

COMPLETE BEAM ENGINEERING REPORT

beam multi span check

Project number	7890
Client	Not specified
Location	Not specified
Responsible engineer	Not specified
Design standard	ACI 318-19
Calculation units	SI canonical calculations
Minimum stirrup diameter	10 mm / #3
Report status	Ready for engineering review
Generated	2026-08-26T21:45:48.086750Z

1. Executive engineering narrative

This report records the complete CIVORA reinforced-concrete beam workflow. Beam geometry and loading were defined, the structural analysis was completed, flexural and shear reinforcement were designed, longitudinal reinforcement was selected, and the final detailing, drawings and bar bending schedule were generated.

The report is prepared for engineering review. Development and extension lengths were computed automatically per ACI 318-19 Chapter 25 / §9.7.3.3 (see Section 2A).

Nominal continuity bars are detailing reinforcement and are not classified as flexural-demand verified reinforcement.

2. Design basis and assumptions

Structural concrete code	ACI 318-19
Concrete model	Normal-weight concrete unless noted otherwise
Internal calculation units	N, mm, MPa
Main reinforcement	metric
Minimum stirrup diameter	10 mm / #3
Development length basis	Computed automatically per ACI 318-19 Chapter 25
Drawing status	Engineering detailing schematic - review before issue

2A. Engineering Assumptions & Defaults

Declared values used automatically wherever this project was set up in Simple Mode - nothing here is silently decided.

Clear cover	38 mm
Stirrup diameter	#3 (10 mm)
Compression steel depth d'	65 mm
Long-term creep factor xi	2.0 (5 yr+ sustained load)
Max aggregate size	19 mm
Support bearing width	230 mm
Anchorage & cutoff extensions	Computed automatically per ACI 318-19 Chapter 25
Side-face (skin) reinforcement	Computed automatically per ACI 318-19 9.7.2.3 when h > 900mm

3. Beam geometry and materials

Beam name	beam multi span check
Beam width	300 mm
Overall depth	600 mm
Effective depth	550 mm
Concrete strength	30 MPa
Main-steel yield strength	420 MPa
Stirrup yield strength	420 MPa
Top clear cover	40 mm
Bottom clear cover	40 mm
Side clear cover	40 mm
Preferred bar catalogue	metric

4. Spans and supports

Span	Length
SP1	6000 mm
SP2	4500 mm
SP3	3500 mm
SP4	5500 mm

Support	Type	Physical width	Status
S1	fixed	300 mm	providedUnverified
S2	pinned	230 mm	providedUnverified
S3	pinned	230 mm	providedUnverified
S4	pinned	230 mm	providedUnverified
S5	none	Not specified mm	unknown

5. Applied loading

ID	Span	Type	Start	End	Start value	End value	Unit
L1	SP1	Point load	3000 mm	3000 mm	10000	10000	N
L2	SP1	uniformDistributed	0 mm	6000 mm	5	5	N/mm
L3	SP2	uniformDistributed	0 mm	4500 mm	10	10	N/mm
L4	SP3	uniformDistributed	0 mm	3500 mm	15	15	N/mm
L5	SP4	uniformDistributed	0 mm	5500 mm	5	5	N/mm

6. Structural analysis summary

Stage status	valid
Analysis revision	5
Primary scenario	legacy-unfactored
Envelope method	civora-action-envelope-1

Span	Maximum positive moment	Maximum negative moment	Maximum absolute shear
Span 1	14.72 kN.m	-23.63 kN.m	-20.28 kN
Span 2	14.20 kN.m	-23.63 kN.m	27.51 kN
Span 3	-0.28 kN.m	-75.63 kN.m	-47.54 kN
Span 4	-0.00 kN.m	-75.63 kN.m	27.50 kN

- Analysis warnings
- Support "N1" left face lies outside the analyzed beam domain.
 - Support "N5" has no physical face geometry; support-face actions remain unresolved.

7. Flexural design results

Region	Face	Critical location	Mu	As required	As minimum	As governing	Selected bars	Status
F3	top	0 mm	21.93 kN.m	107.65 mm2	542.00 mm2	542.00 mm2	Not specified	pass
F1	bottom	3000 mm	14.72 kN.m	72.10 mm2	542.00 mm2	542.00 mm2	Not specified	pass
F4	top	6000 mm	23.63 kN.m	116.03 mm2	542.00 mm2	542.00 mm2	Not specified	pass
F2	bottom	8750.76 mm	14.20 kN.m	69.56 mm2	542.00 mm2	542.00 mm2	Not specified	pass
F5	top	14000 mm	75.63 kN.m	376.30 mm2	542.00 mm2	542.00 mm2	Not specified	pass

CODE REFERENCE

ACI 318-19 §9.6.1 - Minimum Flexural Reinforcement

As,min = max(0.25 x sqrt(f'c)/fy, 1.4/fy) x bw x d (§9.6.1.2). This prevents a brittle failure if the concrete cracks - the steel must be strong enough to carry at least the moment that caused first cracking. Statistical calibration ensures the reinforced cracked section capacity exceeds the uncracked plain-concrete capacity.

FORMULA - As,min (typical)

As,min = max(0.25 x sqrt(f'c) / fy , 1.4/fy) x bw x d

CODE REFERENCE

ACI 318-19 §6.3.2 - Effective Flange Width of T-Beams

For monolithically cast slabs and beams, an effective slab width (overhanging flange) participates in beam flexure. ACI limits the overhang each side to the lesser of: 8 x slab thickness, half the clear distance to the adjacent beam, or one-eighth the beam's clear span. Compressive force in T-beam flanges dramatically increases moment capacity over rectangular sections.

8. Shear design and stirrup schedule

Stage status	valid
Result revision	8
Selected stirrup	10 mm / 10
Selected spacing	250 mm
Minimum permitted stirrup	10 mm / #3
Recommendation status	Recommended

CODE REFERENCE
ACI 318-19 §9.5 - Shear Strength & Stirrup Design
Where $V_u > \phi V_c/2$, minimum shear reinforcement is required (§9.6.3.1). Stirrups are designed for $V_s = V_u/\phi - V_c$. Spacing $s \leq d/2$ for $V_s \leq 4 \times \sqrt{f'_c} \times b_w \times d$ and $s \leq d/4$ for higher shear demands. Maximum stirrup spacing also ensures every potential 45-degree crack is crossed by at least one stirrup leg.

WHY THIS MATTERS
Shear failure in beams is brittle and sudden. Unlike flexural failure (which shows warning cracks), shear failure can occur with no visible warning. The strength reduction factor for shear ($\phi = 0.75$) is lower than for flexure ($\phi = 0.90$) precisely because shear failure is less ductile.

9. Longitudinal reinforcement

Run	Face	Start	End	Reinforcement	Layers	Classification
F3-run	top	0 mm	1893.45 mm	3-16	1	Demand-designed
F1-run	bottom	793.45 mm	5138.88 mm	3-16	1	Demand-designed
F4-run	top	4038.88 mm	7615.79 mm	3-16	1	Demand-designed
F2-run	bottom	6515.79 mm	10983.15 mm	3-16	1	Demand-designed
F5-run	top	9883.15 mm	19500 mm	3-16	1	Demand-designed
nominal-top-gap-1-run	top	1893.45 mm	4038.88 mm	2-12	1	Nominal detailing
nominal-top-gap-2-run	top	7615.79 mm	9883.15 mm	2-12	1	Nominal detailing
nominal-bottom-gap-1-run	bottom	0 mm	793.45 mm	2-12	1	Nominal detailing
nominal-bottom-gap-2-run	bottom	5138.88 mm	6515.79 mm	2-12	1	Nominal detailing
nominal-bottom-gap-3-run	bottom	10983.15 mm	19500 mm	2-12	1	Nominal detailing

10. Anchorage and development-length verification

Run	Required length	Available length	Development status	Overall status
F3-run	759.51 mm	1893.45 mm	verified	conditionallyVerified
F1-run	759.51 mm	2138.88 mm	verified	verified
F4-run	759.51 mm	1615.79 mm	verified	verified
F2-run	759.51 mm	2232.39 mm	verified	verified
F5-run	759.51 mm	4116.85 mm	verified	verified

11. Bar bending schedule

Mark	Bar	Dia.	Qty	Cut length	Total length	Weight	Status
B1	Ø16	16	3	1895 mm	5.685 m	8.98 kg	verified
B2	Ø16	16	3	4345 mm	13.035 m	20.60 kg	verified
B3	Ø16	16	3	3575 mm	10.725 m	16.95 kg	verified
B4	Ø16	16	3	4465 mm	13.395 m	21.17 kg	verified
B5	Ø16	16	3	9615 mm	28.845 m	45.58 kg	verified
B6	Ø12	12	2	2145 mm	4.290 m	3.81 kg	nominalDetailingNotFlexu ralDemand
B7	Ø12	12	2	2265 mm	4.530 m	4.03 kg	nominalDetailingNotFlexu ralDemand
B8	Ø12	12	2	795 mm	1.590 m	1.41 kg	nominalDetailingNotFlexu ralDemand
B9	Ø12	12	2	1375 mm	2.750 m	2.44 kg	nominalDetailingNotFlexu ralDemand
B10	Ø12	12	2	8515 mm	17.030 m	15.14 kg	nominalDetailingNotFlexu ralDemand
ST1	Ø10	10	79	1440 mm	113.760 m	70.22 kg	shearDesignVerified

12. Design warnings and limitations

- Any stale or invalid design stage must be rerun before issue.
- End-support anchorage requires confirmation by the responsible engineer.
- Development and extension lengths are externally verified inputs.
- Nominal continuity bars are detailing steel and are not demand-verified steel.
- Drawings are engineering detailing schematics and require project review.
- No stirrup smaller than 10 mm / #3 may be issued.

Landscape drawing sheets follow at the end of this report.

CIVORA STRUCTURAL ENGINEERING

ACI 318-19 / BS 8110 Reinforced Concrete Design

ENGINEER: Engineer of Record

SCALE: NTS

PROJECT: Beam Design Project

MEMBER ID: BEAM REINFORCEMENT ELEVATION

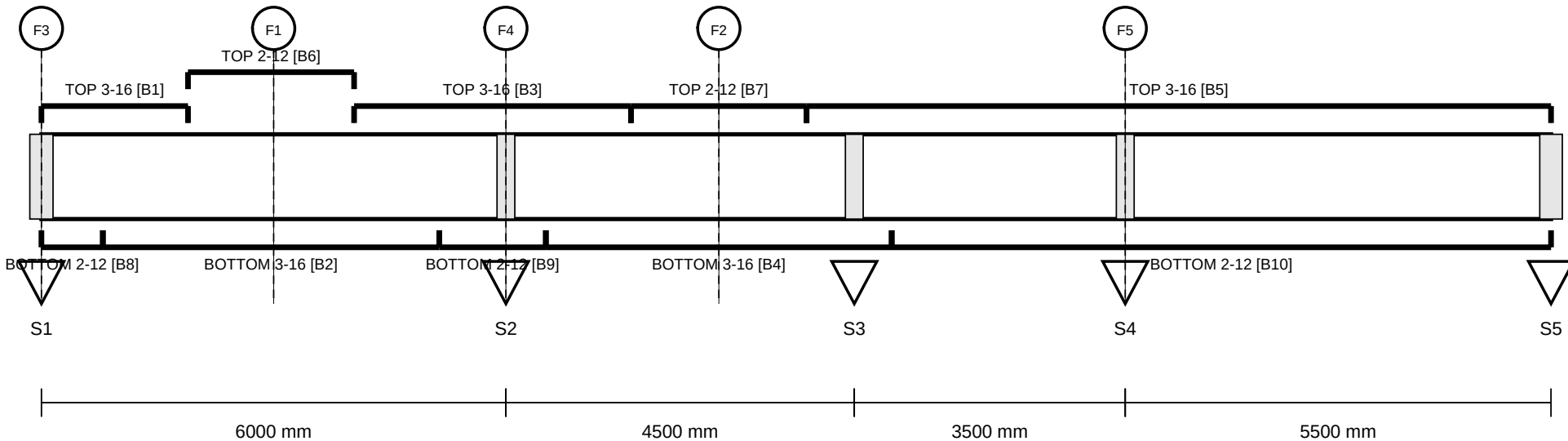
DATE: 2026-08-27

SHEET: D-01

REV	DATE	DESCRIPTION	BY	CHK
0	2026-08-27	Preliminary design issue	-	-

CONCEPTUAL DESIGN ONLY - NOT FOR CONSTRUCTION WITHOUT INDEPENDENT VERIFICATION BY A LICENSED PE

COMPLETE BEAM REINFORCEMENT ELEVATION



Nominal continuity bars are detailing reinforcement.

NOTES: Dimensions are in millimetres. Verify all dimensions against approved project drawings. Nominal continuity bars are detailing reinforcement.

MINIMUM STIRRUP: 10 mm / #3

CIVORA STRUCTURAL ENGINEERING

ACI 318-19 / BS 8110 Reinforced Concrete Design

PROJECT: Beam Design Project

MEMBER ID: GOVERNING REINFORCEMENT SECTIONS

ENGINEER: Engineer of Record

SCALE: NTS

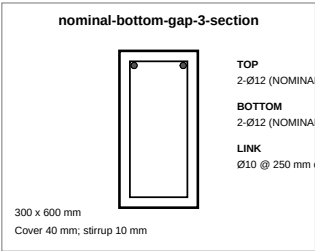
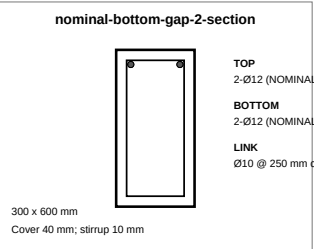
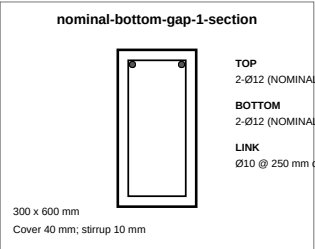
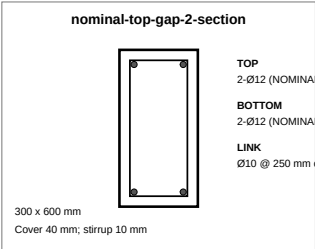
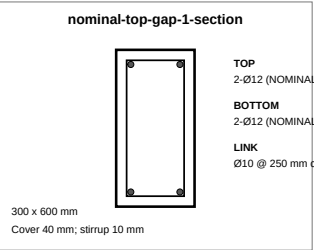
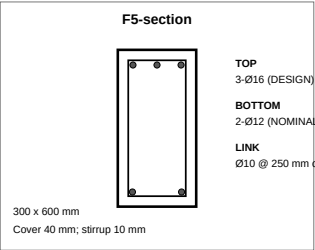
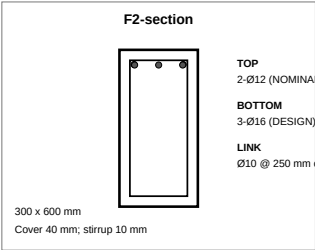
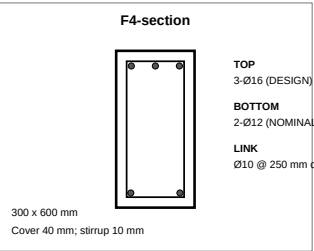
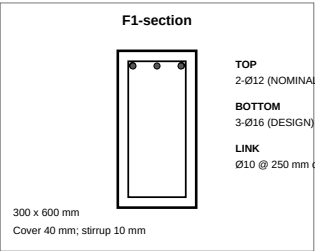
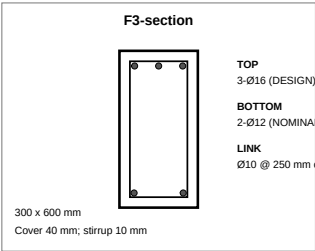
DATE: 2026-08-27

SHEET: D-02

REV	DATE	DESCRIPTION	BY	CHK
0	2026-08-27	Preliminary design issue	-	-

CONCEPTUAL DESIGN ONLY - NOT FOR CONSTRUCTION WITHOUT INDEPENDENT VERIFICATION BY A LICENSED PE

GOVERNING REINFORCEMENT SECTIONS



CIVORA STRUCTURAL ENGINEERING ACI 318-19 / BS 8110 Reinforced Concrete Design			PROJECT: Beam Design Project MEMBER ID: BAR BENDING SCHEDULE AND REINFORCEMENT NOTES		
ENGINEER: Engineer of Record SCALE: NTS			DATE: 2026-08-27 SHEET: D-03		

REV	DATE	DESCRIPTION	BY	CHK
0	2026-08-27	Preliminary design issue	-	-

CONCEPTUAL DESIGN ONLY - NOT FOR CONSTRUCTION WITHOUT INDEPENDENT VERIFICATION BY A LICENSED PE

Mark	Bar	Dia.	Qty	Cut length	Total length	Weight	Status
B1	Ø16	16	3	1895 mm	5.685 m	8.98 kg	verified
B2	Ø16	16	3	4345 mm	13.035 m	20.60 kg	verified
B3	Ø16	16	3	3575 mm	10.725 m	16.95 kg	verified
B4	Ø16	16	3	4465 mm	13.395 m	21.17 kg	verified
B5	Ø16	16	3	9615 mm	28.845 m	45.58 kg	verified
B6	Ø12	12	2	2145 mm	4.290 m	3.81 kg	nominalDetailingNotFlexuralDemand
B7	Ø12	12	2	2265 mm	4.530 m	4.03 kg	nominalDetailingNotFlexuralDemand
B8	Ø12	12	2	795 mm	1.590 m	1.41 kg	nominalDetailingNotFlexuralDemand
B9	Ø12	12	2	1375 mm	2.750 m	2.44 kg	nominalDetailingNotFlexuralDemand
B10	Ø12	12	2	8515 mm	17.030 m	15.14 kg	nominalDetailingNotFlexuralDemand
ST1	Ø10	10	79	1440 mm	113.760 m	70.22 kg	shearDesignVerified

NOTES: Dimensions are in millimetres. Verify all dimensions against approved project drawings. Nominal continuity bars are detailing reinforcement.	MINIMUM STIRRUP: 10 mm / #3
---	------------------------------------

Fabrication notes

- 1. Verify all dimensions against approved project drawings.
- 2. Development and anchorage lengths require engineer confirmation.
- 3. Nominal continuity bars are detailing steel, not demand-verified steel.
- 4. No stirrup smaller than 10 mm / #3 shall be used.