MarshDesignLtd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Project: 2 The Barn, Hall Ing Lane			Job Ref.: 9533	
	Section: Timber Beam Load Bearing Check			Sheet no./rev.	
	Calc. by: MF	Date: 18/12/2023	Chk'd by	Date	App'd by	Date

CHECK OF EXISTNG OAK BEAM LOAD BEARING CAPACITY FOR MAXIMUM LENGTH:

CLEAR SPAN: 4000mm - Maximum Span to one side of New Timber Column

LOADS ON EXISTING BEAM:

W_{D1} = 2.4m x 0.5kN/m^2 = 1.2 kN/m — ***FROM WALL***

W_{D2} = 1/2 x 3.6m x 0.5kN/m^3 = 0.9 kN/m — ***FROM FLOOR***

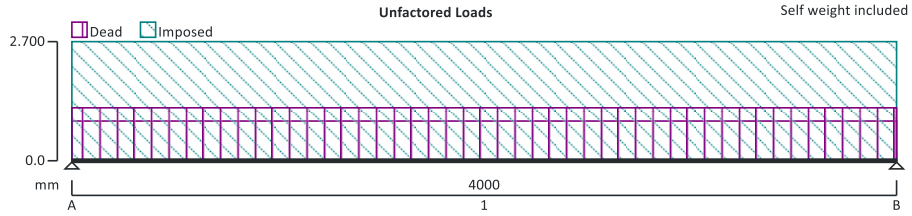
W_L = 1/2 x 3.6m x 1.5kN/m^2 = 2.7 kN/m — ***FROM FLOOR***

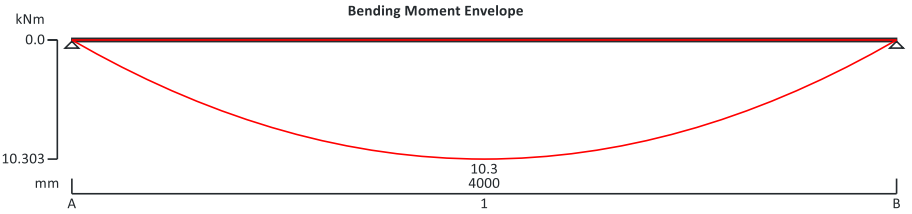
MarshDesignLtd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Project: 2 The Barn, Hall Ing Lane				Job Ref.: 9533	
	Section: Timber Beam Load Bearing Check				Sheet no./rev.	
	Calc. by: MF	Date: 18/12/2023	Chk'd by	Date	App'd by	Date

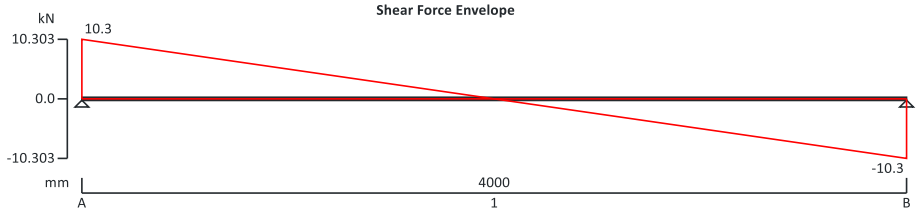
CALCULATIONS:

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02







Applied loading

Beam loads

Dead self weight of beam × 1
Dead full UDL 0.900 kN/m
Imposed full UDL 2.700 kN/m
Dead full UDL 1.200 kN/m

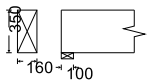
Load combinations

Load combination 1	Support A	Dead × 1.00
		Imposed × 1.00
	Span 1	Dead × 1.00
		Imposed × 1.00
	Support B	Dead × 1.00
		Imposed × 1.00

Analysis results

Maximum moment	M_{max} = **10.303** kNm	M_{min} = **0.000** kNm
Design moment	M = max(abs(M_{max}),abs(M_{min})) = **10.303** kNm	
Maximum shear	F_{max} = **10.303** kN	F_{min} = **-10.303** kN

Design shear	$F = \max(\text{abs}(F_{max}),\text{abs}(F_{min})) =$ **10.303** kN	
Total load on beam	$W_{tot} =$ **20.606** kN	
Reactions at support A	$R_{A\_max} =$ **10.303** kN	$R_{A\_min} =$ **10.303** kN
Unfactored dead load reaction at support A	$R_{A\_Dead} =$ **4.903** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed} =$ **5.400** kN	
Reactions at support B	$R_{B\_max} =$ **10.303** kN	$R_{B\_min} =$ **10.303** kN
Unfactored dead load reaction at support B	$R_{B\_Dead} =$ **4.903** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed} =$ **5.400** kN	



Timber section details

Breadth of sections	$b =$ **160** mm
Depth of sections	$h =$ **350** mm
Number of sections in member	$N =$ **1**
Overall breadth of member	$b_b = N \times b =$ **160** mm
Timber strength class	**D30**

Member details

Service class of timber	**1**
Load duration	**Long term**
Length of span	$L_{s1} =$ **4000** mm
Length of bearing	$L_b =$ **100** mm

Section properties

Cross sectional area of member	$A = N \times b \times h =$ **56000** mm^2
Section modulus	$Z_x = N \times b \times h^2 / 6 =$ **3266667** mm^3
	$Z_y = h \times (N \times b)^2 / 6 =$ **1493333** mm^3
Second moment of area	$I_x = N \times b \times h^3 / 12 =$ **571666667** mm^4
	$I_y = h \times (N \times b)^3 / 12 =$ **119466667** mm^4
Radius of gyration	$i_x = \sqrt{(I_x / A)} =$ **101.0** mm
	$i_y = \sqrt{(I_y / A)} =$ **46.2** mm

Modification factors

Duration of loading - Table 17	$K_3 =$ **1.00**
Bearing stress - Table 18	$K_4 =$ **1.00**
Total depth of member - cl.2.10.6	$K_7 = 0.81 \times (h^2 + 92300\ mm^2) / (h^2 + 56800\ mm^2) =$ **0.97**
Load sharing - cl.2.9	$K_8 =$ **1.00**

Lateral support - cl.2.10.8

Ends held in position and members held in line, as by direct connection of sheathing, deck or joists

Permissible depth-to-breadth ratio - Table 19	**5.00**
Actual depth-to-breadth ratio	$h / (N \times b) =$ **2.19**

PASS - Lateral support is adequate

MarshDesignLtd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Project: 2 The Barn, Hall Ing Lane				Job Ref.: 9533	
	Section: Timber Beam Load Bearing Check				Sheet no./rev.	
	Calc. by: MF	Date: 18/12/2023	Chk'd by	Date	App'd by	Date

Compression perpendicular to grain

Permissible bearing stress (no wane) $\sigma_{c\_adm} = \sigma_{cp1} \times K_3 \times K_4 \times K_8 =$ **2.800** N/mm^2

Applied bearing stress $\sigma_{c\_a} = R_{A\_max} / (N \times b \times L_b) =$ **0.644** N/mm^2

$\sigma_{c\_a} / \sigma_{c\_adm} =$ **0.230**

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

Bending parallel to grain

Permissible bending stress $\sigma_{m\_adm} = \sigma_m \times K_3 \times K_7 \times K_8 =$ **8.733** N/mm^2

Applied bending stress $\sigma_{m\_a} = M / Z_x =$ **3.154** N/mm^2

$\sigma_{m\_a} / \sigma_{m\_adm} =$ **0.361**

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress $\tau_{adm} = \tau \times K_3 \times K_8 =$ **1.400** N/mm^2

Applied shear stress $\tau_a = 3 \times F / (2 \times A) =$ **0.276** N/mm^2

$\tau_a / \tau_{adm} =$ **0.197**

PASS - Applied shear stress is less than permissible shear stress

Deflection

Modulus of elasticity for deflection $E = E_{min} =$ **6000** N/mm^2

Permissible deflection $\delta_{adm} = \min(0.551 \text{ in}, 0.003 \times L_{s1}) =$ **12.000** mm

Bending deflection $\delta_{b\_s1} =$ **5.006** mm

Shear deflection $\delta_{v\_s1} =$ **0.589** mm

Total deflection $\delta_a = \delta_{b\_s1} + \delta_{v\_s1} =$ **5.595** mm

$\delta_a / \delta_{adm} =$ **0.466**

PASS - Total deflection is less than permissible deflection

THE EXISTING OAK BEAM ADEQUATE TO SUPPORT THE FLOOR AT A MAXIMUM 4000mm SPAN BETWEEN THE WALLS AND NEW SUPPORTING COLUMN

MarshDesignLtd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Project: 2 The Barn, Hall Ing Lane			Job Ref.: 9533	
	Section: Timber Beam Load Bearing Check			Sheet no./rev.	
	Calc. by: MF	Date: 18/12/2023	Chk'd by	Date	App'd by	Date

DESIGN OF POST P_1 TO SUPPORT THE FLOOR:

POINT LOADS ON POST FROM OAK BEAM:

$$R_{AD} = R_{BD} = 1/2 \times W_D \times L / 2 = 7.5\ kN$$

$$R_{AL} = R_{BL} = 1/2 \times W_L \times L / 2 = 8.24\ kN$$

MarshDesignLtd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Project: 2 The Barn, Hall Ing Lane				Job Ref.: 9533	
	Section: Timber Beam Load Bearing Check				Sheet no./rev.	
	Calc. by: MF	Date: 18/12/2023	Chk'd by	Date	App'd by	Date

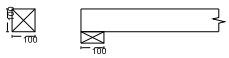
CALCULATIONS

TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02

Analysis results

Maximum reaction	R = **15.740** kN
Design axial compression	P = **15.740** kN



Timber section details

Breadth of sections	b = **100** mm
Depth of sections	h = **100** mm
Number of sections in member	N = **1**
Overall breadth of member	b_b = N × b = **100** mm
Timber strength class	**C24**

Member details

Service class of timber	**1**
Load duration	**Long term**
Length of bearing	L_b = **100** mm

Effective length - cl.2.11.3

Unbraced length in x-axis	L_x = **2100** mm
Effective length factor in x-axis - Table 21	K_x = **1**
Effective length in x-axis	L_{ex} = L_x × K_x = **2100** mm
Unbraced length in y-axis	L_y = **2100** mm
Effective length factor in y-axis - Table 21	K_y = **1**
Effective length in y-axis	L_{ey} = L_y × K_y = **2100** mm

Section properties

Cross sectional area of member	A = N × b × h = **10000** mm^2
Section modulus	Z_x = N × b × h^2 / 6 = **166667** mm^3
	Z_y = h × (N × b)^2 / 6 = **166667** mm^3
Second moment of area	I_x = N × b × h^3 / 12 = **8333333** mm^4
	I_y = h × (N × b)^3 / 12 = **8333333** mm^4
Radius of gyration	i_x = √(I_x / A) = **28.9** mm
	i_y = √(I_y / A) = **28.9** mm

Modification factors

Duration of loading - Table 17	K_3 = **1.00**
Bearing stress - Table 18	K_4 = **1.00**
Total depth of member - cl.2.10.6	K_7 = (300 mm / h)$^{0.11}$ = **1.13**
Load sharing - cl.2.9	K_8 = **1.00**
Members subject to axial compression - Table 22	K_{12} = **0.58**

Slenderness ratio - cl.2.11.4

Permissible slenderness ratio	λ_{max} = **180**
Slenderness ratio	λ = max(L_{ex} / i_x, L_{ey} / i_y) = **72.746**

PASS - Slenderness ratio is less than permissible slenderness ratio

Compression perpendicular to grain

Permissible bearing stress (no wane) $\sigma_{c\_adm} = \sigma_{cp1} \times K_3 \times K_4 \times K_8 =$ **2.400** N/mm^2

Applied bearing stress $\sigma_{c\_a} = R / (N \times b \times L_b) =$ **1.574** N/mm^2

$\sigma_{c\_a} / \sigma_{c\_adm} =$ **0.656**

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

Compression parallel to grain

Permissible compressive stress $\sigma_{c\_adm} = \sigma_c \times K_3 \times K_8 \times K_{12} =$ **4.544** N/mm^2

Applied compressive stress $\sigma_{c\_a} = P / A =$ **1.574** N/mm^2

$\sigma_{c\_a} / \sigma_{c\_adm} =$ **0.346**

PASS - Applied compressive stress is less than permissible compressive stress