Deep beam (simple) design

Deep beam (simple) · ACI 318-25

Project & Model Summary

Item	Value
Designer	Hangil Engineer
Date	2026-06-26
Note	AStrutTie v2 — STM design check
Template	Deep beam (simple)
Design code	ACI 318-25
Unit system	SI
Nodes	7
Members	13
Struts	8
Ties	5
Supports	2

Materials & Design Parameters

Item	Value
Concrete fck	24 MPa
Rebar fy	400 MPa
Confinement βc	1
Member thickness b	600.00 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
BC1	881.46
BC2	964.29
BC3	881.46
TC1	-82.83
TC2	-82.83
V1	128.85
V2	128.85
D1	-153.17
D2	-153.17
D3	-1011.75
D4	-153.17
D5	-153.17
D6	-1011.75

Governing envelope per member

Member	Max tension (kN)	Governing (T)	Max compression (kN)	Governing (C)
BC1	881.46	LC01	0.00	—
BC2	964.29	LC01	0.00	—
BC3	881.46	LC01	0.00	—
TC1	0.00	—	-82.83	LC01
TC2	0.00	—	-82.83	LC01
V1	128.85	LC01	0.00	—
V2	128.85	LC01	0.00	—
D1	0.00	—	-153.17	LC01
D2	0.00	—	-153.17	LC01
D3	0.00	—	-1011.75	LC01
D4	0.00	—	-153.17	LC01
D5	0.00	—	-153.17	LC01

Member	Max tension (kN)	Governing (T)	Max compression (kN)	Governing (C)
D6	0.00	—	-1011.75	LC01

1. Tie (rebar) strength check [OK]

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

Item	Governing combination	Fu (kN)	φ	fy (MPa)	As,req (mm²)	As,prov (mm²)	SF	Verdict
BC1	LC01	881.46	0.75	400	2938.19	4053.60	1.38	**OK**
BC2	LC01	964.29	0.75	400	3214.29	4053.60	1.26	**OK**
BC3	LC01	881.46	0.75	400	2938.19	4053.60	1.38	**OK**
V1	LC01	128.85	0.75	400	429.49	1719.00	4.00	**OK**
V2	LC01	128.85	0.75	400	429.49	1719.00	4.00	**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
TC1	LC01	82.83	0.75	20.40	600.00	9.02	200.00	22.17	**OK**
TC2	LC01	82.83	0.75	20.40	600.00	9.02	200.00	22.17	**OK**
D1	LC01	153.17	0.75	15.30	600.00	22.25	369.85	16.62	**OK**
D2	LC01	153.17	0.75	15.30	600.00	22.25	369.85	16.62	**OK**
D3	LC01	1011.75	0.75	15.30	600.00	146.95	403.45	2.75	**OK**
D4	LC01	153.17	0.75	15.30	600.00	22.25	369.85	16.62	**OK**
D5	LC01	153.17	0.75	15.30	600.00	22.25	369.85	16.62	**OK**
D6	LC01	1011.75	0.75	15.30	600.00	146.95	403.45	2.75	**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
B1	CCT	LC01	881.46	0.75	16.32	600.00	120.02	200.00	1.67	**OK**
B2	CTT (interior)	LC01	964.29	0.75	12.24	600.00	175.07	200.00	1.14	**OK**
B3	CTT (interior)	LC01	964.29	0.75	12.24	600.00	175.07	200.00	1.14	**OK**
B4	CCT	LC01	881.46	0.75	16.32	600.00	120.02	200.00	1.67	**OK**
T1	CCT (interior)	LC01	153.17	0.75	16.32	600.00	20.86	369.85	17.73	**OK**
T2	CCC	LC01	1500.00	0.75	20.40	600.00	163.40	400.00	2.45	**OK**
T3	CCT (interior)	LC01	153.17	0.75	16.32	600.00	20.86	369.85	17.73	**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·ψp·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
BC1	Straight (case (a) assumed)	25.40	1219.94	488.57	0.40	NG
BC3	Straight (case (a) assumed)	25.40	1219.94	488.57	0.40	NG

Bill of Materials

Mark	Category	Detail	Value
BC1	Rebar	Tie main rebar (D25×8EA)	4053.60 mm²
BC2	Rebar	Tie main rebar (D25×8EA)	4053.60 mm²
BC3	Rebar	Tie main rebar (D25×8EA)	4053.60 mm²
V1	Rebar	Tie main rebar (D19×6EA)	1719.00 mm²
V2	Rebar	Tie main rebar (D19×6EA)	1719.00 mm²
C	Concrete	fck=24 MPa · 6.40 m² × 0.60 m	3.84 m³

Summary [OK]

OK 20 / NG 0 / SF min 1.14 (20 checks)

Statically indeterminate (degree 2; 14 equations < 16 unknowns) — solved by ACore stiffness analysis · 1 combination(s).