Problem

1) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness of the steel spring leaves, the ratio of total depth to the width of the spring is 3. Also determine the deflection of the spring

Given data

$n = 12$

$n_f = 2$

$2L_1 = 1.05\ m \Rightarrow 2L_1 = 1050\ mm$

$l = 85\ mm$

$2W = 5.4\ kN \quad W = 2.7 \times 10^3\ N$

$\sigma = 280 MPa = 280 N/mm^2$

$\frac{n \times t}{b} = 3$

$\therefore$ Given $\rightarrow \frac{n \times t}{3} = b$

To find:

(i) t

(ii) δ

Solution:

$n = n_f + n_g$

$12 = 2 + n_g$

$n_g = 10$

Effective length $(2L) = 2L_1 - l$

$= 1050 - 85$

$2L = 965$

$L = 482.5 m$

$$\sigma_f = \frac{18 W L}{b t^2 (2n_g + 3n_f)}$$

$$\sigma_f = \frac{18 \times 2.7 \times 10^3 \times 482.5}{b \times \frac{n \times t}{3} \times t^2 (2n_g + 3n_f)}$$

$$\sigma_f = \frac{18 \times 2.7 \times 10^3 \times 482.5}{\frac{12 \times t^3}{3} (2(10) + 3(2))}$$

$$\sigma_f = \frac{225475.96}{t^3}$$

$$280 = \frac{225475.96}{t^3}$$

$$\boxed{t = 9.3 \text{ mm}}$$

$$\frac{n \times t}{b} = 3$$

$$\frac{12 \times 9.3}{b} = 3$$

$$\boxed{b = 37.2 \text{ mm}}$$

$$\delta = \frac{12 W L^3}{E b t^3 (2n_g + 3n_f)}$$

$$= \frac{12 \times 2.7 \times 10^3 \times (482.5)^3}{2 \times 10^5 \times 37.2 \times 9.3^3 (2(10) + 3(5))}$$

$$\boxed{\delta = 23.4 \text{ mm}}$$

Result:

$t = 9.3$ mm

$\delta = 23.4$ mm

1) Design a leaf spring for the following specification Total load = 140 KN, Number of spring supporting the load = 4, Maximum number of leaves = 10, Span of spring = 1000 mm. Permissible deflection = 80 mm. Take E = 200 kN/mm² and allowable stress in the spring material is 600 MPa.

Given data:

$W_{total} = 140\,kN = 140 \times 10^3\,N$

No of spring = 4

$n = 10$

$2L = 1000\,mm$, $L = 500\,mm$

$\delta = 80\,mm$

$E = 200\,kN/mm^2 = 2 \times 10^5\,N/mm^2$

$\sigma = 600\,MPa = 600\,N/mm^2$

To design

Leaf Spring

Solution

$W_{total} = 140\,kN$

Since there are four springs;

Load carried by a single spring is

$$2W = \frac{140 \times 10^3}{4}$$

$$\boxed{2W = 35 \times 10^3 N}$$

$$\boxed{W = 17.5 \times 10^3 KN}$$

We know that

$$\sigma = \frac{6WL}{nbt^2}$$

$$600 = \frac{6 \times 17.5 \times 10^3 \times 500}{nbt^2}$$

$$\boxed{nbt^2 = 87500} \rightarrow (1)$$

$$\delta = \frac{6WL^3}{Enbt^3}$$

$$80 = \frac{6 \times 17.5 \times 10^3 \times 500^3}{2 \times 10^5 \times nbt^3}$$

$$\boxed{nbt^3 = 8.2 \times 10^5} \rightarrow (2)$$

② ÷ ① we get

$$\frac{\pi b t^3}{\pi b t^2} = \frac{8.2 \times 10^5}{87500}$$

$$\boxed{t = 9.375 \text{ mm}}$$

Sub t in ①

$$\pi b t^2 = 87500$$

$$10 \times b \times (9.375)^2 = 87500$$

$$\boxed{b = 99.5 \text{ mm}}$$

Result:

$b = 99.5$ mm

$t = 9.375$ mm