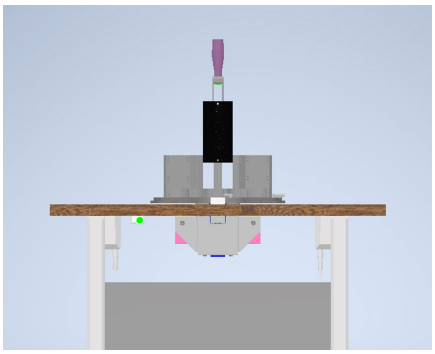
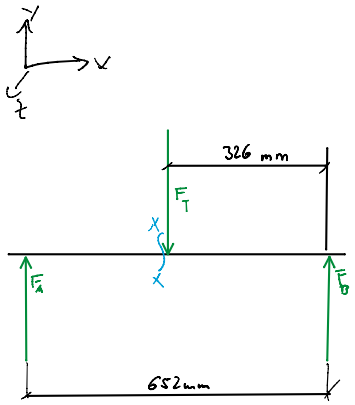
Tischplattenberechnung

Donnerstag, 4. März 2021 12:52





geg: $m_T = 125kg$, $m_{MA} = 20kg$ ↑ Annahme Mitarbeiterfaktor

$g = 9,81 \frac{m}{s^2}$

$l_1 = 652mm$

$l_2 = 326mm$

$F_T = (m_T + m_{MA}) \cdot g = (125kg + 20kg) \cdot 9,81 \frac{m}{s^2}$

$F_T = 1422,45N$

$\sum M_{(B)} = 0 = -F_T \cdot l_2 + F_A \cdot l_1$

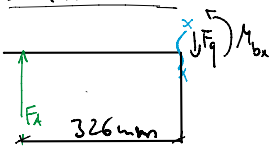
$F_A = \frac{F_T \cdot l_2}{l_1} = \frac{1422,45N \cdot 326mm}{652mm} = 711,225N$

$\sum F_y = 0 = F_A - F_T + F_B$

$F_B = F_T - F_A = 1422,45N - 711,225N$

$F_B = 711,225N$

Schnitt x-x



$\sum M_{(x)} = 0 = -F_A \cdot 326mm + M_{bx}$

$F_q = F_A = 711,225N$

$M_{bx} = F_q \cdot 326mm$

$= 711,225N \cdot 0,326m$

$M_{bx} = 231,86Nm \triangleq M_{b\,max}$

TB 1-14 Flächenmomente 2. Grades und Widerstandsmomente[1)]

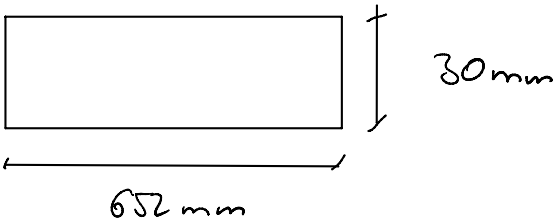
Querschnitt	Biegung	
	axiales Flächenmoment 2. Grades I_b	axiales Widerstandsmoment W_b
Rechteck	$I_x = \frac{b \cdot h^3}{12}$ $I_y = \frac{h \cdot b^3}{12}$	$W_x = \frac{b \cdot h^2}{6}$ $W_y = \frac{h \cdot b^2}{6}$

$\sigma_{b\,max} = \frac{M_{b\,max}}{W_b}$

$W_b = \frac{b \cdot h^2}{6}$

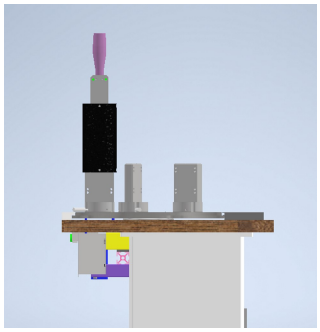
$= \frac{652mm \cdot 30^2 mm^2}{6}$

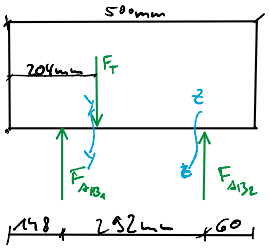
$W_b = 97800mm^3$



$\sigma_{b\,max} = \frac{231,86 \cdot 10^3 Nmm}{97800mm^3}$

$= 2,37N/mm^2$





gegj: $l_1 = 250mm$
$l_2 = 204mm$
$l_3 = 500mm$
$F_T = 1422,45\,N$

$$\curvearrowleft \sum M_{(AB_1)} = 0 = -F_T \cdot 0,056m + F_{AB_2} \cdot 0,292m$$

$$F_{AB_2} = \frac{F_T \cdot 0,056m}{0,292m} = \frac{1422,45N \cdot 0,056m}{0,292m}$$

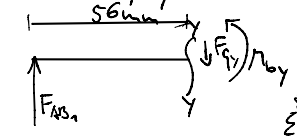
$$F_{AB_2} = \underline{272,80N}$$

$$\uparrow + \sum F_y = 0 = F_{AB_1} - F_T + F_{AB_2}$$

$$F_{AB_1} = F_T - F_{AB_2} = 1422,45N - 272,80N$$

$$F_{AB_1} = \underline{1149,65N}$$

Schnitt y-y



$$F_{q_y} = F_{AB_1} \hat{=} 1149,65N$$

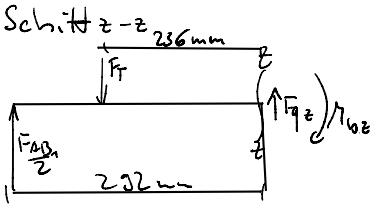
$$\curvearrowleft \sum M_{(y)} = 0 = -F_{AB_1} \cdot 56mm + M_{by}$$

$$M_{by} = F_{AB_1} \cdot 56mm$$

$$= 1149,65N \cdot 0,056m$$

$$M_{by} = \underline{64,38\,Nm}$$

Schnitt z-z



$$\sum F_y = 0 = F_{AB_1} - F_T + F_{q_z}$$

$$F_{q_z} = -F_{AB_1} + F_T$$

$$= -1149,65N + 1422,45N$$

$$F_{q_z} = \underline{272,8N}$$

$$\curvearrowleft \sum M_{(z)} = 0 = F_T \cdot 236mm - F_{AB_1} \cdot 292mm - M_{bz}$$

$$M_{bz} = F_T \cdot 0,236m - F_{AB_1} \cdot 0,292m$$

$$= 1422,45N \cdot 0,236m - 1149,65N \cdot 0,292m$$

$$M_{bz} = \underline{4 \cdot 10^{-4}\,Nm} \hat{=} 0,0004\,Nm$$

Biegefestigkeit auf reduziertem Querschnitt

$I_{ges} = I_1 - I_2 - I_3$

$I_1 = \frac{b \cdot h^3}{12}$

$I_1 = \frac{900\,mm \cdot 30^3\,mm^3}{12}$

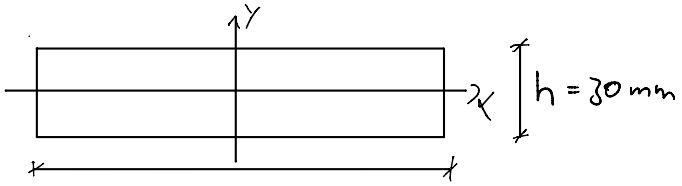
$I_1 = 2025000\,mm^4$

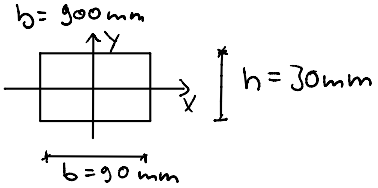
$I_2 = \frac{90\,mm \cdot 30^3\,mm^3}{12}$

$I_2 = 202500\,mm^4$

$I_3 = \frac{129\,mm \cdot 30^3\,mm^3}{12}$

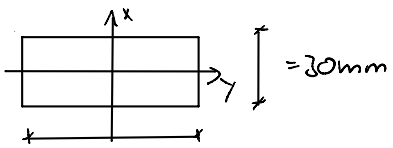
$I_3 = 290250\,mm^4$





$I_{ges} = 2025000\,mm^4 - 202500\,mm^4 - 290250\,mm^4$

$I_{ges} = 1532250\,mm^4$



$W_{ges} = \frac{I_{ges}}{e}$ $\qquad e = 15\,mm$

$= \frac{1532250\,mm^4}{15\,mm}$

$W_{ges} = 102150\,mm^3$

$\sigma_{bmax} = \frac{M_{bmax}}{W_{ges}} = \frac{231,86 \cdot 10^3\,Nmm}{102150\,mm^3} = 2,27\,N/mm^2 \leq \sigma_{bzul} = 120\,N/mm^2$

σ_{bzul} nach DIN 68 364: 2003-05: hat eine Biegefestigkeit von 120 N/mm², da Multiplexplatten deutlich verbesserte Materialeigenschaften haben wird die Multiplexplatte halten.