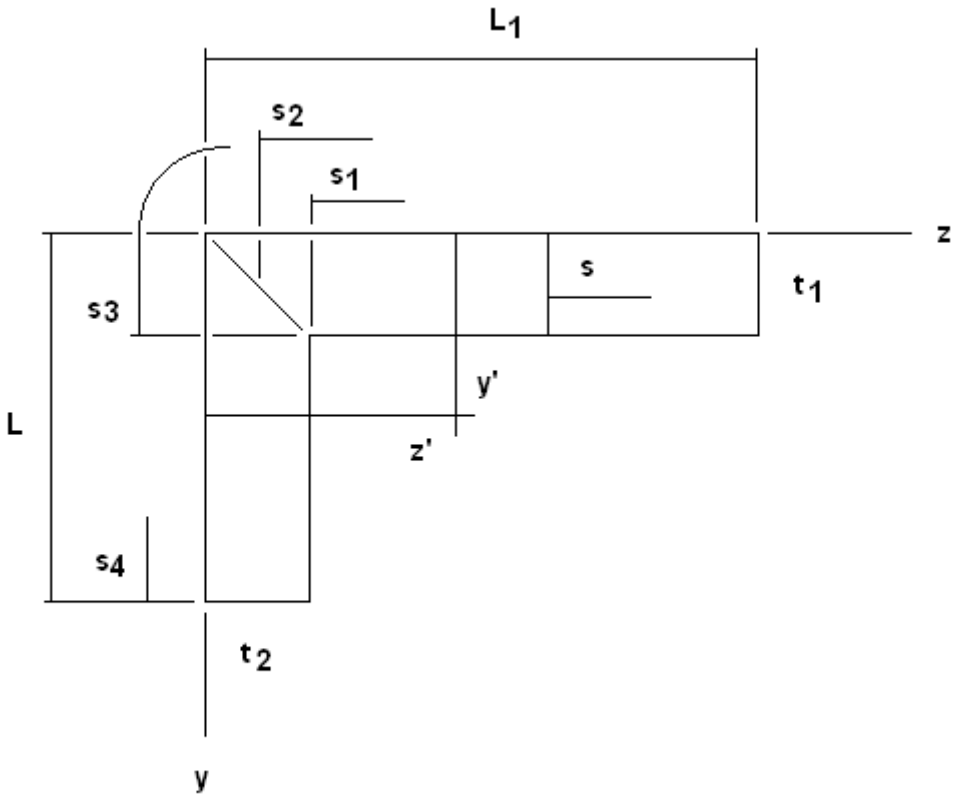
L Section Analysis $TOL := 10^{-12}$



Dimensions ... $t_1 := 5 \cdot mm$ ... and ... $t_2 := 5 \cdot mm$

$L_1 := 50 \cdot mm$

Let ... $x_b := 20 \cdot mm$ ... length along beam

$L(x) := t_1 + x$

Let ... $L_x := L(x_b)$ $L_x = 25\,mm$

Lengths ...

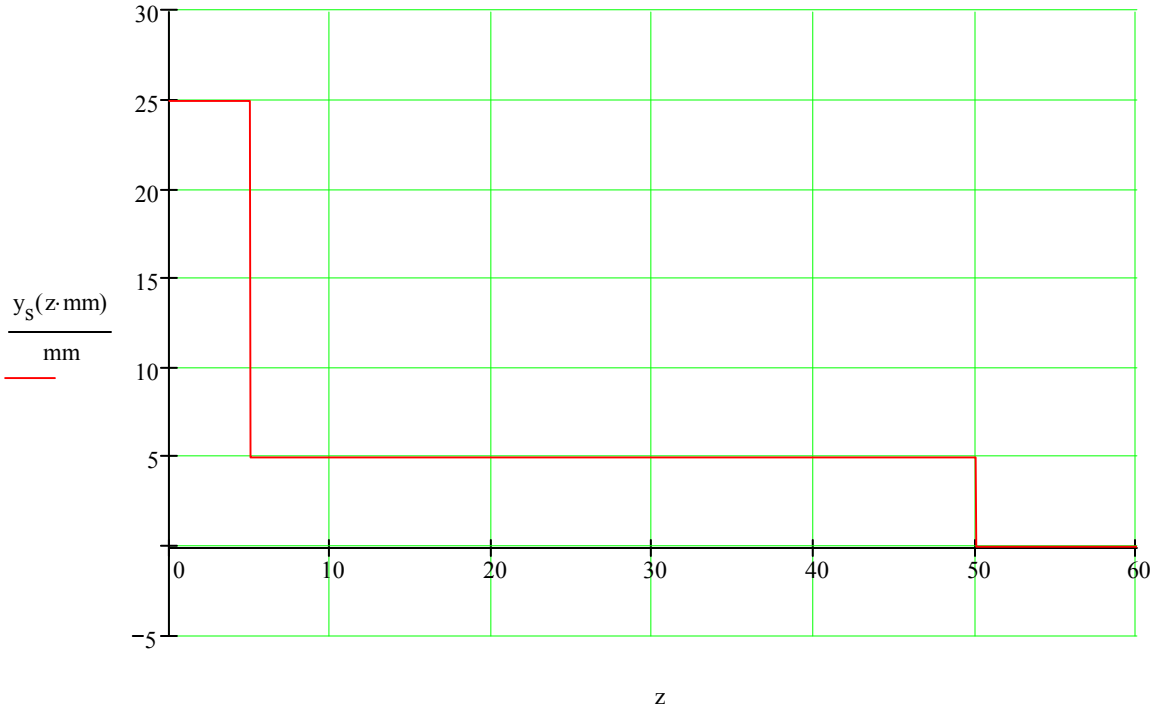
$s_1 := L_1 - t_2$ $\quad s_1 = 45\,mm$

$s_2 := L_1 - 0.5 \cdot t_2$ $\quad s_2 = 47.5\,mm$

$s_3 := L_1 + 0.5 \cdot (t_1 - t_2)$ $\quad s_3 = 50\,mm$

$s_4 := L_1 + L_x - 0.5 \cdot (t_1 + t_2)$ $\quad s_4 = 70\,mm$

$$y_s(z) := \begin{cases} L_x & \text{if } 0 \cdot mm \le z \le t_2 \\ t_1 & \text{if } t_2 < z \le L_1 \\ 0 \cdot mm & \text{otherwise} \end{cases}$$



$$A_s := \int_0^{L_1} y_s(z)\,dz \qquad A_s = 350.000\,mm^2$$

$$A'_s := (L_1 - t_2)\cdot t_1 + L_x\cdot t_2 \qquad A'_s = 350\,mm^2$$

$$Ay_s := \int_0^{L_1}\int_0^{y_s(z)} y\,dy\,dz \qquad Ay_s = 2125.00\,mm^3$$

$$y_{bar} := \frac{Ay_s}{A_s} \qquad y_{bar} = 6.071\,mm$$

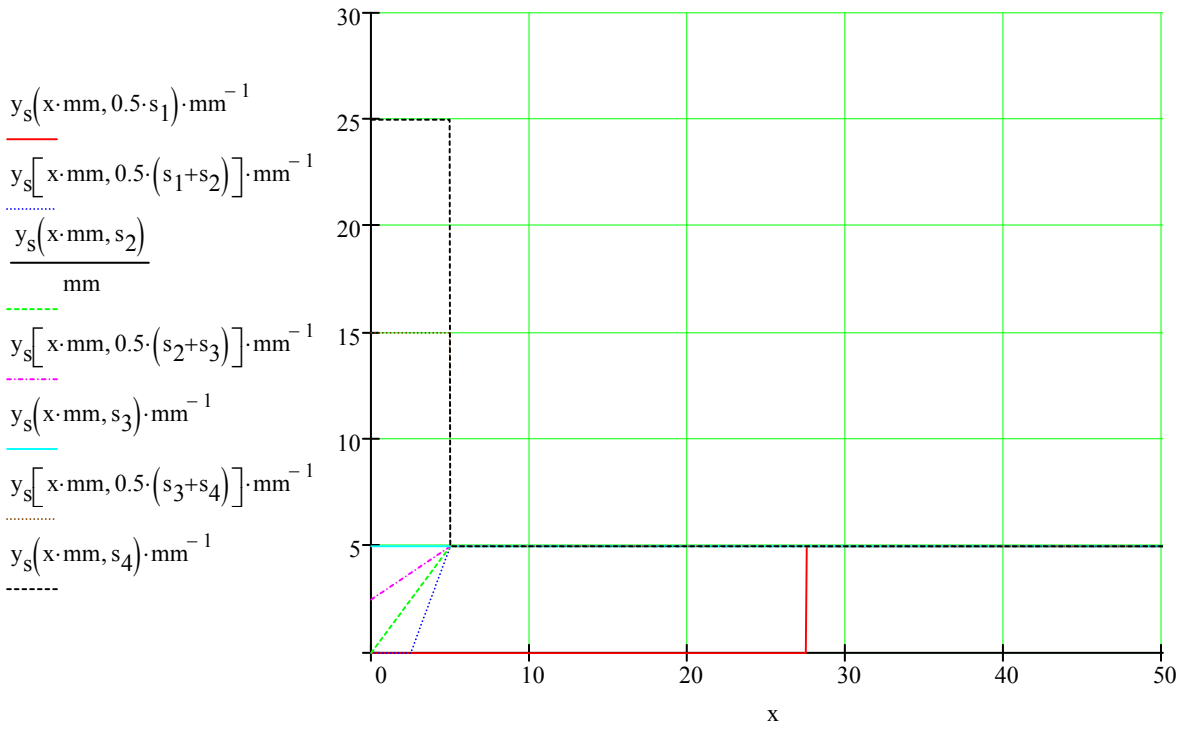
$$A'y_s := \frac{(L_1 - t_2)\cdot t_1^{\,2} + L_x^{\,2}\cdot t_2}{2\cdot\left[(L_1 - t_2)\cdot t_1 + L_x\cdot t_2\right]} \qquad A'y_s = 6.071\,mm$$

$$Az_s := \int_0^{L_1}\int_0^{y_s(z)} z\,dy\,dz \qquad Az_s = 6500\,mm^3$$

$$z_{bar} := \frac{Az_s}{A_s} \qquad z_{bar} = 18.571\,mm$$

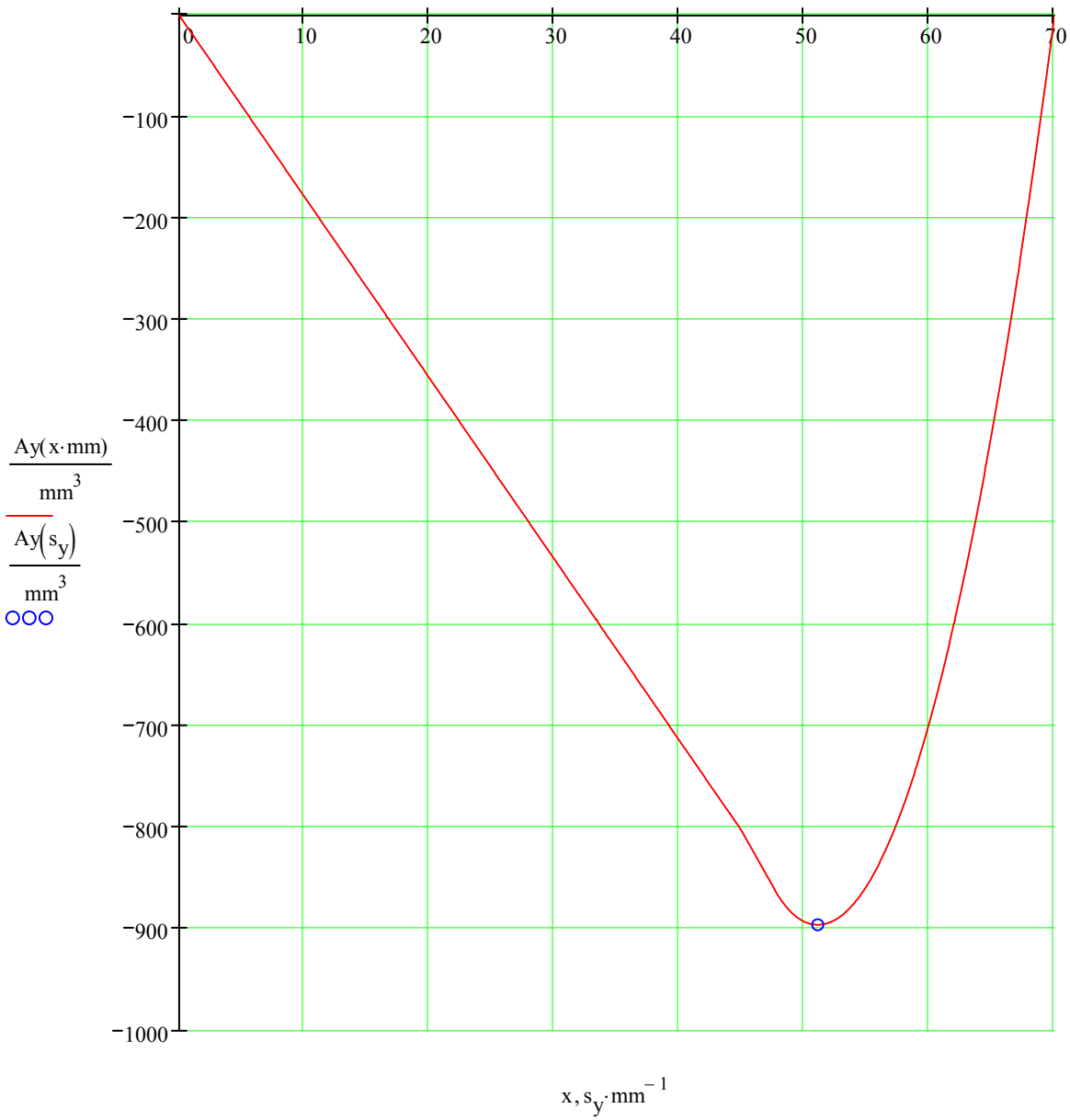
$$A'z_s := \frac{(L_1 - t_2)\cdot t_1\cdot(L_1 + t_2) + L_x\cdot t_2^{\,2}}{2\cdot\left[(L_1 - t_2)\cdot t_1 + L_x\cdot t_2\right]} \qquad A'z_s = 18.571\,mm$$

$$y_s(z,s) := \begin{cases} \text{if } s \le s_1 \\ \quad \begin{cases} 0\cdot mm & \text{if } z < L_1 - s \\ t_1 & \text{otherwise} \end{cases} \\ \text{if } (s_1 < s \le s_2) \\ \quad \begin{cases} 0\cdot mm & \text{if } z < t_2 - 2\cdot(s - s_1) \\ t_1\cdot\dfrac{z - \left[t_2 - 2\cdot(s - s_1)\right]}{2\cdot(s - s_1)} & \text{if } t_2 - 2\cdot(s - s_1) \le z < t_2 \\ t_1 & \text{otherwise} \end{cases} \\ \text{if } (s_2 < s \le s_3) \\ \quad \begin{cases} 2\cdot(s - s_2) + \left[t_1 - 2\cdot(s - s_2)\right]\cdot\dfrac{z}{t_2} & \text{if } z < t_2 \\ t_1 & \text{otherwise} \end{cases} \\ \text{otherwise} \\ \quad \begin{cases} s - s_3 + t_1 & \text{if } z < t_2 \\ t_1 & \text{otherwise} \end{cases} \end{cases}$$



$$Ay(s) := \int_0^{L_1} \int_0^{y_s(z,s)} \left(y - y_{bar}\right) dy\, dz$$

$s_y := y_{bar} - 0.5 \cdot t_1 + s_2$ $\quad s_y = 51.071\ mm$ $\quad Ay\left(s_y\right) = -895.727\ mm^3$



$$Az(s) := \int_0^{L_1} \int_0^{y_s(z,s)} \left(z - z_{bar}\right) dy\, dz$$

$s_z := L_1 - z_{bar}$ $\quad s_z = 31.429\,mm$ $\quad Az\left(s_z\right) = 2469.388\,mm^3$