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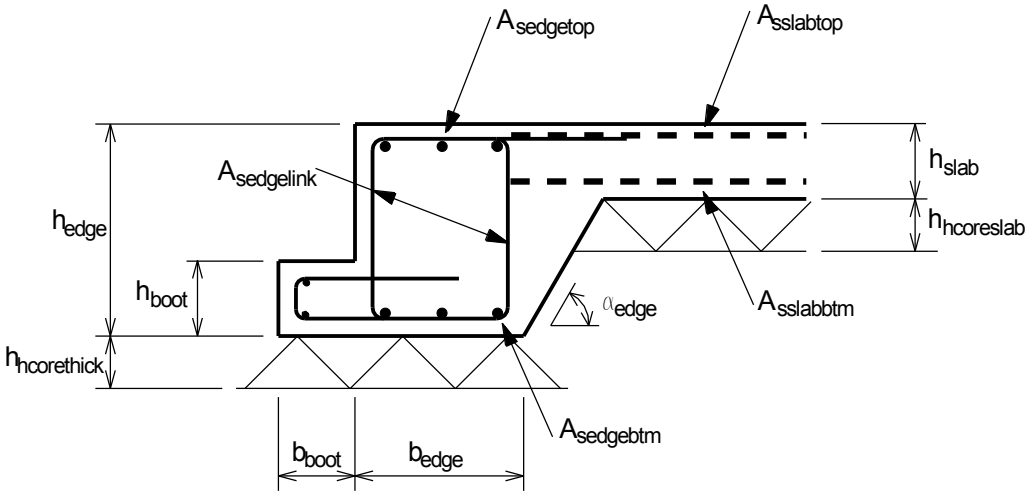
Project				Job Ref.	
Raft Foundation Design for a Typical 2 Storey House Example (BS8110 : PART 1 : 1997)					
Section				Sheet no./rev.	
Civil & Geotechnical Engineering				1	
Dr.C.Sachpazis	Date 16/04/2013	Chk'd by -	Date	App'd by	Date

RAFT FOUNDATION DESIGN (BS8110 : PART 1 : 1997)



Raft and soil definition

Soil definition

Allowable bearing pressure;	q_{allow} = **75.0** kN/m^2		
No of types of soil;	**Two or more types**;	Soil density;	**Firm to loose**;
Design depres'n dia under slab;	$\phi_{depslab}$ = **3350** mm;	Design dep'n dia under thicks;	$\phi_{depthick}$ = **3400** mm

Raft slab definition

Max dim between joints;	l_{max} = **10.000** m;	Slab thickness;	h_{slab} = **200** mm
Depth of h'core beneath slab;	$h_{hcoreslab}$ = **150** mm;	(Dispersal allowed for bearing pressure check);	
Concrete strength;	f_{cu} = **35** N/mm^2;	Poissons ratio of concrete;	ν = **0.2**
Slab mesh reinft strength;	f_{yslab} = **500** N/mm^2;	Partial safety factor for reinft;	γ_s = **1.15**;
Min mesh for shrinkage (top);	**A142**;	Actual mesh adopted in top;	**2 x A142**;
Mesh adopted in bottom;	**A393**;		
Cover to top reinforcement;	c_{top} = **20** mm;	Cover to btm reinforcement;	c_{btm} = **40** mm

Edge beam definition

Overall depth;	h_{edge} = **450** mm;	Width;	b_{edge} = **450** mm
Depth of boot;	h_{boot} = **225** mm;	Width of boot;	b_{boot} = **180** mm
Angle of chamfer to horizontal;	α_{edge} = **60** deg		
Strength of main bar reinf't;	f_y = **500** N/mm^2;	Strength of link reinf't;	f_{ys} = **500** N/mm^2
Reinf't provided in top;	**3 T25 $A_{sedgetop}$ = 1473 mm^2**;	Reinf't provided in bottom;	**2 T25 $A_{sedgebtm}$=982 mm^2**
Link reinf't provided;	**2 T10 legs at 275 ctrs (A_{sv}/s_v = 0.571 mm)**;		
Bottom cover to links;	c_{beam} = **40** mm		
Boot main reinforcement;	**T8 at 300 ctrs (A_{sboot} = 168 mm^2/m)**;		

Internal beam definition

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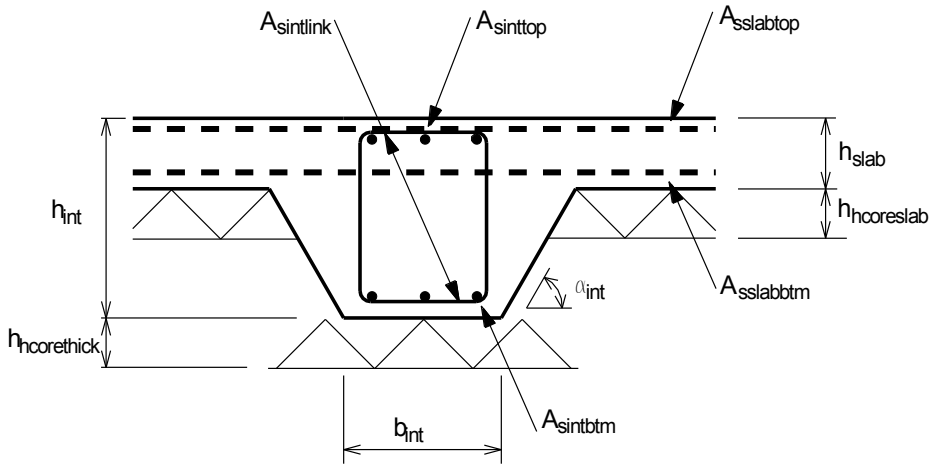

Overall depth;	h_{int} = **450** mm;	Width;	b_{int} = **450** mm
Angle of chamfer to horizontal;	α_{int} = **60** deg		
Strength of main bar reinf't;	f_y = **500** N/mm^2;	Strength of link reinf't;	f_{ys} = **500** N/mm^2
Reinf't provided in top;	**2 T20 ($A_{sinttop}$ = 628 mm^2)**;	Reinf't provided in bottom;	**2 T20 ($A_{sintbtm}$=628 mm^2)**;
Link reinf't provided;	**2 T10 legs at 225 ctrs (A_{sv}/s_v = 0.698 mm)**;		
Bottom cover to links;	c_{beam} = **40** mm		

Slab design checks

Basic loading

Slab self weight;	w_{slab} = **4.8** kN/m^2;	Hardcore;	$w_{hcoreslab}$ = **3.2** kN/m^2

Applied loading

Dead udl;	w_{Dudl} = **0.5** kN/m^2;	Live udl;	w_{Ludl} = **2.0** kN/m^2

Slab bearing pressure check

Total uniform load at formation; w_{udl} = **10.5** kN/m^2

Pass - w_{udl} <= q_{allow} - Applied bearing pressure is less than allowable;

Slab bending check

Area of steel reqd in top; $A_{sslabtopreq}$ = **260** mm^2/m

Pass - $A_{sslabtopreq}$ <= $A_{sslabtop}$ - Area of reinforcement provided in top to span local depressions is adequate;

Area of steel reqd in btm; $A_{sslabbtmreq}$ = **260** mm^2/m

Pass - $A_{sslabbtmreq}$ <= $A_{sslabbtm}$ - Area of reinforcement provided in bottom to span local depressions is adequate;

Applied shear stress;	v = **0.055** N/mm^2;	Shear capacity;	v_c = **0.481** N/mm^2

Pass - v <= v_c - Shear capacity of slab is adequate;

Internal slab deflection check

Allowable span to depth ratio;	$Ratio_{allow}$ = **52.000**;	Actual span to depth ratio;	$Ratio_{actual}$ = **23.493**

Pass - $Ratio_{actual}$ <= $Ratio_{allow}$ - Slab span to depth ratio is adequate;

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Edge beam design checks

Basic loading

Hardcore; $w_{hcorethick}$ = **2.1** kN/m^2; Edge beam self weight; w_{edge} = **7.0** kN/m

Edge load number 1; Load type; **Longitudinal line load**

Dead load; w_{Dedge1} = **13.2** kN/m; Live load; w_{Ledge1} = **0.0** kN/m

Longitudinal line load width; b_{edge1} = **102** mm; Centroid of load; x_{edge1} = **51** mm

Edge load number 2; Load type; **Longitudinal line load**

Dead load; w_{Dedge2} = **16.1** kN/m; Live load; w_{Ledge2} = **5.6** kN/m

Longitudinal line load width; b_{edge2} = **100** mm; Centroid of load; x_{edge2} = **230** mm

Edge beam bearing pressure check

Area of top steel reqd in slab to distribute loads; $A_{sslabreq}$ = **89** mm^2/m

Pass - $A_{sslabreq}$ <= $A_{sslabtop}$ - Area of reinforcement provided to transfer moment into slab is adequate;

The allowable bearing pressure under the edge beam will not be exceeded;

Edge beam bending and shear check

Area of steel reqd in top; $A_{sedgetopreq}$ = **604** mm^2

Pass - $A_{sedgetopreq}$ <= $A_{sedgetop}$ - Area of reinforcement provided in top of edge beams is adequate;

Area of steel reqd in bottom; $A_{sedgebtmreq}$ = **625** mm^2

Pass - $A_{sedgebtmreq}$ <= $A_{sedgebtm}$ - Area of reinforcement provided in bottom of edge beams is adequate;

Applied shear stress; v_{edge} = **0.565** N/mm^2; Design conc shear strength; v_{cedge} = **0.607** N/mm^2

Link area/spacing ratio reqd; A_{sv}_upon_$s_{vreqedge}$ = **0.534** mm

Link area/spacing ratio prov; A_{sv}_upon_$s_{vprovedge}$ = **0.571** mm

Pass - A_{sv}_upon_$s_{vreqedge}$ <= A_{sv}_upon_$s_{vprovedge}$ - Shear reinforcement provided in edge beams is adequate;

Boot design check

Area of reinforcement req; $A_{sbootreq}$ = **62** mm^2/m; Area of reinf't provided; A_{sboot} = **168** mm^2/m

Pass - $A_{sbootreq}$ <= A_{sboot} - Area of reinforcement provided in boot is adequate for bending;

Applied shear stress; v_{boot} = **0.174** N/mm^2; Design conc shear strength; v_{cboot} = **0.390** N/mm^2

Pass - v_{boot} <= v_{cboot} - Shear capacity of the boot is adequate;

Corner design checks

Applied loading

Corner load number 1; Load type; **Line load in x direction**

Dead load; $w_{Dcorner1}$ = **13.2** kN/m; Live load; $w_{Lcorner1}$ = **0.0** kN/m

Centroid of load; $y_{corner1}$ = **51** mm

Corner load number 2; Load type; **Line load in x direction**

Dead load; $w_{Dcorner2}$ = **16.1** kN/m; Live load; $w_{Lcorner2}$ = **5.6** kN/m

Centroid of load; $y_{corner2}$ = **230** mm

Corner load number 3; Load type; **Line load in y direction**

Dead load; $w_{Dcorner3}$ = **14.3** kN/m; Live load; $w_{Lcorner3}$ = **0.0** kN/m

Centroid of load; $x_{corner3}$ = **51** mm

Corner load number 4; Load type; **Line load in y direction**

Dead load; $w_{Dcorner4}$ = **11.7** kN/m; Live load; $w_{Lcorner4}$ = **0.0** kN/m

Centroid of load; $x_{corner4}$ = **230** mm

Corner bearing pressure check

Area of top steel reqd in beam to distribute load; $A_{scornerbp}$ = **703** mm^2

Pass - $A_{scornerbp}$ <= $A_{sedgetop}$ - Area of reinforcement provided to resist eccentric moment is adequate;

The allowable bearing pressure at the corner will not be exceeded;

Corner beam bending and shear check

Area of top steel reqd in beam; $A_{scorner}$ = **1255** mm^2

Pass - $A_{scorner}$ <= $A_{sedgetop}$ - Area of reinforcement provided in top of edge beams at corners is adequate;

Applied shear stress; v_{corner} = **0.690** N/mm^2; Design conc shear strength; $v_{ccorner}$ = **0.606** N/mm^2

Link area/spacing ratio reqd; A_{sv}_upon_$s_{vreqcorner}$ = **0.534** mm

Link area/spacing ratio prov; A_{sv}_upon_$s_{vprovedge}$ = **0.571** mm

Pass - A_{sv}_upon_$s_{vreqcorner}$ <= A_{sv}_upon_$s_{vprovedge}$ - Shear reinforcement provided in edge beams at corners is adequate;

Corner beam deflection check

Allowable span to depth ratio; $Ratio_{allowcorner}$ = **7.719**; Actual span to depth ratio; $Ratio_{actualcorner}$ = **6.488**

Pass - $Ratio_{actualcorner}$ <= $Ratio_{allowcorner}$ - Edge beam span to depth ratio is adequate;

<u>Internal beam design checks</u>

Basic loading

Hardcore; $w_{hcorethick}$ = **2.1** kN/m^2; Internal beam self weight; w_{int} = **7.1** kN/m

Internal beam load number 1; Load type; **Longitudinal line load**

Dead load; w_{Dint1} = **11.1** kN/m; Live load; w_{Lint1} = **5.3** kN/m

Longitudinal line load width; b_{int1} = **140** mm; Centroid of load from c-line; x_{int1} = **0** mm

Internal beam bearing pressure check

Applied bearing pressure; q_{int} = **42.1** kN/m^2

Pass - q_{int} <= q_{allow} - Applied bearing pressure is less than allowable;

Area of top steel reqd due to dep'n under slab/to resist moment due to load eccentricity; $A_{sslabtopintreq}$ = **58** mm^2/m

PASS - $A_{sslabtopintreq}$ <= $A_{sslabtop}$ - Area of reinf't in top of slab is adequate to transfer moment due to load eccentricity;

Area of btm steel reqd to resist moment due to load eccentricity; $A_{sslabbtmintreq}$ = **0** mm^2/m

PASS - $A_{sslabbtmintreq}$ <= $A_{sslabbtm}$ - Area of reinf't in bottom of slab is adequate to transfer moment due to load eccentricity;

Internal beam bending and shear check

Area of steel reqd in top; $A_{sinttopreq}$ = **483** mm^2

Pass - $A_{sinttopreq}$ <= $A_{sinttop}$ - Area of reinforcement provided in top of internal beams is adequate;

Area of steel reqd in bottom; $A_{sintbtmreq}$ = **505** mm^2

Pass - $A_{sintbtmreq}$ <= $A_{sintbtm}$ - Area of reinforcement provided in bottom of internal beams is adequate;

Applied shear stress; v_{int} = **0.369** N/mm^2; Design conc shear strength; v_{cint} = **0.423** N/mm^2

Link area/spacing ratio reqd; A_{sv}_upon_$s_{vreqint}$ = **0.653** mm

Link area/spacing ratio prov; A_{sv}_upon_$s_{vprovint}$ = **0.698** mm

Pass - A_{sv}_upon_$s_{vreqint}$ <= A_{sv}_upon_$s_{vprovint}$ - Shear reinforcement provided in internal beams is adequate