SOLID SLAB DESIGN REPORT - TWO-WAY SLAB

Element: Solid Slab Panel 1

Design Code: BS EN 1992-1-1:2004 | Date: 28 October 2026

REFERENCE	CALCULATIONS	OUTPUT
EN1991-1-1 Load Calculations	**SLAB LOADING** Slab thickness, h = 160.0 mm Concrete unit weight, γ = 25.0 kN/m³ $Self-weight: Gk, self = h \times \gamma = \frac{160.0}{1000} \times 25.0 = 4.0 kN/m^2$ Floor finish = 1.0 kN/m² Ceiling & services = 1.2 kN/m² Total dead load Gk = 4.0 + 1.0 + 1.2 = 6.2 kN/m² Live load Qk = 1.2000000000000002 kN/m² $n = 1.35G_k + 1.5Q_k$ $n = 1.35(6.2) + 1.5(1.2000000000000002) = 10.17 kN/m^2$ Ultimate load n = 10.17 kN/m², per metre strip	**h = 160.0 mm** **Gk = 6.2 kN/m²** **Qk = 1.2000000000000002 kN/m²** **n = 10.17 kN/m**
EN1992-1-1 Geometry & Slab Type	**SLAB GEOMETRY AND PANEL TYPE** Panel type: interior_panel Ly = 5000.0 mm, Lx = 5000.0 mm $\frac{L_y}{L_x} = \frac{5000.0}{5000.0} = 1.0$ Aspect ratio ≤ 2.0 → Two-way span Cover CC = 25.0 mm Bar diameter φ = 12.0 mm **Effective depth main reinforcement (B1)** $d = h - CC - \frac{\phi}{2} = 160.0 - 25.0 - \frac{12.0}{2} = 129.0 mm$ **Effective depth secondary reinforcement (B2)** $d' = h - CC - \phi - \frac{\phi}{2} = 160.0 - 25.0 - 12.0 - \frac{12.0}{2} = 117.0 mm$	**Ly/Lx = 1.0** **Two-way span** **d = 129.0 mm** **d' = 117.0 mm**
Concise EN1992-1-1 App. Table A2/A3 Moment Calculations	**MOMENT CALCULATIONS** **Positive moments at mid-span:** +βsy = 0.024, +βsx = 0.024 **Long span positive Moment** $^{+}M_{sy} = \beta_{sy} n L_x^2 = 0.024 \times 10.17 \times 5.0^2 = 6.102 kNm$ **Short span positive Moment** $^{+}M_{sx} = \beta_{sx} n L_x^2 = 0.024 \times 10.17 \times 5.0^2 = 6.102 kNm$ **Negative moments at continuous edges:** -βsy = 0.032, -βsx = 0.031 **Long span negative Moment** $^{-}M_{sy} = \beta_{sy} n L_x^2 = 0.032 \times 10.17 \times 5.0^2 = 8.136 kNm$ **Short span negative Moment** $^{-}M_{sx} = \beta_{sx} n L_x^2 = 0.031 \times 10.17 \times 5.0^2 = 7.882 kNm$	**+Msy = 6.102 kNm** **+Msx = 6.102 kNm** **-Msy = 8.136 kNm** **-Msx = 7.882 kNm**

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§6.1 Mid-span Design (Bottom Steel)	**REINFORCEMENT DESIGN – B1 (SHORT SPAN BOTTOM)** **SHORT SPAN (B1) – Mid-span bottom steel** fck = 25.0 N/mm², fyk = 500.0 N/mm² Design per unit width, b = 1000.0 mm For slabs, allow 20% moment redistribution and fck ≤ C50/60 Moment redistribution factor δ = 0.8 $k_{bal} = \frac{0.454(\delta - 0.44)}{1.25} - \frac{0.182(\delta - 0.44)^2}{1.25^2} = 0.116$ **Step 1: Moment capacity** $k = \frac{M_{Ed}}{bd^2 f_{ck}} = \frac{6.102 \times 10^6}{1000.0 \times 129.0^2 \times 25.0} = 0.015$ Since k = 0.015 < 0.116 → No compression reinforcement **Step 2: Lever arm z** $\frac{z}{d} = 0.5 + \sqrt{0.25 - \frac{k}{1.134}} = 0.5 + \sqrt{0.25 - \frac{0.015}{1.134}} = 0.99$ $z = 0.99 \times d = 0.99 \times 129.0 = 127.0mm$ Limiting values of Z; $z_{lim} = 0.95 \times d = 0.95 \times 129.0 = 123.0mm$ Adopted z = 123.0 mm **Step 3: Required reinforcement** $A_{s,req} = \frac{M_{Ed}}{0.87 f_{yk} z} = \frac{6.102 \times 10^6}{0.87 \times 500.0 \times 123.0} = 114.05mm^2/m$ **Step 4: Minimum reinforcement** $f_{ctm} = 0.3(f_{ck})^{2/3} = 0.3 \times (25.0)^{2/3} = 2.565N/mm^2$ $As,min = 0.26 \times \frac{f_{ctm}}{f_{yk}} \times b \times d = 0.26 \times \frac{2.565}{500.0} \times 1000.0 \times 129.0 = 172.06mm^2/m$ $0.0013bd = 0.0013 \times 1000.0 \times 129.0 = 168.0mm^2/m$ $As,min = max(0.0013bd, As,min) = 172.0mm^2/m$ **Step 5: Final required area** $As,req,final = max(As,min, As,req) = 172.0mm^2/m$ **Step 6: Provided reinforcement (B1)** Provide; H12.0 @ 200.0 mm c/c (B1) $A_{s,prov} = \frac{\pi\phi^2}{4} \times \frac{1000}{s} = \frac{\pi \times 12.0^2}{4} \times \frac{1000}{200.0} = 565mm^2/m$ Status: Adequate Reinforcement	**B1: As,req = 172.0 mm²/m** **As,prov = 565 mm²/m** **Spacing = 200.0 mm**
§7.3.3	**CRACK CONTROL CHECK** **SERVICEABILITY LIMIT STATE (SLS): CRACK WIDTH SPACING VERIFICATION - B1** **Steel stress fs** $f_s = \frac{f_{yk} \times (G_k + 0.3Q_k)}{1.15(1.35G_k + 1.5Q_k)} \times \frac{As_{req}}{As_{prov}} \times \frac{1}{\delta}$ $f_s = \frac{500.0 \times (6.2 + 0.3 \times 1.2000000000000002)}{1.15 \times (1.35 \times 6.2 + 1.5 \times 1.2000000000000002)} \times \frac{172.0}{565} \times \frac{1}{0.8} = 106.66N/mm^2$ Maximum allowable spacing for σs = 106.66 N/mm² is S_{max} = 300.0 mm Since spacing provided S = 200.0 mm, which is ≤ S_{max} = 300.0 mm, PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm).	**fs = 106.66 N/mm²** **Smax = 300.0 mm** **Actual S = 200.0 mm** **Status: PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm)**

REFERENCE	CALCULATIONS	OUTPUT

Table 7.2N Maximum bar diameters ϕ^*_s for crack control[1]

Steel stress[2] [MPa]	Maximum bar size [mm] w_k= 0,4 mm	w_k= 0,3 mm	w_k= 0,2 mm
160	40	32	25
200	32	25	16
240	20	16	12
280	16	12	8
320	12	10	6
360	10	8	5
400	8	6	4
450	6	5	-

Table 7.3N Maximum bar spacing for crack control[1]

Steel stress[2] [MPa]	Maximum bar spacing [mm] w_k=0,4 mm	w_k=0,3 mm	w_k=0,2 mm
160	300	300	200
200	300	250	150
240	250	200	100
280	200	150	50
320	150	100	-
360	100	50	-

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REFERENCE	CALCULATIONS	OUTPUT
§6.1 Mid-span Design (Bottom Steel)	**REINFORCEMENT DESIGN – B2 (LONG SPAN BOTTOM)** **LONG SPAN (B2) – Mid-span bottom steel** fck = 25.0 N/mm², fyk = 500.0 N/mm² Design per unit width, b = 1000.0 mm For slabs, allow 20% moment redistribution and fck ≤ C50/60 Moment redistribution factor δ = 0.8 $k_{bal} = \frac{0.454(\delta - 0.44)}{1.25} - \frac{0.182(\delta - 0.44)^2}{1.25^2} = 0.116$ **Step 1: Moment capacity** $k = \frac{M_{Ed}}{bd^2 f_{ck}} = \frac{6.102 \times 10^6}{1000.0 \times 117.0^2 \times 25.0} = 0.018$ Since k = 0.018 < 0.116 → No compression reinforcement **Step 2: Lever arm z** $\frac{z}{d} = 0.5 + \sqrt{0.25 - \frac{k}{1.134}} = 0.5 + \sqrt{0.25 - \frac{0.018}{1.134}} = 0.98$ $z = 0.98 \times d = 0.98 \times 117.0 = 115.0mm$ Limiting values of Z; $z_{lim} = 0.95 \times d = 0.95 \times 117.0 = 111.0mm$ Adopted z = 111.0 mm **Step 3: Required reinforcement** $A_{s,req} = \frac{M_{Ed}}{0.87 f_{yk} z} = \frac{6.102 \times 10^6}{0.87 \times 500.0 \times 111.0} = 126.37mm^2/m$ **Step 4: Minimum reinforcement** $f_{ctm} = 0.3(f_{ck})^{2/3} = 0.3 \times (25.0)^{2/3} = 2.565N/mm^2$ $As,min = 0.26 \times \frac{f_{ctm}}{f_{yk}} \times b \times d = 0.26 \times \frac{2.565}{500.0} \times 1000.0 \times 117.0 = 156.05mm^2/m$ $0.0013bd = 0.0013 \times 1000.0 \times 117.0 = 152.0mm^2/m$ $As,min = max(0.0013bd, As,min) = 156.0mm^2/m$ **Step 5: Final required area** $As,req,final = max(As,min, As,req) = 156.0mm^2/m$ **Step 6: Provided reinforcement (B2)** Provide; H12.0 @ 300.0 mm c/c (B2) $A_{s,prov} = \frac{\pi\phi^2}{4} \times \frac{1000}{s} = \frac{\pi \times 12.0^2}{4} \times \frac{1000}{300.0} = 377mm^2/m$ Status: Adequate Reinforcement	**B2: As,req = 156.0 mm²/m** **As,prov = 377 mm²/m** **Spacing = 300.0 mm**
§7.3.3	**CRACK CONTROL CHECK** **SERVICEABILITY LIMIT STATE (SLS): CRACK WIDTH SPACING VERIFICATION - B2** **Steel stress fs** $f_s = \frac{f_{yk} \times (G_k + 0.3Q_k)}{1.15(1.35G_k + 1.5Q_k)} \times \frac{As_{req}}{As_{prov}} \times \frac{1}{\delta}$ $f_s = \frac{500.0 \times (6.2 + 0.3 \times 1.2000000000000002)}{1.15 \times (1.35 \times 6.2 + 1.5 \times 1.2000000000000002)} \times \frac{156.0}{377} \times \frac{1}{0.8} = 145.11N/mm^2$ Maximum allowable spacing for σs = 145.11 N/mm² is S_{max} = 300.0 mm Since spacing provided S = 300.0 mm, which is ≤ S_{max} = 300.0 mm, PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm).	**fs = 145.11 N/mm²** **Smax = 300.0 mm** **Actual S = 300.0 mm** **Status: PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm)**

REFERENCE	CALCULATIONS	OUTPUT

Table 7.2N Maximum bar diameters ϕ^*_s for crack control[1]

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160	40	32	25
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240	20	16	12
280	16	12	8
320	12	10	6
360	10	8	5
400	8	6	4
450	6	5	-

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160	300	300	200
200	300	250	150
240	250	200	100
280	200	150	50
320	150	100	-
360	100	50	-

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§6.1 Continuous Edge Design (Top Steel)	**REINFORCEMENT DESIGN – T1 (SHORT SPAN TOP)** **SHORT SPAN (T1) – Continuous edge top steel** fck = 25.0 N/mm², fyk = 500.0 N/mm² Design per unit width, b = 1000.0 mm For slabs, allow 20% moment redistribution and fck ≤ C50/60 Moment redistribution factor δ = 0.8 $k_{bal} = \frac{0.454(\delta - 0.44)}{1.25} - \frac{0.182(\delta - 0.44)^2}{1.25^2} = 0.116$ **Step 1: Moment capacity** $k = \frac{M_{Ed}}{bd^2 f_{ck}} = \frac{7.882 \times 10^6}{1000.0 \times 129.0^2 \times 25.0} = 0.019$ Since k = 0.019 < 0.116 → No compression reinforcement **Step 2: Lever arm z** $\frac{z}{d} = 0.5 + \sqrt{0.25 - \frac{k}{1.134}} = 0.5 + \sqrt{0.25 - \frac{0.019}{1.134}} = 0.98$ $z = 0.98 \times d = 0.98 \times 129.0 = 127.0mm$ Limiting values of Z; $z_{lim} = 0.95 \times d = 0.95 \times 129.0 = 123.0mm$ Adopted z = 123.0 mm **Step 3: Required reinforcement** $A_{s,req} = \frac{M_{Ed}}{0.87 f_{yk} z} = \frac{7.882 \times 10^6}{0.87 \times 500.0 \times 123.0} = 147.31mm^2/m$ **Step 4: Minimum reinforcement** $f_{ctm} = 0.3(f_{ck})^{2/3} = 0.3 \times (25.0)^{2/3} = 2.565N/mm^2$ $As,min = 0.26 \times \frac{f_{ctm}}{f_{yk}} \times b \times d = 0.26 \times \frac{2.565}{500.0} \times 1000.0 \times 129.0 = 172.06mm^2/m$ $0.0013bd = 0.0013 \times 1000.0 \times 129.0 = 168.0mm^2/m$ $As,min = max(0.0013bd, As,min) = 172.0mm^2/m$ **Step 5: Final required area** $As,req,final = max(As,min, As,req) = 172.0mm^2/m$ **Step 6: Provided reinforcement (T1)** Provide; H12.0 @ 200.0 mm c/c (T1) $A_{s,prov} = \frac{\pi\phi^2}{4} \times \frac{1000}{s} = \frac{\pi \times 12.0^2}{4} \times \frac{1000}{200.0} = 565mm^2/m$ Status: Adequate Reinforcement	**T1: As,req = 172.0 mm²/m** **As,prov = 565 mm²/m** **Spacing = 200.0 mm**
§7.3.3	**CRACK CONTROL CHECK** **SERVICEABILITY LIMIT STATE (SLS): CRACK WIDTH SPACING VERIFICATION - T1** **Steel stress fs** $f_s = \frac{f_{yk} \times (G_k + 0.3Q_k)}{1.15(1.35G_k + 1.5Q_k)} \times \frac{As_{req}}{As_{prov}} \times \frac{1}{\delta}$ $f_s = \frac{500.0 \times (6.2 + 0.3 \times 1.2000000000000002)}{1.15 \times (1.35 \times 6.2 + 1.5 \times 1.2000000000000002)} \times \frac{172.0}{565} \times \frac{1}{0.8} = 106.66N/mm^2$ Maximum allowable spacing for σs = 106.66 N/mm² is S_{max} = 300.0 mm Since spacing provided S = 200.0 mm, which is ≤ S_{max} = 300.0 mm, PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm).	**fs = 106.66 N/mm²** **Smax = 300.0 mm** **Actual S = 200.0 mm** **Status: PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm)**

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280	16	12	8
320	12	10	6
360	10	8	5
400	8	6	4
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160	300	300	200
200	300	250	150
240	250	200	100
280	200	150	50
320	150	100	-
360	100	50	-

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§6.1 Continuous Edge Design (Top Steel)	**REINFORCEMENT DESIGN – T2 (LONG SPAN TOP)** **LONG SPAN (T2) – Continuous edge top steel** fck = 25.0 N/mm², fyk = 500.0 N/mm² Design per unit width, b = 1000.0 mm For slabs, allow 20% moment redistribution and fck ≤ C50/60 Moment redistribution factor δ = 0.8 $k_{bal} = \frac{0.454(\delta - 0.44)}{1.25} - \frac{0.182(\delta - 0.44)^2}{1.25^2} = 0.116$ **Step 1: Moment capacity** $k = \frac{M_{Ed}}{bd^2 f_{ck}} = \frac{8.136 \times 10^6}{1000.0 \times 117.0^2 \times 25.0} = 0.024$ Since k = 0.024 < 0.116 → No compression reinforcement **Step 2: Lever arm z** $\frac{z}{d} = 0.5 + \sqrt{0.25 - \frac{k}{1.134}} = 0.5 + \sqrt{0.25 - \frac{0.024}{1.134}} = 0.98$ $z = 0.98 \times d = 0.98 \times 117.0 = 114.0mm$ Limiting values of Z; $z_{lim} = 0.95 \times d = 0.95 \times 117.0 = 111.0mm$ Adopted z = 111.0 mm **Step 3: Required reinforcement** $A_{s,req} = \frac{M_{Ed}}{0.87 f_{yk} z} = \frac{8.136 \times 10^6}{0.87 \times 500.0 \times 111.0} = 168.5mm^2/m$ **Step 4: Minimum reinforcement** $f_{ctm} = 0.3(f_{ck})^{2/3} = 0.3 \times (25.0)^{2/3} = 2.565N/mm^2$ $As,min = 0.26 \times \frac{f_{ctm}}{f_{yk}} \times b \times d = 0.26 \times \frac{2.565}{500.0} \times 1000.0 \times 117.0 = 156.05mm^2/m$ $0.0013bd = 0.0013 \times 1000.0 \times 117.0 = 152.0mm^2/m$ $As,min = max(0.0013bd, As,min) = 156.0mm^2/m$ **Step 5: Final required area** $As,req,final = max(As,min, As,req) = 168.0mm^2/m$ **Step 6: Provided reinforcement (T2)** Provide; H12.0 @ 300.0 mm c/c (T2) $A_{s,prov} = \frac{\pi\phi^2}{4} \times \frac{1000}{s} = \frac{\pi \times 12.0^2}{4} \times \frac{1000}{300.0} = 377mm^2/m$ Status: Adequate Reinforcement	**T2: As,req = 168.0 mm²/m** **As,prov = 377 mm²/m** **Spacing = 300.0 mm**
§7.3.3	**CRACK CONTROL CHECK** **SERVICEABILITY LIMIT STATE (SLS): CRACK WIDTH SPACING VERIFICATION - T2** **Steel stress fs** $f_s = \frac{f_{yk} \times (G_k + 0.3Q_k)}{1.15(1.35G_k + 1.5Q_k)} \times \frac{As_{req}}{As_{prov}} \times \frac{1}{\delta}$ $f_s = \frac{500.0 \times (6.2 + 0.3 \times 1.2000000000000002)}{1.15 \times (1.35 \times 6.2 + 1.5 \times 1.2000000000000002)} \times \frac{168.0}{377} \times \frac{1}{0.8} = 156.69N/mm^2$ Maximum allowable spacing for σs = 156.69 N/mm² is S_{max} = 300.0 mm Since spacing provided S = 300.0 mm, which is ≤ S_{max} = 300.0 mm, PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm).	**fs = 156.69 N/mm²** **Smax = 300.0 mm** **Actual S = 300.0 mm** **Status: PASS: Provided bar spacing is adequate for crack control limit (wk = 0.3mm)**

REFERENCE	CALCULATIONS	OUTPUT
	Table 7.2N Maximum bar diameters ϕ^*_s for crack control[1] Steel stress[2] [MPa] | Maximum bar size [mm] w_k= 0,4 mm | w_k= 0,3 mm | w_k= 0,2 mm 160 | 40 | 32 | 25 200 | 32 | 25 | 16 240 | 20 | 16 | 12 280 | 16 | 12 | 8 320 | 12 | 10 | 6 360 | 10 | 8 | 5 400 | 8 | 6 | 4 450 | 6 | 5 | - **Table 7.3N Maximum bar spacing for crack control[1]** Steel stress[2] [MPa] | Maximum bar spacing [mm] w_k=0,4 mm | w_k=0,3 mm | w_k=0,2 mm 160 | 300 | 300 | 200 200 | 300 | 250 | 150 240 | 250 | 200 | 100 280 | 200 | 150 | 50 320 | 150 | 100 | - 360 | 100 | 50 | -	
EN1992-1-1 App. Table A2/A3 Shear forces	**SHEAR FORCE CALCULATIONS** **Continuous Edges:** βvx = 0.33, βvy = 0.33 $VEd_x = \beta_{vx} n L_x = 0.33 \times 10.17 \times 5.0 = 16.78 kN$ $VEd_y = \beta_{vy} n L_x = 0.33 \times 10.17 \times 5.0 = 16.78 kN$ **Discontinuous Edges:** βvx = 0.0, βvy = 0.0 $VEd_x = \beta_{vx} n L_x = 0.0 \times 10.17 \times 5.0 = 0.0 kN$ $VEd_y = \beta_{vx} n L_x = 0.0 \times 10.17 \times 5.0 = 0.0 kN$	**Continuous Edges:** **VEd,x = 16.78 kN** **VEd,y = 16.78 kN** **Discontinuous Edges:** **VEd,x = 0.0 kN** **VEd,y = 0.0 kN**
EN1992-1-1 App. Table A2/A3 Shear Capacity (Lx)	**SHEAR CAPACITY – SHORT SPAN (Lx)** **Short span Lx:** **k factor** $k = 1 + \sqrt{\frac{200}{d}} \leq 2$ $k = 1 + \sqrt{\frac{200}{129.0}} = 2.25$ $k = min(2.25, 2.0) = 2.0$ **Reinforcement ratio** $\rho_1 = \frac{As,prov}{bd} \leq 0.02$ $\rho_1 = \frac{565}{1000 \times 129.0} = 0.0044$ $\rho_1 = min(0.0044, 0.02) = 0.0044$ **VRd,c** $VRd,c = 0.12k(100\rho_1 fck)^{(1/3)} bd$ $VRd,c = 0.12 \times 2.0 \times (100 \times 0.0044 \times 25.0)^{(1/3)} \times 1000 \times 129.0 = 68.77 kN$ $VRd,c,min = 0.035 \times k^{(3/2)} \times \sqrt{fck} \times b \times d$ $VRd,c,min = 0.035 \times 2.0^{(3/2)} \times \sqrt{25.0} \times 1000 \times 129.0 = 63.85 kN$ $Design - VRd,c = max(68.77 kN, 63.85 kN) = 68.77 kN$ $Check: VEd = 16.78 kN \leq VRd,c = 68.77 kN \rightarrow PASS$	**VEd,x = 16.78 kN** **VRd,c (Lx) = 68.77 kN** **Status: PASS**

REFERENCE	CALCULATIONS	OUTPUT
EN1992-1-1 App. Table A2/A3 Shear Capacity (Ly)	**SHEAR CAPACITY – LONG SPAN (Ly)** **Long span Ly:** **k factor** $k = 1 + \sqrt{\frac{200}{d}} \leq 2$ $k = 1 + \sqrt{\frac{200}{117.0}} = 2.31$ $k = min(2.31, 2.0) = 2.0$ **Reinforcement ratio** $\rho_1 = \frac{As,prov}{bd} \leq 0.02$ $\rho_1 = \frac{377}{1000 \times 117.0} = 0.0032$ $\rho_1 = min(0.0032, 0.02) = 0.0032$ **VRd,c** $VRd,c = 0.12k(100\rho_1 fck)^{(1/3)}bd$ $VRd,c = 0.12 \times 2.0 \times (100 \times 0.0032 \times 25.0)^{(1/3)} \times 1000 \times 117.0 = 56.29kN$ $VRd,c,min = 0.035 \times k^{(3/2)} \times \sqrt{fck} \times b \times d$ $VRd,c,min = 0.035 \times 2.0^{(3/2)} \times \sqrt{25.0} \times 1000 \times 117.0 = 57.91kN$ $Design - VRd,c = max(56.29kN, 57.91kN) = 57.91kN$ $Check: VEd = 16.78kN \leq VRd,c = 57.91kN \rightarrow PASS$	**VEd,y = 16.78 kN** **VRd,c (Ly) = 57.91 kN** **Status: PASS**

REFERENCE	CALCULATIONS	OUTPUT
§7.4.2 Deflection	**DEFLECTION CHECK** **Step 1: Reference reinforcement ratio** $\rho_0 = \sqrt{f_{ck}} \times 10^{-3}$ $\rho_0 = \sqrt{25.0} \times 10^{-3} = 0.005$ **Step 2: Tension reinforcement ratio** $\rho = \frac{A_{s,prov}}{bd}$ $\rho = \frac{565}{1000 \times 129.0} = 0.0013$ $\rho = 0.0013$ **Step 3: Structural system factor** K = 1.5 (Structural system factor from Table 7.4N) **Step 4: Basic L/d ratio** $\rho \le \rho_0 \rightarrow \frac{L}{d} = K\left[11 + 1.5\sqrt{f_{ck}} \times \frac{\rho_0}{\rho} + 3.2\sqrt{f_{ck}} \times \left(\frac{\rho_0}{\rho} - 1\right)^{\frac{3}{2}}\right]$ $L/d)_{basic} = 168.05$ **Step 5: Modification factor** **(i)Steel stress modification factor** $\beta_s = \frac{A_{s,prov}}{A_{s,req}}$ $\beta_s = \frac{565}{114.0} = 3.29$ $\beta_s = min(1.5, 3.29) = 1.5$ **(ii)Span modification factor** $\beta_L = \frac{7}{Lx}$ $\beta_L = \frac{7}{5.0} = 1.4$ $\beta_L = min(1.0, 1.4) = 1.0$ **Step 6: Permitted L/d** $L/d)_{permitted} = \beta_s \times \beta_L \times (L/d)_{basic}$ $L/d)_{permitted} = 1.5 \times 1.0 \times 168.05 = 40.0$ **Step 7: Actual L/d** $L/d)_{actual} = \frac{L_s}{d}$ $L/d)_{actual} = \frac{5000.0}{129.0} = 38.76$ **Step 8: Check** Since L/d (actual) ≤ L/d (permitted), OK	**Permitted L/d = 40.0** **Actual L/d = 38.76** **Status: Since L/d (actual) ≤ L/d (permitted), OK**