

A-Z Building Services A: Addlestone KT15 E: hthuse@azbs09@msn.com T: 07969925562	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 4	
	Calcs by SB	Calcs date 13/08/2026	Checked by	Checked date	Approved by	Approved date

Reinforcement required in bottom

K factor

$$K_{slab\text{btm}} = M_{\Sigma c} / (f_{cu} \times d_{slab\text{av}}^2) = \mathbf{0.004}$$

Lever arm

$$Z_{slab\text{btm}} = d_{slab\text{av}} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{slab\text{btm}}/0.9)}) = \mathbf{99.7 \text{ mm}}$$

Area of steel required for bending

$$A_{ssl\text{ab}\text{btm}\text{bend}} = M_{\Sigma c} / ((1.0/\gamma_s) \times f_{yslab} \times Z_{slab\text{btm}}) = \mathbf{31 \text{ mm}^2/\text{m}}$$

Area of steel required

$$A_{ssl\text{ab}\text{btm}\text{req}} = \max(A_{ssl\text{ab}\text{btm}\text{bend}}, A_{ssl\text{ab}\text{min}}) = \mathbf{195 \text{ mm}^2/\text{m}}$$

PASS - $A_{ssl\text{ab}\text{btm}\text{req}} \leq A_{ssl\text{ab}\text{btm}}$ - Area of reinforcement provided in bottom to span local depressions is adequate

Shear check

Applied shear stress

$$v = V_{\Sigma} / d_{tslab\text{min}} = \mathbf{0.108 \text{ N/mm}^2}$$

Tension steel ratio

$$\rho = 100 \times A_{ssl\text{ab}\text{top}} / d_{tslab\text{min}} = \mathbf{0.342}$$

From BS8110-1:1997 - Table 3.8

Design concrete shear strength

$$v_c = \mathbf{0.675 \text{ N/mm}^2}$$

PASS - $v \leq v_c$ - Shear capacity of the slab is adequate

Internal slab deflection check

Basic allowable span to depth ratio

$$\text{Ratio}_{\text{basic}} = \mathbf{26.0}$$

Moment factor

$$M_{\text{factor}} = M_{\Sigma c} / d_{bslab\text{av}}^2 = \mathbf{0.124 \text{ N/mm}^2}$$

Steel service stress

$$f_s = 2/3 \times f_{yslab} \times A_{ssl\text{ab}\text{btm}\text{bend}} / A_{ssl\text{ab}\text{btm}} = \mathbf{26.660 \text{ N/mm}^2}$$

Modification factor

$$MF_{\text{slab}} = \min(2.0, 0.55 + [(477 \text{ N/mm}^2 - f_s) / (120 \times (0.9 \text{ N/mm}^2 + M_{\text{factor}}))])$$

$$MF_{\text{slab}} = \mathbf{2.000}$$

Modified allowable span to depth ratio

$$\text{Ratio}_{\text{allow}} = \text{Ratio}_{\text{basic}} \times MF_{\text{slab}} = \mathbf{52.000}$$

Actual span to depth ratio

$$\text{Ratio}_{\text{actual}} = l_{\text{slab}} / d_{bslab\text{av}} = \mathbf{14.000}$$

PASS - $\text{Ratio}_{\text{actual}} \leq \text{Ratio}_{\text{allow}}$ - Slab span to depth ratio is adequate

Edge beam design checks

Basic loading

Hardcore

$$W_{h\text{core}\text{thick}} = \gamma_{h\text{core}} \times h_{h\text{core}\text{thick}} = \mathbf{3.0 \text{ kN/m}^2}$$

Edge beam

Rectangular beam element

$$W_{\text{beam}} = 24 \text{ kN/m}^3 \times h_{\text{edge}} \times b_{\text{edge}} = \mathbf{2.2 \text{ kN/m}}$$

Boot element

$$W_{\text{boot}} = 24 \text{ kN/m}^3 \times h_{\text{boot}} \times b_{\text{boot}} = \mathbf{0.8 \text{ kN/m}}$$

Chamfer element

$$W_{\text{chamfer}} = 24 \text{ kN/m}^3 \times (h_{\text{edge}} - h_{\text{slab}})^2 / (2 \times \tan(\alpha_{\text{edge}})) = \mathbf{0.2 \text{ kN/m}}$$

Slab element

$$W_{\text{slab}\text{elmt}} = 24 \text{ kN/m}^3 \times h_{\text{slab}} \times (h_{\text{edge}} - h_{\text{slab}}) / \tan(\alpha_{\text{edge}}) = \mathbf{0.3 \text{ kN/m}}$$

Edge beam self weight

$$W_{\text{edge}} = W_{\text{beam}} + W_{\text{boot}} + W_{\text{chamfer}} + W_{\text{slab}\text{elmt}} = \mathbf{3.5 \text{ kN/m}}$$

Edge load number 1

Load type

Longitudinal line load

Dead load

$$W_{\text{Dedge}\text{1}} = \mathbf{5.0 \text{ kN/m}}$$

Live load

$$W_{\text{Ledge}\text{1}} = \mathbf{2.0 \text{ kN/m}}$$

Ultimate load

$$W_{\text{ultedge}\text{1}} = 1.4 \times W_{\text{Dedge}\text{1}} + 1.6 \times W_{\text{Ledge}\text{1}} = \mathbf{10.2 \text{ kN/m}}$$

Longitudinal line load width

$$b_{\text{edge}\text{1}} = \mathbf{175 \text{ mm}}$$

Centroid of load from outside face of raft

$$X_{\text{edge}\text{1}} = \mathbf{88 \text{ mm}}$$

Edge beam bearing pressure check

Effective bearing width of edge beam

$$b_{\text{bearing}} = b_{\text{edge}} + b_{\text{boot}} + (h_{\text{edge}} - h_{\text{slab}}) / \tan(\alpha_{\text{edge}}) = \mathbf{562 \text{ mm}}$$

Total uniform load at formation level

$$W_{\text{udledge}} = W_{\text{Dudl}} + W_{\text{Ludl}} + W_{\text{edge}} / b_{\text{bearing}} + W_{h\text{core}\text{thick}} = \mathbf{19.2 \text{ kN/m}^2}$$

Centroid of longitudinal and equivalent line loads from outside face of raft

Load x distance for edge load 1

$$\text{Moment}_1 = W_{\text{ultedge}\text{1}} \times X_{\text{edge}\text{1}} = \mathbf{0.9 \text{ kN}}$$

Sum of ultimate longitud'l and equivalent line loads

$$\Sigma \text{UDL} = \mathbf{10.2 \text{ kN/m}}$$

Sum of load x distances

$$\Sigma \text{Moment} = \mathbf{0.9 \text{ kN}}$$