^2$ $\tau_d / f_{v,d} = 0.500$ PASS - Design shear strength exceeds design shear stress			
Deflection - cl.7.2 Deflection limit $\delta_{lim} = \min(14 \text{ mm}, 0.004 \times L_{s1}) = 6.400 \text{ mm}$ Instantaneous deflection due to permanent load $\delta_{instG} = 0.520 \text{ mm}$ Final deflection due to permanent load $\delta_{finG} = \delta_{instG} \times (1 + k_{def}) = 0.832 \text{ mm}$ Instantaneous deflection due to variable load $\delta_{instQ} = 0.806 \text{ mm}$ Factor for quasi-permanent variable action $\psi_2 = 0.3$ Final deflection due to variable load $\delta_{finQ} = \delta_{instQ} \times (1 + \psi_2 \times k_{def}) = 0.950 \text{ mm}$ Total final deflection $\delta_{fin} = \delta_{finG} + \delta_{finQ} = 1.782 \text{ mm}$ $\delta_{fin} / \delta_{lim} = 0.279$ PASS - Total final deflection is less than the deflection limit			

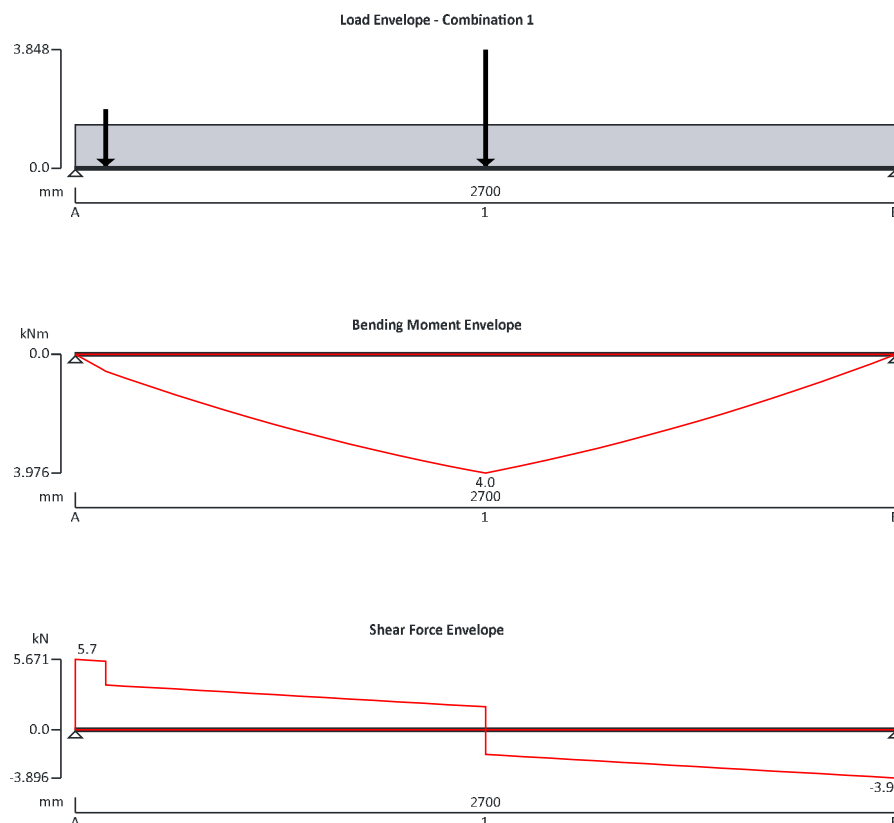
Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 7
Joist strengthening supporting trimmer joist		By/Date	MM / Dec-25

TIMBER BEAM ANALYSIS & DESIGN (EN1995)

TIMBER BEAM ANALYSIS & DESIGN TO EN1995-1-1:2004

In accordance with EN1995-1-1:2004 + A2:2014 and Corrigendum No.1 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 1.7.05



Applied loading

Beam loads

Permanent self weight of beam $\times 1$
 Permanent full UDL 0.360 kN/m
 Variable full UDL 0.560 kN/m
 Permanent point load 1.050 kN at 1350 mm
 Variable point load 1.620 kN at 1350 mm
 Permanent point load 0.520 kN at 100 mm
 Variable point load 0.810 kN at 100 mm

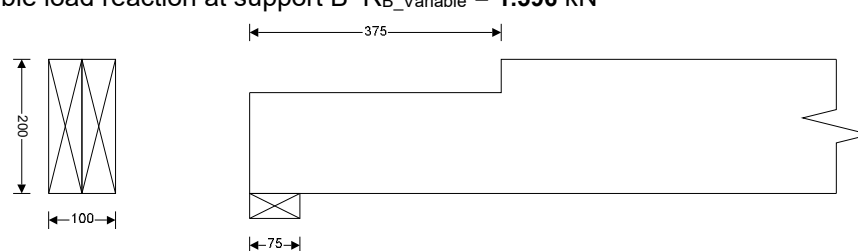
Load combinations

Load combination 1

Support A

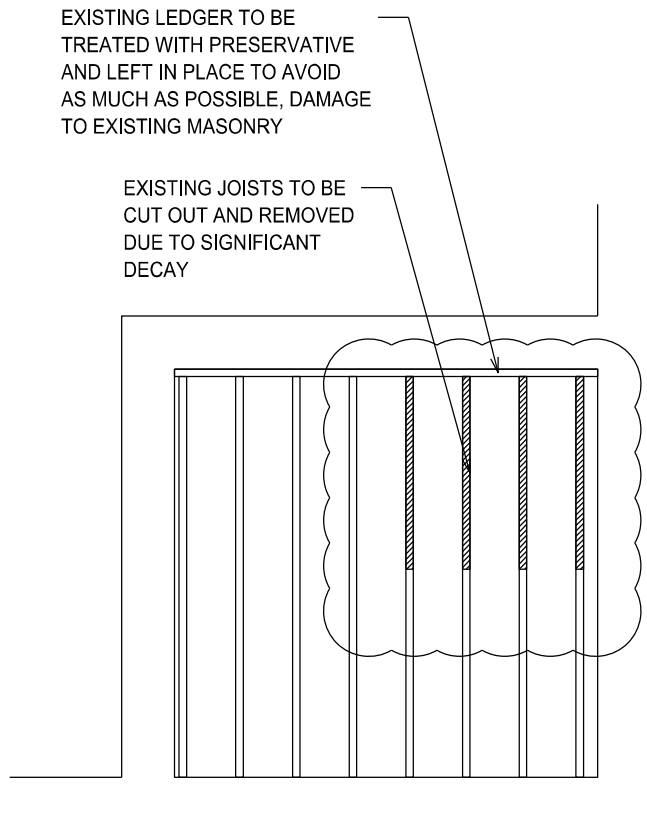
Permanent $\times 1.35$

Variable $\times 1.50$

Project		Sheet no./rev.
Moxham House, 17 Woolley Street, Bradford on Avon		BSW2 / 8
Joist strengthening supporting trimmer joist		By/Date MM / Dec-25
Span 1		Permanent $\times 1.35$ Variable $\times 1.50$
Support B		Permanent $\times 1.35$ Variable $\times 1.50$
Analysis results		
Maximum moment	$M_{\max} = 3.976 \text{ kNm}$	$M_{\min} = 0.000 \text{ kNm}$
Design moment	$M = \max(\text{abs}(M_{\max}), \text{abs}(M_{\min})) = 3.976 \text{ kNm}$	
Maximum shear	$F_{\max} = 5.671 \text{ kN}$	$F_{\min} = -3.896 \text{ kN}$
Design shear	$F = \max(\text{abs}(F_{\max}), \text{abs}(F_{\min})) = 5.671 \text{ kN}$	
Total load on beam	$W_{\text{tot}} = 9.566 \text{ kN}$	
Reactions at support A	$R_{A_{\max}} = 5.671 \text{ kN}$	$R_{A_{\min}} = 5.671 \text{ kN}$
Unfactored permanent load reaction at support A	$R_{A_{\text{Permanent}}} = 1.594 \text{ kN}$	
Unfactored variable load reaction at support A	$R_{A_{\text{Variable}}} = 2.346 \text{ kN}$	
Reactions at support B	$R_{B_{\max}} = 3.896 \text{ kN}$	$R_{B_{\min}} = 3.896 \text{ kN}$
Unfactored permanent load reaction at support B	$R_{B_{\text{Permanent}}} = 1.112 \text{ kN}$	
Unfactored variable load reaction at support B	$R_{B_{\text{Variable}}} = 1.596 \text{ kN}$	
		
Timber section details		
Breadth of timber sections	$b = 50 \text{ mm}$	
Depth of timber sections	$h = 200 \text{ mm}$	
Number of timber sections in member	$N = 2$	
Overall breadth of timber member	$b_b = N \times b = 100 \text{ mm}$	
Timber strength class - EN 338:2016 Table 1	C16	
Member details		
Load duration - cl.2.3.1.2	Long-term	
Service class of timber - cl.2.3.1.3	1	
Length of span	$L_{s1} = 2700 \text{ mm}$	
Length of bearing	$L_b = 75 \text{ mm}$	
Top edge of member notched at all supports		
Member depth at notch	$h_e = 150 \text{ mm}$	
Distance from face of support to corner of notch	$a = 300 \text{ mm}$	
Length of taper	$L_t = 0 \text{ mm}$	
Section properties		
Cross sectional area of member	$A = N \times b \times h = 20000 \text{ mm}^2$	

Project Moxham House, 17 Woolley Street, Bradford on Avon		Sheet no./rev. BSW2 / 9
Joist strengthening supporting trimmer joist		By/Date MM / Dec-25
Section modulus	$W_y = N \times b \times h^2 / 6 = 666667 \text{ mm}^3$ $W_z = h \times (N \times b)^2 / 6 = 333333 \text{ mm}^3$	
Second moment of area	$I_y = N \times b \times h^3 / 12 = 6666667 \text{ mm}^4$ $I_z = h \times (N \times b)^3 / 12 = 16666667 \text{ mm}^4$	
Radius of gyration	$r_y = \sqrt{I_y / A} = 57.7 \text{ mm}$ $r_z = \sqrt{I_z / A} = 28.9 \text{ mm}$	
Partial factor for material properties and resistances		
Partial factor for material properties - Table 2.3 $\gamma_M = 1.300$		
Modification factors		
Modification factor for load duration and moisture content - Table 3.1		
$k_{mod} = 0.700$		
Deformation factor for service classes - Table 3.2	$k_{def} = 0.600$	
Depth factor for bending - exp.3.1	$k_{h,m} = 1.000$	
Depth factor for tension - exp.3.1	$k_{h,t} = 1.000$	
Bending stress re-distribution factor - cl.6.1.6(2)	$k_m = 0.700$	
Crack factor for shear resistance - cl.6.1.7(2)	$k_{cr} = 0.670$	
Load configuration factor - exp.6.4	$k_{c,90} = 1.500$	
System strength factor - cl.6.6	$k_{sys} = 1.000$	
Lateral buckling factor - cl.6.3.3(5)	$k_{crit} = 1.000$	
Reduction factor for notched members - exp.6.61	$k_v = 1.000$	
Compression perpendicular to the grain - cl.6.1.5		
Design compressive stress	$\sigma_{c,90,d} = R_{A,max} / (N \times b \times (L_b + \min(L_b, 30 \text{ mm}))) = 0.540 \text{ N/mm}^2$	
Design compressive strength	$f_{c,90,d} = k_{mod} \times k_{sys} \times k_{c,90} \times f_{c,90,k} / \gamma_M = 1.777 \text{ N/mm}^2$ $\sigma_{c,90,d} / f_{c,90,d} = 0.304$	
PASS - Design compressive strength exceeds design compressive stress at bearing		
Bending - cl 6.1.6		
Design bending stress	$\sigma_{m,d} = M / W_y = 5.964 \text{ N/mm}^2$	
Design bending strength	$f_{m,d} = k_{h,m} \times k_{mod} \times k_{sys} \times k_{crit} \times f_{m,k} / \gamma_M = 8.615 \text{ N/mm}^2$ $\sigma_{m,d} / f_{m,d} = 0.692$	
PASS - Design bending strength exceeds design bending stress		
Shear - cl.6.1.7		
Applied shear stress	$\tau_d = 3 \times F / (2 \times k_{cr} \times N \times b \times h_e) = 0.846 \text{ N/mm}^2$	
Permissible shear stress	$f_{v,d} = k_{mod} \times k_{sys} \times k_v \times f_{v,k} / \gamma_M = 1.723 \text{ N/mm}^2$ $\tau_d / f_{v,d} = 0.491$	
PASS - Design shear strength exceeds design shear stress		
Deflection - cl.7.2		
Deflection limit	$\delta_{lim} = \min(14 \text{ mm}, 0.004 \times L_{s1}) = 10.800 \text{ mm}$	

Project	Moxham House, 17 Woolley Street, Bradford on Avon	Sheet no./rev.	BSW2 / 10
	Joist strengthening supporting trimmer joist	By/Date	MM / Dec-25
Instantaneous deflection due to permanent load $\delta_{instG} = 1.532$ mm Final deflection due to permanent load $\delta_{finG} = \delta_{instG} \times (1 + k_{def}) = 2.451$ mm Instantaneous deflection due to variable load $\delta_{instQ} = 2.239$ mm Factor for quasi-permanent variable action $\psi_2 = 0.3$ Final deflection due to variable load $\delta_{finQ} = \delta_{instQ} \times (1 + \psi_2 \times k_{def}) = 2.642$ mm Total final deflection $\delta_{fin} = \delta_{finG} + \delta_{finQ} = 5.092$ mm $\delta_{fin} / \delta_{lim} = 0.472$ PASS - Total final deflection is less than the deflection limit			



Existing First Floor Joist Layout

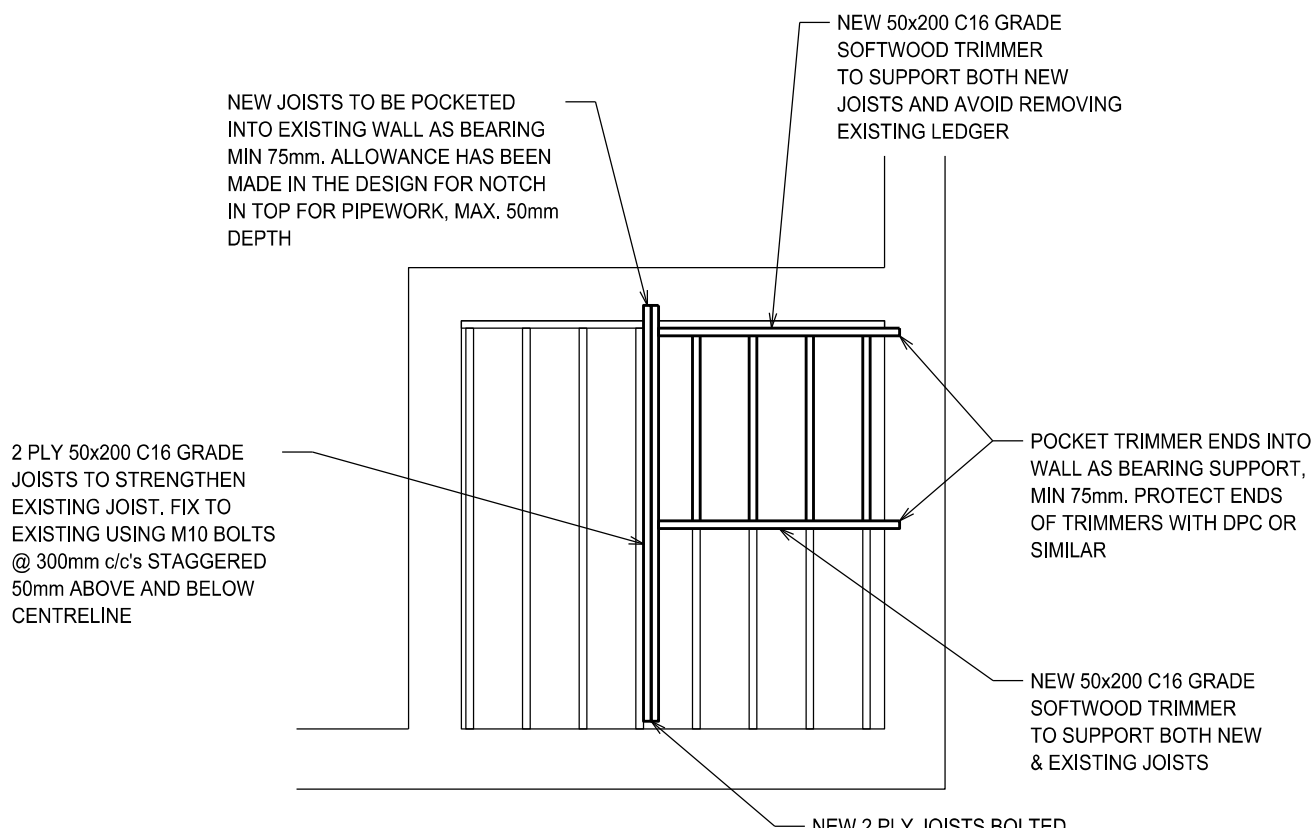
GENERAL NOTES

- DO NOT SCALE FROM THIS DRAWING, IF IN DOUBT ASK.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND SPECIFICATIONS.
- ANY DISCREPANCIES ARE TO BE REPORTED IMMEDIATELY IN WRITING TO THE ENGINEER FOR VERIFICATION.
- REFER TO BIOCRAFT SOUTHWEST LTD DRAWING FOR SETTING OUT DIMENSIONS.
- THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE NEW AND EXISTING BUILDING WHILST THE WORKS ARE IN PROGRESS.
- ALL TEMPORARY WORKS ARE TO BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL ESTABLISH AND MAINTAIN SAFE WORKING PRACTICES AND SHALL FULLY DISCHARGE THEIR OBLIGATIONS UNDER HEALTH AND SAFETY REGULATIONS.

GENERAL NOTES (CONT.)

- ALL WORKS SHALL COMPLY WITH ALL RELEVANT STATUTORY REQUIREMENTS, BRITISH STANDARDS, EUROCODES, CODES OF PRACTICE, BUILDING REGULATIONS AND RECOGNISED GOOD PRACTICE.
- FOR COORDINATION OF ALL SERVICE HOLES/ PENETRATIONS THROUGH FLOOR, REFER TO BIOCRAFT SOUTHWEST LTD SETTING OUT/ LAYOUT DRAWINGS AND DETAILS.
- ALL PROPRIETARY MATERIALS TO BE USED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

	Project		Moxham House, 17 Woolley Street, Bradford on Avon			STRUCTURAL SOLUTIONS  Dairy Studios 102 Lincoln Street Bristol BS5 0BJ  0117 924 5014	
	Title		Existing (Part) First Floor Joist Layout				
	Scale @ A4	1:50	Date	01/12/25			Sheet Size A4
Drawing Status	Project No.	BSW3	Drawing No.	400	 MM	 -	Rev. P1
PRELIMINARY							



Proposed First Floor Joist Layout

TIMBER NOTES

1. THE WHOLE OF THE STRUCTURAL TIMBER IS TO COMPLY WITH THE RELEVANT CLAUSES OF BS 5268 &/OR BS EN 1995-1.
2. THE GRADE OF ALL STRUCTURAL TIMBER ELEMENTS SHALL BE NOT LESS THAN C16 OR AS NOTED OTHERWISE ON THE DRAWINGS AND SPECIFICATIONS.
3. ALL TIMBER SHALL BE PRESSURE IMPREGNATED WITH PRESERVATIVE AND ALL CUT ENDS OR SURFACES SHALL BE RETREATED WITH BRUSH APPLIED COAT OF THE SAME PRESERVATIVE.
4. PRESERVATIVE TREATMENT OF TIMBER IS TO BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF BS 8417 AND BS EN 599:1.
5. HOLES FOR BOLTS SHALL BE DRILLED WITH A DIAMETER NOT MORE THAN 2.0mm GREATER THAN THE BOLT SIZE.
6. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED/SHERARDIZED MILD STEEL AND BE MINIMUM GRADE 4.6 UNLESS NOTED OTHERWISE ON THE DRAWINGS.

TIMBER NOTES (CONT.)

7. FIRST FLOOR JOISTS 50x200 C16 TO MATCH EXISTING UNLESS NOTED OTHERWISE.
8. ALL JOIST HANGERS/MECHANICAL FASTENERS ETC. ARE TO BE GALVANIZED MILD STEEL AND ARE TO BE FULLY NAILED/SCREWED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

NEW 2 PLY JOISTS BOLTED TO EXISTING USING 4 No. M10 GRADE 4.6 BOLTS @ 50mm c/c's. CONTRACTOR TO REVIEW EXISTING JOIST BEARING AND ADVISE ENGINEER

	Project					STRUCTURAL SOLUTIONS  Dairy Studios 102 Lincoln Street Bristol BS5 0BJ  0117 924 5014	
	Moxham House, 17 Woolley Street, Bradford on Avon						
	Title						
	Proposed (Part) First Floor Joist Layout						
Drawing Status	Scale @ A4	1:50	Date		01/12/25	Sheet Size	A4
	Project No.	BSW3	Drawing No.	401	 MM  -	Rev.	P1
PRELIMINARY							