

# ShopBot®

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future.

## Project: Strength Crusher

**Overview:** Teach your students to design and engineer the strongest pillar they can within a 4" x 4" x 44" size. Use these plans to cut and build the crushing module. Then apply weight to the crusher to see who has the strongest structure before it crushes to pieces. A great way to incorporate science, technology, engineering and mathematics to your program.

**Materials:** 3/4" Plywood

**Minimum Cutting Area:** 4' x 8'

**Bit Size:** 1/4"

**Finishing:** Spray the entire project with a clear polyurethane. This will protect the wood and prolong the life of your crusher.



*\*\*Always read the entire project details before starting to cut the file yourself\*\**

*\*\*Account for the thickness of the physical material on hand and the material thickness in the file\*\**

*\*\*This file is zeroed to the tables surface, Zero your bit to the tables surface\*\**



Included with the cut file is a hold down toolpath that shows where it is safe to put screws. Run this file separately from the cut file so you can screw down the work piece, or if you have a different size board or different type of hold down disregard the file.



As the file starts cutting the profile of the parts make sure the cut is going all the way through the work piece and into the table surface. If you need to adjust any part of the file make sure you do not remove the hold down or you will lose position.



Tabs are used to hold all the pieces to the scrap wood attached to them. Use a utility knife to score these edges. Never try to push a piece out without cutting the tab, it will tear the grain on your project. Sand remaining tab flat.



A 1/4" roundover bit adds a nice edge to the entire project.



When assembling this project consider the fact that weight will be applied constantly when this project is put to use. So take your time and glue, screw and nail it properly.



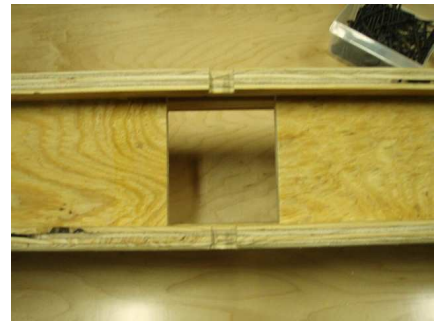
After gluing make sure the project is clamped together and the clamps are left on until the glue has had time to setup.



A nail gun is also a great way to temporarily hold the parts in place before clamps can be installed.



Add screws throughout the project where you feel the need for them. Running 2" screws up through the bottom of the feet is highly recommended.



Make sure the space left in the middle of the base is wide enough to fit the main arm assembly of this project. It is a good idea to check this before the glue has had time to setup.



Set the main arm assembly onto the base. Wood screws or nails can be used to temporarily hold it in place.



Strengthen this point with some bolt on hardware. 3/8" or 7/16" diameter will work fine, use whatever you have laying around the shop.



Glue and screw the diagonal pieces so they attach to the rear of the base and to the main arm assembly. Position the two arm pieces into the slot.



Start assembling the arm. Note the middle holes are not centered, they are off to one side, they need to be positioned as pictured above.



One of the small squares has a pocket on the bottom side, glue and screw this to the support that is below the upper arm.



Glue and screw the other small square so the 4" pocket is facing up.



The larger square goes on the other side. Use the provided pocket, glue and screw.



The up arm gets a set of squares as well. Make sure this is positioned above the lower arm.



Glue and screw to make sure this project holds together once the weight is applied.



If this project is going to see a lot of use, take some scrap pieces of wood and reinforce both bottom pieces that attach to the lower arms. Once can never have enough strength.



This project can be made from several materials.. Hot glue and cardboard. Try something stronger, wood and wood glue.



Once the 4" x 4" x 44" pillar is created, load it into the machine.



Start applying weights until the tower has crumbled apart. Make this into a competition among students. Which design can hold the most weight? Try limiting the materials being used? Only allow so many linear feet of material? Have the students design and cut parts on the ShopBot to make a CNC cut pillar. Enjoy.



No weights laying around? No problem. Set a 5 gallon bucket of water on the pedestal, start filling it up, when the column crushes, have them weigh the bucket of water on a scale and convert water gallons into weight.

Be creative, don't be afraid to try new things, the students will love this, they go crazy when it is crushing day and can finally see who has the strongest structure.