

A-Z Building Services A: Addlestone K115 E: hihuseyni0809@msn.com T: 01969925562	Project 1 storey outbuilding - RAFT FOUNDATION - 150mm slab			Job no. 2023-7459	
	Calcs for Wendover Lower Rochester Road Higham Rochester Kent ME3 7HD			Start page no./Revision 6	
	Calcs by SB	Calcs date 13/08/2026	Checked by	Checked date	Approved by Approved date

Edge beam shear check

Applied shear stress

$$V_{edge} = V_{\Sigma edge} / (b_w \times d_{edgetop}) = \mathbf{0.191 \text{ N/mm}^2}$$

Tension steel ratio

$$\rho_{edge} = 100 \times A_{sedge} / (b_w \times d_{edgetop}) = \mathbf{0.348}$$

From BS8110-1:1997 - Table 3.8

Design concrete shear strength

$$V_{cedge} = \mathbf{0.558 \text{ N/mm}^2}$$

$$V_{edge} \leq V_{cedge} + 0.4 \text{ N/mm}^2 - \text{Therefore minimum links required}$$

Link area to spacing ratio required

$$A_{sv_upon_svreqedge} = 0.4 \text{ N/mm}^2 \times b_w / ((1.0/\gamma_s) \times f_{ys}) = \mathbf{0.356 \text{ mm}}$$

Link area to spacing ratio provided

$$A_{sv_upon_svproedge} = N_{edgeline} \times \pi \times \phi_{edgeline}^2 / (4 \times S_{vedge}) = \mathbf{0.754 \text{ mm}}$$

$$\text{PASS} - A_{sv_upon_svreqedge} \leq A_{sv_upon_svproedge} - \text{Shear reinforcement provided in edge beams is adequate}$$

Boot design check

Effective cantilever span

$$l_{boot} = b_{boot} + d_{boot}/2 = \mathbf{255 \text{ mm}}$$

Approximate ultimate bearing pressure

$$q_{ult} = 1.55 \times q_{allow} = \mathbf{77.5 \text{ kN/m}^2}$$

Cantilever moment

$$M_{boot} = q_{ult} \times l_{boot}^2 / 2 = \mathbf{2.5 \text{ kNm/m}}$$

Shear force

$$V_{boot} = q_{ult} \times l_{boot} = \mathbf{19.7 \text{ kN/m}}$$

K factor

$$K_{boot} = M_{boot} / (f_{cu} \times d_{boot}^2) = \mathbf{0.003}$$

Lever arm

$$Z_{boot} = d_{boot} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{boot}/0.9)}) = \mathbf{151 \text{ mm}}$$

Area of reinforcement required

$$A_{sbootreq} = M_{boot} / ((1.0/\gamma_s) \times f_{yboot} \times Z_{boot}) = \mathbf{38 \text{ mm}^2/\text{m}}$$

$$\text{PASS} - A_{sbootreq} \leq A_{sboot} - \text{Area of reinforcement provided in boot is adequate for bending}$$

Applied shear stress

$$V_{boot} = V_{boot} / d_{boot} = \mathbf{0.124 \text{ N/mm}^2}$$

Tension steel ratio

$$\rho_{boot} = 100 \times A_{sboot} / d_{boot} = \mathbf{0.237}$$

From BS8110-1:1997 - Table 3.8

Design concrete shear strength

$$V_{cboot} = \mathbf{0.551 \text{ N/mm}^2}$$

$$\text{PASS} - V_{boot} \leq V_{cboot} - \text{Shear capacity of the boot is adequate}$$

Corner design checks

Basic loading

Corner bearing pressure check

Total uniform load at formation level

$$W_{udlcorner} = W_{Dudl} + W_{Ludl} + W_{edge} / b_{bearing} + W_{hcorethick} = \mathbf{19.2 \text{ kN/m}^2}$$

$$\text{PASS} - W_{udlcorner} \leq q_{allow} - \text{Applied bearing pressure is less than allowable}$$

Corner beam bending check

Cantilever span of edge beam

$$l_{corner} = \phi_{depthick} / \sqrt{(2)} + d_{edgetop} / 2 = \mathbf{1081 \text{ mm}}$$

Moment and shear due to self weight

Ultimate self weight udl

$$W_{edgeult} = 1.4 \times W_{edge} = \mathbf{4.9 \text{ kN/m}}$$

Average ultimate slab udl (approx)

$$W_{cornerslab} = \max(0 \text{ kN/m}, 1.4 \times W_{slab} \times (\phi_{depthick} / (\sqrt{(2)} \times 2) - (b_{edge} + (h_{edge} - h_{slab}) / \tan(\alpha_{edge}))))$$

$$W_{cornerslab} = \mathbf{0.5 \text{ kN/m}}$$

Self weight and slab bending moment

$$M_{cornersw} = (W_{edgeult} + W_{cornerslab}) \times l_{corner}^2 / 2 = \mathbf{3.1 \text{ kNm}}$$

Self weight and slab shear force

$$V_{cornersw} = (W_{edgeult} + W_{cornerslab}) \times l_{corner} = \mathbf{5.7 \text{ kN}}$$

Moment and shear due to udl's

Maximum ultimate udl

$$W_{cornerudl} = ((1.4 \times W_{Dudl}) + (1.6 \times W_{Ludl})) \times \phi_{depthick} / \sqrt{(2)} = \mathbf{14.3 \text{ kN/m}}$$

Bending moment

$$M_{cornerudl} = W_{cornerudl} \times l_{corner}^2 / 6 = \mathbf{2.8 \text{ kNm}}$$

Shear force

$$V_{cornerudl} = W_{cornerudl} \times l_{corner} / 2 = \mathbf{7.7 \text{ kN}}$$

Resultant moments and shears

Total design moment

$$M_{\Sigma corner} = M_{cornersw} + M_{cornerudl} = \mathbf{5.9 \text{ kNm}}$$

Total design shear force

$$V_{\Sigma corner} = V_{cornersw} + V_{cornerudl} = \mathbf{13.5 \text{ kN}}$$