



David Edwards & Associates

E V E R Y D A Y E N G I N E E R I N G

PICKERS PALMERS

Structural Calculations

25293

Paul Dawson

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David Edwards & Associates EVERY DAY ENGINEERING 28 Old Church Road Clevedon BS21 6LY	Project Pickers Palmers				Job no. 25293	
	Calcs for Timber Post Justification				Start page no./Revision 1	
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Existing 120 x 47 timber posts indicated upon the drawing below. Most onerous area of roof supported by post 11m². Perimeter posts are at closer centres and support less load.

Proposed loadings

Dead

Kingspan KS1000RW 151mm panels = 0.13kN/m²

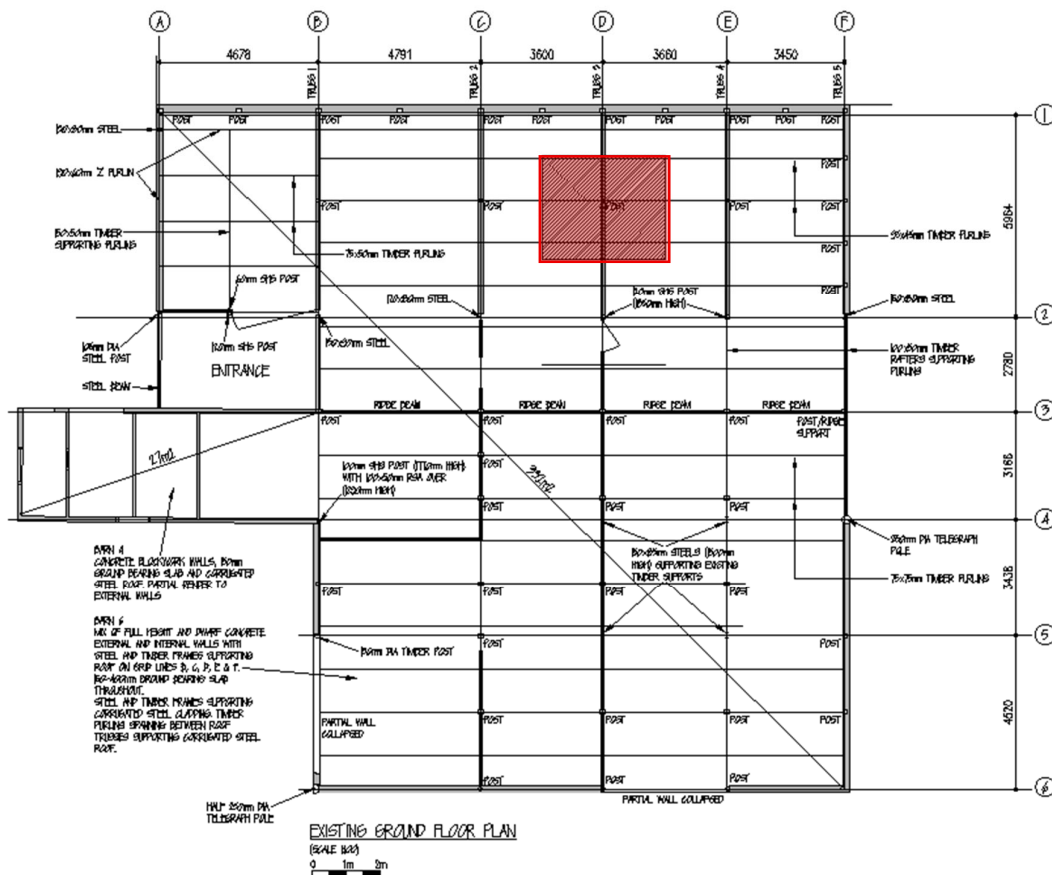
Supporting Purlins = 0.1kN/m²

Total Dead Load = 0.23kN/m²

Imposed Loading

Snow = 0.6k/m²

ULS on top of timber Post = (0.23 x 11 x 1.35) + (0.6 x 11 x 1.5) = 13.32kN



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TIMBER POST

TIMBER COLUMN WITH BIAXIAL BENDING AND COMPRESSION

In accordance with EN1995-1-1:2004 + A2:2014 incorporating corrigendum June 2006 and the UK national annex

Tedds calculation version 2.2.28

Design section 1

User note: Check column at base

Partial factor for material properties and resistances

Partial factor for material properties - Table 2.3; $\gamma_M = 1.300$

Member details

Load duration - cl.2.3.1.2;

Long-term

Service class - cl.2.3.1.3;

1

Timber section details

Number of timber sections in member;

N = 1

Breadth of sections;

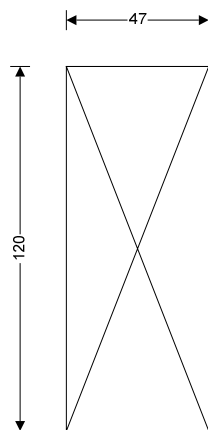
b = 47 mm

Depth of sections;

h = 120 mm

Timber strength class - EN 338:2016 Table 1;

C16



47x120 timber section

Cross-sectional area, A, 5640 mm²

Section modulus, W_y, 112800 mm³

Section modulus, W_z, 44180 mm³

Second moment of area, I_y, 6768000 mm⁴

Second moment of area, I_z, 1038230 mm⁴

Radius of gyration, i_y, 34.6 mm

Radius of gyration, i_z, 13.6 mm

Timber strength class C16

Characteristic bending strength, f_{m,k}, 16 N/mm²

Characteristic shear strength, f_{v,k}, 3.2 N/mm²

Characteristic compression strength parallel to grain, f_{c,0,k}, 17 N/mm²

Characteristic compression strength perpendicular to grain, f_{c,90,k}, 2.2 N/mm²

Characteristic tension strength parallel to grain, f_{t,0,k}, 8.5 N/mm²

Mean modulus of elasticity, E_{0,mean}, 8000 N/mm²

Fifth percentile modulus of elasticity, E_{0,05}, 5400 N/mm²

Shear modulus of elasticity, G_{mean}, 500 N/mm²

Characteristic density, ρ_k, 310 kg/m³

Mean density, ρ_{mean}, 370 kg/m³

Span details

Unbraced length - Major axis;

L_y = 1520 mm

Effective length - Major axis;

L_{e,y} = 0.9 × L_y = 1368 mm

Unbraced length - Minor axis;

L_z = 1520 mm

Effective length - Minor axis;

L_{e,z} = 0.9 × L_z = 1368 mm

Bearing length;

L_b = 100 mm

Analysis results

Design axial compression force;

P_d = 13.32 kN

Modification factors

Duration of load and moisture content - Table 3.1; k_{mod} = 0.7

Deformation factor - Table 3.2; k_{def} = 0.6

Crack factor for shear resistance - cl.6.1.7(2); k_{cr} = 0.67

Check compression parallel to the grain - cl.6.1.4

Design axial compression;

P_d = 13.32 kN

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Design compressive stress;

$$\sigma_{c,0,d} = P_d / A = \mathbf{2.362 \text{ N/mm}^2}$$

Design compressive strength;

$$f_{c,0,d} = k_{mod} \times f_{c,0,k} / \gamma_M = \mathbf{9.154 \text{ N/mm}^2}$$

$$\sigma_{c,0,d} / f_{c,0,d} = \mathbf{0.258}$$

PASS - Design parallel compression strength exceeds design parallel compression stress

Check columns subjected to either compression or combined compression and bending - cl.6.3.2

Effective length for y-axis bending;

$$L_{e,y} = 0.9 \times L_y = \mathbf{1368 \text{ mm}}$$

Slenderness ratio;

$$\lambda_y = L_{e,y} / i_y = \mathbf{39.491}$$

Relative slenderness ratio - exp. 6.21;

$$\lambda_{rel,y} = \lambda_y / \pi \times \sqrt{(f_{c,0,k} / E_{0.05})} = \mathbf{0.705}$$

Effective length for z-axis bending;

$$L_{e,z} = 0.9 \times L_z = \mathbf{1368 \text{ mm}}$$

Slenderness ratio;

$$\lambda_z = L_{e,z} / i_z = \mathbf{100.827}$$

Relative slenderness ratio - exp. 6.22;

$$\lambda_{rel,z} = \lambda_z / \pi \times \sqrt{(f_{c,0,k} / E_{0.05})} = \mathbf{1.801}$$

Both $\lambda_{rel,y} > 0.3$ and $\lambda_{rel,z} > 0.3$, column stability check is required

Straightness factor;

$$\beta_c = \mathbf{0.2}$$

Instability factors - exp.6.25, 6.26, 6.27 & 6.28;

$$k_y = 0.5 \times (1 + \beta_c \times (\lambda_{rel,y} - 0.3) + \lambda_{rel,y}^2) = \mathbf{0.789}$$

$$k_z = 0.5 \times (1 + \beta_c \times (\lambda_{rel,z} - 0.3) + \lambda_{rel,z}^2) = \mathbf{2.271}$$

$$k_{c,y} = 1 / (k_y + \sqrt{(k_y^2 - \lambda_{rel,y}^2)}) = \mathbf{0.875}$$

$$k_{c,z} = 1 / (k_z + \sqrt{(k_z^2 - \lambda_{rel,z}^2)}) = \mathbf{0.274}$$

Column stability checks - exp.6.23 & 6.24;

$$\sigma_{c,0,d} / (k_{c,y} \times f_{c,0,d}) = \mathbf{0.295}$$

$$\sigma_{c,0,d} / (k_{c,z} \times f_{c,0,d}) = \mathbf{0.943}$$

PASS - Column stability is acceptable

Dimensions, Weight & Thermal Performance

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Core Thickness (mm)	40	53	60	73	80	91	100	115	120	137	150	167
Overall Thickness (mm)	71	84	91	104	111	122	131	146	151	168	181	198
U-value (W/m²K)	0.47	0.35	0.31	0.25	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.11
Weight (kg/m²)	9.0	9.5	9.7	10.2	10.5	10.9	11.3	11.8	12.0	12.7	13.2	13.8

The QuadCore insulation used in QuadCore KS1000RW Roof Panels have a Thermal Conductivity (λ) of 0.018W/m.K

QuadCore KS1000RW Roof Panels have a Thermal Transmittance (U-Value), calculated using the method required by the Building Regulations Part L2 (England & Wales), Building Standards Section 6 (Scotland), Part L (Republic of Ireland) and Part F2 (Northern Ireland).

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