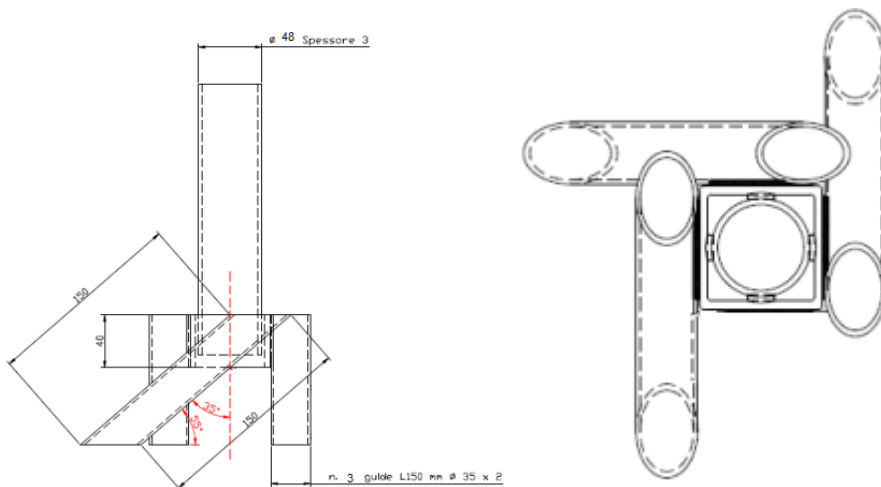


Technical Report and prescriptions for the correct installation of the device TSRS33060



DESCRIPTION: Anchoring Device for the installation on ground of poles which support sign panels. Anchor with 3 guides and anchoring inserts of variable length. Made by S235JR Steel hot dip Galvanized in order to preserve the resistance in the time.



Static Analysis Of the device with pole and sign panel

For the Static Analysis the actions have been considered on the bidimensional surface seen that the ex position to the wind is relevant orthogonal to the installed panel only.

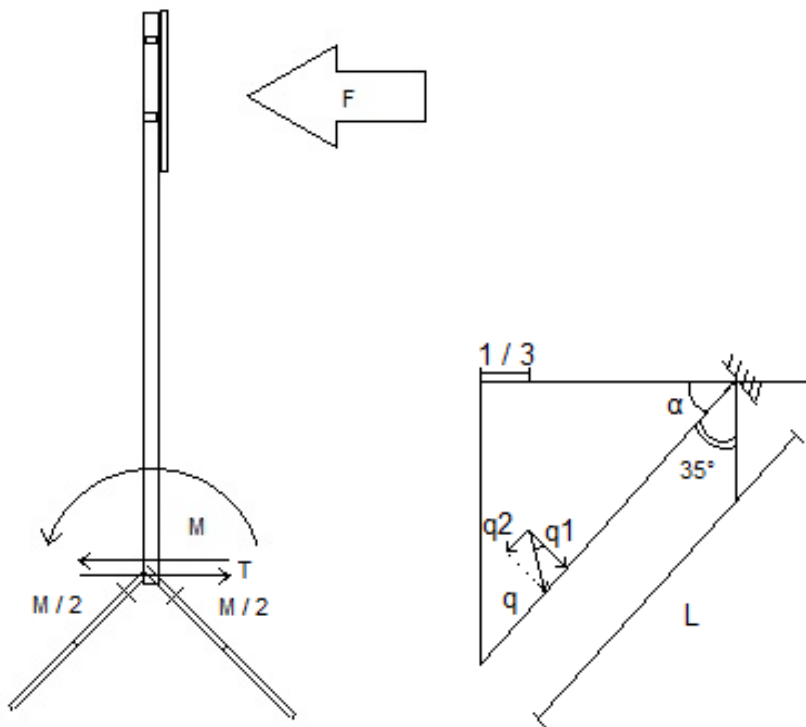
The tangential component given the narrow surface exposed can be considered as negligible. Anchoring inserts are considered as installed in the direction of the acting force.

The third insert, even if not considered for its contribution to the stability in this scheme, is prescribed to be used and if possible it should be introduced in the direction of the pavement.

The analysis has been developed in two phases that determine 2 different tables to which refer for the employability of the device and its versions.

The former analyzes the mechanical resistance of the device to the force deriving from the wind load pressure. The latter analyzes the volume of soil mass that must be activated as a function of the cohesion of the ground and the length of the insert that must be employed.

Resistance Analysis



$$F = Area * \frac{1}{2} * \rho * v_b^2$$

$$T = F$$

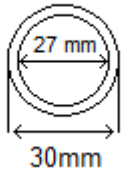
$$M_{TOT} = F * h$$

$$\alpha = 90^\circ - 35^\circ = 55^\circ$$

$$q_2 = q * \text{sen}(\alpha)$$

$$q_1 = q * \text{cos}(\alpha)$$

The analysis determines the relation between the action of the wind on the loaded surface, considered a force on the barycenter of the panel assumed at an heighth of 2,5 meters from the ground, and the yield point of the steel (S235) of the inserts at the inner side of the pole where the force is brought back.



Insert data:

Diameter 30mm

Thickness 1,5 mm

Sectional Area = $A = 130 \text{ mm}^2$

$W_{pl} = 1220 \text{ mm}^3$

$L = \text{Effective length of the burried insert}$
= from 450 to 850 mm

$\sigma_{max} = 235 * (-5\%) = 223,08 \text{ MPa}$

Equilibrium force "q" determined by the insert resistance:

$$\sigma_{max} = \frac{N}{A} + \frac{M}{W_{pl}} =$$

$$= \frac{q * \text{sen}(\alpha)}{A} + \frac{q * \text{cos}(\alpha) * \frac{2}{3} * L}{W}$$

So the maximum bending moment transferable to the insert $M/2$

$$\frac{M}{2} = q_1 * \frac{2}{3} L$$

Once the acceptable bending moment of the 2 inserts has been determined, is possible to define the maximum wind force as a relationship between wind speed and dimension of the panel in a state of equilibrium.

$$M_{TOT} = 2 * \frac{M}{2} = F * h$$

where:

$$v_b = \sqrt{\frac{M_{TOT}}{\text{Area} * \frac{1}{2} \rho * h}}$$

In table 1 below are listed the maximum reference values that the system is able to face with in relation with the surface of the panel.

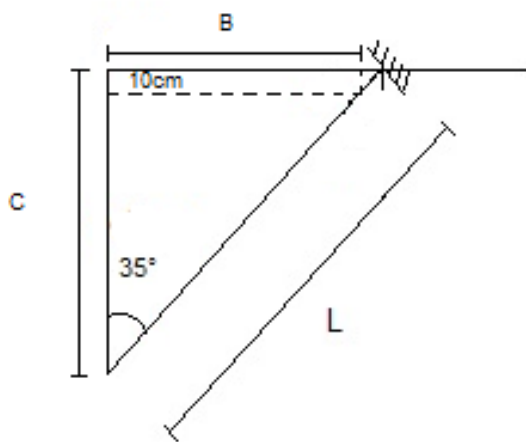
Table 1

Area m2	m/s	Km/h	Pressure N/mq
0,30	31	111,6	600,25
0,35	30	108	562,50
0,40	28	100,8	490
0,45	27	97,2	455,62
0,50	25	90	390,62
0,55	24	86,4	360
0,60	23	82,8	330,62

Static Behaviour Analysis

Considered the limit value determined by the mechanical resistance of the system to the action of the wind is now possible to make some consideration regarding the soil characteristics that for each of the cases in table 1, bring to the determination of the inserts to be employed. The parameter is the undrained cohesion of the soil (C_u) expressed in "KPa" that determines the volume of soil mass that must be activated in order to contrast the wind speed avoiding the overturning of the post. The length of the inserts can assume in millimeters the values: 600, 750 and 1000. In the calculation of the interested area the first 10 cm of organic soil are not considered because they will be probably inconsistent.

A flat homogeneous soil distributed around the device is considered.



$$V = \frac{B * (C - 10cm)}{2}$$

$$C_u = q / V$$

TABLE 2

Cu Soil	Insert L600	Insert L750	Insert L1000
80 KPa	OK	OK	OK
75 KPa	OK	OK	OK
70 KPa	NO	OK	OK
65 KPa	NO	NO	OK

For values of "Cu" above the maximum value listed in the table 2 all the type of elements suitable for the last value available have to be considered.

For values of "Cu" lower than the minimum listed in table 2, a deeper analysis is recommended this could provide for a pull out test on site on the device.

PRESCRIPTION FOR THE PROPER USE

- Make sure that the resistance conditions are sufficient in relation with the wind forces of the installation area and the dimensions of the panel (table 1)
- Make sure that the device is employed opposed of at least 2 inserts in the same direction of the acting forces (ortogonal to the panel surface)
- In case of presence of pavement introduce the third insert in the direction of it.
- Make sure that inserts supplied together with the anchoring device will be employed only.
- Make sure that all the anchoring inserts are completely drew-in into the soil through the appropriate hollow section guide. The insert stuck into the hollow section guide for the whole length of the guide.
- For the correct installation of the device refer anyways to the user's manual provided by TreeSystem srl for this device.