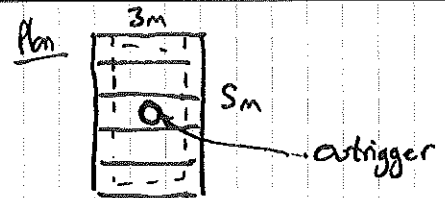


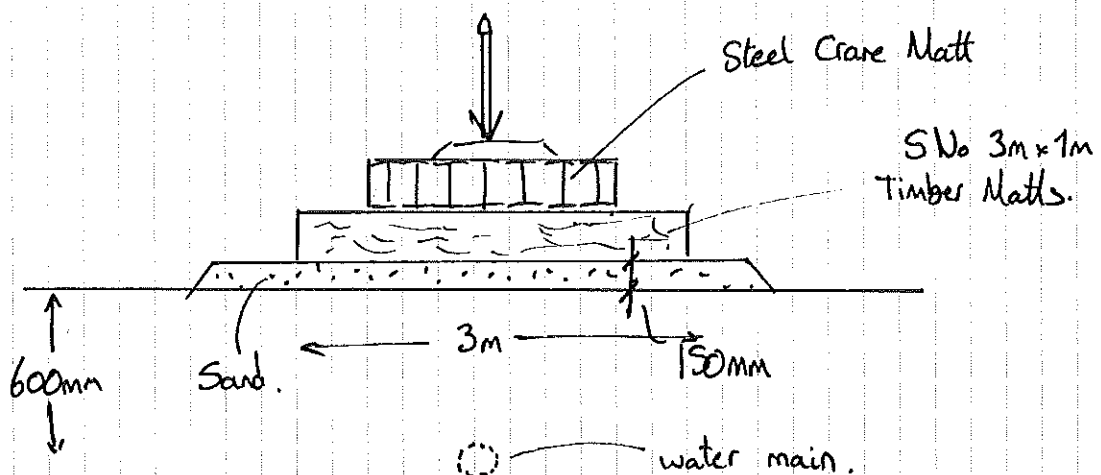
Project 109 LAMBETH - NEW MATT CONFIGURATION

New Matt
 $3m \times 5m$
 $= 15m^2$



Sand layer
 $\times 0.15m$ deep $= 2.25m^3$ of sand for 2 No mats.

Pressure $= 99.7 \times 9.81 = 65.2 kN/m^2$ serviceability load.
Under Matt



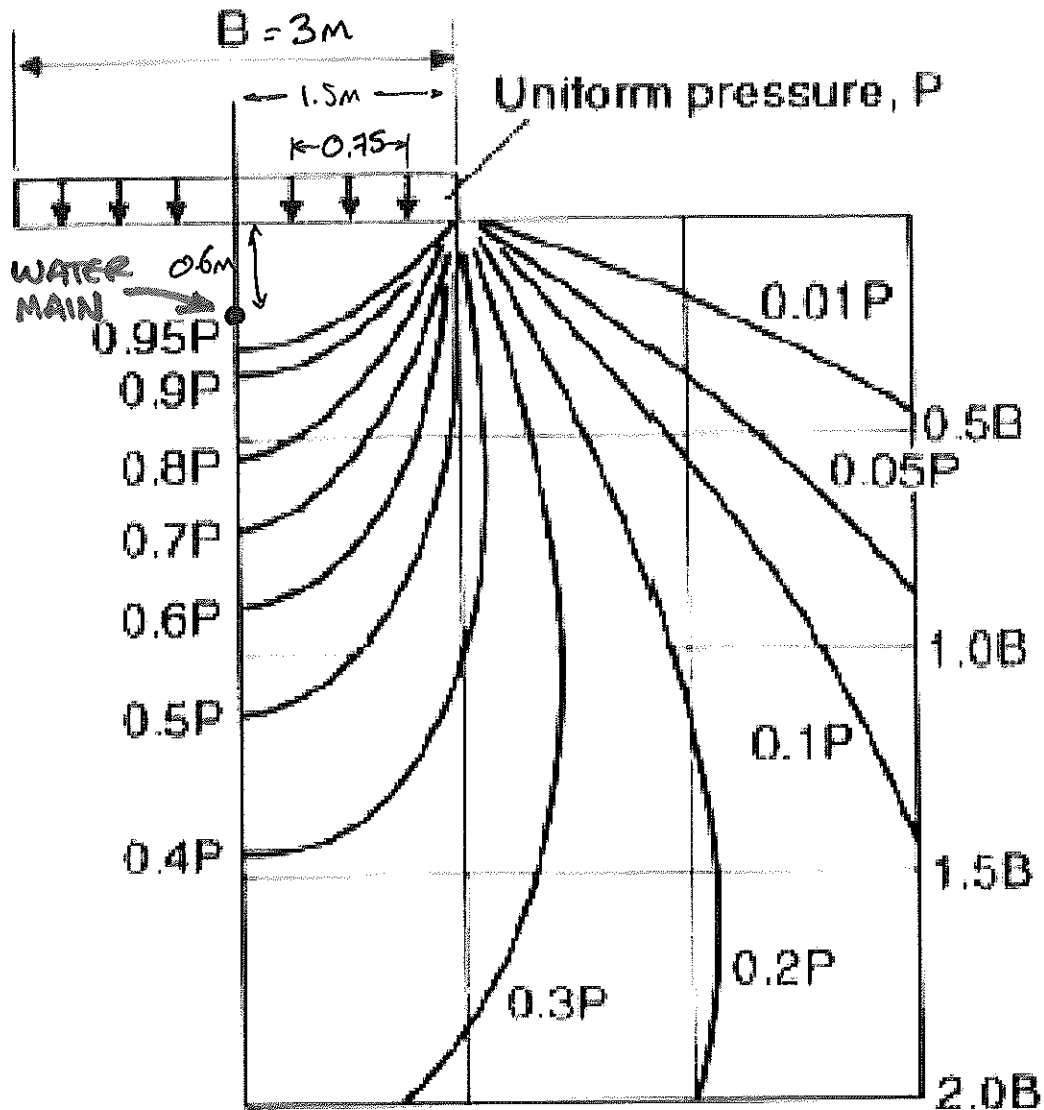
Pressure at water main $= 0.95 \times 65.2 kN/m^2$
 $= 62 kN/m^2$

$\therefore$ ensure new pipe can accept this load.

Safe Ground Bearing Capacity	Study 1 - DA1	147 kN/m ²	} very worst credible GUL - unlikely
	- DA2	76 kN/m ²	

Study 2	- DA1	209 kN/m ²	} likely GUL
	- DA2	107 kN/m ²	

$\therefore$ Take study 2 forward $\therefore$ worst factor of safety $= \frac{1.64}{\therefore OK}$



(b) Strip footing

Study 1 - GWL @ road surface (very worst credible)

3

DESIGN APPROACH 1 (Variable Unfavourable 1.0, Material Factors not reduced)

C'	ϕ'	N _q	N _v	N _c
0	28	10.7	10.9	20.7

Foundation load P (kN)	978	Foundation Moment (on width)	0	EccB	0
Foundation load H (kN)	0	Foundation Moment (on length)	0	EccL	0
Foundation width Bf (m)	3	Soil unit weight	8 kN/m ³		
Eff width Bf' (m)	3.00	Soil surface load (q ₀)	3.4 kN/m ²		
Foundation length Lf (m)	5				
Eff length Lf' (m)	5.00				

$$\zeta_{cs} = 1 + \frac{B_f}{L_f} \cdot \frac{N_q}{N_c} = 1.31$$

$$\zeta_{\gamma s} = 1 - 0.4 \frac{B_f}{L_f} = 0.76$$

$$\zeta_{qs} = 1 + \frac{B_f}{L_f} \tan \phi' = 1.32$$

$$\zeta_{as} = \zeta_{qi} = \frac{1 - \zeta_{qi}}{N_c \tan \phi'} = 1.00$$

INCLINATION

$$\zeta_{\gamma i} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{m_i+1} = 1.00$$

$$\zeta_{qi} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{m_i} = 1.00$$

$$m_i = \frac{2 + \frac{B_f'}{L_f'}}{\frac{B_f'}{L_f'} + 1} = 1.63$$

$$\zeta_{sw} = (1 - \tan \alpha)^2 = 1.00 \quad \begin{matrix} \text{w slope} \\ \text{Chi qg yg} \end{matrix} \quad \begin{matrix} 0 \text{ degrees} \\ 1.00 \end{matrix}$$

$$Q_{ult} = q_u \cdot B_f' \cdot L_f' = [c' N_c \zeta_{cs} \zeta_{ci} + 0.5 B \gamma' N_{\gamma} \zeta_{\gamma s} \zeta_{\gamma i} + q_0 N_q \zeta_{qs} \zeta_{qi}] B_f' \cdot L_f'$$

2205 kN 147 kN/m²

q_u

i	incination	considered
g	ground surface	not considered
t	tilting foundation base	not considered
s	shape of shallow foundation	considered

q u design	Design Load	99.7 te
Qu design		978 kN
q u design		65 kN/m ²
Factor of Safety		2.25

Size of matt = 3m x 5m

Soil unit weight = 18 kN/m³ - 10 kN/m³ = 8 kN/m³

Surcharge taken as termac road surface.

Study 1 - GWL @ road surface. (very worst credible)

DESIGN APPROACH 2 (Variable Unfavourable 1.3, Material Factors reduced)

C'	ϕ'	Nq	NV	Nc
0	21.6	6.4	5.4	14.8

Foundation load P (kN)	1271.5
Foundation load H (kN)	0
Foundation width Bf (m)	3
Eff width Bf (m)	3.00
Foundation length Lf (m)	5
Eff length Lf (m)	5.00

$$\zeta_{cs} = 1 + \frac{B_f}{L_f} \cdot \frac{N_q}{N_c} = 1.26$$

$$\zeta_{qs} = 1 - 0.4 \frac{B_f}{L_f} = 0.76$$

$$\zeta_{qs} = 1 + \frac{B_f}{L_f} \tan \phi' = 1.24$$

$$\zeta_{ci} = \zeta_{qi} = \frac{1 - \zeta_{qi}}{N_c \tan \phi'} = 1.00$$

INCLINATION

$$\zeta_{qs} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{m_i+1} = 1.00$$

$$\zeta_{qi} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^m = 1.00$$

$$m_i = \frac{2 + \frac{B_f'}{L_f'}}{\frac{B_f'}{L_f'} + 1} = 1.53$$

$$\zeta_{w} = (1 - \tan w)^2$$

w slope 0 degrees
Chi qg yg 1.00

Foundation Moment (on width)	0	EccB	0
Foundation Moment (on length)	0	EccL	0
Soil unit weight	8 kN/m³		
Soil surface load (q ₀)	3.4 kN/m²		

$$Q_{ult} = q_u \cdot B_f' \cdot L_f' = [c' N_c \zeta_{cs} \zeta_{ci} + 0.5 B_f' N_q \zeta_{qs} \zeta_{qi} + q_0 N_q \zeta_{qs} \zeta_{qi}] B_f' \cdot L_f'$$

1141 kN
76 kN/m²

i	inclination	considered
g	ground surface	not considered
t	tilting foundation base	not considered
s	shape of shallow foundation	considered
q u design	Design Load	99.7 te
	Qu design	978 kN
	q u design	65 kN/m²
Factor of Safety		1.17

Size of mat = 3m x 5m
 Soil unit weight = 18 kN/m³ - 10 kN/m³ (water) = 8 kN/m³
 Surcharge taken as tarmac road surface.

Study 2 - QWL 1m below road surface (likely)

5

DESIGN APPROACH 1 (Variable Unfavourable 1.0, Material Factors not reduced)

C'	ϕ'	N _q	N _y	N _c
0	28	10.7	10.9	20.7

Foundation load P (kN)	978	Foundation Moment (on width)	0	EccB	0
Foundation load H (kN)	0	Foundation Moment (on length)	0	EccL	0
Foundation width Bf (m)	3.00	Soil unit weight	13 kN/m ³		
Eff width Bf (m)	3.00	Soil surface load (q ₀)	3.4 kN/m ²		
Foundation length Lf (m)	5.00				
Eff length Lf (m)	5.00				

$$\zeta_{cs} = 1 + \frac{B_f}{L_f} \cdot \frac{N_q}{N_c} = 1.31$$

$$\zeta_{qs} = 1 - 0.4 \frac{B_f}{L_f} = 0.76$$

$$\zeta_{qs} = 1 + \frac{B_f}{L_f} \tan \phi' = 1.32$$

SHAPE

$$Q_{ult} = q_u \cdot B_f \cdot L_f = [c' N_c \zeta_{cs} \zeta_{ci} + 0.5 B \gamma' N_q \zeta_{qs} \zeta_{qi} + q_0 N_q \zeta_{qs} \zeta_{qi}] B_f \cdot L_f$$

3135 kN 209 kN/m² q_u

$$\zeta_{sa} = \zeta_{qi} = \frac{1 - \zeta_{qi}}{N_c \tan \phi'} = 1.00$$

INCLINATION

$$\zeta_{qs} = \left(1 - \frac{H}{P + B_f L_f c' \cot \phi'} \right)^{mi+1} = 1.00$$

$$\zeta_{qi} = \left(1 - \frac{H}{P + B_f L_f c' \cot \phi'} \right)^{mi} = 1.00$$

$$m_i = \frac{2 + \frac{B_f}{L_f}}{1 + \frac{B_f}{L_f}} = 1.63$$

$$\zeta_{sw} = (1 - \tan \alpha)^2 = 1.00$$

w slope 0 degrees
Chi dg yg

i	inclination	considered
g	ground surface	not considered
t	tilting foundation base	not considered
s	shape of shallow foundation	considered

q u design	Design Load	99.7 te
Qu design		978 kN
q u design		65 kN/m ²
Factor of Safety		3.21

Size of mat = 3m x 5m
Soil unit weight = 18 kN/m³ - 5 kN/m³ = 13 kN/m³
(1/2 of)

Surcharge taken as terrace road surface.

Study 2 - Cul 1m below road surface (likely)

DESIGN APPROACH 2 (Variable Unfavourable 1.3, Material Factors reduced)

C'	ϕ'	Nq	Ny	Nc
0	21.6	6.4	5.4	14.8

Foundation load P (kN) 1271.5

Foundation load H (kN) 0

Foundation width Bf (m) 3

Eff width Bf (m) 3.00

Foundation length Lf (m) 5

Eff length Lf (m) 5.00

$\zeta_{qs} = 1 + \frac{B_f N_q}{L_f N_c}$ 1.26

$\zeta_{\gamma} = 1 - 0.4 \frac{B_f}{L_f}$ 0.76

$\zeta_{qs} = 1 + \frac{B_f}{L_f} \tan \phi'$ 1.24

$\zeta_{ci} = \zeta_{qi} \frac{1 - \zeta_{qi}}{N_c \tan \phi'}$ 1.00

$\zeta_{\gamma} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{m+1}$ 1.00

$\zeta_{qi} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{mi}$ 1.00

$\zeta_{ci} = \left(1 - \frac{H}{P + B_f' L_f' c' \cot \phi'} \right)^{mi}$ 1.00

$m_1 = \frac{B_f'}{L_f'} \frac{B_f'}{B_f' + L_f'}$ 1.63

$\zeta_{\gamma} = (1 - \tan w)^2$ w slope Chi qg yg 0 degrees 1.00

Foundation Moment (on width) 0 EccB 0

Foundation Moment (on length) 0 EccL 0

Soil unit weight 13 kN/m³

Soil surface load (q₀) 3.4 kN/m²

SHAPE

$$Q_{ult} = q_u \cdot B_f' \cdot L_f' = [c' N_c \zeta_{cs} \zeta_{ci} + 0.5 B_f' \gamma' N_{\gamma} \zeta_{\gamma s} \zeta_{\gamma i} + q_0 N_q \zeta_{qs} \zeta_{qi}] B_f' \cdot L_f'$$

1601 kN

107 kN/m²

q_u

i	inclination	considered
g	ground surface	not considered
t	tilting foundation base	not considered
s	shape of shallow foundation	considered

q u design	Design Load	99.7 te
	Qu design	978 kN
	q u design	65 kN/m2

Factor of Safety $\frac{1.64}{1.64}$

Size of mat = 3m x 5m

Soil unit weight = 18 kN/m³ - 5 kN/m³ = 13 kN/m³.

Surcharge taken as 6m x road surface.