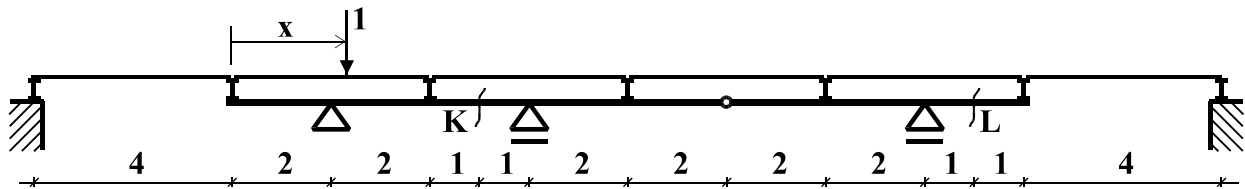


ĆWICZENIE PROJEKTOWE NR 1 Z MECHANIKI BUDOWLI

TEMAT: Wyznaczanie linii wpływu sił wewnętrznych.

ZADANIE 1.

Dla belki jak na rys. 1 wyznaczyć linie wpływu reakcji oraz sił wewnętrznych w oznaczonych przekrojach.



Rys. 1. Schemat ustroju.

LINIA WPLYWU REAKCJI R_C

$$x \in (0;10)$$

$$\sum M_D^p = R_C \cdot 4 = 0$$

$$R_C = 0$$

$$x \in (10;16)$$

$$\sum M_D^p = R_C \cdot 4 - 1 \cdot (x - 10) = 0$$

$$R_C = \frac{x - 10}{4} \quad \left| \begin{array}{ll} x = 10 & R_C = 0 \\ x = 14 & R_C = 1 \\ x = 16 & R_C = 1,5 \end{array} \right.$$

LINIA WPLYWU REAKCJI R_A

$$x \in (0;10)$$

$$\sum M_B = R_A \cdot 4 - 1 \cdot (6-x) - R_C \cdot 8 = 0$$

$$R_A = \frac{6-x}{4} \quad \left| \begin{array}{ll} x = 0 & R_A = 1,5 \\ x = 2 & R_A = 1 \\ x = 6 & R_A = 0 \\ x = 10 & R_A = -1 \end{array} \right.$$

$$x \in (10;16)$$

$$\sum M_B = R_A \cdot 4 - 1 \cdot (6-x) - R_C \cdot 8 = 0$$

$$R_A = \frac{6-x + \frac{x-10}{4} \cdot 8}{4} \quad \left| \begin{array}{ll} x = 10 & R_A = -1 \\ x = 14 & R_A = 0 \\ x = 16 & R_A = 0,5 \end{array} \right.$$
$$R_A = \frac{x-14}{4}$$

LINIA WPLYWU REAKCJI R_B

$$\sum Y = R_A + R_B + R_C - 1 = 0$$

$$R_B = 1 - R_A - R_C$$

$$x \in (0;10)$$

$$R_B = 1 - \frac{6-x}{4} \quad \left| \begin{array}{ll} x = 0 & R_B = -0,5 \\ x = 2 & R_B = 0 \\ x = 6 & R_B = 1 \\ x = 10 & R_B = 2 \end{array} \right.$$
$$R_B = \frac{x-2}{4}$$

$$x \in (10;16)$$

$$R_B = 1 - \frac{x-14}{4} - \frac{x-10}{4} \quad \left| \begin{array}{l} x = 10 \\ x = 14 \\ x = 16 \end{array} \right. \quad \begin{array}{l} R_B = 2 \\ R_B = 0 \\ R_B = -1 \end{array}$$

$$R_B = \frac{14-x}{2}$$

LINIA WPLYWU SIŁY POPRZECZNEJ W PRZEKROJU K (Q_K)

$$x \in (0;5)$$

$$Q_K = -R_B - R_C$$

$$Q_K = -\frac{x-2}{4} \quad \left| \begin{array}{l} x = 0 \\ x = 2 \\ x = 5 \end{array} \right. \quad \begin{array}{l} Q_K = 0,5 \\ Q_K = 0 \\ Q_K = -0,75 \end{array}$$

$$x \in (5;16)$$

$$Q_K = R_A$$

$$x \in (5;10)$$

$$Q_K = \frac{6-x}{4} \quad \left| \begin{array}{l} x = 5 \\ x = 6 \\ x = 10 \end{array} \right. \quad \begin{array}{l} Q_K = 0,25 \\ Q_K = 0 \\ Q_K = -1 \end{array}$$

$$x \in (10;16)$$

$$Q_K = \frac{x-14}{4} \quad \left| \begin{array}{l} x = 10 \\ x = 14 \\ x = 16 \end{array} \right. \quad \begin{array}{l} Q_K = -1 \\ Q_K = 0 \\ Q_K = 0,5 \end{array}$$

LINIA WPLYWU MOMENTU ZGINAJĄCEGO W PRZEKROJU K (M_K)

$$x \in (0;5)$$

$$M_K = R_B \cdot 1 + R_C \cdot 9$$

$$Q_K = \frac{x-2}{4} \quad \left| \begin{array}{ll} x = 0 & M_K = -0,5 \\ x = 2 & M_K = 0 \\ x = 5 & M_K = 0,75 \end{array} \right.$$

$$x \in (5;16)$$

$$M_K = R_A \cdot 3$$

$$x \in (5;10)$$

$$M_K = \frac{6-x}{4} \cdot 3 \quad \left| \begin{array}{ll} x = 5 & M_K = 0,75 \\ x = 6 & M_K = 0 \\ x = 10 & M_K = -3 \end{array} \right.$$

$$x \in (10;16)$$

$$M_K = \frac{x-14}{4} \cdot 3 \quad \left| \begin{array}{ll} x = 10 & M_K = -3 \\ x = 14 & M_K = 0 \\ x = 16 & M_K = 1,5 \end{array} \right.$$

LINIA WPLYWU SIŁY POPRZECZNEJ W PRZEKROJU L (Q_L)

$$x \in (0;15)$$

$$Q_L = 0$$

$$x \in (15;16)$$

$$Q_L = 1$$

LINIA WPŁYWU MOMENTU ZGINAJĄCEGO W PRZEKROJU L (M_L)

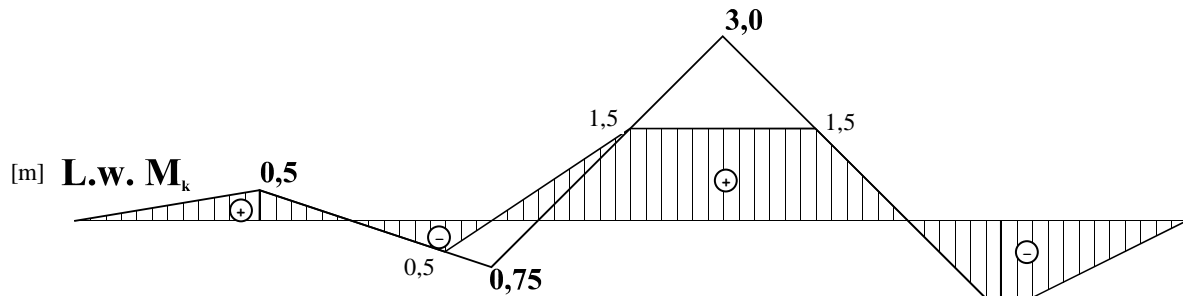
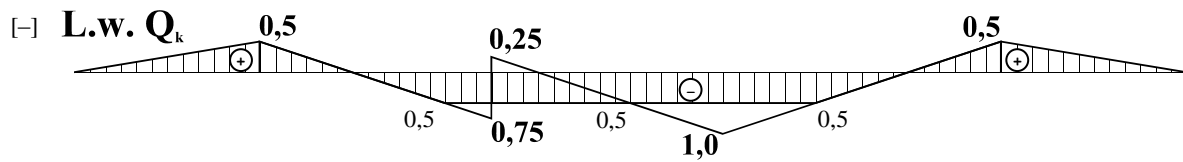
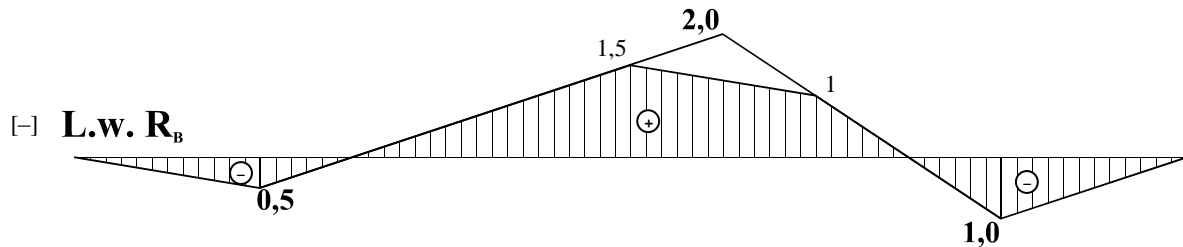
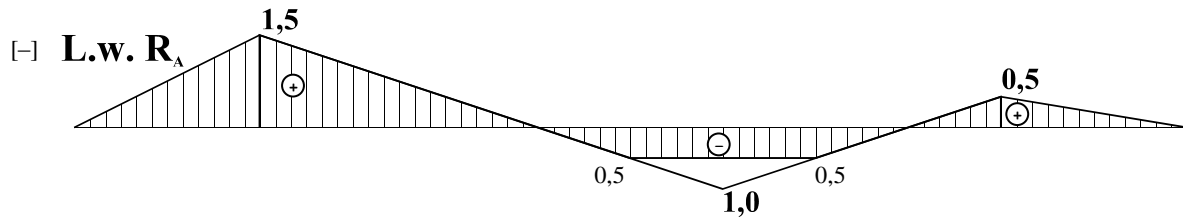
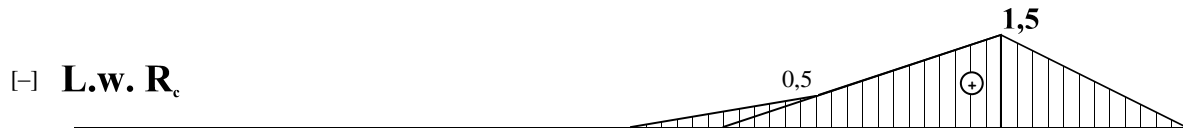
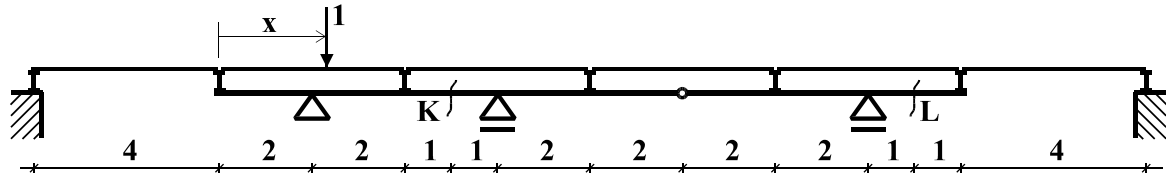
$$x \in (0;15)$$

$$M_L = 0$$

$$x \in (15;16)$$

$$M_L = -1 \cdot (x - 15)$$

	$x = 15$	$M_L = 0$
	$x = 16$	$M_L = -1$



Rys. 2. Wyniki obliczeń.