Table 1.14: (Continued)

Simple Beam — uniform load partially distributed

$R_1 = V_1$ (max. when $a < c$) .... $= \frac{wb}{2\ell}(2c + b)$

$R_2 = V_2$ (max. when $a > c$) .... $= \frac{wb}{2\ell}(2a + b)$

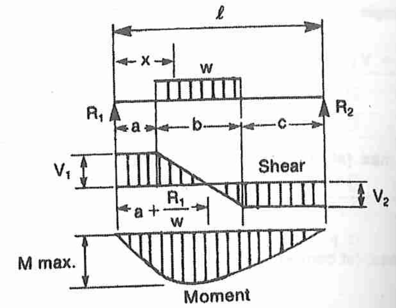
V_x (when $x > a$ and $< (a + b)$) .... $= R_1 - w(x - a)$

M max. $\left(\text{at } x = a + \frac{R_1}{w}\right)$ .... $= R_1\left(a + \frac{R_1}{2w}\right)$

M_x (when $x < a$) .... $= R_1 x$

M_x (when $x > a$ and $< (a + b)$) .... $= R_1 x - \frac{w}{2}(x - a)^2$

M_x (when $x > (a + b)$) .... $= R_2(\ell - x)$



Beam fixed at both ends — symmetrical trapezoidal load

$R = V$ .... $= \frac{w\ell}{2}\left(1 - \frac{a}{\ell}\right)$

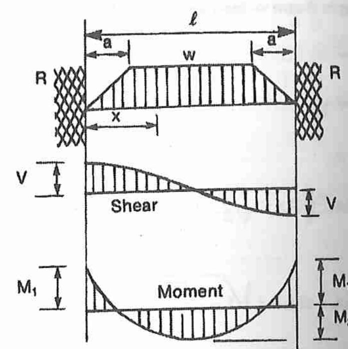
M_1 .... $= -\frac{w\ell^2}{12}\left(1 - 2\frac{a^2}{\ell^2} + \frac{a^3}{\ell^3}\right)$

M_2 .... $= \frac{w\ell^2}{24}\left(1 - 2\frac{a^3}{\ell^3}\right)$

M_x (when $x < a$) .... $= M_1 + R_1 x - \frac{wx^3}{6a}$

M_x (when $a < x < \ell - a$) .... $= M_1 + R_1 x - \frac{wa}{2}\left(x - \frac{2}{3}a\right) - \frac{w}{2}(x - a)^2$

Note: When $a = \ell/2$ loading is triangular



Simple Beam — concentrated load at any point

$R_1 = V_1$ (max. when $a < b$) .... $= \frac{Pb}{\ell}$

$R_2 = V_2$ (max. when $a > b$) .... $= \frac{Pa}{\ell}$

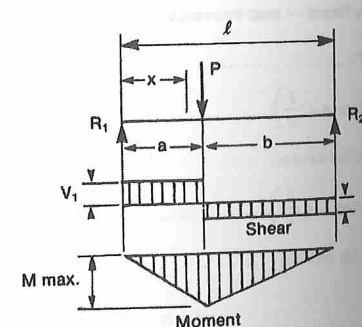
M max. (at point of load) .... $= \frac{Pab}{\ell}$

M_x (when $x < a$) .... $= \frac{Pbx}{\ell}$

Δmax. $\left(\text{at } x = \sqrt{\frac{a(a + 2b)}{3}} \text{ when } a > b\right)$ $= \frac{Pab(a + 2b)\sqrt{3a(a + 2b)}}{27\,EI\ell}$

Δa (at point of load) .... $= \frac{Pa^2b^2}{3\,EI\ell}$

Δ_x (when $x < a$) .... $= \frac{Pbx}{6\,EI\ell}(\ell^2 - b^2 - x^2)$



Note:
w: Distributed load per unit length. In the case of triangular distribution, w represents the maximum intensity of load per unit length.
P: Concentrated load.

Table 1.14: (Continued)

Beam fixed at both ends — uniformly distributed loads

$R = V$ .... $= \frac{w\ell}{2}$

V_x .... $= w\left(\frac{\ell}{2} - x\right)$

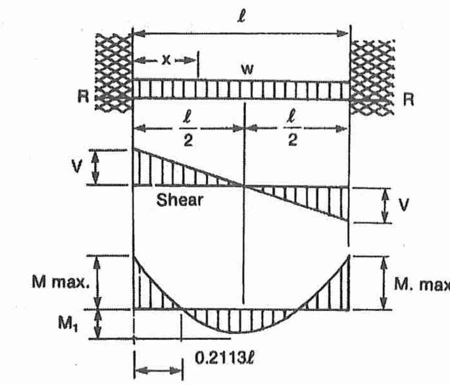
M max. (at ends) .... $= -\frac{w\ell^2}{12}$

M_1 (at centre) .... $= \frac{w\ell^2}{24}$

M_x .... $= \frac{w}{12}(6\ell x - \ell^2 - 6x^2)$

Δmax. (at centre) .... $= \frac{w\ell^4}{384\,EI}$

Δ_x .... $= \frac{wx^2}{24\,EI}(\ell - x)^2$



Beam fixed at both ends — concentrated load at any point

$R_1 = V_1$ (max. when $a < b$) .... $= \frac{Pb^2}{\ell^3}(3a + b)$

$R_2 = V_2$ (max. when $a > b$) .... $= \frac{Pa^2}{\ell^3}(a + 3b)$

M_1 (max. when $a < b$) .... $= -\frac{Pab^2}{\ell^2}$

M_2 (max. when $a > b$) .... $= -\frac{Pa^2b}{\ell^2}$

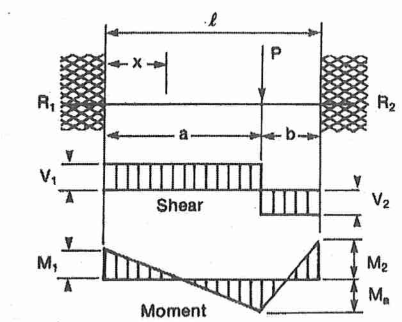
M_a (at point of load) .... $= \frac{2Pa^2b^2}{\ell^3}$

M_x (when $x < a$) .... $= R_1 x - \frac{Pab^2}{\ell^2}$

Δmax. $\left(\text{when } a > b \text{ at } x = \frac{2a\ell}{3a + b}\right)$ .... $= \frac{2Pa^3b^2}{3\,EI\,(3a + b)^2}$

Δ_a (at point of load) .... $= \frac{Pa^3b^3}{3\,EI\ell^3}$

Δ_x (when $x < a$) .... $= \frac{Pb^2x^2}{6\,EI\ell^3}(3a\ell - 3ax - bx)$



Beam fixed at both ends — uniform load partially distributed

M_1 .... $= \frac{w}{12\ell^2}\left[(\ell - a)^3(\ell + 3a) - c^3(4\ell - 3c)\right]$

M_2 .... $= \frac{w}{12\ell^2}\left[(\ell - c)^3(\ell + 3c) - a^3(4\ell - 3a)\right]$

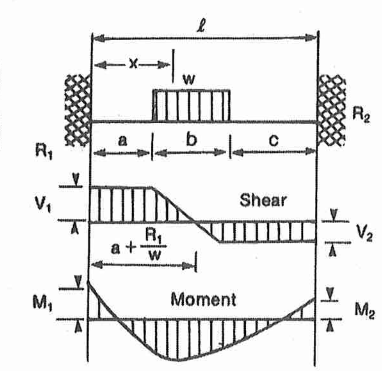
$R_1 = V_1$ .... $= \frac{1}{\ell}\left[M_1 - M_2 + wb\left(c + \frac{b}{2}\right)\right]$

$R_2 = V_2$ .... $= \frac{1}{\ell}\left[M_2 - M_1 + wb\left(a + \frac{b}{2}\right)\right]$

M_x (when $x < a$) .... $= R_1 x - M_1$

M_x (when $a < x < (a + c)$) .... $= R_1 x - M_1 - \frac{w}{2}(x - a)^2$

M_x (when $x > (a + c)$) .... $= R_2(\ell - x) - M_2$



Note:
w: Distributed load per unit length. In the case of triangular distribution, w represents the maximum intensity of load per unit length.
P: Concentrated load.