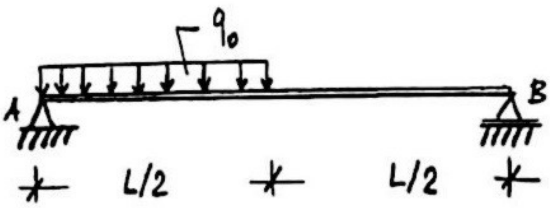
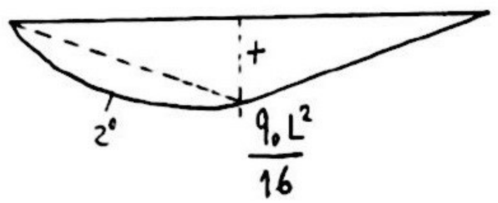


Şekildeki kirişte orta noktadaki çökme ve dönme değeri ile B mesnedindeki dönmeyi hesaplayınız.

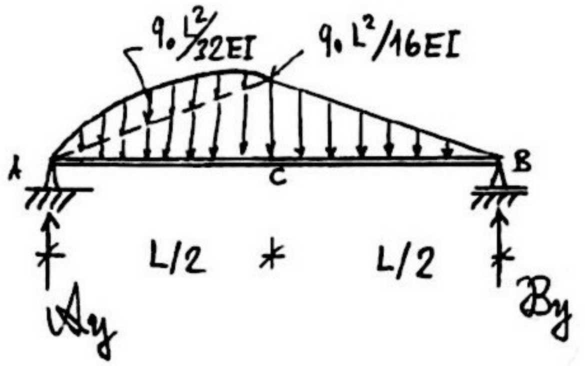


$$\circlearrowleft \Sigma M_A = 0 : \quad q_0 \frac{L}{2} \cdot \frac{L}{4} - B_y L = 0$$

$$B_y = q_0 L / 8$$

$$\uparrow \Sigma Y_i = 0 : \quad A_y + \frac{q_0 L}{8} - \frac{q_0 L}{2} = 0$$

$$A_y = 3 q_0 L / 8$$



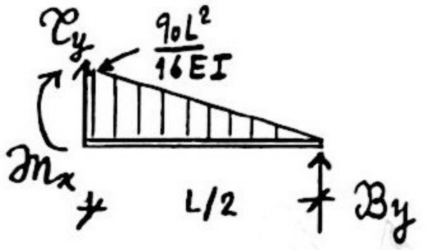
Eşlenik sistemde mesnet tepkileri

$\Sigma M_A = 0$

$$\mathfrak{B}_y \cdot L - \frac{1}{2} \cdot \frac{q_0 L^2}{16EI} \cdot L \cdot \frac{L}{2} - \frac{2}{3} \frac{q_0 L^2}{32EI} \frac{L}{2} \cdot \frac{L}{4} = 0$$

$$\mathfrak{B}_y = \frac{7}{384} \frac{q_0 L^3}{EI}$$

Eşlenik kirişi C noktasından ikiye ayırıp sağdaki parçayı göz önüne alalım.



$$\Sigma Y_i = 0 \rightarrow \mathcal{T}_c + \frac{7}{384} \frac{q_0 L^3}{EI} - \frac{1}{2} \frac{q_0 L^2}{16EI} \cdot \frac{L}{2} = 0$$

$$\mathcal{T}_c = \theta_c = -\frac{1}{384} \frac{q_0 L^3}{EI}$$

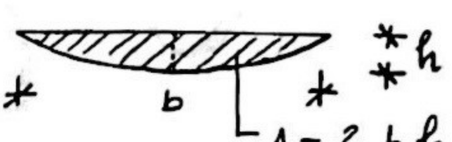
$$\Sigma M_c = 0 \rightarrow \mathfrak{M}_c - \frac{7}{384} \frac{q_0 L^3}{EI} \cdot \frac{L}{2} + \frac{1}{2} \frac{q_0 L^2}{16EI} \cdot \frac{L}{2} \cdot \frac{1}{3} \frac{L}{2} = 0$$

$$\mathfrak{M}_c = v_c = \frac{5}{768} \frac{q_0 L^4}{EI}$$

B mesnedindeki dönme miktarı

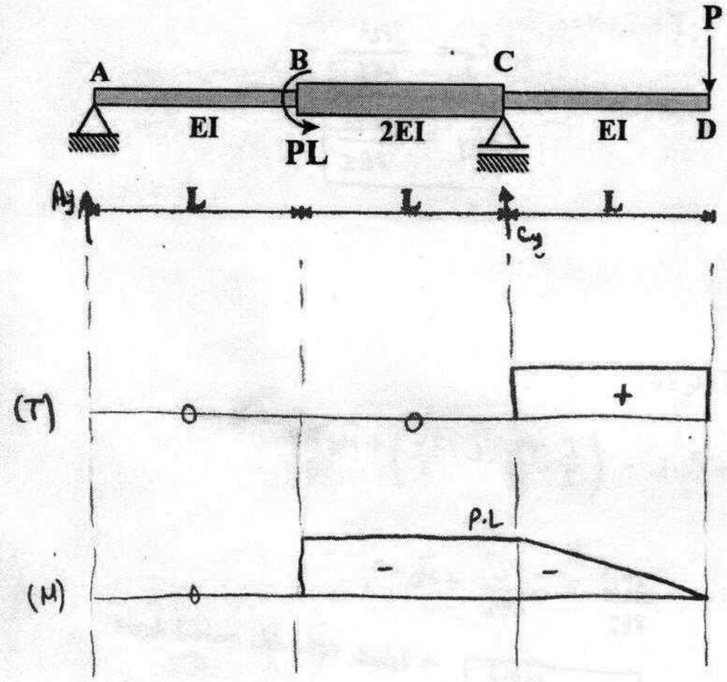
$$\mathcal{T}_B = \theta_B = -\mathfrak{B}_y = -\frac{7}{384} \frac{q_0 L^3}{EI}$$

Bilgi :



$A = \frac{2}{3} b h$

Soru



Şekilde yükleme hali ve boyutları verilmekte olan değişken kesitli çıkmalı kirişte D noktasındaki çökmeyi (v_D) **Mohr** yöntemiyle bulunuz.

$+\uparrow \sum F_y = 0$

$$A_y + C_y - P = 0 \qquad \boxed{A_y + C_y = P}$$

$\circlearrowleft + \sum M_A = 0$

$$2L \cdot C_y - 3L \cdot P + PL = 0$$

$$\boxed{C_y = P} \qquad \boxed{A_y = 0}$$

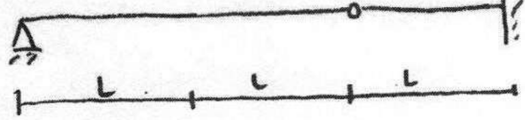
$$\left(\frac{1}{\rho}\right)_{AB} = \frac{M}{EI} = \boxed{0}$$

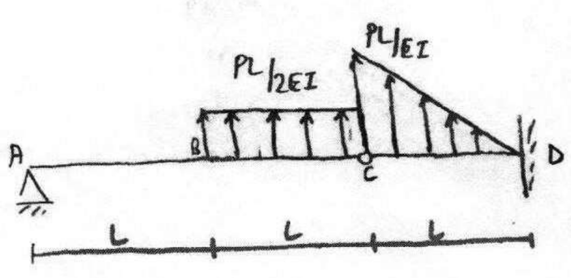
$$\left(\frac{1}{\rho}\right)_{BC} = \boxed{\frac{-P.L}{2EI}}$$

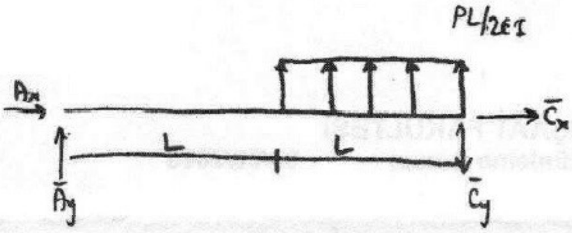
$$\left(\frac{1}{\rho}\right)_{CD} = \boxed{\frac{-P.L}{EI}}$$

Eğrilik eşlenik sisteme yayılı yük olarak yüklenir. Burada moment değeri negatif olduğu yerlerde yayılı yük yukarı doğrudur.

Eşlenik sistem:







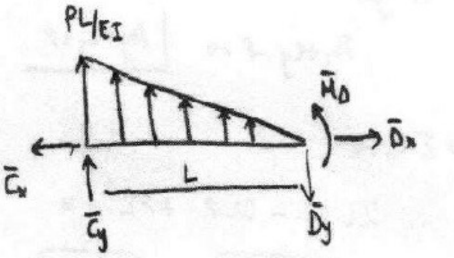
$\xrightarrow{+} \Sigma F_x = 0 \qquad A_x = 0 \qquad \boxed{\bar{C}_x = 0}$

$\circlearrowleft + \Sigma M_A = 0$

$$\left(\frac{PL}{2EI}\cdot L\right)\cdot\left(\frac{L}{2}+L\right) - 2L\bar{C}_y = 0$$

$$2L\bar{C}_y = \frac{3PL^3}{4EI}$$

$$\boxed{\bar{C}_y = \frac{3PL^2}{8EI}}$$



$\circlearrowleft + \Sigma M_C = 0$

$$-\bar{C}_y\cdot L - \left(\frac{1}{2}\cdot\frac{PL}{EI}\cdot L\cdot\frac{2L}{3}\right) + \bar{M}_D = 0$$

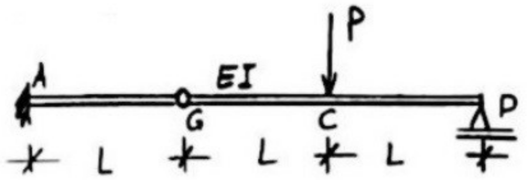
$$-\frac{3PL^3}{8EI} - \frac{PL^3}{3EI} + \bar{M}_D = 0$$

$$\boxed{\bar{M}_D = \frac{17PL^3}{24EI}}$$ → Eşlenik sistemdeki moment değeri

Esas sistemde çökme değerdir.

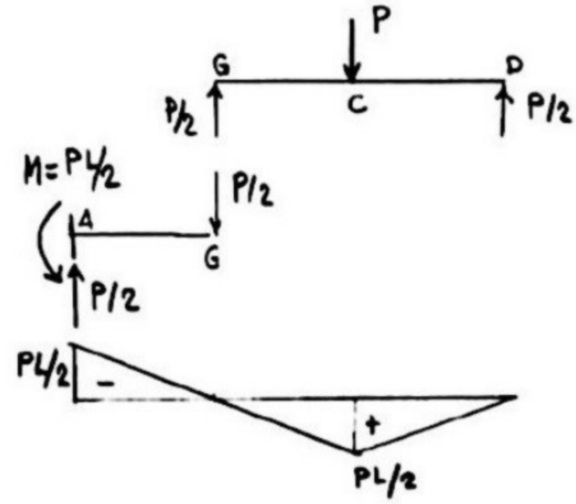
$$\shortparallel$$

$$\boxed{V_D = \frac{17PL^3}{24EI}}$$ ✓

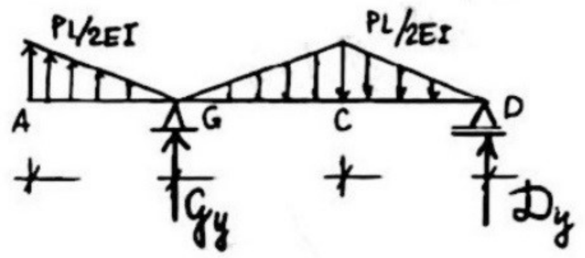


Şekilde yükleme durumu görülmekte olan sabit mesnetli gerber kirişinde C noktasındaki çökme ile D noktasındaki dönmeyi Mohr yöntemi ile bulunuz.

Çözüm:

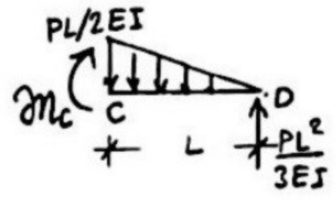


Eşlenik sistem



$$\Sigma M_G=0 \rightarrow 2\left(\frac{PL^2}{4EI}\cdot\frac{2L}{3}\right)+\frac{PL^2}{4EI}\left(L+\frac{L}{3}\right)-2L\,D_y=0$$

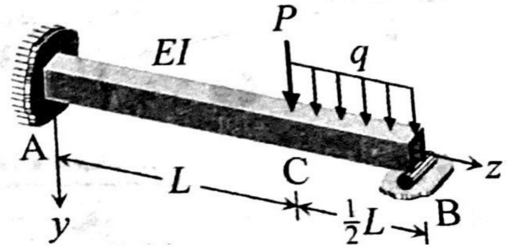
$$D_y=\frac{PL^2}{3EI} \qquad \theta_D=\tau_D=-D_y=-\frac{PL^2}{3EI}$$

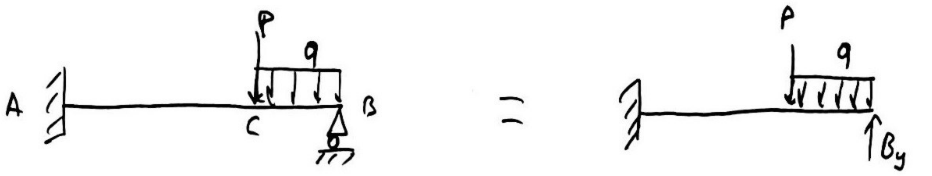


$$\Sigma M_c=0 \qquad M_c-\frac{PL^3}{3EI}+\frac{PL^2}{4EI}\cdot\frac{L}{3}=0 \qquad M_c=\frac{PL^3}{4EI}$$

$$v_c=M_c=\frac{PL^3}{4EI}$$

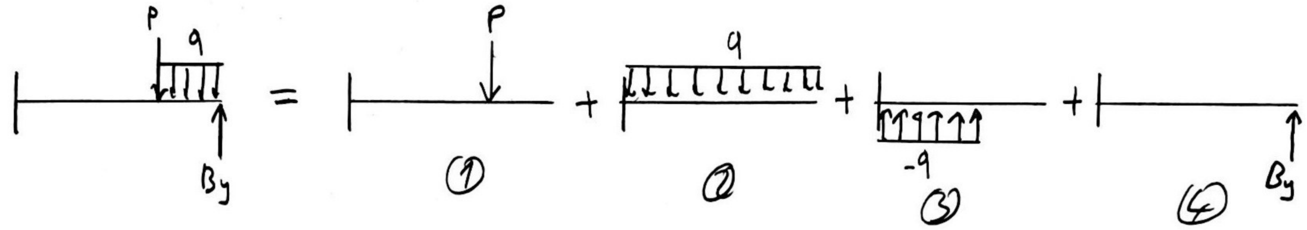
kirişte bağ kuvvetlerini süperpozisyon ilkesini kullanarak hesaplayınız. rijitlik EI, yükler arasındaki ilişki $P = qL$.





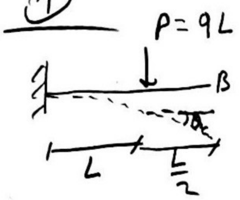
Statika belirli konsol kiriş

Statikçe belirli konsol kiriş için süperpozisyon ilkesi



Süperpozisyon yöntemi $\rightarrow$ $v_B = v_{1B} + v_{2B} + v_{3B} + v_{4B} = 0$ olmalı

1

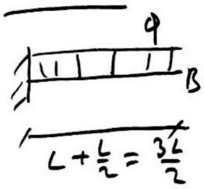


$$v_{1B} = \frac{PL^3}{3EI} + \theta_{1C}\frac{L}{2} \quad ; \quad \theta_{1C} = \frac{PL^2}{2EI}$$

biliniyor (elde edilmişti)

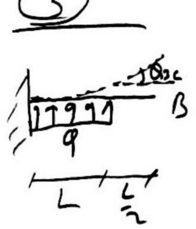
$$v_{1B} = \frac{qL^4}{3EI} + \frac{qL^4}{4EI} = \frac{7qL^4}{12EI}$$

2



$$v_{2B} = \frac{q\left(\frac{3L}{2}\right)^4}{8EI} = \frac{81qL^4}{128EI}$$

3

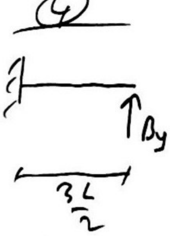


$$v_{3C} = \frac{-qL^4}{8EI} \quad ; \quad \theta_{3C} = \frac{-qL^3}{6EI}$$

(biliniyor)

$$v_{3B} = v_{3C} + \theta_{3C}\cdot\frac{L}{2} = \frac{-qL^4}{8EI} - \frac{qL^4}{12EI} = -\frac{5qL^4}{24EI}$$

4



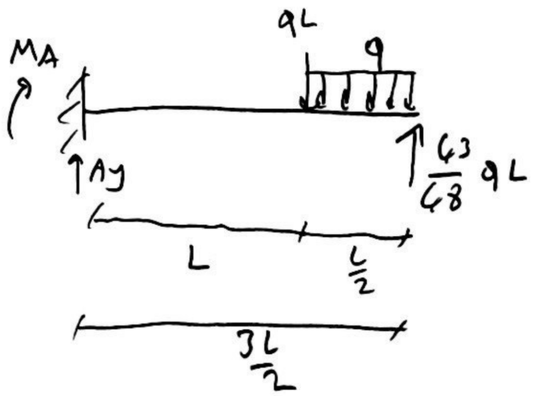
$$v_{4B} = -\frac{B_y\left(\frac{3}{2}L\right)^3}{3EI} = -\frac{9B_yL^3}{8EI}$$

$$v_B = v_{B1} + v_{B2} + v_{B3} + v_{B4} = \frac{7qL^4}{12EI} + \frac{81qL^4}{128EI} - \frac{5qL^4}{24EI} - \frac{9B_yL^3}{8EI}$$

$$v_B = \frac{129qL^4}{128EI} - \frac{9B_yL^3}{8EI}$$

B_y dis yük olarak alinmissa da bu kuvvet B noktasinda yer degistirmeyi sinirlayan mesnet reaksiyonudur. Dolayisiyla $v_B = 0$

$$\frac{129qL^4}{128\cancel{EI}} - \frac{9B_yL^3}{8\cancel{EI}} = 0 \Rightarrow B_y = \frac{43}{48}qL \quad (\uparrow)$$

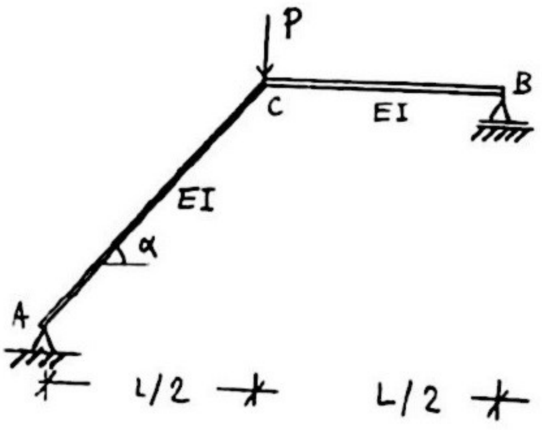


$$\Sigma M_A = 0 \Rightarrow M_A = \frac{43}{48}qL\cdot\frac{3L}{2} - \left(\frac{qL}{2}\right)\cdot\left(L+\frac{L}{4}\right) - (qL)\cdot L$$

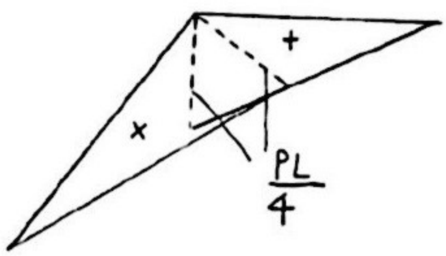
$$M_A = -\frac{9}{32}qL^2$$

$$\Sigma F_y = 0 \Rightarrow A_y + \frac{43}{48}qL = \frac{qL}{2} + qL$$

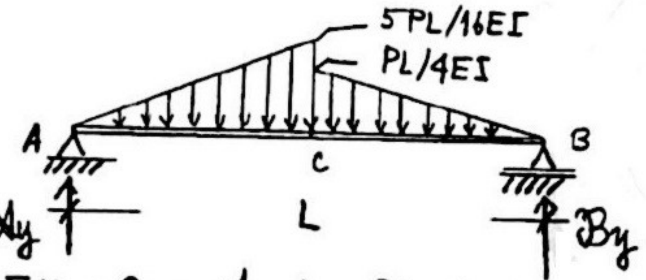
$$A_y = \frac{29}{48}qL \quad (\uparrow)$$



Şekildeki sistemde C noktasındaki çökme ve dönme değerini hesaplayınız. $\tan\alpha = 3/4$

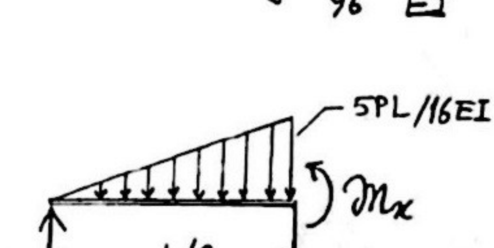


Bu tür eğik kirişlerde moment diyagramı $EI\cos\alpha$ 'ya bölünerek eşlenik kirişe yük olarak yüklenir.



$$\Sigma M_B = 0 \quad : \quad \mathcal{A}_y L - \frac{PL}{4EI}\cdot\frac{L}{2}\cdot\frac{1}{2}\cdot\frac{2}{3}\frac{L}{2} - \frac{5}{16}\frac{PL}{EI}\cdot\frac{L}{2}\cdot\frac{1}{2}\left(\frac{L}{2}+\frac{1}{3}\frac{L}{2}\right) = 0$$

$$\mathcal{A}_y = \frac{7}{96}\frac{PL^2}{EI}$$



$1 - \Sigma Y_i = 0$

$$\mathcal{T}_c = \frac{7}{96}\frac{PL^2}{EI} - \frac{5PL}{16EI}\cdot\frac{L}{2}\cdot\frac{1}{2} = -\frac{1}{192}\frac{PL^2}{EI}$$

$2 - \Sigma M_c = 0$

$$\mathcal{M}_c = \frac{7}{96}\frac{PL^2}{EI}\cdot\frac{L}{2} - \frac{5PL}{16EI}\cdot\frac{L}{2}\cdot\frac{1}{2}\cdot\frac{1}{3}\frac{L}{2} = \frac{3}{128}\frac{PL^3}{EI}$$

$$\theta_c = -\frac{1}{192}\frac{PL^2}{EI} \qquad v_c = \frac{3}{128}\frac{PL^3}{EI}$$