Wind Force on MMT Enclosure

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The MMT can be mounted on top of a semi-trailer. As such the MMT will be subjected to wind pressure when the truck is moving. This pressure is then transferred to the MMT mounting mechanisms such as bolts, tape and glue. This memo derives the wind pressure exerted on the MMT and offers information that is needed to design adequate mounting arrangements.

Wind has pressure due to its velocity[1]. This pressure is calculated from the equation $Vp = 0.6V^2$, where Vp is the velocity pressure in Pascals (Pa) and V = velocity, in m/s. 0.6 is a constant, derived from the density of the air, at 20°C and average RH. A strong wind blowing at a force of 80 km/h (48mp/h) will exert a pressure of 296 Pascals on a fixed object.

Wind velocity, when stopped, can be converted into static pressure to determine the force exerted on a defined surface area. The conversion factor[2] of Pascals to pound-force is:

$$1 \text{ Pascal (Pa)} = 1.45e^{-4} \text{ pound-force per square inch (lbf/in}^2\text{)}$$

The worst case scenario for calculating the wind force on an MMT is to assume a wind velocity of 200 MPH. Under this assumption the following calculations are made:

$$Vp = [0.6 \times (88.89 \text{ m/s})^2] = 4740.7 \text{ Pascals}$$

$$\text{Pound-force} = [4740.7 \times 1.45e^{-4}] = 0.687 \text{ lbf/in}^2$$

The maximum surface area on the MMT that can be subjected to wind pressure is approximately 12 in^2. Hence, the total force exerted on an MMT that is experiencing a 200 MPH wind force is:

$$\text{Total force} = [12 \times 0.687] \approx 8 \text{ lb.}$$

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[1] http://www.vent-axia.com/sharing/windflow.asp

[2] http://www.gordonengland.co.uk/conversion/sidef.htm#calcs