

Barratt Associates Ltd.

Structural, Civil and Geotechnical Engineers

Project reference: 22203

Project Address: 3 Heol Las, Ynysmeudwy, Pontardawe, Swansea, SA8 4PR

Client: Richard Rose

Description: 7N Block Retaining wall check with raft line load, Raft Foundation Check

Design Code

Design for steel is based on:

Eurocode 3: Design of steel structures

Eurocode 5: Design of timber structures

Details prepared by:

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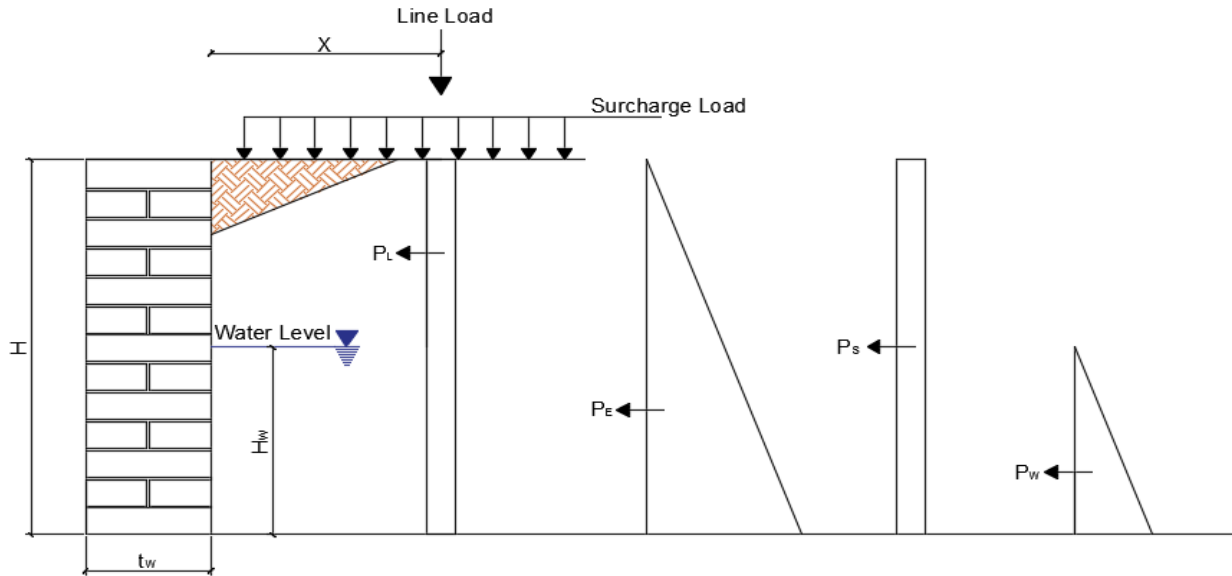
Structural, Civil and Geotechnical Engineers

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Project	3 Heol Las, Ynysmeudwy, Pontardawe, Swansea, SA8 4PR	Made by	IL	Job No
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Description	7N Block Retaining wall check with raft line load	Revision	-	1
		Date	8-6-22	22203

DESIGN STATUS: OK



Maximum height of masonry retaining wall is

2800 mm

DIMENSIONS (mm)

Wall height

H= 2800 mm

Wall thickness

T_w= 1125 mm

Ground water height

H_w = 0 mm

MATERIAL PROPERTIES

Characteristic flexural strength parallel to the joints

f_{yk1}= 0.25 N/mm²

Shear strength of masonry

f_{vk0}= 0.25 N/mm²

Partial factor

γ_m= 2.5

K value

K = 0.55

f_m^β = 1.71 N/mm² (β=0.3)

f_b^α = 10.75 N/mm² (k=0.7)

Masonry density =

21 kN/m³

SOIL PROPERTIES

Design angle of int'l friction of retained mat'l

Ø = 45 degree

Design cohesion of retained mat'l

C = 0 kN/m²

Density of retained mat'l

q = 16 kN/m³

Submerged Density of retained mat'l

q_s = 16.00 kN/m³

Design angle of int'l friction of base mat'l

Ø_b= 35 degree

Design cohesion of base material

C_b= 0 kN/m²

Density of base material

q_b= 16 kN/m³

Allowable gross ground bearing pressure

GBP = 150 kN/m²

LOADINGS

Surcharge load -- live

SQK = 1 kN/m²

Surcharge load -- dead

SGK= 0 kN/m²

Line load -- live

LQK = 6 kN/m

Line load -- dead

LGK= 4 kN/m

Distance of line load from wall

X = 0 mm

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LATERAL FORCES (unfactored)

Ka =	0.17	[default ka = (1-SIN Ø)/(1+SIN Ø)]
Kp =	3.69	[default kp = (1+SIN Øb)/(1-SIN Øb)]
Kpc =	3.84	[default kpc = 2kp ^{0.5}]
Kac =	0.83	[2ka ^{0.5}]

	Force (kN)	Lever arm (m)	Moment about TOE (kNm)	γ _f	F _{ult} (kN)	M _{ult} (kNm)
PE =	15.68	LE = 0.933	14.63	1.35	21.17	19.76
PS(GK) =	0.00	LS = 1.40	0.00	1.35	0.00	0.00
PS(QK) =	0.48	LS = 1.40	0.67	1.50	0.72	1.01
PL(GK) =	0.69	LL = 2.80	1.92	1.35	0.93	2.59
PL(QK) =	1.03	LL = 2.80	2.88	1.50	1.54	4.32
PW =	0.00	LW = 0.00	0.00	1.35	0.00	0.00
Total	17.88		20.11		24.36	27.68

STRUCTURAL DESIGNS (ultimate)

DESIGN CHECKS : OK

WALL (per metre length)

MOMENT of RESISTANCE :

design flexural strength $f_{xd} = f_{yk1} / \gamma_m =$ 0.15 N/mm²

Bending moment due to lateral forces, M= 27.68 kNm

Moment capacity of wall M_c= 31.64 kNm
> 27.68

OK

SHEAR RESISTANCE:

Characteristic shear strength= $f_{vk} = f_{vk0} =$ 0.25 N/mm² (but not greater than 0.065fb)

Design shear strength $f_v = f_{vk} / \gamma_m =$ 0.100 N/mm²

Lateral shear force $F_v =$ 24.36 kN

Shear capacity $F_{v,c} = f_v A =$ 113 kN
> 24.36

OK

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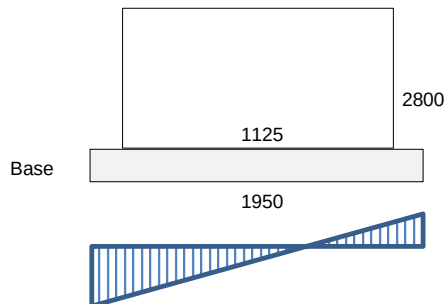
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LATERAL FORCES (unfactored)

Ka =	1.00	[default ka = (1-SIN Ø)/(1+SIN Ø)]
Kp =	2.40	[default kp = (1+SIN Øb)/(1-SIN Øb)]
Kpc =	3.10	[default kpc = 2kp ^{0.5}]
Kac =	2.00	[2ka ^{0.5}]

	Force (kN)	Lever arm (m)	Moment about TOE (kNm)	γ _f	F _{ult} (kN)	M _{ult} (kNm)
PE =	15.68	LE = 0.933	14.63	1.35	21.17	19.76
PS(GK) =	0.00	LS = 1.400	0.00	1.35	0.00	0.00
PS(QK) =	0.48	LS = 1.400	0.67	1.50	0.72	1.01
PL(GK) =	0.69	LL = 2.800	1.92	1.35	0.93	2.59
PL(QK) =	1.03	LL = 2.800	2.88	1.50	1.54	4.32
PW =	0.00	LW = 0.000	0.00	1.35	0.00	0.00
Total	17.88		20.11		24.36	27.68



Masonry density = 21 kN/m³

STABILITY CHECK

Unfactored

Weight of wall + fill (per metre length) = P =	66.150 kN
Moment on wall = M =	20.11 kN.m
Plan area of base = A =	1.950 m ²
Section modulus of base = Z =	0.634 m ³
Pressure under base at front = P/A + M/Z =	65.657 kN/m ²
Pressure under base at back = P/A - M/Z =	2.189 kN/m ²
Bearing capacity of ground under base =	150 kN/m ²

Ratio actual ÷ permissible
0.44
0.01

Ultimate

Weight of wall + fill (per metre length) = P =	66.150 kN
Ultimate moment on wall = M _{ult} =	27.68 kN.m
Plan area of base = A =	1.950 m ²
Section modulus of base = Z =	0.634 m ³
Pressure under base at front = P/A + M/Z =	77.605 kN/m ²
Pressure under base at back = P/A - M/Z =	-9.759 kN/m ²
Bearing capacity of ground under base =	150 kN/m ²

Ratio actual ÷ permissible
0.52
-0.07

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Project	3 Heol Las, Ynysmeudwy, Pontardawe, Swansea, SA8 4PR	Made by	Date	Job No
Client	Richard Rose	IL	8-6-22	22203
Description	Load breakdown	Checked	Revision	Page No
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Loading

Load breakdown for pitched roof

Roof pitch = 25 °

		Characteristic	Factor	Design	
Dead	Slate, Timber battens, and felt	0.55	1.35	0.74	kN/m ²
	Ceiling and services	0.15	1.35	0.20	kN/m ²
	Rafters & Insulation	0.20	1.35	0.27	kN/m ²
Live	Snow	0.75	1.5	1.13	kN/m ²
	$w_{1,1}' =$	1.65	$w_{1,1} =$	2.34	kN/m ²
	Load on plan	$w_1' =$	$w_1 =$	2.58	kN/m ²

Load breakdown for flat roof

		Characteristic	Factor	Design	
Dead	Ashphalt and waterproofing	0.45	1.35	0.61	kN/m ²
	Ceiling and services	0.15	1.35	0.20	kN/m ²
	Joists and Insulation	0.2	1.35	0.27	kN/m ²
Live	Snow	0.75	1.5	1.13	kN/m ²
	$w_{2,1}' =$	1.55	$w_{2,1} =$	2.21	kN/m ²
	Load on plan	$w_2' =$	$w_2 =$	2.21	kN/m ²

Load breakdown for timber floor

		Characteristic	Factor	Design	
Dead	Flooring	0.15	1.35	0.20	kN/m ²
	Ceiling and services	0.15	1.35	0.20	kN/m ²
	Joists and Insulation	0.2	1.35	0.27	kN/m ²
Live	Domestic	1.5	1.5	2.25	kN/m ²
	$w_{3,1}' =$	2	$w_{3,1} =$	2.93	kN/m ²
	Load on plan	$w_3' =$	$w_3 =$	2.93	kN/m ²

Load breakdown for stud wall

		Characteristic	Factor	Design	
Dead	12mm ply sheathing	0.08	1.35	0.11	kN/m ²
	Timber cladding	0.35	1.35	0.47	kN/m ²
	Studs & insulation	0.24	1.35	0.32	kN/m ²
Live	Plasterboarded, skim & services	0.15	1.5	0.23	kN/m ²
	$w_{4,1}' =$	0.82	$w_{4,1} =$	1.13	kN/m ²
	Load on plan	$w_4' =$	$w_4 =$	1.13	kN/m ²

Load breakdown for masonry

	Density	$\gamma =$	19 kN/m ³
	Thickness	$t =$	0.10 m
	Characteristic load	$w_5' = \gamma t =$	1.9 kN/m ²
	Design load	$w_5 = 1.35w_5' =$	2.565 kN/m ²

Load breakdown for concrete floor

		Characteristic	Factor	Design	
Dead	Flooring	0.15	1.35	0.20	kN/m ²
	Ceiling and services	0	1.35	0.00	kN/m ²
	Concret Slab and Insulation	7.2	1.35	9.72	kN/m ²
Live	Domestic	1.5	1.5	2.25	kN/m ²
	$w_{3,1}' =$	8.85	$w_{3,1} =$	12.17	kN/m ²
	Load on plan	$w_3' =$	$w_3 =$	12.17	kN/m ²

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Client	Richard Rose	IL		8-6-22		22203	
Description	Raft check considering simply supported beam, front elevation	Checked		Revision		Page No	
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1.Loads

See page 2 for load breakdown

Loaded width for pitched roof =

Loaded width for flat roof =

Loaded width for concrete floor =

Loaded height for stud wall =

Loaded height for masonry wall =

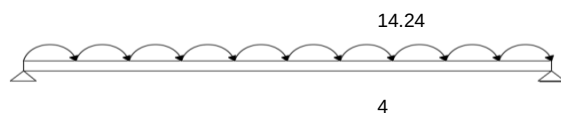
$d_1 = 2.00$ m

$d_2 = 0.00$ m

$d_3 = 1.00$ m

$d_4 = 0.00$ m

$d_5 = 2.40$ m



Beam self weight

$w_s = 0$ kN/m

Factored load on beam

$w = \sum w_n d_n + 1.35 w_s = 14.24$ kN/m

Unfactored load on beam

$w' = \sum w'_n d_n + w_s = 9.86$ kN/m

Beam clear span

$L = 4$ m

Design bending moment

$M = wL^2/8 = 28.49$ kN.m

Design shear force

$V_{Ed} = wL/2 = 28.49$ kN

Section design to Eurocode 2 (BS EN 1992-1)

RECTANGULAR BEAMS

Originated from TCC11.xls, v 4.3 on CD © 2003-2010 TCC



Beam type **SIMPLY SUPPORTED**

INPUT

Location **3 Heol Las, Ynysmeudwy SA8 4PR**

M kNm **28.5**

δ **0.85**

span mm **4000**

h mm **300**

b mm **1000**

gk kN/m **14.20**

qk kN/m **9.80**

$\psi_2 = 0.3$ **Dwelling**

f_{ck} **35** N/mm²

f_{yk} **500** N/mm²

Steel class **A**

$\gamma_c = 1.50$

$\gamma_s = 1.15$

$\Delta c_{dev} = 10$

REBAR	$\emptyset$	COVER
Tension	8	50
Comp'n	8	50
Side	--	50

to main bars

brittle partitions? **YES**

OUTPUT

3 Heol Las, Ynysmeudwy SA8 4PR

Effective depth,

$d = 300 - 50 - 8/2 = 246.0$ mm

Neutral axis,

$x = [246 - \sqrt{(246^2 - 2E6 \times 28.5 \times 1.5 / 0.85 / 1000 / 35)}] / 0.8 = 7.4$ mm

(x/d) limit = 0.450

x/d actual = 0.030 ok

Lever arm,

$z = 246 - 0.4 \times 7.4 = 243.0 > 0.95d = 233.7$ mm

Tension steel,

$A_s = 28.5E6 / 233.7 / 434.8 = 280$ mm²

9.2.1.1 (1)

$A_{s \min} = 1.3 \times 1000 \times 300 = 411$ mm²

7.3.2 (2)

$A_{s \text{ crack}} = 0.4 \times 0.8 \times 3 \times 300 / 2 \times 1000 / 500 = 249$ mm²

for deflection,

$A_{s \text{ def}} = 21$ mm²

PROVIDE 9H8 TENSION STEEL = 452 mm²



Service stress,

SLS $M = 28.5 \times 24 / 33.9 = 23.8$ kNm

$\rho = 229$ N/mm²

Modification factor = 310 / 229.4 = 1.351

Permissible $L/d = 1.351 \times 1.000 \times 219.337 = 296.42$

Actual $L/d = 4000 / 246 = 16.26$ ok