

Continuous beam

Two to five spans · pattern loading to the UK NA · moment and shear envelopes, reactions

Reference	NAE-RC-018 · version 1.0
Standards	BS EN 1992-1-1:2004+A1:2014, 5.1.3 and 5.4 (linear elastic analysis) · BS EN 1990:2002+A1:2005 (6.10)
National Annex	NA+A2:2014 to BS EN 1992-1-1:2004+A1:2014, NA.2 5.1.3(1)P, option (b): all spans and alternate spans loaded
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What it does

Linear elastic analysis of a continuous beam or one-way slab strip of two to five spans under uniformly distributed loads. Three arrangements of the variable load are analysed: all spans, odd spans and even spans loaded, the other spans carrying the permanent load only. The sheet gives the envelope of the support (hogging) and span (sagging) moments, the largest shear and the reactions at every support, with the diagrams drawn to scale. Use the moments and shears in NAE-RC-004 Beam bending and shear.

How to use

1. Open the Calculation sheet and choose the number of spans.
2. Enter the span lengths and one permanent and one variable UDL, common to every span. Spans beyond the number chosen are ignored and may be left blank.
3. Read the Results block and the envelopes. The load arrangements are option (b) of UK NA to BS EN 1992-1-1 5.1.3(1)P: all spans and alternate spans loaded.

Scope and limitations

Prismatic member (one EI for all spans) on knife-edge supports that do not settle, simply supported at both ends (no cantilevers, no end fixity), uniform loads over every span. The three-moment equation is solved exactly. Moment redistribution (5.5) is not applied: the elastic moments are given. The loads are factored with the γ_G and γ_Q entered; one γ_G for every span, as the UK NA load arrangements require. Point loads, partial loads, settlement, torsion and the supporting structure are for the user. A negative reaction (uplift) is flagged; check equilibrium (EQU) and hold-down separately. The diagrams use 20 stations per span; the values in the calculation are exact.

Further reading and independent cross-check

- UK NA to BS EN 1992-1-1, NA.2 5.1.3(1)P: alternate spans and all spans loaded.
- The Concrete Centre, How to design concrete structures using Eurocode 2: Beams (moment coefficients for comparison).
- IStructE, Manual for the design of concrete building structures to Eurocode 2.

NA Engineering is not affiliated with The Concrete Centre or CIRIA; their publications are referenced for information only.

About NA Engineering

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Revision history

v1.0	29 Oct 2026 · First issue
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Project
Element
Date

Job no.
Made by
Checked

Inputs · spans and loads

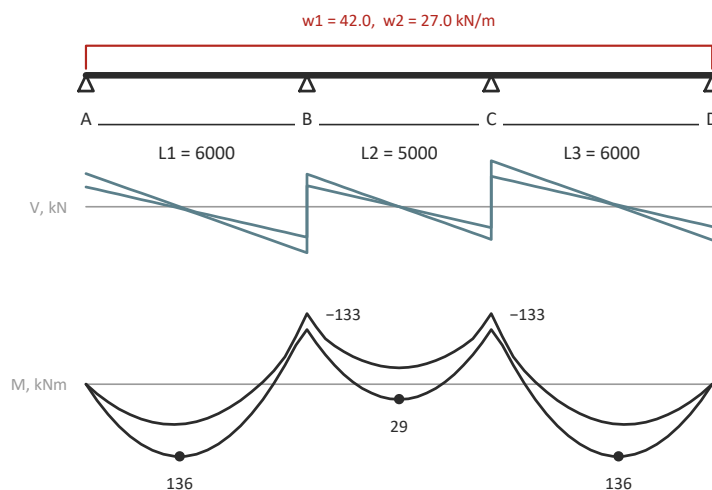
Characteristic values

Number of spans	n	3	
Span 1, centres of supports	L_1	6000	mm
Span 2, centres of supports	L_2	5000	mm
Span 3, centres of supports (used when $n \geq 3$)	L_3	6000	mm
Span 4, centres of supports (used when $n \geq 4$)	L_4	5000	mm
Span 5, centres of supports (used when $n \geq 5$)	L_5	6000	mm
UDL, permanent (include the self weight)	g_k	20.00	kN/m
UDL, variable	q_k	10.00	kN/m
EN 1990 A1.2(B) Partial factor, permanent	γ_G	1.35	
EN 1990 A1.2(B) Partial factor, variable	γ_Q	1.50	
Inputs valid and consistent			OK

Results

Largest sagging moment (span)	$M_{Ed,span}$	135.8	kNm
Largest hogging moment (support)	$M_{Ed,sup}$	132.6	kNm
Largest shear force (at a support)	$V_{Ed,max}$	148.1	kN
Largest reaction	R_{max}	253.1	kN
Smallest reaction	R_{min}	63.9	kN
			OK

Your beam, to scale · envelopes of the three load cases: shear force (blue) and bending moment (dark, sagging below)



Calculation

(6.10)	Design load, loaded span $\gamma_G g_k + \gamma_Q q_k$	w_1	42.00	kN/m
UK NA 5.1.3	Design load, unloaded span $\gamma_G g_k$	w_2	27.00	kN/m

Load cases (UK NA 5.1.3(1)P): 1 every span carries w_1 ; 2 odd spans w_1 , even spans w_2 ; 3 even spans w_1 , odd spans w_2 . Support moments from the three-moment equation $M_j - 1 L_j + 2 M_j (L_j + L_{j+1}) + M_{j+1} L_{j+1} = -(w_j L_j^3 + w_{j+1} L_{j+1}^3) / 4$, $M = 0$ at the end supports. The envelope is the worst of the three cases at every point.

Moments are signed: + sagging (tension at the bottom), – hogging.

5.4	Moment at support B, most negative of the cases	M_B	-132.6	kNm	
5.4	Moment at support C, most negative of the cases	M_C	-132.6	kNm	
5.4	Moment at support D, most negative of the cases	M_D	–	kNm	
5.4	Moment at support E, most negative of the cases	M_E	–	kNm	
5.4	Largest moment in span 1, worst of the cases	M_1	135.8	kNm	at 2.54 m
5.4	Largest moment in span 2, worst of the cases	M_2	28.6	kNm	at 2.50 m
5.4	Largest moment in span 3, worst of the cases	M_3	135.8	kNm	at 3.46 m
5.4	Largest moment in span 4, worst of the cases	M_4	–	kNm	
5.4	Largest moment in span 5, worst of the cases	M_5	–	kNm	
	Largest shear at support A	V_A	106.8	kN	
	Largest shear at support B	V_B	148.1	kN	
	Largest shear at support C	V_C	148.1	kN	
	Largest shear at support D	V_D	106.8	kN	
	Largest shear at support E	V_E	–	kN	
	Largest shear at support F	V_F	–	kN	
	Reaction at support A (max / min)	R_A	106.8 / 63.9	kN	
	Reaction at support B (max / min)	R_B	253.1 / 203.1	kN	
	Reaction at support C (max / min)	R_C	253.1 / 203.1	kN	
	Reaction at support D (max / min)	R_D	106.8 / 63.9	kN	
	Reaction at support E (max / min)	R_E	–	kN	
	Reaction at support F (max / min)	R_F	–	kN	
	Largest sagging moment (0: none)	M_{span}	135.77	kNm	
	Largest hogging moment, as a magnitude (0: none)	M_{sup}	132.61	kNm	
	Largest shear	V_{max}	148.10	kN	
	Largest reaction	R_{max}	253.10	kN	
	Smallest reaction	R_{min}	63.90	kN	

Elastic moments, no redistribution. Redistribution (5.5) has to be applied to each load case on its own, with the shears and reactions recalculated and the envelope formed again; 5.5(4) also limits the spans (adjacent spans within 0.5 to 2 times each other) and needs the x_u / d check. It is not done here.

Shears are at the support centrelines. 6.2.1(8): for a member under a mainly uniform load the design shear need not be checked closer than d to the support face; any shear reinforcement required must be continued to the support, and V_{Ed} at the face must not exceed $V_{Rd,max}$. Anchor the bottom bars at the supports separately (9.2.1.4).

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