Let's Talk About …Wind Effects on Scaffolds

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Wind is air in motion relative to the earth. In general, it is three-dimensional, with both horizontal and vertical components.

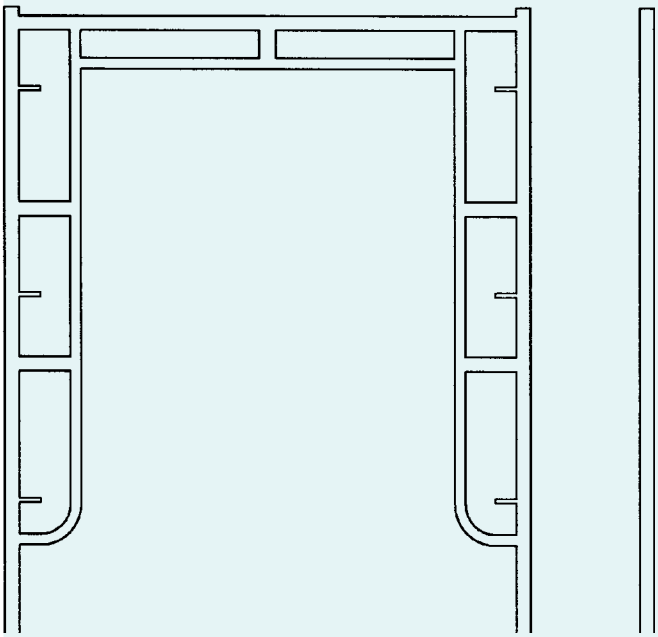
The various components of wind flow are going to have a significant effect on our scaffold, especially if it is enclosed.

Let's use, as an example, an ordinary every-day walk-through frame, 6'6" high, 5 ft wide, and legs of 1 5/8" diameter steel tube.

Looking at it from the side, all we see is the area of the leg.

78" x 1 5/8" = 126.75 in2 = 0.88 SF

This is what the wind "sees" when it blows directly at the side of the frame.

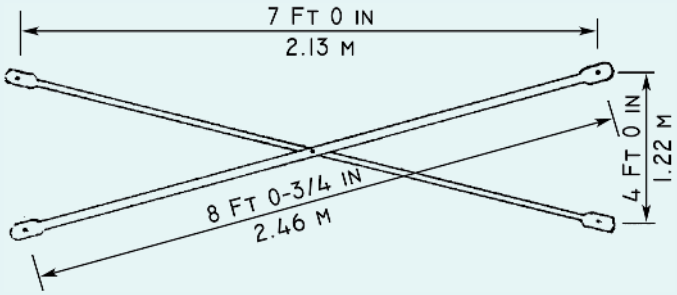


This is called the "Frontal Area," even though it really ought to be called the "Side Area."

Crossbrace 4x7 (8'0¾" long), 1" OD steel tube.

Frontal area of 1 tube: 96.75 x 1 = 96.75 in2

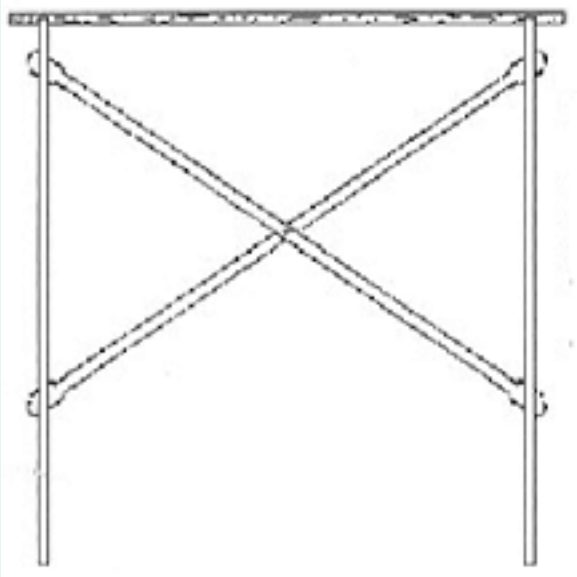
2 tubes = 193.5 in2 = 1.34 SF



Planks on the top ledger of frames for working platform.

The plank is 2" thick, 8 ft long.

Therefore its area is 1.33333 square feet.



The diagram above, as we mentioned before, is called the "Frontal Area" of the Scaffold, what the wind "sees" if it is blowing directly at 90 degrees to the scaffold.

Frontal area of scaffold:

2 legs = 2 x 0.88 SF = 1.76 SF

Xbrace = 1.34 SF

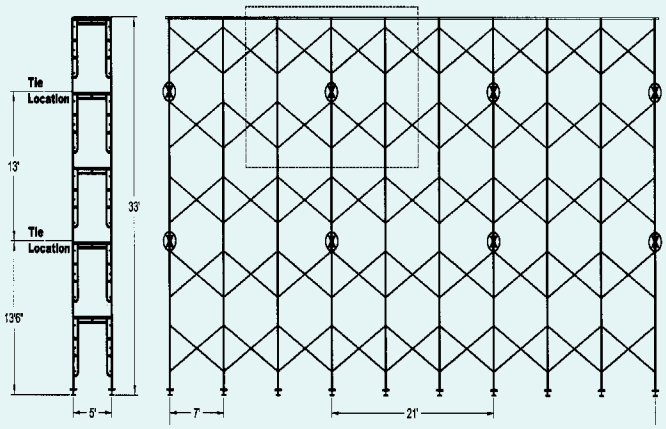
Plank = 1.00 SF

TOTAL = 4.10 SF If the wind blows on this, the force will be 4.1x16.7 = 68.5 lb

Let's take a simple example:

A façade scaffold, 33 ft high (measured to the top of the platform) and 63 ft long. We'll ignore the guardrail system.

Canadian Standard S-269.3 requires that Formwork be designed to resist "wind pressures based on those listed by the National Building Code of Canada, using 1 in 10 probability with a gust factor of 2 and a minimum wind pressure of 0.8 kPa." That is 16.71 psi. This is our only scaffold standard specifying wind load for design.



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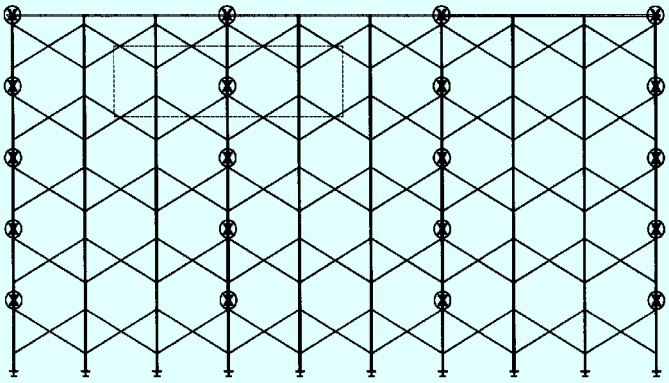


The entire scaffold is subjected to a wind force of 16.7 psf. A typical tie supports the following:

Frames:	6 x 0.88	=	5.28 SF
Braces:	4 x 1.34	=	5.36 SF
Plank:	1.33333 x 3	=	4 SF
TOTAL:			14.64 SF

Wind Force = 14.64 x 16.7 = 244.49 lb

Not a big deal – this load is easily carried by #9 wire and a 2x4. Tests done at Purdue University showed that a double-wrap #9 wire tie will have a safe working load ranging from 600 to 800 lb with a factor of safety of 4:1.

Now –

Let's consider the same scaffold, with tarpaulins covering it, for sandblasting or weather protection, or some other reason.

The same tie now carries a full 13 x 21 = 273 sq ft of sail area.
Wind load on the sail is 273 x 16.7 = 4,559 lb.

WE DON'T HAVE TIES THAT CAN SUPPORT THAT KIND OF LOAD.

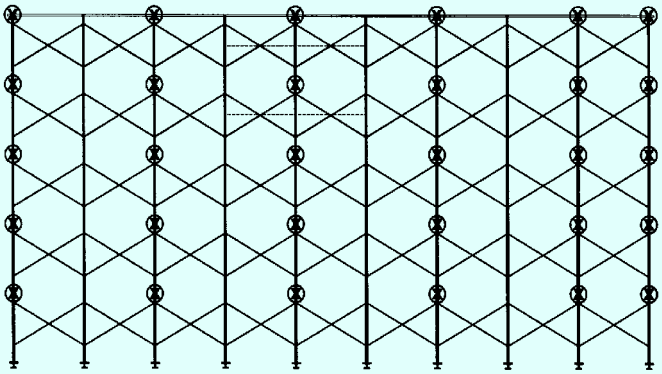
If we take the "Rule of Thumb" and double up on the ties, we set ties at the top of every frame, at 21 ft centers along the scaffold.
Now, an upper tie is supporting 6.5 x 21 = 136.5 square feet of sail.
The load on the tie is 136.5 x 16.7 = 2,280 lb.
This is still too high a load for normal ties.
So our next step is to place a tie at every other line of frames. So now we have ties at each frame connection vertically, and on every other line of frames. Remember that you always have to have a tie at both ends of your scaffold, even if the very next frame is also tied

Now each tie supports 6.5 x 14 = 91 SF @ 16.7 psf = 1,520 lb.
Even this is too high for normal ties.
So we have to consider placing a tie at every single frame connection.
Now an upper tie supports 6.5 x 7 = 45.5 square feet of sail.
The wind force on the tie now is 45.5 x 16.7 = 760 lb.
Now we're back into reality..

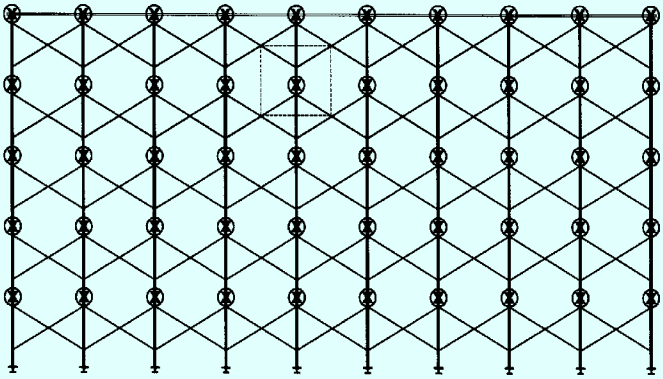
Enclosure material connectors are generally designed to release the fabric at 60 mph or about 9 psf. So we could consider reducing the number of ties slightly.

BUT – if the wind is blowing the fabric directly against the scaffold, the release doesn't work, and you still need the same number of ties.
We've just seen that it isn't realistic just to "double up" on the number of ties when you add enclosure material to a scaffold. And there are a number of details to be considered besides just the wind speed, as you'll see if you refer to the Building Code.

We just looked at a simplified example, with the wind blowing exactly at 90 degrees to the scaffold. When the wind blows at an angle, it decreases the direct force on one side of the scaffold, but it increases the forces on the next side.



It would be kind of nice to have some sort of "rule of thumb" values to use when you put enclosure material onto a scaffold. We don't have that yet, unless we say that we're going to install a tie at every single frame connection point.



We're not saying that it's necessary to hire an engineer every time you have an enclosed scaffold, but you do need to have someone involved who knows what is required, and how to deal with it.

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