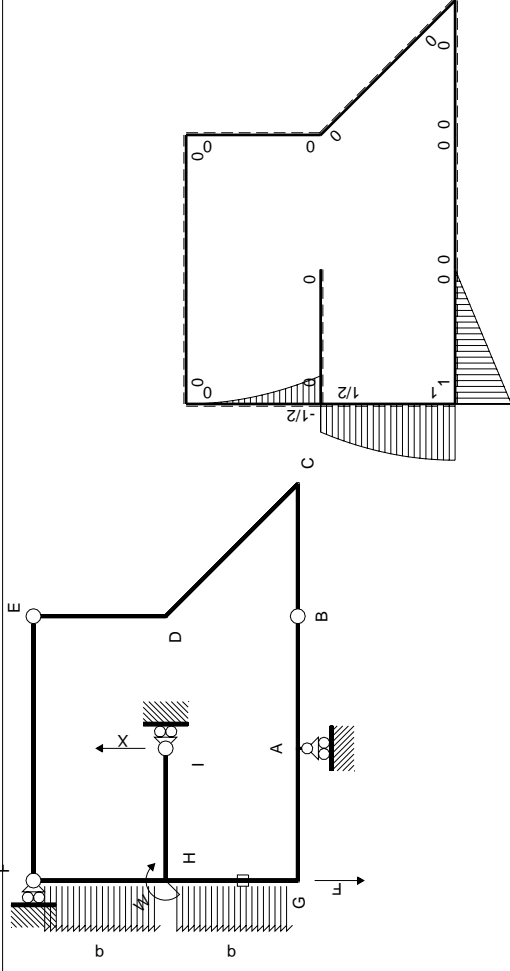
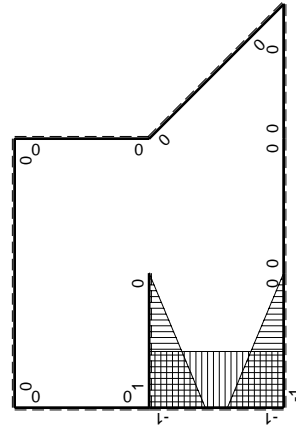


$\left[\begin{matrix} \oplus \\ \ominus \end{matrix} \right] F_b$



Schema di calcolo iperstatico

(\oplus) M_o flessione da carichi assegnati



(\oplus) M_x flessione da iperstatica $X=1$

Quadro contributi PLV per iperstatica $X=V_1$

\rightarrow	$M_x(x)$	$M_o(x)$	$M_x M_o$	$M_x M_x$	$\int M_x M_o / EJ dx$	$\int M_x M_x / EJ dx$
AB b	0	0	0	0	0	0
BA b	0	0	0	0	0	0
BC b	0	0	0	0	0	0
CB b	0	0	0	0	0	0
CD $\sqrt{2}b$	0	0	0	0	0	0
DE b	0	0	0	0	0	0
ED b	0	0	0	0	0	0
EF 2b	0	0	0	0	0	0
FE 2b	0	0	0	0	0	0
GA b	$-b+x$	$Fb-Fx$	$-Fb^2+2Fbx-Fx^2$	$b^2-2bx+x^2$	$-1/3Fb^3/EJ$	$1/3Xb^3/EJ$
AG b	x	$-Fx$	$-Fx^2$	x^2		
FH b	0	$-1/2qx^2$	0	0	0	0
HF b	0	$1/2Fb-Fx+1/2qx^2$	0	0	0	0
HI b	$b-x$	0	0	$b^2-2bx+x^2$	0	$1/3Xb^3/EJ$
IH b	$-x$	0	0	x^2	0	$1/3Xb^3/EJ$
HG b	$-b$	$1/2Fb+Fx-1/2qx^2$	$-1/2Fb^2-Fbx+1/2FX^2$	b^2	$-5/6Fb^3/EJ$	Xb^3/EJ
GH b	b	$-Fb+1/2qx^2$	$-Fb^2+1/2FX^2$	b^2		
HG	elongazione asta $N_{1HG} = N_{HG} - HG$					
A	molla nodo $-V_{1A}(V_{oA} + XV_{1A})/k_A$					
	totali					
	iperstatica $X=V_1$					
	29/23F					

Sviluppi di calcolo iperstatica

$$L_{GA}^{xx} = \int_0^b (1 - 2x/b + x^2/b^2) b^2 1/EJ dx = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (b - b + 1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{AG}^{xx} = \int_0^b (x^2/b^2) b^2 1/EJ dx = \left[1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{HI}^{xx} = \int_0^b (1 - 2x/b + x^2/b^2) b^2 1/EJ dx = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (b - b + 1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{IH}^{xx} = \int_0^b (x^2/b^2) b^2 1/EJ dx = \left[1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{HG}^{xx} = \int_0^b (1) b^2 1/EJ dx = \left[x \right]_0^b b^2 1/EJ$$

$$= (b) b^2 1/EJ = b^3/EJ$$

$$L_{GH}^{xx} = \int_0^b (1) b^2 1/EJ dx = \left[x \right]_0^b b^2 1/EJ$$

$$= (b) b^2 1/EJ = b^3/EJ$$

$$L_{GA}^{xo} = \int_0^b (-1 + 2x/b - x^2/b^2) Fb^2 1/EJ dx = \left[-x + x^2/b - 1/3 x^3/b^2 \right]_0^b Fb^2 1/EJ$$

$$= (-b + b - 1/3 b) Fb^2 1/EJ = -1/3 Fb^3/EJ$$

$$L_{AG}^{xo} = \int_0^b (-x^2/b^2) Fb^2 1/EJ dx = \left[-1/3 x^3/b^2 \right]_0^b Fb^2 1/EJ$$

$$= (-1/3 b) Fb^2 1/EJ = -1/3 Fb^3/EJ$$

$$L_{HG}^{xo} = \int_0^b (-1/2 - x/b + 1/2 x^2/b^2) Fb^2 1/EJ dx - 1 \cdot (-1) \cdot (-1) Fb^3/EJ$$

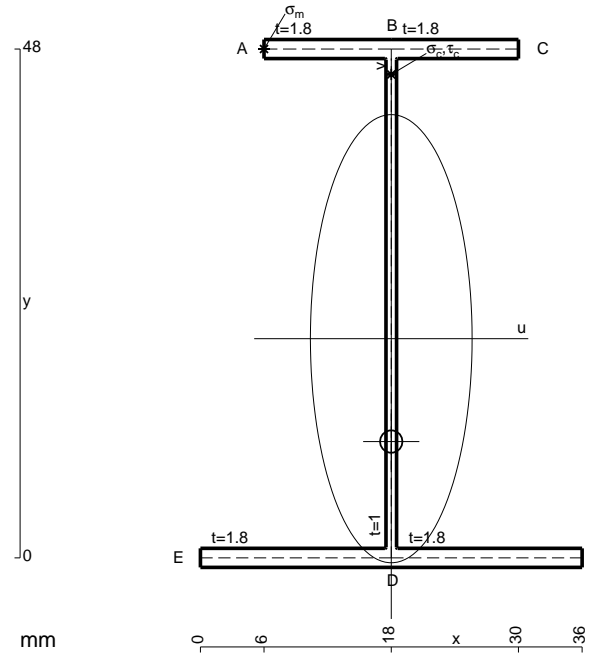
$$= \left[-1/2 x - 1/2 x^2/b + 1/6 x^3/b^2 \right]_0^b Fb^2 1/EJ - 1 \cdot (-1) \cdot (-1) Fb^3/EJ$$

$$= (-1/2 b - 1/2 b + 1/6 b) Fb^2 1/EJ - 1 \cdot (-1) \cdot (-1) Fb^3/EJ = -11/6 Fb^3/EJ$$

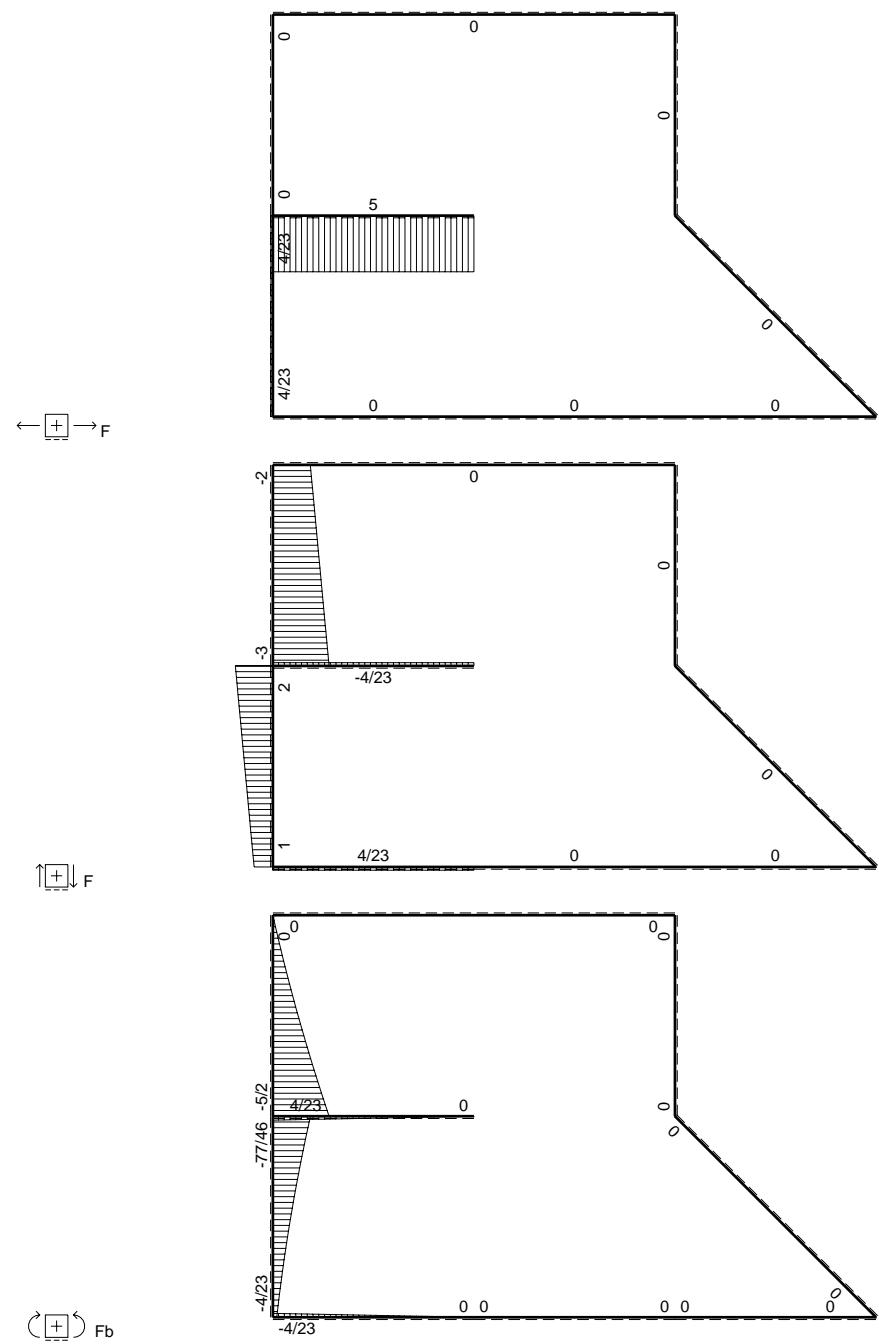
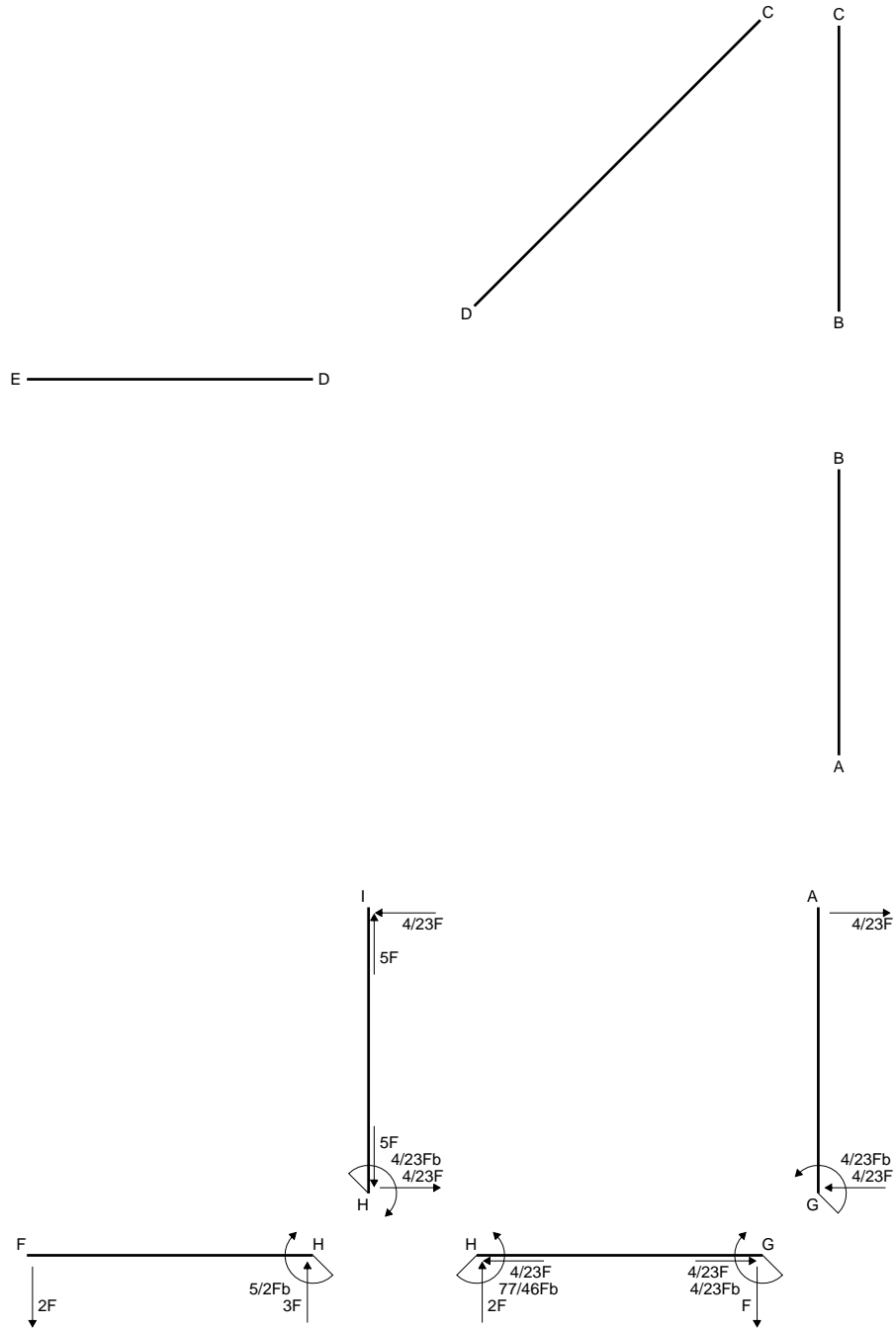
$$L_{GH}^{xo} = \int_0^b (-1 + 1/2 x^2/b^2) Fb^2 1/EJ dx - 1 \cdot (-1) \cdot (-1) Fb^3/EJ$$

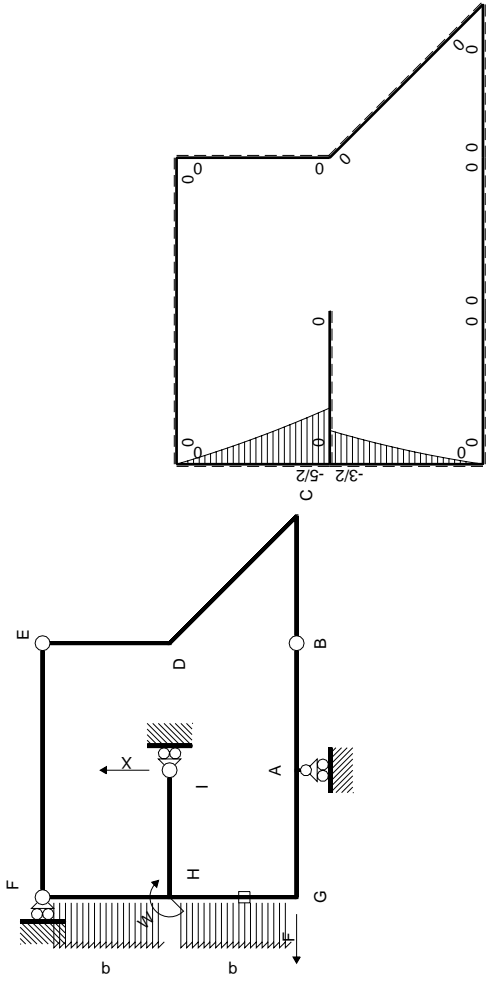
$$= \left[-x + 1/6 x^3/b^2 \right]_0^b Fb^2 1/EJ - 1 \cdot (-1) \cdot (-1) Fb^3/EJ$$

$$= (-b + 1/6 b) Fb^2 1/EJ - 1 \cdot (-1) \cdot (-1) Fb^3/EJ = -11/6 Fb^3/EJ$$



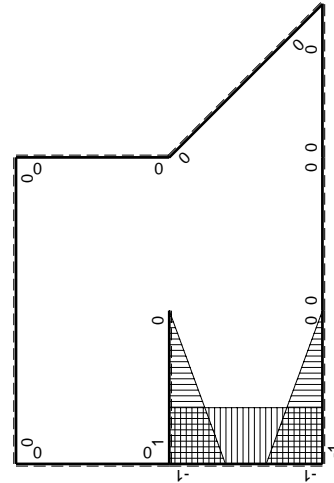
- A = 156. mm²
- J_u = 69701. mm⁴
- J_v = 9072. mm⁴
- J_i = 132.6 mm⁴
- y_o = -9.705 mm
- y_g = 20.68 mm
- T_y = -1590. N
- M_x = -612150. Nmm
- x_m = 6. mm
- y_m = 48. mm
- u_m = -12. mm
- v_m = 27.32 mm
- σ_m = -Mv/J_u = 240. N/mm²
- x_c = 18. mm
- y_c = 48. mm
- v_c = 27.32 mm
- σ_c = -Mv/J_u = 240. N/mm²
- τ_c = TS'/tJ_u = 26.93 N/mm²
- τ_g = TS'/tJ_u = 26.93 N/mm²
- t_c = 1590. mm
- σ_o = √(σ²+3τ²) = 244.5 N/mm²





Schema di calcolo iperstatico

M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

Quadro contribuiti PLV per iperstatica $X=V_1$

\rightarrow	$M_x(x)$	$M_0(x)$	$M_x M_0$	$M_x^2 M_x$	$\int M_x M_0 / EJ dx$	$\int X M_x^2 M_x / EJ dx$
AB b	0	0	0	0	0	0
BA b	0	0	0	0	0	0
BC b	0	0	0	0	0	0
CB b	0	0	0	0	0	0
CD $\sqrt{2}b$	0	0	0	0	0	0
DE b	0	0	0	0	0	0
ED b	0	0	0	0	0	0
EF 2b	0	0	0	0	0	0
FE 2b	0	0	0	0	0	0
GA b	-b+x	0	0	$b^2-2bx+x^2$	0	$1/3Xb^3/EJ$
AG b	x	0	0	x^2	0	0
FH b	0	$-2Fx-1/2qx^2$	0	0	0	0
HF b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0
HI b	b-x	0	0	$b^2-2bx+x^2$	0	$1/3Xb^3/EJ$
IH b	-x	0	0	x^2	0	0
HG b	-b	$-3/2Fb+2Fx-1/2qx^2$	$3/2Fb^2-2Fbx+1/2Fx^2$	b^2	$2/3Fb^3/EJ$	Xb^3/EJ
GH b	b	$Fx+1/2qx^2$	$Fbx+1/2Fx^2$	b^2	$2/3Fb^3/EJ$	Xb^3/EJ
HG	elongazione asta $N_{1HG}^{HG} \pm HG$					
A	molla nodo $-V_{1A}(V_{0A} + XV_{1A})/k_A$					
	totali					
	iperstatica $X=V_1$					
	4/23F					

Sviluppi di calcolo iperstatica

$$L_{GA}^{xx} = \int_0^b (1 - 2x/b + x^2/b^2) b^2 1/EJ dx = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (b - b + 1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{AG}^{xx} = \int_0^b (x^2/b^2) b^2 1/EJ dx = \left[1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{HI}^{xx} = \int_0^b (1 - 2x/b + x^2/b^2) b^2 1/EJ dx = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (b - b + 1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{IH}^{xx} = \int_0^b (x^2/b^2) b^2 1/EJ dx = \left[1/3 x^3/b^2 \right]_0^b b^2 1/EJ$$

$$= (1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{HG}^{xx} = \int_0^b (1) b^2 1/EJ dx = \left[x \right]_0^b b^2 1/EJ$$

$$= (b) b^2 1/EJ = b^3/EJ$$

$$L_{GH}^{xx} = \int_0^b (1) b^2 1/EJ dx = \left[x \right]_0^b b^2 1/EJ$$

$$= (b) b^2 1/EJ = b^3/EJ$$

$$L_{HG}^{x_0} = \int_0^b (3/2 - 2x/b + 1/2 x^2/b^2) Fb^2 1/EJ dx - 1 (-1) (-1) Fb^3/EJ$$

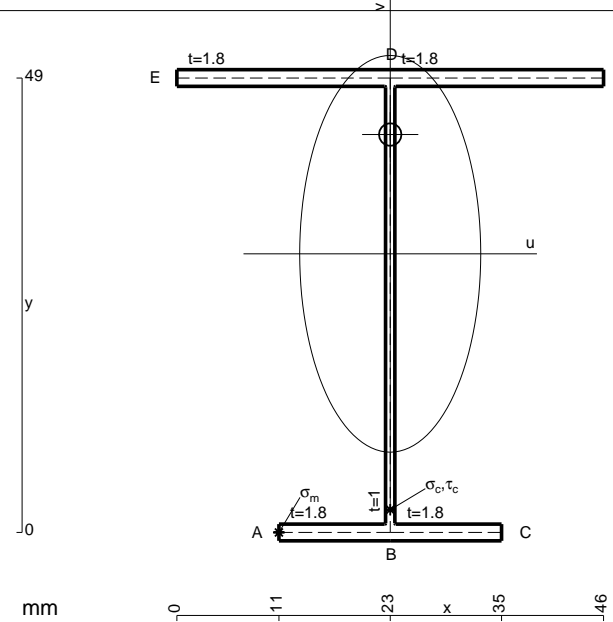
$$= \left[3/2 x - x^2/b + 1/6 x^3/b^2 \right]_0^b Fb^2 1/EJ - 1 (-1) (-1) Fb^3/EJ$$

$$= (3/2 b - b + 1/6 b) Fb^2 1/EJ - 1 (-1) (-1) Fb^3/EJ = -1/3 Fb^3/EJ$$

$$L_{GH}^{x_0} = \int_0^b (x/b + 1/2 x^2/b^2) Fb^2 1/EJ dx - 1 (-1) (-1) Fb^3/EJ$$

$$= \left[1/2 x^2/b + 1/6 x^3/b^2 \right]_0^b Fb^2 1/EJ - 1 (-1) (-1) Fb^3/EJ$$

$$= (1/2 b + 1/6 b) Fb^2 1/EJ - 1 (-1) (-1) Fb^3/EJ = -1/3 Fb^3/EJ$$



- A = 175. mm²
- J_u = 80057. mm⁴
- J_v = 16674. mm⁴
- J_i = 152.4 mm⁴
- y_o = 12.86 mm
- y_g = 30.04 mm
- T_y = -990. N
- M_x = -552750. Nmm
- x_m = 11. mm
- u_m = -12. mm
- v_m = -30.04 mm
- σ_m = -Mv/J_u = -207.4 N/mm²
- x_c = 23. mm
- v_c = -30.04 mm
- σ_c = -Mv/J_u = -207.4 N/mm²
- τ_c = TS'/tJ_u = 16.05 N/mm²
- τ_g = TS'/tJ_u = 16.05 N/mm²
- t_c = 330. mm
- σ_o = √σ²+3τ² = 209.3 N/mm²

