# Vedlegg 17

## Statiske tabeller og diagram for knekking

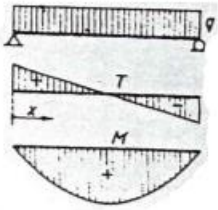
**Statiske tabeller:**

**1.**

$R_A = \frac{ql}{2}$ $\quad T_x = q\left(\frac{l}{2} - x\right)$ $\quad M_x = \frac{qlx}{2} - \frac{qx^2}{2}$ $\quad y = \frac{ql^3x}{24EI}\left(1 - 2\frac{x^2}{l^2} + \frac{x^3}{l^3}\right)$

$R_B = \frac{ql}{2}$ $\quad w_a = w_b = \frac{ql^2}{4}$ $\quad M_{max} = \frac{ql^2}{8}$ för $x = 0{,}5\,l$ $\quad y_{max} = \frac{5ql^4}{384EI}$

för $x = 0{,}5\,l$




| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $x/l$ | 0 | 0,1 | 0,2 | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 | 0,9 | 1,0 |
| $M_x/M_{max}$ | 0 | 0,36 | 0,64 | 0,84 | 0,96 | 1,00 | 0,96 | 0,84 | 0,64 | 0,36 | 0 |
| $y/y_{max}$ | 0 | 0,314 | 0,594 | 0,813 | 0,952 | 1,00 | 0,952 | 0,813 | 0,594 | 0,314 | 0 |

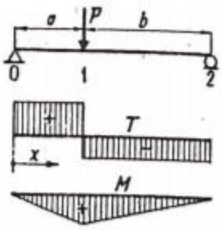
**2.**

$R_A = \frac{Pb}{l}$ $\quad T_x^{0-1} = R_A$ $\quad w_a = Pb\left(1 - \frac{b^2}{l^2}\right)$ $\quad M_x^{0-1} = \frac{Pbx}{l}$

$R_B = \frac{Pa}{l}$ $\quad T_x^{1-2} = -R_B$ $\quad w_b = Pa\left(1 - \frac{a^2}{l^2}\right)$ $\quad M_x^{1-2} = \frac{Pa(l-x)}{l}$

$y_{mitt} = \frac{Pa(3l^2 - 4a^2)}{48EI}$ $\quad (a < b)$ $\quad M_{max} = M_1 = \frac{Pab}{l}$

$y^{0-1} = \frac{Plbx}{6EI}\left(1 - \frac{b^2}{l^2} - \frac{x^2}{l^2}\right)$ $\quad y^{1-2} = \frac{Pla(l-x)}{6EI}\left(\frac{2x}{l} - \frac{a^2}{l^2} - \frac{x^2}{l^2}\right)$ $\quad y_1 = \frac{Pa^2b^2}{3EIl}$



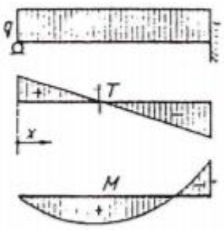

**Beträffande** $R$, $T$ **och** $M$ **jfr 162:415 A. Beträffande** $y$ **jfr 162: 414 och tabell 1:49 A.**

**3.**

$R_A = \frac{3ql}{8}$ $\quad M_B = -\frac{ql^2}{8}$ $\quad y = \frac{ql^3x}{48EI}\left(1 - 3\frac{x^2}{l^2} + 2\frac{x^3}{l^3}\right)$

$R_B = \frac{5ql}{8}$ $\quad M_x = \frac{qlx}{2}\left(\frac{3}{4} - \frac{x}{l}\right)$ $\quad y_{mitt} = \frac{ql^4}{192EI}$

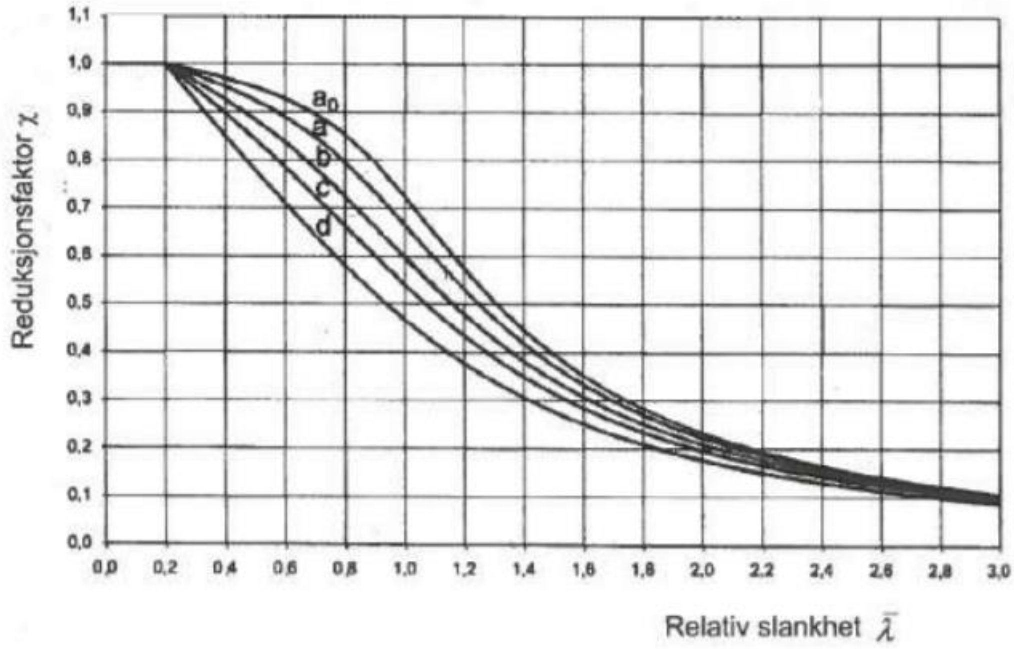
$T_x = R_A - qx$ $\quad +M_{max} = \frac{9}{128}ql^2$ för $x = 0{,}375l$ $\quad y_{max} = \frac{ql^4}{185EI}$ för $x = 0{,}42l$

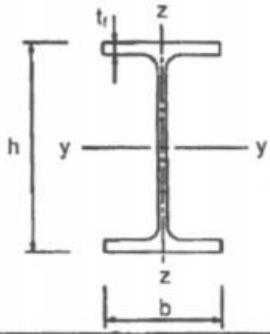
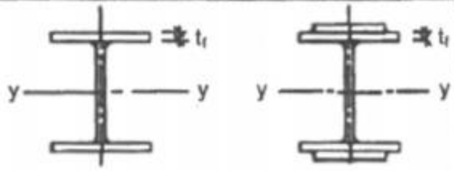


**Tabell og diagram for knekking:**

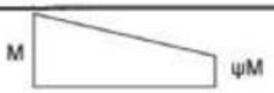
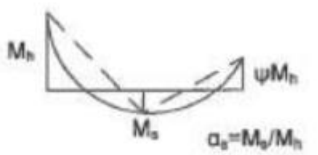
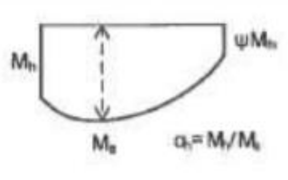
I NS-EN 1993-1-1 [5.4] er trykkstavenes knekkapasitet gitt indeksen "b", og er for bøyningsknekking gitt ved

$$N_{b,Rd} = \frac{\chi f_y A}{\gamma_{M1}} \quad \text{for tverrsnitt i klasse 1, 2 og 3}$$




| Tverrsnitt | | Begrensninger | | Bøyeakse | Knekkurve S235 S275 S355 S420 | Knekkurve S460 |
|---|---|---|---|---|---|---|
| Valsede I-profiler |  | $h/b>1,2$ | $t_f \leq 40$ mm | y - y<br>z - z | a<br>b | $a_0$<br>$a_0$ |
| | | | 40 mm$<t_f \leq 100$ mm | y - y<br>z - z | b<br>c | a<br>a |
| | | $h/b \leq 1,2$ | $t_f \leq 100$ mm | y - y<br>z - z | b<br>c | a<br>a |
| | | | $t_f > 100$ mm | y - y<br>z - z | d<br>d | c<br>c |
| Sveiste I-tverrsnitt |  | | $t_f \leq 40$ mm | y - y<br>z - z | b<br>c | b<br>c |
| | | | $t_f > 40$ mm | y - y<br>z - z | c<br>d | c<br>d |
| Hultverrsnitt |  | | Varmvalset | Alle | a | $a_0$ |
| | | | Kaldvalset | Alle | c | c |

<table>
<tr><th rowspan="3">Interaksjons-faktor</th><th rowspan="3">Tverrsnittsform</th><th colspan="2">Dimensjoneringsmetode</th></tr>
<tr><th>Elastisk<br>Klasse 3 og 4</th><th>Plastisk<br>Klasse 1 og 2</th></tr>
<tr><td></td><td></td></tr>
<tr><td>$k_{yy}$</td><td>I- og RHS profiler</td><td>$C_{my}\left(1+0,6\bar{\lambda}_y\frac{N_{Ed}}{\chi_y N_{Rd}}\right)$<br>$\le C_{my}\left(1+0,6\frac{N_{Ed}}{\chi_y N_{Rd}}\right)$</td><td>$C_{my}\left(1+\left(\bar{\lambda}_y-0,2\right)\frac{N_{Ed}}{\chi_y N_{Rd}}\right)$<br>$\le C_{my}\left(1+0,8\frac{N_{Ed}}{\chi_y N_{Rd}}\right)$</td></tr>
<tr><td>$k_{yz}$</td><td>I- og RHS</td><td>$k_{zz}$</td><td>$0,6\cdot k_{zz}$</td></tr>
<tr><td>$k_{zy}$</td><td>I- og RHS</td><td>$0,8\cdot k_{yy}$</td><td>$0,6\cdot k_{yy}$</td></tr>
<tr><td rowspan="2">$k_{zz}$</td><td>I-profiler</td><td rowspan="2">$C_{mz}\left(1+0,6\bar{\lambda}_z\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$<br>$\le C_{mz}\left(1+0,6\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$</td><td>$C_{mz}\left(1+\left(2\bar{\lambda}_z-0,6\right)\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$<br>$\le C_{mz}\left(1+1,4\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$</td></tr>
<tr><td>RHS-profiler</td><td>$C_{mz}\left(1+\left(\bar{\lambda}_z-0,2\right)\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$<br>$\le C_{mz}\left(1+0,8\frac{N_{Ed}}{\chi_z N_{Rd}}\right)$</td></tr>
</table>

<table>
<tr><th rowspan="2">Momentdiagram</th><th rowspan="2" colspan="2">Område</th><th colspan="2">$C_{my}$ , $C_{mz}$ og $C_{mLT}$</th></tr>
<tr><th>fordelt last</th><th>punktlast</th></tr>
<tr><td>
</td><td colspan="2">$-1\le\psi\le 1$</td><td colspan="2">$0,6+0,4\psi\ge 0,4$</td></tr>
<tr><td rowspan="3">
</td><td>$0\le\alpha_s\le 1$</td><td>$-1\le\psi\le 1$</td><td>$0,2+0,8\alpha_s\ge 0,4$</td><td>$0,2+0,8\alpha_s\ge 0,4$</td></tr>
<tr><td rowspan="2">$-1\le\alpha_s<0$</td><td>$0\le\psi\le 1$</td><td>$0,1-0,8\alpha_s\ge 0,4$</td><td>$-0,8\alpha_s\ge 0,4$</td></tr>
<tr><td>$-1\le\psi<0$</td><td>$0,1(1-\psi)$<br>$-0,8\alpha_s\ge 0,4$</td><td>$0,2(-\psi)$<br>$-0,8\alpha_s\ge 0,4$</td></tr>
<tr><td rowspan="3">
</td><td>$0\le\alpha_h\le 1$</td><td>$-1\le\psi\le 1$</td><td>$0,95+0,05\alpha_h$</td><td>$0,9+0,1\alpha_h$</td></tr>
<tr><td rowspan="2">$-1\le\alpha_h<0$</td><td>$0\le\psi\le 1$</td><td>$0,95+0,05\alpha_h$</td><td>$0,9+0,1\alpha_h$</td></tr>
<tr><td>$-1\le\psi\le 0$</td><td>$0,95$<br>$+0,05\alpha_h\left(1+2\psi\right)$</td><td>$0,9$<br>$-0,1\alpha_h\left(1+2\psi\right)$</td></tr>
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