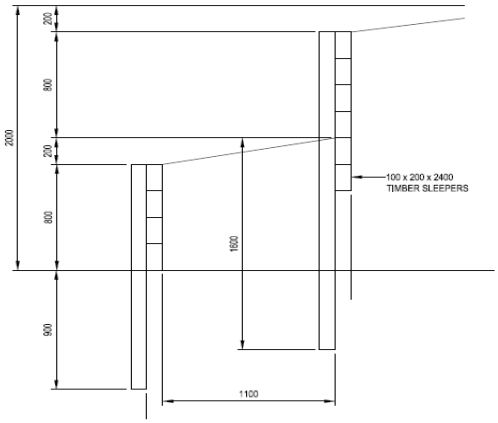
TIMBER RETAINING WALL DESIGN

1) TIMBER JOIST/SLEEPER - (200 WIDE X 100 DEEP) Oak

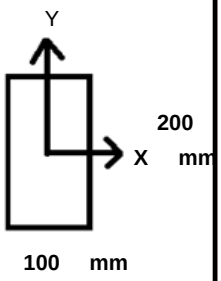
GENERAL DATA

Timber Grade:	**TH2**
Timber Class:	**1**
E min (Mpa) :	7000
Member extends:	75mm bearing
Timber Density (kN/Cum):	7.0
Bending Stress (Mpa) :	7.8



MEMBER DATA

Depth 'h' [*mm*] =	200
Width 'b' [*mm*] =	100
Bearing [*mm*] =	75
Total 'l' [*mm*] =	2400
Ixx [*cm4*] =	6666.67
Zxx [*cm3*] =	666.67
Iyy [*cm4*] =	1666.67
Zyy [*cm3*] =	333.33
Self weight, kN =	0.34

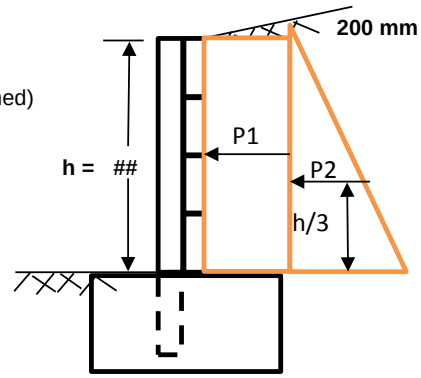


STRESS MODIFICATION FACTORS

Class factor K2 =	0.80
Load duration factor K3 =	1.25
Bearing stress factor K4 =	1.10
Shear at notched end (top) K5 =	1.00
Shear at notched end (btm) K5 =	1.00
Total depth factor K7 =	1.00
Load share factor K8 =	1.00
Allowable Bending Stress; σ (Mpa) :	7.80
Allowable Shear Stress; σ' (Mpa) :	2.00

LOADING

UDL (Self weight) =	0.14	kN/m
UDL (p-Surcharge) =	2.00	kN/m^2
Angle of Repose =	30^o	K= 0.33 (Assumed)
Density of Soil (d) =	16.0	kN/m^3



P1 = K x p x h = 0.528 kN/m

P2 = K x d x h x h /2 = 2.64 kN/m

however assume load at bottom 200 deep beam

P3 = K x p x 0.2 = 0.132 kN/m

P4 = K x d x 0.2 = 1.056 kN/m w = 1.188 kN/m

Reaction on support = 1.426 kN

Bending Moment in sleeper = 1.711 kN/m

BENDING STRESS CHECK

Applied Bending Stress =	5.13	N/mm^2
Allowable Design Bending Stress =	7.80	N/mm^2
(K2 x K3 x K7 x K8 x σ)		
Usage factor =	**0.66**	

SHEAR STRESS CHECK

Applied Shear Stress =	0.07	N/mm^2
Allowable Design Shear Stress =	2.00	N/mm^2
(K2 x K3 x K5 x K8) x σ')		
Usage factor =	**0.04**	

DEFLECTION CHECK

Actual Deflection = 5 w l^4 /384 E Iyy	4.40	mm
Allowable deflection; l /325 =	7.38	mm
Usage factor =	0.60	

Rajesh Sapkal
Civil Engineer
35, Rodwell Court
KT12 1RF

2) TIMBER POST - (200 Wide X 150 Deep)

Properties : Self weight, kN = 0.21

Iyy = 200 x 150^3 /12 = 6E+07 mm^4

Design Load on Post = (P1 + P2) X l = 3.17 x 2 = 7.60 kN (Shear)

Design Moment on Post = P1 x l x (h/2+0.1) + P2 x l x ((h +0.2) /3+0.1) = 3.38 kNm

(100 mm extra length)

BENDING STRESS CHECK		
Applied Bending Stress =	4.51	N/mm^2
Allowable Design Bending Stress =	7.80	N/mm^2
(K2 x K3 x K7 x K8 x σ)		
Usage factor =	**0.58**	

SHEAR STRESS CHECK		
Applied Shear Stress =	0.25	N/mm^2
Allowable Design Shear Stress =	2.00	N/mm^2
(K2 x K3 x K5 x K8) x σ')		
Usage factor =	**0.13**	

DEFLECTION CHECK		
Actual Deflection = p l^3 /3 E Iyy =	0.57	mm
Allowable deflection; h /325 =	2.46	mm
Usage factor =	0.23	

CLIENT : **Mr & Mrs Smithson, 40 Platt's Lane**
London, NW3 7NT.

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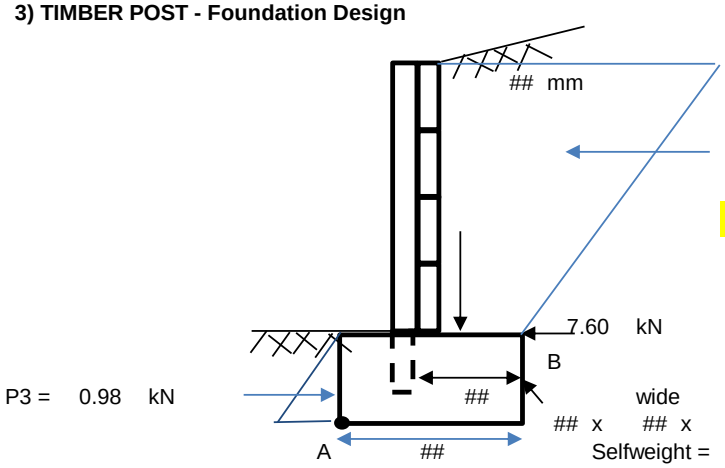
Rajesh Sapkal
Civil Engineer
35, Rodwell Court
KT12 1RF

3) TIMBER POST - Foundation Design



Loading On Foundation top

Lateral Load due to retaining soil = 7.60 kN

Moment above foundation top = 3.38 kNm

Vertical Load on Foundation =						
1.55	kN	(From Post and Sleeper)	@	225	from point A
5.67	kN	Selfweight	@	450	from point A
10.84	kN	(Surcharge +Soil)	@	650	from point A

Overturning Moment about point A

= 7.60 x 0.35 + 3.3792 = 6.04 kNm

Restoring Moment about point A

= 1.55 x 0.225 + 5.67 x 0.45 + 10.84 x 0.65
+ 0.98 x 0.117

= 10.06 kNm

Usage factor = 1.67 With Surcharge

Usage factor = 2.03 Without Surcharge

Summary

Slepper Size = 200 mm Deep X 100 mm wide x 2.4m Long

Post Size = 200 mm wide X 150 mm deep x 1.0m Long

Foundation Size = 900 mm wide X 750 mm Long x 350 mm Deep

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Rajesh Sapkal
Civil Engineer
35, Rodwell Court
KT12 1RF