Green Code Engineering

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71 Goldhurst Terrace
London
NW6 3HA

Structural Calculations
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Checked by: **Islam F**

Job Number: **JN-GCE-173**
Issue Date: **May 2023**

Rev:- 0

Green Code Engineering Ltd		Calculation Sheet		
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Element	Introduction	**Date Rev'd**	

Works	Refurbishment	Outbuilding
Use	Existing Proposed	N/A Residential
Storeys	Existing Proposed	0 1
Basement	Yes / No	No
Building Class		Class 1
Walling	Existing Proposed	N/A Cavity Wall
Brick stresses	Existing Proposed	N/A 1 N/mm2 (ULS)
Foundations	Existing Proposed	N/A Trench Fill
Founding Stratum Soils Report	Material Depth Bearing Pressure Yes / No	Assumed London Clay 1.2m min. Deep Assumed 100 kN/m² No
Upper Floors	Existing Proposed	N/a -
Grd Floor	Existing Proposed	N/A Beam and Block
Roof	Existing Proposed	N/A Flat Roof
Stability	Existing Proposed	N/A Externall walls
Architect	DPL Arhitectural Design Studio	

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Loadings	**Date Rev'd**	

Pitched Roofs

tiles	0.65	
battens/felt	0.15	
rafters	0.15	
Dead on slope	0.95	
Dead on plan		1.25
Live		0.75
D + L (kN/m2)		**2.00**

Roof Space (unhabitable)

joists	0.15
soffit	0.15
Dead	0.30
Live	0.25
D + L (kN/m2)	**0.55**

Flat Roofs

mastic/asphalt	0.40
insulation	0.10
deck	0.15
joists	0.15
soffit	0.15
Dead	0.95
Live	0.75
D + L (kN/m2)	**1.70**

Timber Floors (including loft floors)

boards	0.17
joists	0.18
soffit	0.15
Dead	0.50
imposed	1.50
Partitions	0.50
D+L (kN/m2)	**2.50**

Walling (kN/m2)

102 brick	2.10
plaster	0.15
	2.25

100 blk	1.50
2 x plaster	0.30
	1.80

102 brick	2.10
2 x plaster	0.30
	2.40

140 blk	2.10
2 x plaster	0.30
	2.40

215 brick	4.30
plaster	0.15
	4.45

Stud ptn	
studs/ins	0.20
2 x plaster	0.30
	0.50

215 brick	4.30
2 x plaster	0.30
	4.60

Cavity wall	
brick	2.10
100 blk	1.50
plaster	0.15
	3.75

215 brick	4.30
render	0.40
plaster	0.15
	4.85

tile hung wall	
tiles	0.65
ply	0.15
Studs/ins/plaster	0.40
	1.20

215 block	3.25
render	0.40
plaster	0.15
	3.80

FOUNDATIONS NEAR TREES

In accordance with Clause 4.2.12 of NHBC Part 4: Foundations - Chapter 4.2

Tedds calculation version 2.0.03

Site Details

Distance north of London	N = **0** mi
Distance west of London	W = **0** mi
Reduction depth due to climate variations - cl.4.2.4	Z_c = **0.00** m

Soil Details

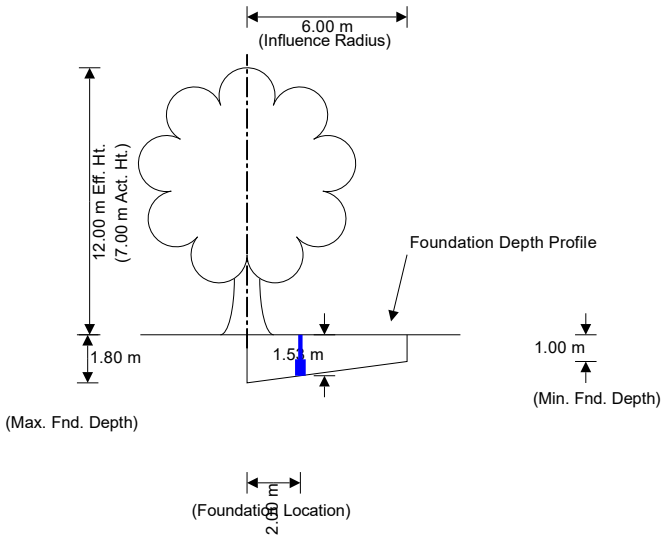
Plasticity index from lab tests	I_p = **40** %
Percentage of particles < 425 μm	p_{425} = **100** %
Modified plasticity index - cl. 4.2.4	$I'_p = I_p \times p_{425} / 100$ % = **40** %
Volume change potential - Table 1	High

Details for Tree - 1

Species of tree — Broad leaf - Holly

tree is to be removed from the site, and H_{act} is greater than or equal to 50% of H_m, with no further planting allowed.

Water demand of tree - Table 3	Low
Mature height of tree - Table 3	H_{m1} = **12.00** m
Influence radius - Table 3b	$r_{inf1} = 0.5 \times H_{m1}$ = **6.00** m
Measured height of tree	H_{act1} = **7.00** m
Distance from centre of tree to face of foundations	D_1 = **2.00** m
Effective height of tree - Table 3a	H_{eff1} = **12.00** m



Minimum foundation depth - Table 4B	Z_{min} = **1.00** m
Look up value for foundation depth - Chart 1 Soils with HIGH volume change potential	$Z_{LookUp1}$ = **1.53** m
Required foundation depth	$Z_{req1} = Z_{LookUp1} - Z_c$ = **1.53** m

Details for Tree - 2

Species of tree — Broad leaf - Ash

tree is to remain at the site, with no further planting allowed.

Water demand of tree - Table 3 — Moderate

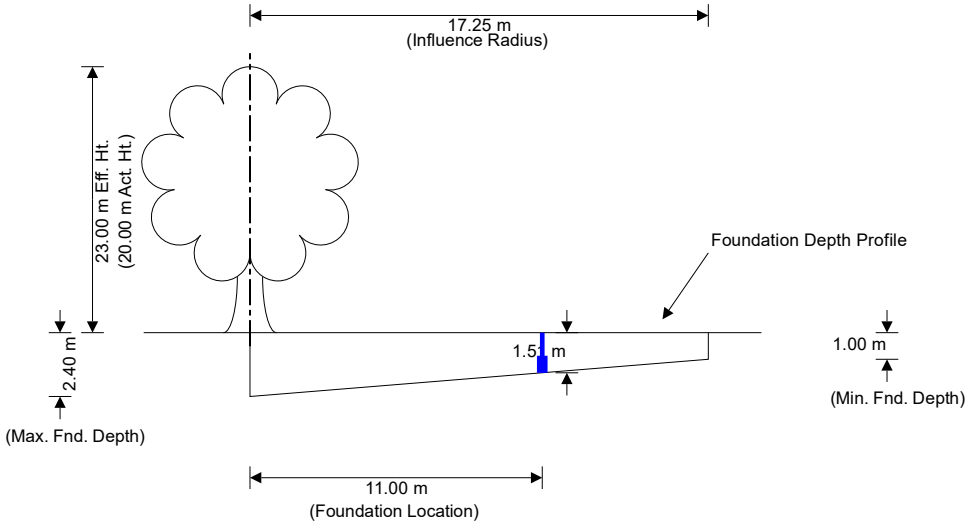
Mature height of tree - Table 3 — H_{m2} = **23.00** m

Influence radius - Table 3b — $r_{inf2} = 0.75 \times H_{m2}$ = **17.25** m

Measured height of tree — H_{act2} = **20.00** m

Distance from centre of tree to face of foundations — D_2 = **11.00** m

Effective height of tree - Table 3a — H_{eff2} = **23.00** m



Minimum foundation depth - Table 4B — Z_{min} = **1.00** m

Look up value for foundation depth - Chart 1 Soils with HIGH volume change potential

$Z_{LookUp2}$ = **1.51** m

Required foundation depth — $Z_{req2} = Z_{LookUp2} - Z_c$ = **1.51** m

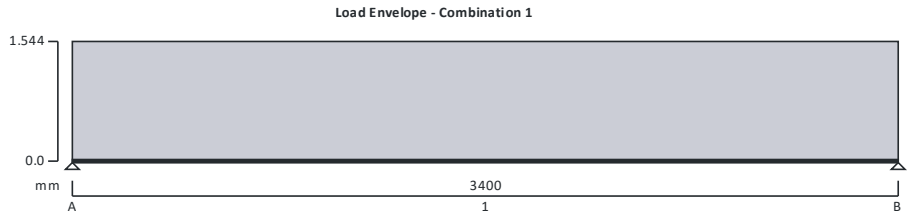
Summary Table

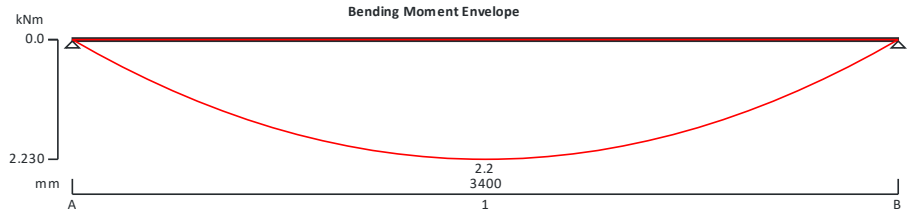
Tree	Name	Distance (m)	Measured Height (m)	Effective Height (m)	Tree to be removed	Required Foundation Depth (m)
1	Holly	2.0	7.0	12.0	Yes	1.53
2	Ash	11.0	20.0	23.0	No	1.51

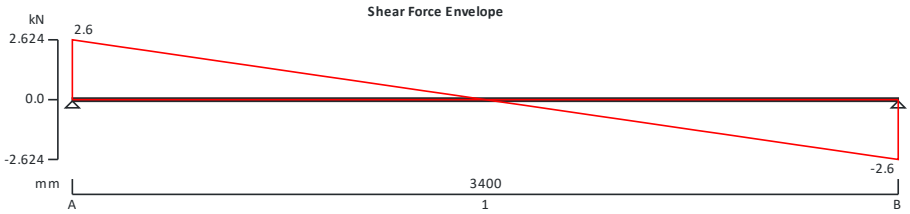
Green Code Engineering LTD 12 Berghem Mews, Blythe Rd London W14 0HN	Project 71 Goldhurst Terrace Kilburn, NW6 3HA			Job no. GCE 173	
	Calcs for Flat Roof Joist			Start page no./Revision 100	
	Calcs by CP	Calcs date 24/05/2023	Checked by IF	Checked date	Approved by IF	Approved date

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02







Applied loading

Beam loads

Flat roof dead(0.8x0.5x0.95)	Dead full UDL 0.400 kN/m
Flat roof live(0.8x0.5x0.75)	Imposed full UDL 0.300 kN/m
Green roof dead(0.8x0.5x2)	Dead full UDL 0.800 kN/m
	Dead self weight of beam × 1

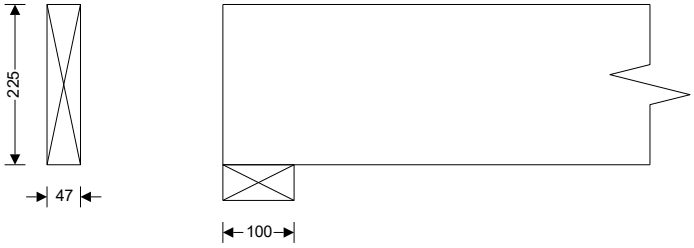
Load combinations

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} = **2.230** kNm	M_{min} = **0.000** kNm
Design moment	M = max(abs(M_{max}),abs(M_{min})) = **2.230** kNm	
Maximum shear	F_{max} = **2.624** kN	F_{min} = **-2.624** kN
Design shear	F = max(abs(F_{max}),abs(F_{min})) = **2.624** kN	

Total load on beam	W_{tot} = **5.248** kN	
Reactions at support A	R_{A_max} = **2.624** kN	R_{A_min} = **2.624** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **2.114** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **0.510** kN	
Reactions at support B	R_{B_max} = **2.624** kN	R_{B_min} = **2.624** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **2.114** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **0.510** kN	



Timber section details

Breadth of sections	b = **47** mm
Depth of sections	h = **225** mm
Number of sections in member	N = **1**
Overall breadth of member	b_b = N × b = **47** mm
Timber strength class	**C24**

Member details

Service class of timber	**1**
Load duration	**Long term**
Length of span	L_{s1} = **3400** mm
Length of bearing	L_b = **100** mm

Section properties

Cross sectional area of member	A = N × b × h = **10575** mm^2
Section modulus	Z_x = N × b × h^2 / 6 = **396563** mm^3
	Z_y = h × (N × b)^2 / 6 = **82838** mm^3
Second moment of area	I_x = N × b × h^3 / 12 = **44613281** mm^4
	I_y = h × (N × b)^3 / 12 = **1946681** mm^4
Radius of gyration	i_x = √(I_x / A) = **65.0** mm
	i_y = √(I_y / A) = **13.6** 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)$^{0.11}$ = **1.03**
Load sharing - cl.2.9	K_8 = **1.00**

Lateral support - cl.2.10.8

Ends held in position and both edges firmly held in line

Permissible depth-to-breadth ratio - Table 19	**7.00**
Actual depth-to-breadth ratio	h / (N × b) = **4.79**

PASS - Lateral support is adequate

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 $\sigma_{c\_a} = R_{B\_max} / (N \times b \times L_b) =$ **0.558** N/mm^2

$\sigma_{c\_a} / \sigma_{c\_adm} =$ **0.233**

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

Bending parallel to grain

Permissible bending stress $\sigma_{m\_adm} = \sigma_m \times K_3 \times K_7 \times K_8 =$ **7.741** N/mm^2

Applied bending stress $\sigma_{m\_a} = M / Z_x =$ **5.624** N/mm^2

$\sigma_{m\_a} / \sigma_{m\_adm} =$ **0.727**

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress $\tau_{adm} = \tau \times K_3 \times K_8 =$ **0.710** N/mm^2

Applied shear stress $\tau_a = 3 \times F / (2 \times A) =$ **0.372** N/mm^2

$\tau_a / \tau_{adm} =$ **0.524**

PASS - Applied shear stress is less than permissible shear stress

Deflection

Modulus of elasticity for deflection $E = E_{min} =$ **7200** N/mm^2

Permissible deflection $\delta_{adm} = \min(0.551 \text{ in}, 0.003 \times L_{s1}) =$ **10.200** mm

Bending deflection $\delta_{b\_s1} =$ **8.361** mm

Shear deflection $\delta_{v\_s1} =$ **0.562** mm

Total deflection $\delta_a = \delta_{b\_s1} + \delta_{v\_s1} =$ **8.924** mm

$\delta_a / \delta_{adm} =$ **0.875**

PASS - Total deflection is less than permissible deflection