

TECH TIP

WIND LOADS

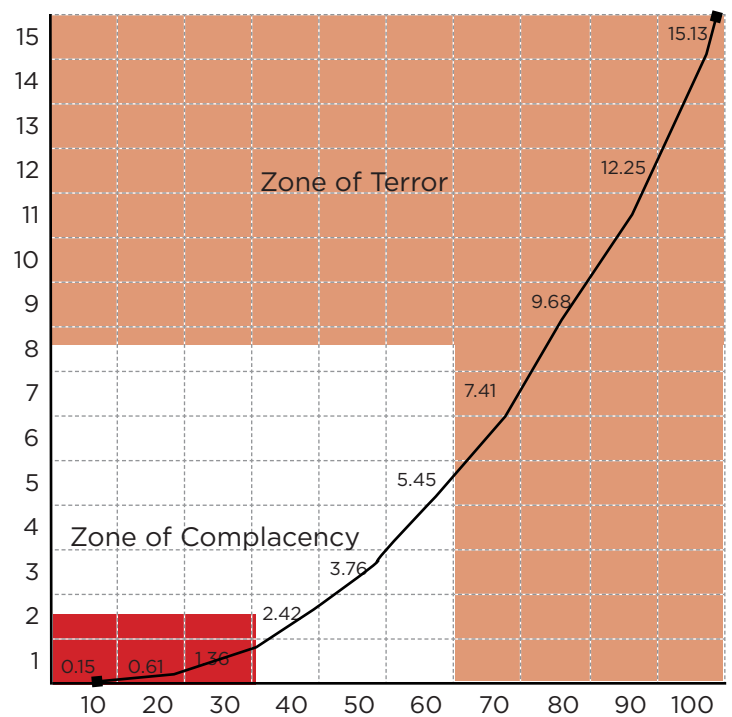
Determining the exact pressure force exerted on a tent by the wind involves several factors, but the most critical is the wind speed itself. The formula for basic wind pressure, without considering the configuration or the dimensions of the tent, involves a conversion factor times the wind speed squared. Several modifiers are also considered based on the type of structure, the topography of the site, the terrain and exposure of the site, the height above ground, and the importance of the tent based on its use.

What sneaks up on tent installers is a zone of complacency where frame tents are set and it appears to be safe because the frame holds the fabric in shape. In recent years, there have been an increasing number of frame tent accidents caused by a lack of proper anchoring when winds suddenly gust.

The key is that the wind pressure is a squared function of the speed. Pressure from a 30 mph wind is nine times more than the pressure created by a 10 mph wind ($30 \text{ mph}^2 / 10 \text{ mph}^2 = 900 / 100 = 9$ times more force). A tent can feel relatively stable and perform well under light winds, but a sudden gust of 30 mph requires the stakes to resist 900% more force. As wind speeds increase, this incremental increase continues to grow. See the accompanying graph of wind speed versus pressure for a typical tent.

Steeply pitched roofs will also be subjected to higher horizontal wind loads, while flatter roofs will be subjected to more uplift load. Open-sided tents can act as horizontal parachutes, catching the wind without allowing it to shed off and around the fabric as an enclosed tent would do.

The angle of outguys also affects the forces imposed on stakes or other anchors. A typical 45-degree outguy has equal vertical and horizontal components of the load. By making the outguy steeper and keeping the horizontal forces the same, the vertical force and outguy tension begins to increase. Similarly, making the outguy flatter keeps the horizontal force constant, the vertical force and tension decreases, changing the diameter slightly to improve holding power. The holding power difference between a 1" diameter stake and a 1-1/4" diameter stake is minimal. It is more important to become extremely proficient at driving and pulling the stakes rather than adding a few stakes to get the necessary holding power. Under certain conditions when ground soil is extremely soft, screw anchors and/or duck bills may be required to get the desired holding capacity.



TECH TIP

WIND LOADS

A common misconception in the tent rental industry is that the amount of anchoring required changes significantly for different styles of tents. But in practice, the wind force pushing on a given tent that is X wide, X long and X high is very similar. As a result, although different styles of tent will require different methods of anchoring, the amount of anchoring will be similar.



Frame Tents

Should be anchored with stakes at the leg and outguys on each frame arch/leg position. Even with the super tube frames in today's market, outguys may be required on some sizes to meet code compliance.



Pole Tents

Require outguying anchors to hold the tent up. Just as important is staking the side poles to prevent the movement of the pole location. When a side pole moves, the value of the outguy is greatly reduced, and many times is the cause of anchor failure, especially on the leeward (back) side of the tent.



Clearspan Structures

Require a different anchoring situation. The aluminum beams and steel plates/connectors are designed to provide additional strength at the leg/eave and rafter apex to handle the applied wind load. Base plates also have a much larger footprint with multiple stakes to do the anchoring. The increased frame weight from the beams and connectors in structure also supplies part of the anchor load. This additional dead weight provides an equivalent in friction holding power that, in other systems, is provided by tent stakes.