ACCELERATION FORCES DURING TRANSPORT

ANTI-SLIP MATS

The dangers resulting from incorrectly secured loads are frequently underestimated. The acceleration forces under normal traffic conditions reach levels approaching the actual weight of the load. The friction force F_F of an anti-slip mat therefore counteracts any displacement of the load and is described in physical terms as follows:

$$F_F = \mu \cdot F_G$$

F_G = weight
μ = coefficient of friction

$$F_G = m \cdot g$$

m = mass
g = gravitational acceleration

The difference between inertia force F_M and friction force F_F is known as securing force F_R:

$$F_R = F_{x,y} - F_F$$

The securing force F_R is the force that the securing equipment has to absorb. Loads are secured correctly by achieving a balance between the opposing forces occurring during transport.

The loads are adequately secured when the sum of the friction force F_F and the securing force F_R is at least as large as the inertia force F_M. The friction force is increased by anti-slip mats, the securing force by tension belts and other equipment.

$$\text{Load securing} = \frac{\text{friction force + securing force}}{}$$

The load has to be secured for normal driving. Normal driving also includes emergency braking, drastic avoidance manoeuvres and poor road surfaces.

The following forces can occur in normal driving:

- maximum 0.8 g in the direction of travel, corresponding to 80 % of the load weight
- maximum 0.5 g to the sides, corresponding to 50 % of the load weight
- maximum 0.5 g to the rear, corresponding to 50 % of the load weight

Example

Ascertaining the preload force F_T with and without anti-slip mats

$$F_T = \frac{(c_x - \mu_D)}{\mu_D \cdot \sin\alpha} \cdot \frac{F_G}{K}$$

c_x = 0,8
μ_D = 0,2 (without anti-slip mat)
$\sin\alpha$ = 1
F_G = 10.000 daN
K = 1,8

$$F_T = \frac{(0{,}8 - 0{,}2)}{0{,}2 \cdot 1} \cdot \frac{10.000 \text{ daN}}{1{,}8}$$

$$F_T = 16.666{,}66 \text{ daN}$$

For a preload force of 500 daN per tension belt, altogether **34 tension belts** are needed here without anti-slip mats.

When anti-slip mats are used to increase the sliding friction coefficient to μ = 0.6, the **number of tension belts is reduced to 4**.

REG ASM AFT EN 092019
Printed September 2019

REGUPOL BSW GmbH
Am Hilgenacker 24
57319 Bad Berleburg
Germany

Tel. +49 2751 803-231
anti-slip-mat@regupol.eu
www.regupol-load-securing.com

REGUPOL