MshStructure Nicosia Haspolat via mersin 10	Project				Job Ref.	
	Calc. by Asst. Prof. Dr. Shihab Ibrahim (PhD, M.ACI, Aff.M.ASCE)				Sheet no./rev. 1	
	Section	Date 09-Jun-25	Chk'd by	Date	App'd by	Date

RC ONE-WAY SLAB DESIGN (ACI 318)

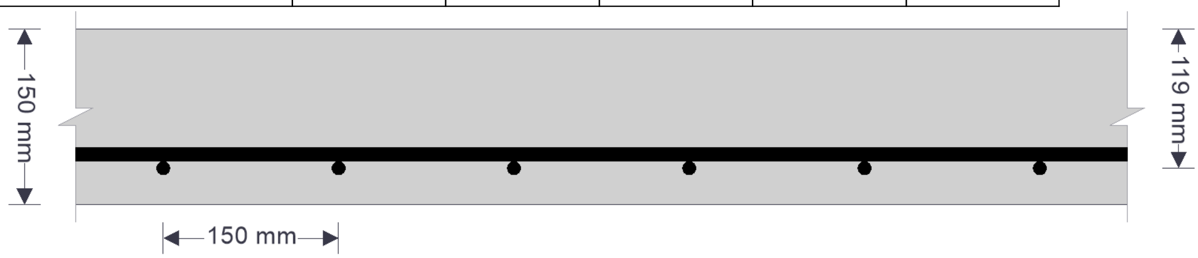
In accordance with ACI318-19 (22)

Design summary

Overall design status PASS

Overall design utilization 0.944

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kNm/m	31.26	29.50	0.944	PASS
Shear	kN/m	48.75	24.80	0.509	PASS
Minimum thickness requirements are met					PASS



Slab definition

Slab type **One-way continuous**

Overall thickness of slab h = **150** mm

Span of slab l_n = **2000** mm

Clear cover to tension reinforcement c_c = **25** mm

Materials

Specified compressive strength of concrete f'_c = **20** MPa

Specified yield strength of reinforcement f_y = **420** MPa

Modulus of elasticity E_{SACI} = **199948** MPa

Compression-controlled strain limit - 21.2.2.1 ε_{ty} = **0.002**

Minimum tensile strain - 7.3.3.1 $\varepsilon_{min} = \varepsilon_{ty} + 0.003 =$ **0.005**

Concrete modification factor λ = **1.00**

Maximum design moment and shear in span (per 1 m width of slab)

Maximum ultimate positive moment M_{us} = **29.50** kNm/m

Maximum ultimate shear force V_u = **24.80** kN/m

Reinforcement calculation - positive moment

Tension steel provided **12ϕ @ 150 mm o.c.**

Depth to tension steel $d = (h - c_c - D / 2) =$ **119** mm

Stress block depth factor $\beta_1 = 0.85$

Reinforcement ratio at strain of ε_{min} $\rho_b = 0.85 \times \beta_1 \times f'_c / f_y \times (0.003 / (0.003 + \varepsilon_{min})) =$ **0.013**

Maximum reinforcement ratio $\rho_{max} = \rho_b =$ **0.013**

Maximum area of tension steel $A_{s\_max} = \rho_{max} \times d =$ **1535** mm^2/m

Min ratio of transverse reinforcement – cl. 7.6.1.1 ρ_t =**0.0018**

Min area tension steel req'd – cl. 7.6.1.1 $A_{s\_min} = \rho_t \times h =$ **270** mm^2/m

Area required for bending A_{s_req} = **39** mm^2/m

Area of tension steel provided A_{s_prov} = **754** mm²/m

PASS - area of steel provided - OK

Steel stress – cl. 24.3.2.1 $f_s = 2/3 \times f_y$ = **280.0** MPa

Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2

$s_{max} = \min(3 \times h, 450\text{ mm}, 380\text{ mm} \times (280\text{ MPa} / f_s) - 2.5 \times c_c, 300\text{ mm} \times (280\text{ MPa} / f_s))$ = **300.0** mm

Actual tensile bar spacing provided s = **150** mm

PASS - spacing of bars (positive moment steel) less than maximum allowable

Library item: Steel calcs (SAG)

Check for section - positive moment

Depth of equivalent rectangular stress block $a = (A_{s\_prov} \times f_y) / (0.85 \times f'_c)$ = **19** mm

Depth of neutral axis $c = a / \beta_1$ = **22** mm

Net tensile strain in long. steel at nominal strength $\varepsilon_t = 0.003 \times [(d - c) / c]$ = **0.0133**

Tensile strain exceeds minimum required, design OK

Required nominal flexural strength M_{us} = **29.50** kNm/m

Strength reduction factor ϕ =**0.9**

Nominal flexural strength $M_{ns\_prov} = A_{s\_prov} \times f_y \times (d - a / 2)$ = **34.73** kNm/m

Design flexural strength $\phi M_{ns\_prov} = \phi \times M_{ns\_prov}$ = **31.26** kNm/m

PASS - Design flexural strength exceeds required flexural strength

Transverse reinforcement - (for shrinkage and temperature)

Transverse reinforcement provided **12ϕ @ 150 mm o.c.**

Transverse reinforcement provided A_{t_prov} = **754** mm²/m

Min ratio of transverse reinforcement – cl. 7.6.1.1 ρ_t = **0.0018**

Minimum area of transverse reinforcement required $A_{t\_req} = \rho_t \times h$ = **270** mm²/m

PASS - area of inner steel provided (transverse) OK

Maximum allowable spacing of bars $s_{max\_t} = \min(5 \times h, 450\text{ mm})$ = **450** mm

Actual transverse bar spacing provided s_t = **150** mm

PASS - spacing of transverse bars is less than allowable

Library item: Transverse steel calcs

Check for shear

Required shear strength V_u = **24.80** kN/m

Size effect factor – cl. 22.5.5.1.3 $\lambda_s = \min(\sqrt{(2 / (1 + 0.004 * d / 1\text{ mm}))}, 1.0)$ = **1.00**

Ratio of longitudinal reinforcement $\rho_w = A_{s\_prov} / d$ = **0.006**

Shear strength provided by concrete $V_c = \min(0.66 \times \lambda_s \times \lambda \times (\rho_w)^{1/3}, 0.42 \times \lambda) \times \sqrt{(f'_c / 1\text{ MPa})} \times 1\text{ MPa} \times d$ = **64.99** kN/m

Shear strength provided by shear steel (assumed) V_s = **0.00** kN/m

Shear capacity of section $V = V_c + V_s$ = **64.99** kN/m

Design shear capacity of section $\phi V = 0.75 \times V$= **48.75** kN/m

PASS - One-way shear capacity

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement c_{min} = **20** mm

Clear cover to tension reinforcement (+ve moment) $c_c = h - d - D/2$ = **25** mm

PASS - cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition **Both ends continuous**

Basic span-to-thickness ratio - Table 7.3.1.1 $ratio_{basic}$ = **28**

Type of concrete **Normal weight**

Concrete density factor - Table 7.3.1.1 $f_{density}$ = **1.00**

Allowable span-to-thickness ratio $ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 700\ N/mm^2))$ = **28.000**

Actual span-to-thickness ratio $ratio_{actual} = l_n / h$ = **13.333**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 150 mm thick in 20 MPa concrete

Tension steel provided (+ve) moment, 12 mm dia. @ 150 mm o.c in 420 MPa steel

Transverse steel provided, 12 mm dia. @ 150 mm o.c in 420 MPa steel