

Pier coping (single column) design

Pier coping (single column) · ACI 318-25

Project & Model Summary

Item	Value
Designer	Hangil Engineer
Date	2026-06-26
Note	AStrutTie v2 — STM design check
Template	Pier coping (single column)
Design code	ACI 318-25
Unit system	SI
Nodes	14
Members	25
Struts	11
Ties	14
Supports	2

Materials & Design Parameters

Item	Value
Concrete fck	24 MPa
Rebar fy	400 MPa
Confinement β_c	1
Member thickness b	2700.00 mm

Load Cases & Combinations

Active combination: LC01

Strength checks (sections 1–3) and the summary are the governing envelope over all 1 load combinations — each line shows its governing combination. The active combination is listed for reference only.

Load cases

Case	Base factor
D	1.00
L	1.00

Combination factors

Combination	D	L
LC01	1.00	1.00

Member axial forces by combination (kN, tension +)

Member	LC01
m1	2151.85
m2	3575.60
m3	3590.80
m4	3380.80
m5	4188.00
m6	2370.61
m7	0.00
m8	-2448.69
m9	-2945.60
m10	-3768.00
m11	-2240.06
m12	0.00
m13	0.00
m14	1583.65
m15	34.55
m16	-1800.00
m17	-1834.55
m18	1448.72
m19	0.00
m20	-3248.26
m21	-3775.45
m22	-37.74
m23	2004.28
m24	-3714.51
m25	-2971.51

Governing envelope per member

Member	Max tension (kN)	Governing (T)	Max compression (kN)	Governing (C)
m1	2151.85	LC01	0.00	—
m2	3575.60	LC01	0.00	—
m3	3590.80	LC01	0.00	—
m4	3380.80	LC01	0.00	—
m5	4188.00	LC01	0.00	—
m6	2370.61	LC01	0.00	—
m8	0.00	—	-2448.69	LC01
m9	0.00	—	-2945.60	LC01
m10	0.00	—	-3768.00	LC01
m11	0.00	—	-2240.06	LC01
m14	1583.65	LC01	0.00	—
m15	34.55	LC01	0.00	—
m16	0.00	—	-1800.00	LC01
m17	0.00	—	-1834.55	LC01
m18	1448.72	LC01	0.00	—
m20	0.00	—	-3248.26	LC01
m21	0.00	—	-3775.45	LC01
m22	0.00	—	-37.74	LC01
m23	2004.28	LC01	0.00	—
m24	0.00	—	-3714.51	LC01
m25	0.00	—	-2971.51	LC01

1. Tie (rebar) strength check [OK]

$$A_{s,req} = F_u / (\phi \cdot f_y)$$

Item	Governing combination	F _u (kN)	φ	f _y (MPa)	A _{s,req} (mm ²)	A _{s,prov} (mm ²)	SF	Verdict
m1	LC01	2151.85	0.75	400	7172.83	7600.50	1.06	OK
m2	LC01	3575.60	0.75	400	11918.67	12160.80	1.02	OK
m3	LC01	3590.80	0.75	400	11969.33	12160.80	1.02	OK
m4	LC01	3380.80	0.75	400	11269.33	11654.10	1.03	OK
m5	LC01	4188.00	0.75	400	13960.00	14187.60	1.02	OK
m6	LC01	2370.61	0.75	400	7902.05	8107.20	1.03	OK
m14	LC01	1583.65	0.75	400	5278.84	5443.50	1.03	OK
m15	LC01	34.55	0.75	400	115.15	1719.00	14.93	OK
m18	LC01	1448.72	0.75	400	4829.07	4870.50	1.01	OK
m23	LC01	2004.28	0.75	400	6680.93	7093.80	1.06	OK

2. Strut strength check [OK]

$w_{req} = F_u / (\phi \cdot 0.85 \cdot \beta_s \cdot \beta_c \cdot f_{ck} \cdot b)$

Item	Governing combination	Fu (kN)	φ	fce (MPa)	b (mm)	w,req (mm)	w,prov (mm)	SF	Verdict
m8	LC01	2448.69	0.75	15.30	2700.00	79.03	189.43	2.40	OK
m9	LC01	2945.60	0.75	15.30	2700.00	95.07	200.00	2.10	OK
m10	LC01	3768.00	0.75	15.30	2700.00	121.62	200.00	1.64	OK
m11	LC01	2240.06	0.75	15.30	2700.00	72.30	189.43	2.62	OK
m16	LC01	1800.00	0.75	15.30	2700.00	58.10	1100.00	18.93	OK
m17	LC01	1834.55	0.75	15.30	2700.00	59.21	200.00	3.38	OK
m20	LC01	3248.26	0.75	15.30	2700.00	104.84	207.38	1.98	OK
m21	LC01	3775.45	0.75	15.30	2700.00	121.86	266.85	2.19	OK
m22	LC01	37.74	0.75	15.30	2700.00	1.22	496.60	407.66	OK
m24	LC01	3714.51	0.75	15.30	2700.00	119.89	266.85	2.23	OK
m25	LC01	2971.51	0.75	15.30	2700.00	95.91	207.38	2.16	OK

3. Nodal-zone strength check [OK]

$w_{req} = F_u / (\phi \cdot 0.85 \cdot \beta_n \cdot \beta_c \cdot f_{ck} \cdot b)$

Item	Type	Governing combination	Fu (kN)	φ	fce (MPa)	b (mm)	w,req (mm)	w,prov (mm)	SF	Verdict
n1	CCT	LC01	2151.85	0.75	16.32	2700.00	65.11	200.00	3.07	OK
n2	CTT	LC01	3575.60	0.75	12.24	2700.00	144.26	200.00	1.39	OK
n3	CTT (interior)	LC01	3590.80	0.75	12.24	2700.00	144.87	200.00	1.38	OK
n4	CTT	LC01	3590.80	0.75	12.24	2700.00	144.87	200.00	1.38	OK
n5	CTT (interior)	LC01	4188.00	0.75	12.24	2700.00	168.97	200.00	1.18	OK
n6	CTT	LC01	4188.00	0.75	12.24	2700.00	168.97	200.00	1.18	OK
n7	CCT	LC01	2370.61	0.75	16.32	2700.00	71.73	200.00	2.79	OK
n9	CCT (interior)	LC01	3248.26	0.75	16.32	2700.00	98.29	207.38	2.11	OK
n10	CCT	LC01	4015.45	0.75	16.32	2700.00	121.50	200.00	1.65	OK
n11	CCT (interior)	LC01	3768.00	0.75	16.32	2700.00	114.02	200.00	1.75	OK
n12	CCC	LC01	5774.55	0.75	20.40	2700.00	139.79	200.00	1.43	OK
n13	CCT (interior)	LC01	2971.51	0.75	16.32	2700.00	89.91	207.38	2.31	OK

Tie Anchorage Check

ℓanc (available, \$23.8.2 extended nodal zone) vs. required ℓd,req (\$25.4). Available = straight along-tie length from the extended-nodal-zone boundary to the bar end (end cover deducted: entered cover, else 40 mm). No hook-tail credit — ℓdh is measured to the outside of the hook, so the hook's contribution is already in ℓd,req; hooks/heads must also fit the perpendicular depth. Shear ties & continuous ends excluded. Anchorage per ACI 318-25 §25.4 (SI): straight §25.4.2.3 (Table 25.4.2.3) ℓd = fy⋅ψt⋅ψe⋅ψg/(c⋅λ⋅√f'c)⋅db, c = 2.1 (db≤D19) / 1.7 (db≥D22) for case (a) — clear cover ≥ db and spacing ≥ 2db (or ≥ db with code-minimum stirrups) — and 1.4 / 1.1 for case (b); case (a) is assumed and marked when cover/spacing are not entered. ℓd ≥ 300 mm; standard hook §25.4.3.1 ℓdh = max[fy⋅ψe⋅ψr⋅ψo⋅ψc/(23⋅λ⋅√f'c)⋅db^1.5, 8db, 150 mm]; headed §25.4.4.2 ℓdt = max[fy⋅ψe⋅ψr⋅ψo⋅ψc/(31⋅λ⋅√f'c)⋅db^1.5, 8db, 150 mm] (normalweight only). √f'c capped at 8.3 MPa (§25.4.1.4). Modification factors default to the conservative (longest) length when detailing is unspecified.

Tie	Termination	db (mm)	ℓd,req (mm)	ℓanc (mm)	SF	Verdict
m1	Straight (case (a) assumed)	25.40	1219.94	1465.91	1.20	OK
m6	Straight (case (a) assumed)	25.40	1219.94	1465.91	1.20	OK
m23	Straight (case (a) assumed)	25.40	1219.94	1434.90	1.18	OK

Bill of Materials

Mark	Category	Detail	Value
m1	Rebar	Tie main rebar (D25×15EA)	7600.50 mm ²
m2	Rebar	Tie main rebar (D25×24EA)	12160.80 mm ²
m3	Rebar	Tie main rebar (D25×24EA)	12160.80 mm ²
m4	Rebar	Tie main rebar (D25×23EA)	11654.10 mm ²
m5	Rebar	Tie main rebar (D25×28EA)	14187.60 mm ²
m6	Rebar	Tie main rebar (D25×16EA)	8107.20 mm ²
m7	Rebar	Tie main rebar (D19×6EA)	1719.00 mm ²
m12	Rebar	Tie main rebar (D19×6EA)	1719.00 mm ²
m13	Rebar	Tie main rebar (D19×6EA)	1719.00 mm ²
m14	Rebar	Tie main rebar (D19×19EA)	5443.50 mm ²
m15	Rebar	Tie main rebar (D19×6EA)	1719.00 mm ²
m18	Rebar	Tie main rebar (D19×17EA)	4870.50 mm ²
m19	Rebar	Tie main rebar (D19×6EA)	1719.00 mm ²
m23	Rebar	Tie main rebar (D25×14EA)	7093.80 mm ²
C	Concrete	fck=24 MPa · 23.49 m ² × 2.70 m	63.42 m ³

Summary [OK]

OK 33 / NG 0 / SF min 1.01 (33 checks)

Statically determinate — 1 combination(s), superposed & enveloped.

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