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76 LAWN ROAD

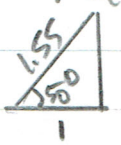
LOADINGS

No: R11438/1
BY: GP
DATE: November 2019

LOADINGS

Pitched Roof

Plain tiles	0.8 kN/m²
rafters & battens	0.15 "
plasterboard + skim	0.2 "
Rafter loading on plan	= 1.15 kN/m²
×1.55 on slope	= 1.8 kN/m²
Snow load 0.6 × 10/30	= 0.2 "
	2.0 kN/m²



Timber floors

finish + boards	0.25 kN/m²
timber joists	0.15 "
2 layer plasterb. ceiling	0.3 "
insulation + services	0.1 "
Dead load	= 0.8 kN/m²
Live "	1.5 "
	2.3 kN/m²
Allow stud plus	0.5 "
	2.8 kN/m²

loft space 2nd floor

Boards	0.1 kN/m²
joists	0.15 "
ceiling	0.3 "
insulation + services	0.1 "
Dead load	= 0.65 kN/m²
Live load	= 0.5 "
	1.15 kN/m²

100 lightweight

Ground Floor Slab

225 RC	5.4 kN/m²
75 screed + finish	2.0 "
ceiling + services	0.3 "
Dead load	= 7.7 kN/m²
Live load + partitions	= 2.5 "
	10.2 kN/m²

Cavity Walls

Inner 100 Hemelite	1.5	1.8 kN/m²
plaster	0.3	
Outer 102 brick	2.1 "	
	3.9 kN/m²	
Wile render	1.8	4.4 kN/m²
2.1 + 0.5	2.6	

Extg 13½ brick walls

brickwork	20 kN/m³ × 0.33 = 6.7 kN/m²
plaster	= 0.3 "
	= 7.0 kN/m²

Extg 9" brick walls

brickwork	20 kN/m² × 0.225 = 4.5 kN/m²
plaster	= 0.3
	4.8 kN/m²

Flat roof

allow asphalt	0.5	1.0
ply	0.12	
joists	0.13	
ceiling	0.2	
snow	0.6	
	1.6 kN/m²	

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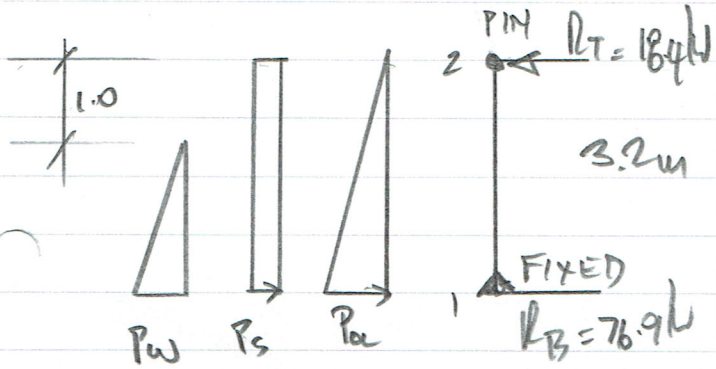
76 LAWN ROAD
RC Retaining Walls

No: 11438/RW1
BY: GP
DATE: November 2019

RC retaining Wall

225 RC wall against underpinning
Ignore contribution of underpinning



Use k_0 = pressure coefficient at rest
$= 1 - \sin\phi$
$= 1 - \sin 25^\circ = 0.58 \Rightarrow 0.6$

$P_a = 0.6 \times 20 \times 3.2 = 38.4$ kN/m

P_s = 5kN/m² surcharge × 0.6 = 3.0kN/m

P_w = ground water = 22kN/m

Analysed on SAND
take $E_c = 28$ kN/mm²
$I_z = 10^3 \times 225^3/12 = 949 \times 10^6$ mm⁴

Total horizontal force
$= 38.4 \times 3.2/2 + 3.0 \times 3.2 + 22 \times 2.2/2$
$= 61.4 + 9.6 + 24.2 = 95.2$ kN

$R_T + R_B$ from Computer analysis
$= 18.4 + 76.9 = 95.3$ kN ✓

Support Moment = 39.9 × 1.5 = 60kNm

$d = 225 - 40 - 10 = 175$

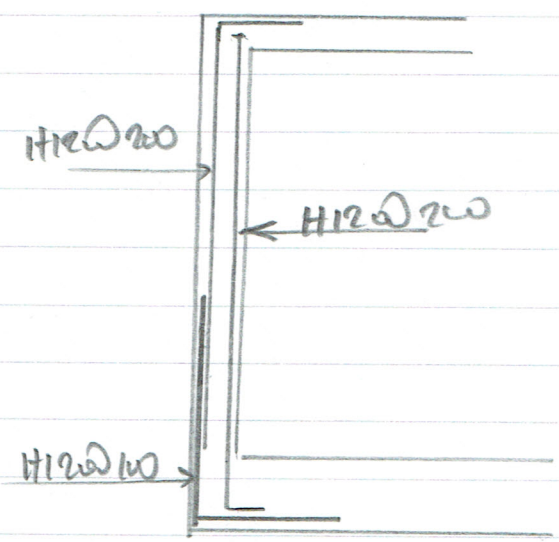
$M_U = .156 \times 40 \times 10^3 \times .175^2 = 191.1$kNm

$M/M_U = \frac{60}{191.1} = 0.31$ $q_1 = 0.94$

$A_S = \frac{60}{.475 \times .95 \times .175} = 760$ mm²
H12@100 = 1130 mm²

$+M = 18 \times 1.5 = 27$kNm

$A_S = \frac{27}{.475 \times .95 \times .175} = 342$ mm²
H12@200 = 565 mm²



Deflection from computer analysis
< 1mm - negligible.

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TABULATE DISPLACEMENTS FORCES REACTIONS
PRINT DATA RESULTS FROM 1
TYPE PLANE FRAME
METHOD ELASTIC NODES
NUMBER OF JOINTS 2
NUMBER OF MEMBERS 1
NUMBER OF SUPPORTS 2
NUMBER OF LOADINGS 1
NUMBER OF SEGMENTS 2
JOINT COORDINATES
1 0 0 S
2 0 3.2 S
JOINT RELEASES
2 MOMENT Z
MEMBER INCIDENCES
  1 2
CONSTANTS E 28E6 ALL
MEMBER PROPERTIES
1 AX 0.225 IZ 949E-6
LOADING CASE  1
MEMBER LOADS
1 FORCE Y LINEAR WA 38.4 WB 0 LA 0 LB 3.2
1 FORCE Y UNIFORM W 3.0
1 FORCE Y LINEAR WA 22 WB 0 LA 0 LB 2.2
SOLVE


LOADING CASE  1
JOINT DISPLACEMENTS
 JOINT     X DISPLACEMENT     Y DISPLACEMENT        Z ROTATION
     1        0.000000000        0.000000000       0.000000000
     2        0.000000000        0.000000000      -0.000579593

LOADING CASE  1
MEMBER FORCES
MEMBER  JOINT        AXIAL FORCE        SHEAR FORCE     BENDING MOMENT
     1      1             0.0000           -76.8856           -39.9087
            2             0.0000           -18.3544             0.0000

LOADING CASE  1
SUPPORT REACTIONS
 JOINT            X FORCE            Y FORCE          Z MOMENT
     1            76.8856             0.0000          -39.9087
     2            18.3544             0.0000            0.0000

EQUILIBRIUM CHECK              SUM OF FORCES          REACTION

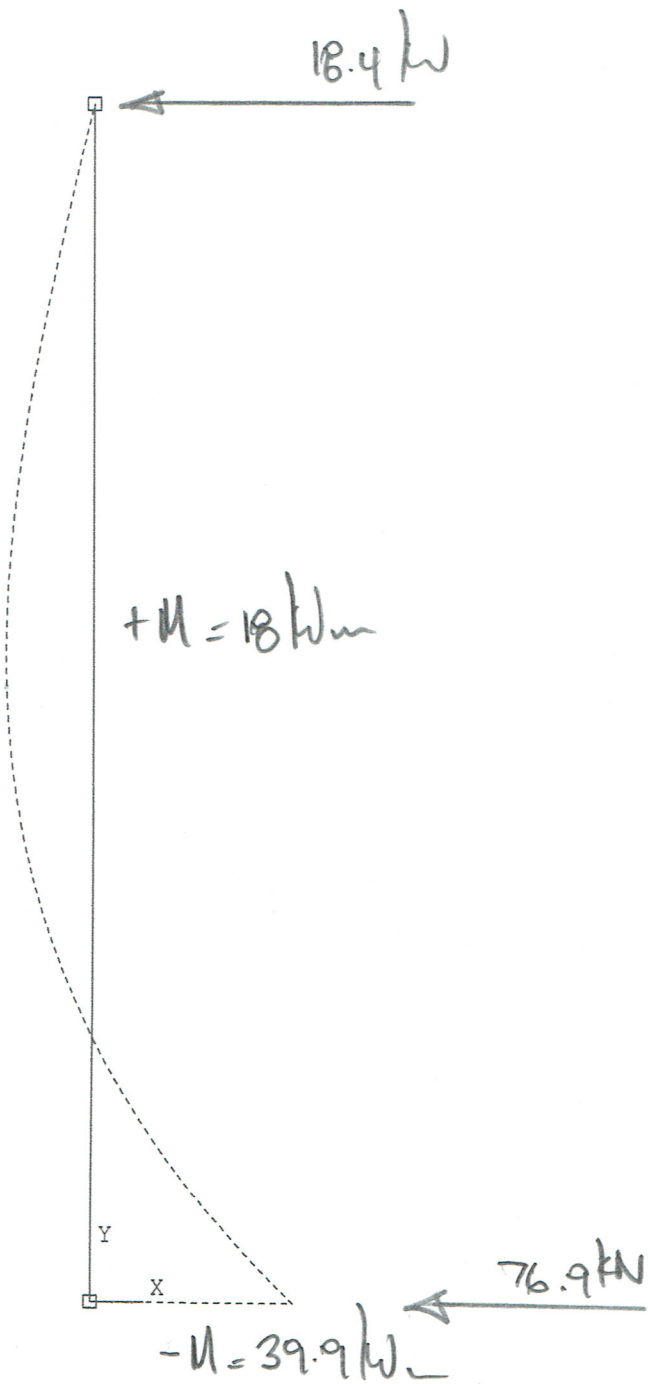
FORCES IN DIRECTION X               -95.2400           95.2400
FORCES IN DIRECTION Y                 0.0000            0.0000
MOMENTS ABOUT AXIS  Z                98.6427          -98.6427
```

76 LAWN ROAD
225 RETAINING WALL

PAGE: R11438/RW3
MADE BY: GP
DATE: NOV 19
REF NO:

STRUCTURE SCALE 1 CM = 0.200 □ = SUPPORTS

MOMENT Z SCALE 1 CM = 15.00 LOADING KEY 1



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76 Lawn Road
RC Retaining Walls

No: R11438/RW4
BY: CP
DATE: September 2019

300 RC walls (propped)

$d = 300-40-10 = 250$

$M_U = .156 \times 40 \times 10^3 \times .25^2 = 390$ kNm

$A_s = \frac{60}{.475 \times .95 \times .250} = 532$ mm²

H12@200 = 565 mm²

Ground floor beam strip (2.A'-c') spanning horizontally across glazed floor

Propps force = 18.4 kN/m unfactored

span = 3.4 clear, 3.7 effective

$M = 1.5 \times 18.4 \times 3.7^2/8 = 47.2$ kNm

450×225 RC strip $d = 450-40-10 = 370$

$M_U = .156 \times 40 \times 225 \times .37^2 = 192$ kNm

$A_s = 47.2/.475 \times .95 \times .37 = 288$ mm² 2H16 (402)

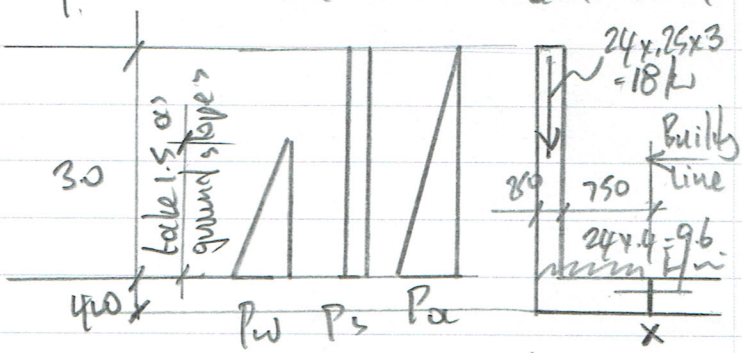
$v = \frac{1.5 \times 18.4 \times 1.7 \times 10^3}{370 \times 225} = 0.56$ N/mm²

nominal links $\frac{A_{sv}}{s_v} = \frac{0.4 \times 225}{475} = 0.19$

H8@300 = 101/300 = 0.3

Free standing walls front garden

As walls can deflect use active pressure coefficients k_a = table 4.5



$P_a = 0.45 \times 20 \times 3.0 = 27$ kN/m

$P_s = 0.45 \times 5 = 2.3$ kN/m

$P_w = 15$ kN/m²

-M = 27×3.0²/6 = 40.5
+2.3×3.0²/2 = 10.4
+15×1.5²/2 = 16.8
} 67.7×1.5 = 102 kNm

250 RC $d = 250-50-10 = 190$ mm

$M_U = .156 \times 40 \times 10^3 \times .190^2 = 225$ kNm

$M/M_U = 102/225 = 0.45$ $\alpha_1 = 0.91$

$A_s = \frac{102}{.475 \times .91 \times .19} = 1241$ mm² H16@150 = 1340 mm²

Moment @ x = 67.7 − 18×.875 − 9.6×1.0²/2 (15.8, 13.2)
= 38.7 kNm ×1.5 = 58 kNm

dowel bars at mid-depth d = 200

$M_U = .156 \times 40 \times 10^3 \times .2^2 = 249.6$ kNm

$M/M_U = \frac{102}{249.6} = 0.41$ $\alpha_1 = 0.92$

$A_s = \frac{58}{.475 \times .92 \times .2} = 664$ mm² H16@300 = 670 mm²

or H16@200 with $\frac{200}{300} \times 640 = 450$ mm embedded

Effect on wall is to reduce stresses therefore not significant