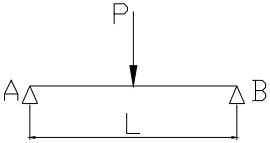
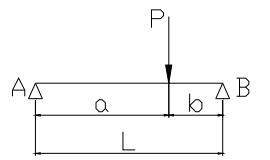
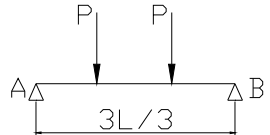
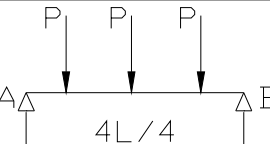
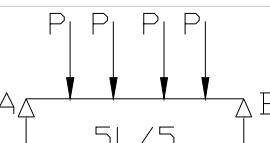
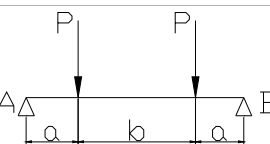
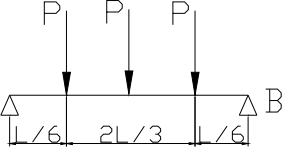
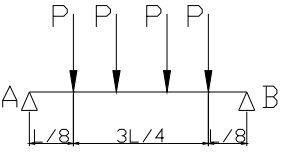
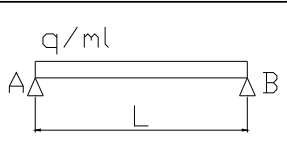
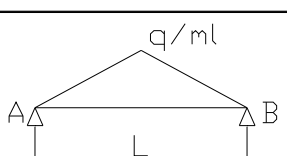
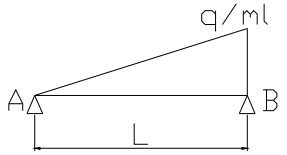
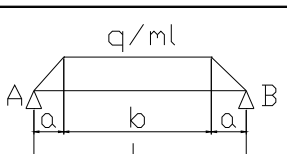
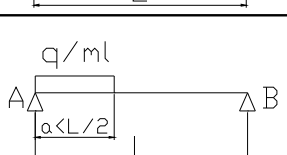
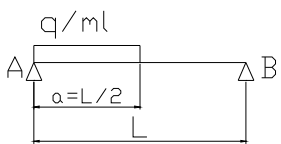
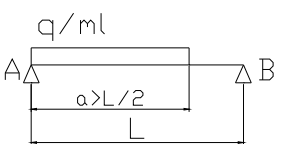


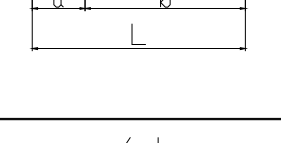
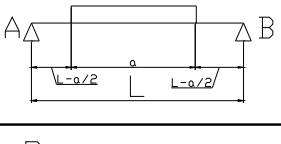
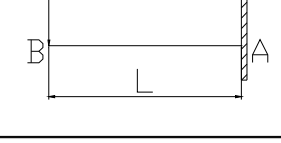
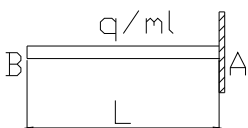
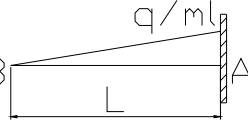



FORMULAIRE DES POUTRES

Cas de charges	Réactions aux appuis	Moment maximum	flèche L en m H en mm σ en DaN/mm ²	Flèche à l/2	Rotation aux appuis
	$\frac{P}{2}$	$M_{L/2} = \frac{PL}{4}$	$0.79 \frac{\sigma L^2}{h}$	$\frac{PL^3}{48EI}$	$\theta_A = -\frac{PL^2}{16EI}$ $\theta_B = +\frac{PL^2}{16EI}$
	$R_A = \frac{Pb}{L}$ $R_B = \frac{Pa}{L}$	$M_0 = M_a = \frac{Pab}{L}$ $M_{L/2} = \frac{Pb}{2}$ (a > b)		$f_{l/2} = \frac{-Pb}{48EI} (3L^2 - 4b^2)$ $f_a = \frac{-Pa^2b^2}{3EIL}$ $f_{max} = \frac{-Pb}{27EIL} \sqrt{3(L^2 - b^2)^3}$	$\theta_A = \frac{Pb}{6EIL} (b^2 - L^2)$ $\theta_B = \frac{Pa}{6EIL} (L^2 - a^2)$
	P	$M_{L/2} = \frac{PL}{3}$	$1.01 \frac{\sigma L^2}{h}$	$\frac{23PL^3}{648EI}$	
	$\frac{3P}{2}$	$M_{L/2} = \frac{PL}{2}$	$0.84 \frac{\sigma L^2}{h}$	$\frac{19PL^3}{384EI}$	
	$2P$	$M_{L/2} = \frac{3PL}{5}$	$1.0 \frac{\sigma L^2}{h}$	$\frac{63PL^3}{1000EI}$	
	P	$M_{L/2} = Pa$	$\frac{\sigma L^2}{h}$	$\frac{Pa(3L^2 - 4a^2)}{24EI}$	

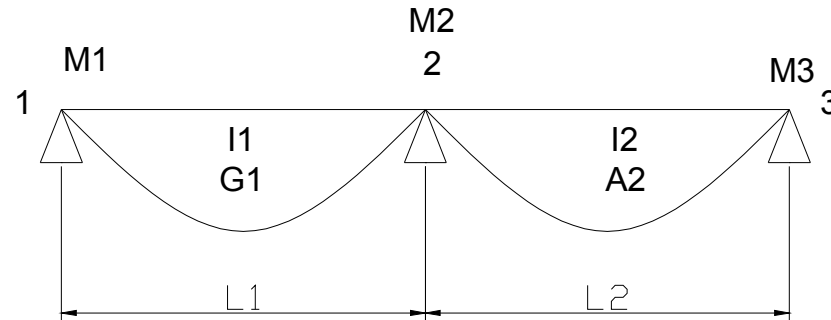
	$\frac{3P}{2}$	$M_{L/2} = \frac{5PL}{12}$	$0.94 \frac{\sigma L^2}{h}$	$\frac{53PL^3}{1296EI}$	
	$2P$	$M_{L/2} = \frac{PL}{2}$	$0.94 \frac{\sigma L^2}{h}$	$\frac{41PL^3}{768EI}$	
	$\frac{qL}{2}$	$\frac{qL^2}{8}$	$0.99 \frac{\sigma L^2}{h}$	$\frac{5qL^4}{384EI}$	$\theta_{A^-} = -\frac{qL^3}{24EI}$ $\theta_{B^+} = +\frac{qL^3}{24EI}$
	$\frac{qL}{4}$	$\frac{qL^2}{12}$	$0.95 \frac{\sigma L^2}{h}$	$\frac{qL^4}{120EI}$	$\theta_{A^-} = -\frac{5qL^3}{192EI}$ $\theta_{B^+} = +\frac{5qL^3}{192EI}$
Cas de charges multiples			$\approx \frac{\sigma L^2}{h}$		
	$R_A = \frac{qL}{6}$ $R_B = \frac{qL}{3}$	$M_0 = \frac{qL^2\sqrt{3}}{27}$ $M_{L/2} = \frac{qL^2}{16}$		$f_{L/2} = -\frac{5qL^4}{768EI}$ $f_{\max} = -\frac{5qL^4}{765EI}$	$\theta_{A^-} = -\frac{7qL^3}{360EI}$ $\theta_{B^+} = +\frac{8qL^3}{360EI}$
	$R_A = \frac{q}{2}(a+b)$ $R_B = \frac{q}{2}(a+b)$	$M_0 = M_{L/2} = \frac{q}{24}(3L^2 - 4a^2)$		$f_{\max} = f_{L/2} = -\frac{q}{EI} \left(\frac{a^2L^2}{48} + \frac{a^4}{120} - \frac{5L^4}{384} \right)$	$\theta_{A^+} = +\frac{q}{24EI}(2a^2L - a^3 - L^3)$ $\theta_{B^+} = +\frac{q}{24EI}(L^3 + a^3 - 2a^2L)$
	$R_A = \frac{qa}{L} \left(L - \frac{a}{2} \right)$	$M_x \Big _0^{L/2} = R_A x - \frac{qx^2}{2}$		$f_{L/2} = -\frac{qa^2}{96EI}(2a^2 - 3L^2)$	

				$f_{L/2} = -\frac{5qL^4}{768EI}$	
	$R_B = \frac{qa^2}{2L}$	$M_x \Big _{L/2} = RAx - \frac{qa}{2} \left(x - \frac{a}{2}\right)$		$f_{L/2} = -\frac{q}{48EI} \left[\frac{L^4}{16} + \left(a(2L-a) - \frac{L^2}{4}\right)^2 \right]$	
	$R_A = -\frac{M}{L}$ $R_B = +\frac{M}{L}$	$M_0 = M_A = M$ $M_B = 0$		$f_{L/2} = -\frac{ML^2}{16EI}$ $f_{\max} = -\frac{ML^2}{15.58EI}$	$\theta_A = -\frac{ML}{3EI}$ $\theta_B = +\frac{ML}{6EI}$
	$R_A = -\frac{M}{L}$ $R_B = +\frac{M}{L}$	$M_{aw} = -\frac{Ma}{L}$ $M_{ae} = +\frac{Mb}{L}$		$f_a = +\frac{Mab}{3EIL}(a-b)$ $f_{L/2} = +\frac{M}{16EI}(4a^2 - L^2)$	$\theta_A = +\frac{M}{EI} \left(a - \frac{L}{3} - \frac{a^2}{2L} \right)$ $\theta_B = -\frac{M}{EI} \left(\frac{L}{6} - \frac{a^2}{2L} \right)$
	$R_A = R_B = \frac{Pa}{2}$	$M_m = +\frac{Pa}{8}(2L-a)$		$f_{L/2} = \frac{Pa}{384EI}(8L^3 - 4a^2L + a^3)$	
	$R_A = P$	$M_A = -PL$		$f_B = -\frac{PL^3}{3EI}$	$\theta_B = +\frac{PL^2}{2EI}$
	$R_A = P$	$M_A = -Pb$		$f_B = -\frac{Pb^3}{3EI}$ $f_C = -\frac{Pb^2}{6EI}(2L+a)$	$\theta_B = \theta_C = +\frac{Pb^2}{2EI}$

	$R_A = qL$	$M_A = -\frac{qL^2}{2}$		$f_B = -\frac{qL^4}{8EI}$	$\theta_B = +\frac{qL^3}{6EI}$
	$R_A = \frac{qL}{2}$	$M_A = -\frac{qL^2}{6}$		$f_B = -\frac{qL^4}{30EI}$	$\theta_B = +\frac{qL^3}{34EI}$
	$R_A = 0$	$M_A = M$		$f_B = -\frac{ML^2}{2EI}$	$\theta_B = \frac{ML}{EI}$

METHODE DE CLAPEYRON

Applicable à une poutre de module d'élasticité longitudinal constant.



$$\frac{M_1 L_1}{I_1} + 2M_2 \left(\frac{L_1}{I_1} + \frac{L_2}{I_2} \right) + \frac{M_3 L_2}{I_2} = -6 \left(\sum \frac{A_1 G_1}{L_1 I_1} + \sum \frac{A_2 G_2}{L_2 I_2} \right)$$

M1, M2, M3 moments fléchissant aux appuis

L1, L2 longueurs des travées

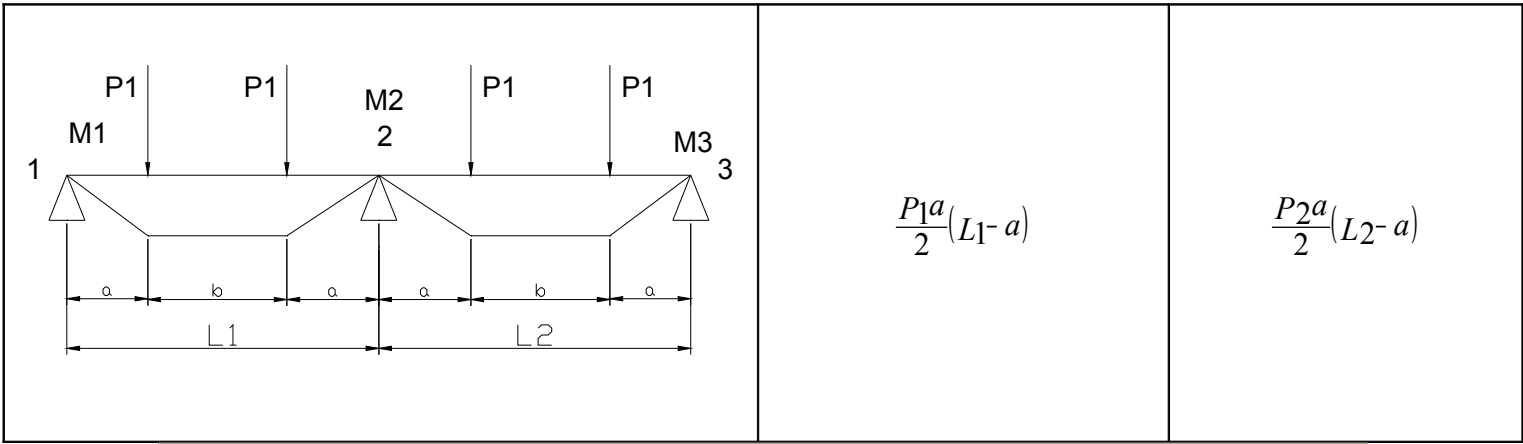
I1, I2 moments d'inerties des travées

A1, A2 aires des moments fléchissant

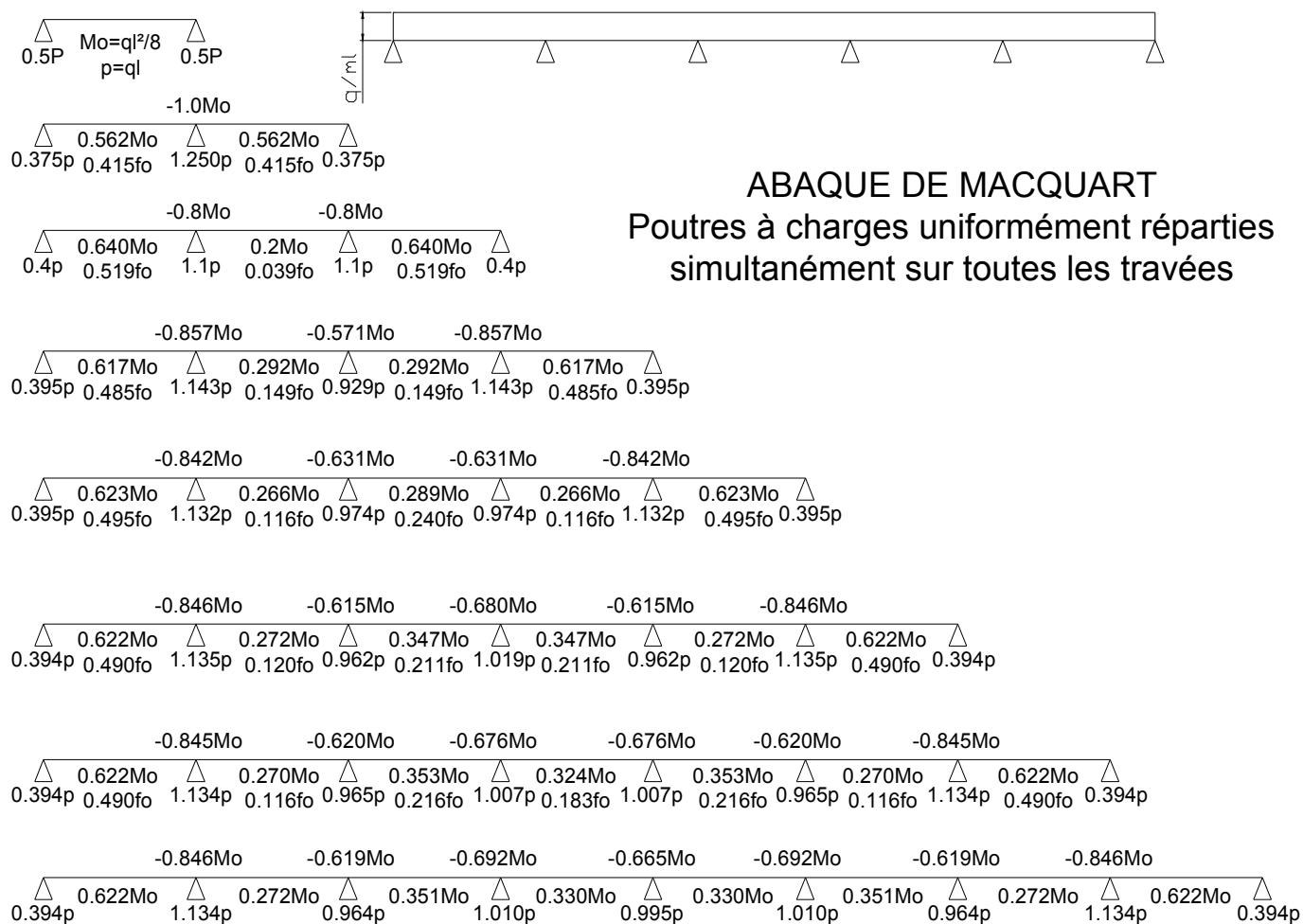
G1, G2 positions des centres de gravité des moments fléchissant

	A1G1/L1	A2G2/L2
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	$\frac{q_1 L_1^3}{24}$	$\frac{q_2 L_2^3}{24}$
	$\frac{P_1 L_1^2}{16}$	$\frac{P_2 L_2^2}{16}$
	$\frac{P_1 a b}{6 L_1} (L_1 + a)$	$\frac{P_2 a b}{6 L_2} (L_2 + b)$



ABAQUE DE MACQUART



dans cette abaque on calcule le moment maximum M_0 , les réactions et la flèche maximum de la travée simple considérée comme isostatique, puis on applique les coefficients donnés ci-dessus pour trouver les différents moments, flèches et réactions des poutres hyperstatiques

nota : le chargement est considéré comme une CUR uniformément répartie sur toute la longueur.