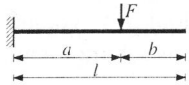
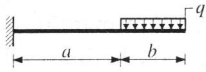
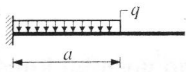
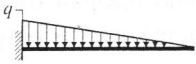
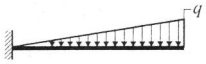
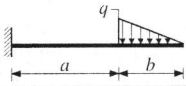
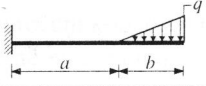
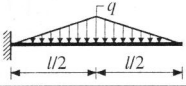
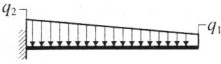
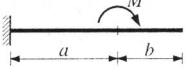


Tabulka 14.1. Deformace konzoly konstantního průřezu

Zatěž. případ	Schéma zatížení	Průhyb volného konce w	Pootočení volného konce φ
1		$\frac{Fa^2}{6EI}(3l-a)$	$\frac{Fa^2}{2EI}$
2		$\frac{Fl^3}{3EI}$	$\frac{Fl^2}{2EI}$
3		$\frac{q}{24EI}(3l^4 - 4a^3l + a^4)$	$\frac{q}{6EI}(l^3 - a^3)$
4		$\frac{qa^3}{24EI}(4l-a)$	$\frac{qa^3}{6EI}$
5		$\frac{ql^4}{8EI}$	$\frac{ql^3}{6EI}$
6		$\frac{ql^4}{30EI}$	$\frac{ql^3}{24EI}$
7		$\frac{11}{120} \cdot \frac{ql^4}{EI}$	$\frac{ql^3}{8EI}$
8		$\frac{qb}{30EI}[5(l-b)l^2 + b^3]$	$\frac{qb}{24EI}(6l^2 - 8lb + 3b^2)$
9		$\frac{qb}{120EI}[10(2l-b)l^2 + b^3]$	$\frac{qb}{24EI}(6l^2 - 4lb + b^2)$
10		$\frac{11}{192} \cdot \frac{ql^4}{EI}$	$\frac{7}{96} \cdot \frac{ql^3}{EI}$
11		$\frac{l^4}{120EI}(11q_1 + 4q_2)$	$\frac{l^3}{24EI}(3q_1 + q_2)$
12		$\frac{Ma}{2EI}(l+b)$	$\frac{Ma}{EI}$
13		$\frac{Ml^2}{2EI}$	$\frac{Ml}{EI}$

Tabulka 14.2. Deformace prostého nosníku konstantního průřezu

Zatěž. případ	Schéma zatížení	Průhyb w , $w_{\max}$	Pootočení φ_a, φ_b podporových průřezů a, b
1		$w_{\max} = \frac{Fab}{27EI} \sqrt{3a(l+b)^3}$ $v\ x = \sqrt{\frac{1}{3}a(l+b)} \text{ pro } a \geq \frac{l}{2}$	$\varphi_a = \frac{Fab}{6EI}(l+b)$ $\varphi_b = \frac{Fab}{6EI}(l+a)$
2		$w_{\max} = \frac{Fl^3}{48EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{Fl^2}{16EI}$
3		$w_{\max} = \frac{23}{648} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{Fl^2}{9EI}$
4		$w_{\max} = \frac{19}{384} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{5}{32} \cdot \frac{Fl^2}{EI}$
5		$w_{\max} = \frac{63}{1000} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{1}{5} \cdot \frac{Fl^2}{EI}$
6		$w_{\max} = \frac{11}{144} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{35}{144} \cdot \frac{Fl^2}{EI}$
7		$w_{\max} = \frac{F}{24EI} (3al^2 - 4a^3)$ $v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{Fa}{2EI} (l-a)$
8		$w_{\max} = \frac{11}{384} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{3}{32} \cdot \frac{Fl^2}{EI}$
9		$w_{\max} = \frac{53}{1296} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{19}{144} \cdot \frac{Fl^2}{EI}$
10		$w_{\max} = \frac{41}{768} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{11}{64} \cdot \frac{Fl^2}{EI}$
11		$w_{\max} = \frac{397}{6000} \cdot \frac{Fl^3}{EI} \quad v\ x = 0,5l$	$\varphi_a = \varphi_b = \frac{51}{240} \cdot \frac{Fl^2}{EI}$
12		$w = \frac{qa^3b}{24EI} (4l-3a) \quad v\ x = a$	$\varphi_a = \frac{qa^2}{24EI} (2l-a)^2$ $\varphi_b = \frac{qa^2}{24EI} (2l^2 - a^2)$
13		$w = \frac{qc}{6EI} \left[\frac{ab}{l} \left(2al - 2a^2 - \frac{c^2}{4} \right) + \frac{c^3}{64} \right] \quad v\ x = a$	$\varphi_a = \frac{q}{24EI} \cdot \frac{bc}{l} \left[4a(l+b) - c^2 \right]$ $\varphi_b = \frac{q}{24EI} \cdot \frac{ac}{l} \left[4b(l+a) - c^2 \right]$

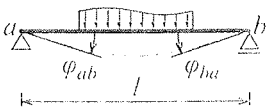
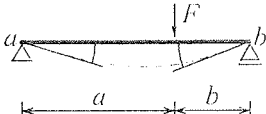
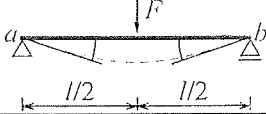
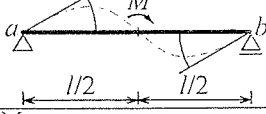
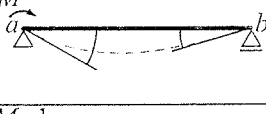
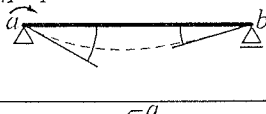
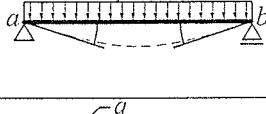
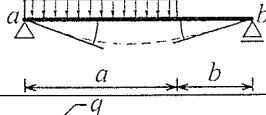
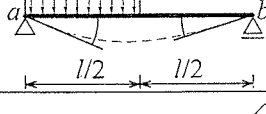
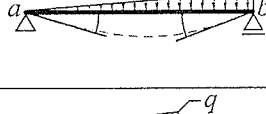
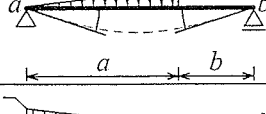
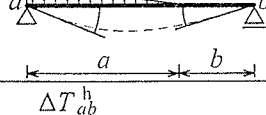
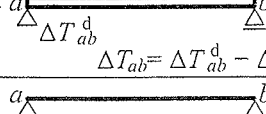
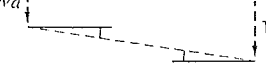
Tabulka 14.2. Deformace prostého nosníku konstantního průřezu (pokračování)

Zatěž. případ	Schéma zatížení	Průhyb w , $w_{\max}$	Pootočení φ_a , φ_b podporových průřezů a , b
14		$w_{\max} = \frac{ql^4}{48EI} \cdot \frac{a^2}{l^2} \left(3 - 2 \frac{a^2}{l^2} \right)$ $v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{qa^2}{12EI} (3l - 2a)$
15		$w_{\max} = \frac{5}{384} \cdot \frac{ql^4}{EI} \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{1}{24} \cdot \frac{ql^3}{EI}$
16		$w = \frac{qa^3 l}{45EI} \left(5 - 9 \frac{a}{l} + 4 \frac{a^2}{l^2} \right)$ $v \ x = a$	$\varphi_a = \frac{qa^2 l}{360EI} \left(40 - 45 \frac{a}{l} + 12 \frac{a^2}{l^2} \right)$ $\varphi_b = \frac{qa^2 l}{90EI} \left(5 - 3 \frac{a^2}{l^2} \right)$
17		$w = \frac{qa^2 bl}{360EI} \left(20 \frac{a}{l} - 13 \frac{a^2}{l^2} \right)$ $v \ x = a$	$\varphi_a = \frac{qa^2 l}{360EI} \left(20 - 15 \frac{a}{l} + 3 \frac{a^2}{l^2} \right)$ $\varphi_b = \frac{qa^2 l}{360EI} \left(10 - 3 \frac{a^2}{l^2} \right)$
18		$w_{\max} = 0,006522 \frac{ql^4}{EI}$ $v \ x = 0,5193l$	$\varphi_a = \frac{7}{360} \cdot \frac{ql^3}{EI}$ $\varphi_b = \frac{8}{360} \cdot \frac{ql^3}{EI}$
19		$w_{\max} = \frac{1}{120} \cdot \frac{ql^4}{EI} \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{5}{192} \cdot \frac{ql^3}{EI}$
20		$w_{\max} = \frac{3}{640} \cdot \frac{ql^4}{EI} \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{1}{64} \cdot \frac{ql^3}{EI}$
21		$w_{\max} = \frac{7}{1024} \cdot \frac{ql^4}{EI} \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{17}{768} \cdot \frac{ql^3}{EI}$
22		$w_{\max} = \frac{19}{3072} \cdot \frac{ql^4}{EI} \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{5}{256} \cdot \frac{ql^3}{EI}$
23		$w_{\max} = \frac{5}{384} \cdot \frac{ql^4}{EI}$ $\left(1 - \frac{8}{5} \frac{a^2}{l^2} + \frac{16}{25} \frac{a^4}{l^4} \right) \quad v \ x = 0,5l$	$\varphi_a = \varphi_b = \frac{ql^3}{24EI} \left(1 - 2 \frac{a^2}{l^2} + \frac{a^3}{l^3} \right)$

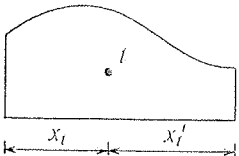
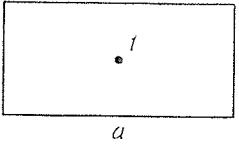
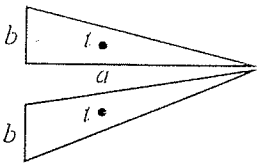
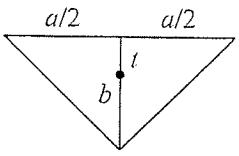
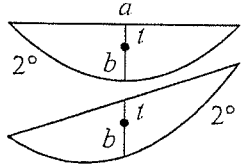
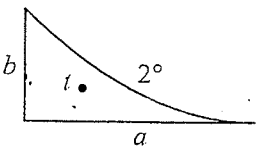
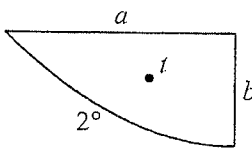
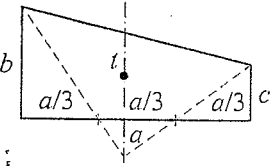
Tabulka 14.2. Deformace prostého nosníku konstantního průřezu (pokračování)

Zatěž. případ	Schéma zatížení	Průhyb w , $w_{\max}$	Pootočení φ_a , φ_b podporových průřezů a , b
24		$w = \frac{5}{768}(q_a + q_b) \frac{l^4}{EI} \text{ v } x = 0,5l$	$\varphi_a = \frac{l^3}{360EI}(8q_a + 7q_b)$ $\varphi_b = \frac{l^3}{360EI}(7q_a + 8q_b)$
25		$w = -\frac{Mab}{3EI} \cdot \frac{a-b}{l} \text{ v } x = a$	$\varphi_a = \frac{-Ml}{6EI} \left(1 - 3 \frac{b^2}{l^2} \right)$ $\varphi_b = \frac{Ml}{6EI} \left(1 - 3 \frac{a^2}{l^2} \right)$
26		$w_{\max} = 0,06415 \frac{Ml^2}{EI}$ $\text{v } x = 0,42265l$	$\varphi_a = \frac{Ml}{3EI}, \quad \varphi_b = \frac{Ml}{6EI}$

Tabulka 5.2 Pootočení u prostého nosníku konstantní ohybové tuhosti

Pootočení φ_{ab} podporového průřezu a		Pootočení φ_{ba} podporového průřezu b
$\varphi_{ab}^F = \frac{1}{6} \frac{F}{EI} \frac{ab}{l} (l+b)$ (5.8a)		$\varphi_{ba}^F = \frac{1}{6} \frac{F}{EI} \frac{ab}{l} (l+a)$ (5.8b)
$\varphi_{ab}^F = \frac{1}{16} \frac{F}{EI} l^2$ (5.9a)		$\varphi_{ba}^F = \frac{1}{16} \frac{F}{EI} l^2$ (5.9b)
$\varphi_{ab}^M = -\frac{1}{6} \frac{M}{EI} \frac{1}{l} (l^2 - 3b^2)$ (5.10a)		$\varphi_{ba}^M = \frac{1}{6} \frac{M}{EI} \frac{1}{l} (l^2 - 3a^2)$ (5.10b)
$\varphi_{ab}^M = -\frac{1}{24} \frac{M}{EI} l$ (5.11a)		$\varphi_{ba}^M = \frac{1}{24} \frac{M}{EI} l$ (5.11b)
$\varphi_{ab}^M = \frac{1}{3} \frac{M}{EI} l$ (5.12a)		$\varphi_{ba}^M = \frac{1}{6} \frac{M}{EI} l$ (5.12b)
$\alpha_{ab} = \frac{1}{3} \frac{l}{EI}$ (5.13a)		$\beta_{ba} = \frac{1}{6} \frac{l}{EI}$ (5.13b)
$\varphi_{ab}^q = \frac{1}{24} \frac{q}{EI} l^3$ (5.14a)		$\varphi_{ba}^q = \frac{1}{24} \frac{q}{EI} l^3$ (5.14b)
$\varphi_{ab}^q = \frac{1}{24} \frac{q}{EI} \frac{a^2}{l} (2l-a)^2$ (5.15a)		$\varphi_{ba}^q = \frac{1}{24} \frac{q}{EI} \frac{a^2}{l} (2l^2 - a^2)$ (5.15b)
$\varphi_{ab}^q = \frac{9}{384} \frac{q}{EI} l^3$ (5.16a)		$\varphi_{ba}^q = \frac{7}{384} \frac{q}{EI} l^3$ (5.16b)
$\varphi_{ab}^q = \frac{7}{360} \frac{q}{EI} l^3$ (5.17a)		$\varphi_{ba}^q = \frac{8}{360} \frac{q}{EI} l^3$ (5.17b)
$\varphi_{ab}^q = \frac{1}{360} \frac{q}{EI} \frac{a^2}{l} (40l^2 - 45al + 12a^2)$ (5.18a)		$\varphi_{ba}^q = \frac{1}{90} \frac{q}{EI} \frac{a^2}{l} (5l^2 - 3a^2)$ (5.18b)
$\varphi_{ab}^q = \frac{1}{360} \frac{q}{EI} \frac{a^2}{l} (20l^2 - 15al + 3a^2)$ (5.19a)		$\varphi_{ba}^q = \frac{1}{360} \frac{q}{EI} \frac{a^2}{l} (10l^2 - 3a^2)$ (5.19b)
$\varphi_{ab}^T = \frac{1}{2} \alpha_T \Delta T_{ab} \frac{l}{h}$ (5.20a)		$\varphi_{ba}^T = \frac{1}{2} \alpha_T \Delta T_{ab} \frac{l}{h}$ (5.20b)
$\varphi_{ab}^w = \frac{w_b - w_a}{l}$ (5.21a)		$\varphi_{ba}^w = \frac{w_a - w_b}{l}$ (5.21b)

Tabulka 5.1 Obsahy a těžiště vybraných obrazců

Poloha těžiště x_t	 Plošný obsah A	Poloha těžiště x'_t
$x_t = \frac{1}{2} a$ (5.1b)	obdélník  $A = ab$ (5.1a)	$x'_t = \frac{1}{2} a$ (5.1c)
$x_t = \frac{1}{3} a$ (5.2b)	trojúhelník  $A = \frac{1}{2} ab$ (5.2a)	$x'_t = \frac{2}{3} a$ (5.2c)
$x_t = \frac{1}{2} a$ (5.3b)	rovnoramenný trojúhelník ¹⁾  $A = \frac{1}{2} ab$ (5.3a)	$x'_t = \frac{1}{2} a$ (5.3c)
$x_t = \frac{1}{2} a$ (5.4b)	parabolická úseč ²⁾  $A = \frac{2}{3} ab$ (5.4a)	$x'_t = \frac{1}{2} a$ (5.4c)
$x_t = \frac{1}{4} a$ (5.5b)	parabolický trojúhelník  $A = \frac{1}{3} ab$ (5.5a)	$x'_t = \frac{3}{4} a$ (5.5c)
$x_t = \frac{5}{8} a$ (5.6b)	polovina parabolické úseče  $A = \frac{2}{3} ab$ (5.6a)	$x'_t = \frac{3}{8} a$ (5.6c)
$x_t = \frac{1}{3} a \frac{b+2c}{b+c}$ (5.7b)	lichoběžník  $A = \frac{1}{2} (b+c) a$ (5.7a)	$x'_t = \frac{1}{3} a \frac{2b+c}{b+c}$ (5.7c)

¹⁾ vzniká u obrazce ohybových momentů, působí-li síla uprostřed nosníku
²⁾ vzniká u obrazce ohybových momentů, působí-li plné spojitě rovnoměrné zatížení