

# Construction Tips for Tower Building

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Most well designed towers break at the joints. In well constructed bridges the highest stresses are in the joints. Further, in well glued joints it is the wood of the joint that fails. Generally glue is stronger than wood. Look at the broken pieces of your tower after testing. Two general rules then follow:

- 1) Glue in such a way to get the maximum surface area of wood glued. (Note that glue is only allowed on your tower where wood pieces are in contact.)
- 2) Reinforce the joints with extra wood. (If you look at real towers and bridges constructed of steel, you will often see the joints reinforced.)

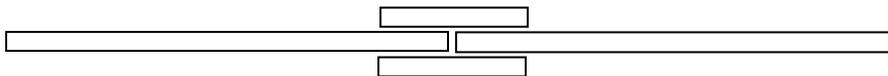
## Weak joint.



## Stronger joint (much larger surface of wood glued)

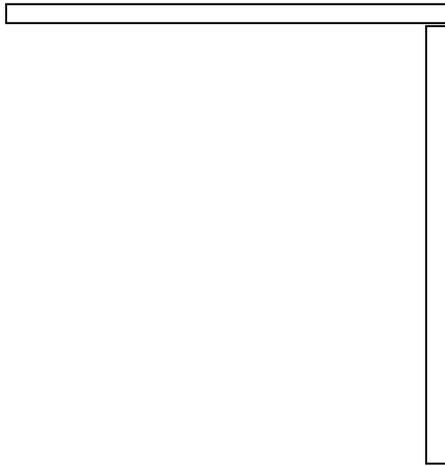


## Even Stronger (but heavier) joint



Reinforce the joints that you expect to be subject to the most stress but remember that you want to keep the tower LIGHT!

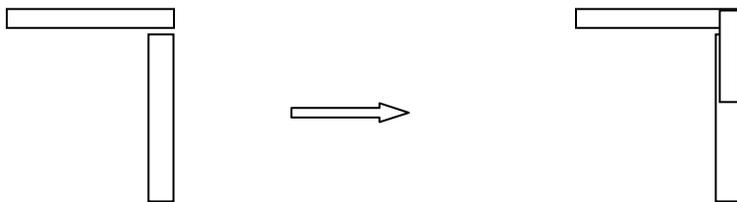
A very common joint brings wood together at right angles:



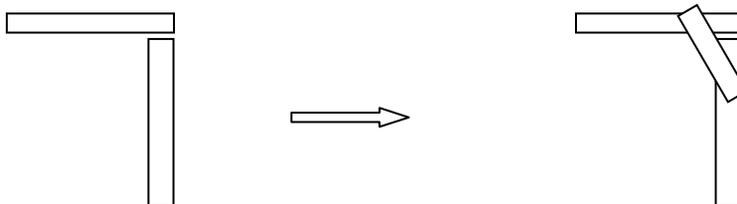
This type of joint can be reinforced two basic ways:

- 1) Overlying reinforcement.
- 2) Bracing reinforcement.

**1) Overlying reinforcement.**

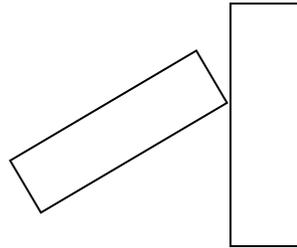


**2) Bracing reinforcement.**

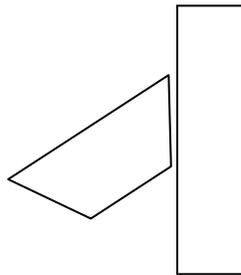


When wood meets at an angle, you should cut the wood so that the maximum surface of wood is in contact at the meeting/gluing point.

### **Poor Contact**

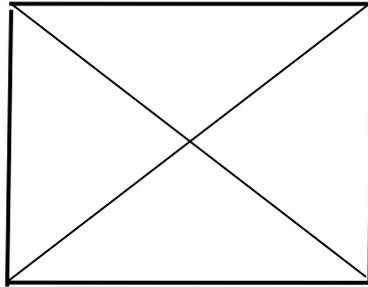


### **Improved Contact**

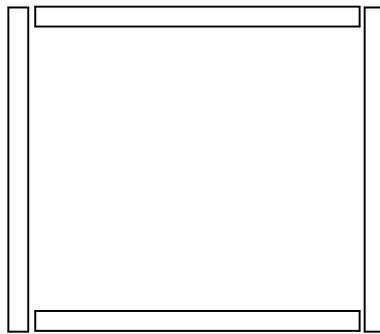


Your drawing is in 2-dimensions, but your tower building takes place in 3-dimensions!

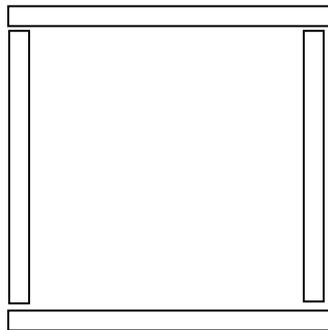
Your tower drawing may include a reinforced box that looks something like this:



It is very nice, but only 2-dimensional. When you build it may look like this:



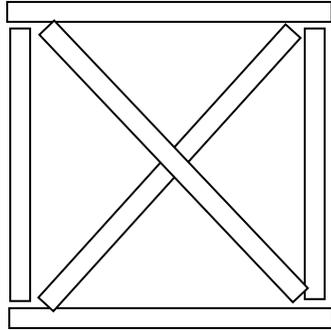
Or this:



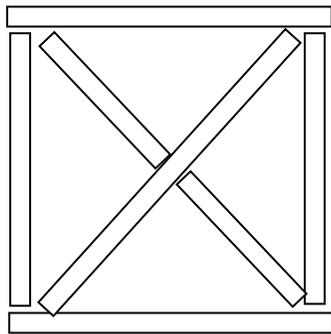
Think about this before hand .... Which will be stronger?

And what about the diagonal pieces?

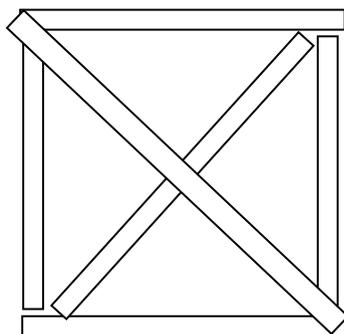
Diagonal pieces are simple in 2-dimensions but complex in 3-dimensions:



If they are inside the box, how will they fit in the center? One can be cut and fitted:



If one is outside the box, it will reinforce the joint and add 3-dimensional rigidity. (Don't forget to glue it in the middle).



In conclusions, it is extremely important that all dimensions are exact.....all legs exactly the same length, at the same angles. And the base and loading platform must be

absolutely level! ANY minor irregularities will cause great unequal stresses and lead to the dreaded "Tower Death by TWISTING"



And, last but not least, two LAWS:

**Do not** let any male persons (particularly fathers, brothers, etc.) TOUCH your tower before you test it. They will want to, they will try to, and....*they will break it!*

**DO** find a sturdy box to carry your tower around in.....