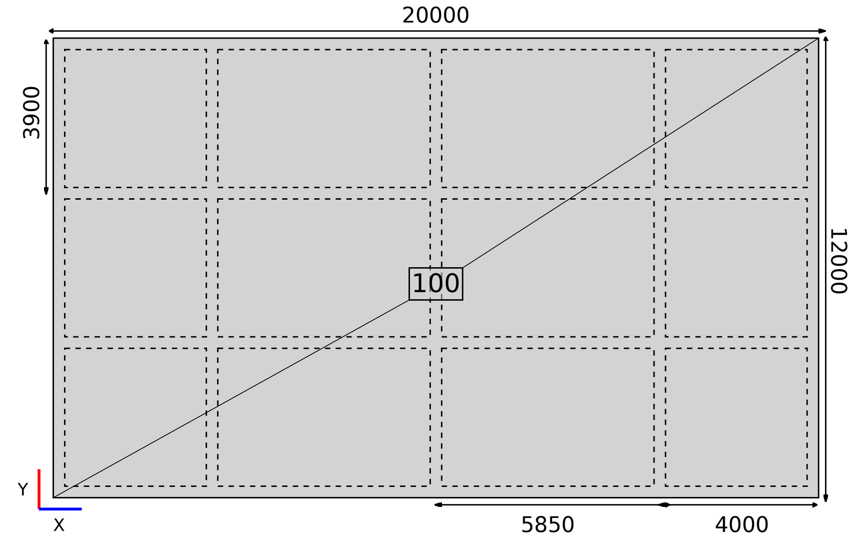
REFERENCES	CALCULATIONS	RESULTS

Input Summary

Input	Description	Value
W_{plan}	**Plan Width** *Total width of floor slab, within the bounds of 5000mm and 30000mm.*	12000 mm
L_{plan}	**Plan Length** *Total length of floor slab, within the bounds of 5000mm and 30000mm.*	20000 mm
D_{slab}	**Slab Depth** *Depth of floor slab in mm.*	100 mm
D_{edge}	**Edge Beam Depth** *Total depth of edge beams (including slab depth) within the bounds of 250mm and 1200mm.*	450 mm
B_{edge}	**Edge Beam Width** *Total width of edge beams, within the bounds of 110mm and 400mm.*	300 mm
$D_{internal}$	**Internal Beam Depth** *Total depth of internal beams (including slab depth) within the bounds of 250mm and 1200mm.*	400 mm
$B_{internal}$	**Internal Beam Width** *Total width of internal beams, within the bounds of 110mm and 400mm.*	300 mm
$No.\ Int_x$	**Internal Beams (X)** *Number of internal beams perpendicular to X-axis.*	3 No.
$No.\ Int_y$	**Internal Beams (Y)** *Number of internal beams perpendicular to Y-axis.*	2 No.
$Top\ Cover$	**Top Cover** *Concrete cover measured to outside of top slab reinforcement.*	30 mm
$Btm\ Cover$	**Bottom Cover** *Concrete cover measured to outside of bottom slab/beam reinforcement. Note, this value is also used for cover to side of bottom reinforcement.*	50 mm
$Mesh_{slab.top}$	**Slab Top Mesh** *Mesh size in top layer of slab.*	SL82
$N_{edge.btm}$	**Edge Bottom** *Number of bars/layers of mesh in bottom layer of edge beams.*	2 No.
$d_{b.edge.btm}$	**Size** *Bar or mesh size in bottom layer of edge beams.*	L11TM200
$N_{edge.top}$	**Edge Top** *Number of bars/layers of mesh in top layer of edge beams.*	4 No.
$d_{b.edge.top}$	**Size** *Bar or mesh size in top layer of edge beams.*	N16
$N_{int.btm}$	**Internal Bottom** *Number of bars/layers of mesh in bottom layer of internal beams.*	2 No.
$d_{b.int.btm}$	**Size** *Bar or mesh size in bottom layer of internal beams.*	L12TM200
$N_{int.top}$	**Internal Top** *Number of bars/layers of mesh in top layer of internal beams.*	4 No.
$d_{b.int.top}$	**Size** *Bar or mesh size in top layer of internal beams.*	N20
$Walls$	**Wall Construction** *Select a type of wall construction. This input dictates the max allowable differential deflection of the slab. Refer AS 2870 Clause 3.1 for further information.*	Clad Frame
Δ_{check}	**Deflection Check** *Select whether program checks Table 4.1 deflection for span ratio, deflection limit or both.*	Span & Limit
L^*_{dist}	**Distributed Load**	4 kPa
L^*_{edge}	**Edge Line Load**	15 kN/m
$Soil\ Profile$	**Moisture Change** *Depth of expected moisture change, obtained from geotechnical investigation. Normal refers to suction change (Hs) less than 3m. Refer Clause 2.1.2.*	Normal
y_s	**Surface Movement (y_s)** *Characteristic surface movement for specified soil type, obtained from geotechnical investigation. Refer Appendix C Clause 2.2.*	30 mm
f'_c	**f'_c** *Concrete characteristic strength in MPa.*	20 MPa
f_{sy}	**f_{sy}** *Yield strength of reinforcing steel in MPa.*	500 MPa



SLAB PLAN

SL82 MESH TOP

BEAM	**DEPTH**	**WIDTH**	**BTM**	**TOP**
EDGE	450	300	2-L11TM200	4-N16
INTERNAL	400	300	2-L12TM200	4-N20

Soil Classification

Table 2.3

Find soil classification for y_s = 30:

TABLE 2.3 CLASSIFICATION BY CHARACTERISTIC SURFACE MOVEMENT (ys)	
Surface Movement (ys)	Site Classification
0 < ys ≤ 20	S
20 < ys ≤ 40	M
40 < ys ≤ 60	H1
60 < ys ≤ 75	H2
ys > 75	E

Depth of expected moisture change is Normal, hence soil classification is M.

Max Differential Deflection

Table 4.1

Find maximum differential deflection along X and Y direction for Clad Frame construction. User has selected to check deflection for span ratio and limit.

TABLE 4.1 MAXIMUM DIFFERENTIAL FOOTING DEFLECTION (Δ) FOR DESIGN OF FOOTINGS AND RAFTS		
Construction	Max Differential Deflection (Span)	Max Differential Deflection (mm)
Clad Frame	L/300	40
Articulated Masonry Veneer	L/400	30
Masonry Veneer	L/600	20
Articulated Full Masonry	L/800	15
Full Masonry	L/2000	10

Table 4.1

$$\therefore \Delta_y = min(\frac{L}{300}, 40) = min(\frac{20000}{300}, 40) = 40mm$$

Table 4.1

$$\therefore \Delta_x = min(\frac{W}{300}, 40) = min(\frac{12000}{300}, 40) = 40mm$$

AS 2870 Simplified Method Suitability

Clause 4.5.1 (Max Beam Spacing)

Clause 4.5.1 mandates that beam spacing is ≤1.25* maximum beam spacing specified in Figure 3.1, excluding soil class E which must have a maximum spacing of 5m.

User input beam spacing will be checked taking into account Clause 5.3.9, which specifies that distance between corner of slab and intersection of first internal beam with edge beam shall be ≤4m.

$$Spacing_x = \frac{20000 - 300 - 2 * 4000}{2 * 1000} = 5.850m$$

Figure 3.1

Figure 3.1 prescribes a maximum (factored) beam spacing for M soil with Clad Frame of 7.5m. Hence the input spacing along X-axis of 5.850m is OK.

$$Spacing_y = \frac{12000 - 300}{(2 + 1) * 1000} = 3.900m$$

Figure 3.1

Figure 3.1 prescribes a maximum (factored) beam spacing for M soil with Clad Frame of 7.5m. Hence the input spacing along Y-axis of 3.900m is OK.

Clause 4.5.1 (Minimum Depth)

Clause 4.5.1 requires the minimum depth of any beam to be ≥ 0.8* maximum beam depth.

$$0.8 * D_{max} = 0.8 * 450 = 360mm$$

$$D_{min} = 400 \geq 360 \ OK$$

Clause 4.5.1 (Max Distributed Load)

AS 2870 Clause 4.5.1 is suitable for a distributed load ≤ 10kPa.

$$L^*_{dist} = 4kPa \leq 10kPa \ OK$$

Clause 4.5.1 (Max Line Load)

AS 2870 Clause 4.5.1 is suitable for a edge line loads ≤ 25kN/m.

$$L^*_{edge} = 15kPa \leq 25kN/m \ OK$$

AS 2870 Compliance Checks

Clause 4.5.1 (Minimum Slab Reinforcement)

Check if slab reinforcement is sufficient for maximum span of 20000mm. For span < 25m, minimum SL82 mesh is required. Specified mesh is SL82, hence reinforcement is sufficient.

L11TM200 mesh has been specified in base of edge beams. Check that width of mesh fits into width of beam.

$$B_{min.edge} = 200 + 2 * cover = 300mm$$

$$B_{edge} = 300mm \ OK$$

L12TM200 mesh has been specified in base of internal beams. Check that width of mesh fits into width of beam.

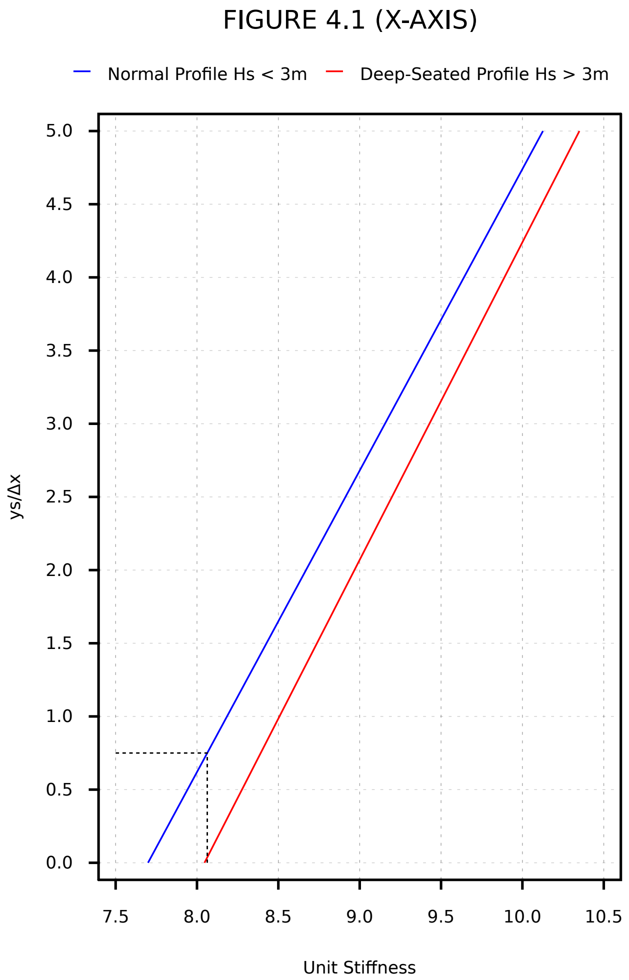
$$B_{min.int} = 200 + 2 * cover = 300mm$$

$$B_{int} = 300mm \ OK$$

REFERENCES	CALCULATIONS	RESULTS
	Beam Stiffness Checks	
Figure 4.1 (Beam Stiffness Check)	Check stiffness of beams perpendicular to X-axis (running in Y-direction).	

$$\frac{y_s}{\Delta_x} = \frac{30}{40} = 0.75$$

Using Figure 4.1 for displacement ratio of 0.75 and Normal movement profile:



$$\therefore Min\ Stiffness_x = 8.06$$

$$Stiffness_x = log_{10}[\Sigma(\frac{B_w D^3}{12})/L_{plan}]$$

$$log_{10}[(\frac{300 * 450^3}{12} + 3 * \frac{300 * 400^3}{12} + \frac{300 * 450^3}{12})/20]$$

$$= 8.67 > Min\ Stiffness_x$$

Therefore beams perpendicular to X-axis (running in Y-direction) have sufficient stiffness.

REFERENCES	CALCULATIONS	RESULTS

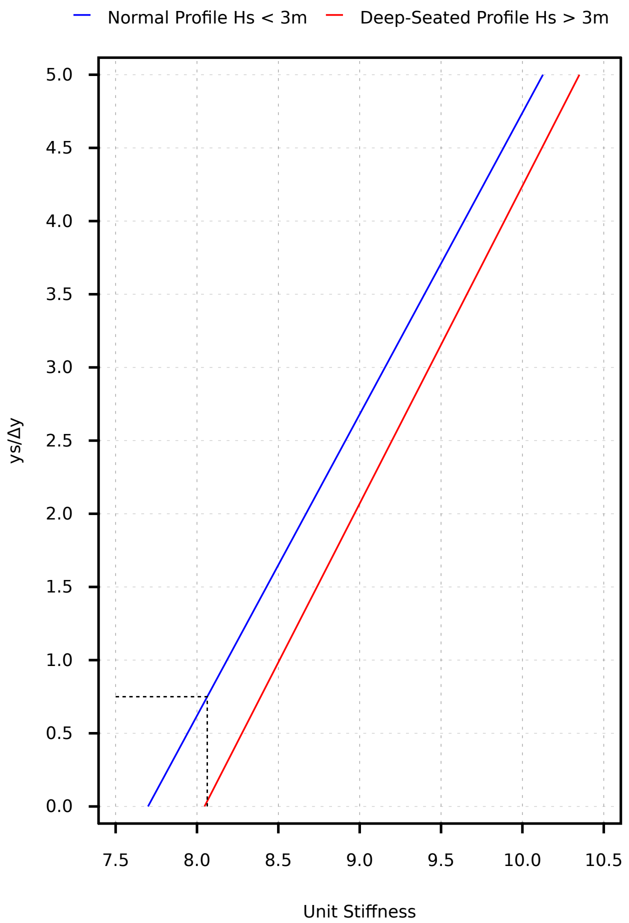
Figure 4.1 (Beam Stiffness Check)

Check stiffness of beams perpendicular to Y-axis (running in X-direction).

$$\frac{y_s}{\Delta_y} = \frac{30}{40} = 0.75$$

Using Figure 4.1 for displacement ratio of 0.75 and Normal movement profile:

FIGURE 4.1 (Y-AXIS)



$$\therefore Min\ Stiffness_y = 8.06$$

$$Stiffness_y = log_{10}[\Sigma(\frac{B_w D^3}{12})/W_{plan}]$$

$$log_{10}[(\frac{300 * 450^3}{12} + 2 * \frac{300 * 400^3}{12} + \frac{300 * 450^3}{12})/12]$$

$$= 8.81 > Min\ Stiffness_y$$

Therefore beams perpendicular to Y-axis (running in X-direction) have sufficient stiffness.

Beam Strength Checks

Clause 4.4(i) (Beam Strength Check)

Clause 4.4(i) states that beam cross-sections should be reinforced so that the ultimate strength (ΦM_u) is 20% greater than the cracking moment capacity (M_{min} = 1.2*M_{cr}). Note this program calculates concrete tensile strength using AS 3600, and does not use the standard tensile strength values prescribed by AS 2870.

AS 3600 Clause 8.1.6.1(1)

$$\therefore \Phi M_u \geq M_{min} = 1.2 * Z * f'_{ct.f}$$

AS 3600 states that the minimum reinforcement requirement for this cracking moment is deemed satisfied if reinforcement is provided such that:

AS 3600 Clause 8.1.6.1(2)

$$A_{st.min} = [\alpha_b * (\frac{D}{d})^2 * \frac{f'_{ct.f}}{f_{sy}}] * b_w d$$

AS 3600 Clause 3.1.1.3

$$Where\ f'_{ct.f} = 0.6\sqrt{f'_c}$$

Minimum reinforcement requirements and section moment capacity for internal/edge beams will be checked for positive and negative bending. Note:

1. Calculations include the contribution of the slab as a flange (b_{ef}) for determination of section modulus (Z), minimum reinforcement ($A_{st.min}$) and minimum moment (M_{min}) requirements, but do not include contribution of the flange for section moment capacity (ΦM_u).
2. Calculations ignore the contribution of compression reinforcement for section moment capacity (ΦM_u).
3. Calculations use AS 3600 for calculation of concrete flexural tensile strength ($f'_{ct.f}$).

Beam Strength Checks (Perpendicular to X-Axis)

Beam	Bending	Z	$A_{st.min}$	A_{st}	Ratio	M_{min}	ΦMu	Ratio
Internal	Positive	1.20e+7	255	668	0.38	38.6	68.6	0.56
Internal	Negative	3.25e+7	541	1256	0.43	104.6	125.0	0.84
Edge	Positive	1.41e+7	243	540	0.45	45.2	65.4	0.69
Edge	Negative	2.74e+7	412	804	0.51	88.0	99.1	0.89

All strength checks passed.

Beam Strength Checks (Perpendicular to Y-Axis)

Beam	Bending	Z	$A_{st.min}$	A_{st}	Ratio	M_{min}	ΦMu	Ratio
Internal	Positive	1.27e+7	286	668	0.43	40.9	68.6	0.6
Internal	Negative	3.25e+7	541	1256	0.43	104.6	125.0	0.84
Edge	Positive	1.49e+7	271	540	0.5	48.0	65.4	0.73
Edge	Negative	2.74e+7	412	804	0.51	88.0	99.1	0.89

All strength checks passed.

Results Summary

Result Name	Results
GEOTECH PARAMETERS	
Surface Movement y_s	30.00 mm
Soil Classification	M
Max Deflection Δ_y	40.00 mm
Max Deflection Δ_x	40.00 mm
CHECKS	
Max Beam Spacing (X-Axis)	PASS
Max Beam Spacing (Y-Axis)	PASS
Min Beam Depth	PASS
Min Slab Reinforcement	PASS
Min Beam Width (Edge)	PASS
Min Beam Width (Internal)	PASS
OUTPUT	
Stiffness (X-Axis)	0.93
Stiffness (Y-Axis)	0.91
Strength (X-Axis)	0.89
Strength (Y-Axis)	0.89
AS 2870 Compliance	PASS

About this Calculator

Calculator Name: AS 2870:2011 Residential Slab Design
Description: The AS 2870:2011 Residential Slab Design tool carries out design and compliance checks for stiffened raft slabs in accordance with AS 2870:2011. Calculations are based on the Simplified Method for Raft Designs outlined in AS 2870 Clause 4.5, which is an extension of the deemed-to-comply values provided in Clause 3.2. The simplified method allows for modification of the deemed-to-comply values to suit changes required by the design engineer. This tool generates engineering drawings from user inputs which can be exported to a PDF.

	Powered by SkyCiv **URL:** https://platform.skyciv.com/quick-design?uid=3012-as2870-residential-slab-design&slab_width=12000&slab_length=20000&slab_depth=100&edge_depth=450&edge_width=300&internal_depth=400&internal_width=300&x_no_internal_beams=3&y_no_internal_beams=2&top_cover=30&btm_cover=50&slab_top_mesh=SL82&edge_btm_no=2&edge_btm_size=L11TM200&edge_top_no=4&edge_top_size=N16&int_btm_no=2&int_btm_size=L12TM200&int_top_no=4&int_top_size=N20&construction_type=Clad Frame&deflection_check=span ratio and limit&distributed_load=4&line_load=15&profile_type=Normal&ys=30&f_c=20&f_sy=500 **Contact:** george.chard@skyciv.com	