

Shelter 2.0 dxf files for CNC cutting:

Shelter 2.0 is a digitally-fabricated structure, designed as a transitional housing option for the time between initial emergency response with tents and temporary housing, and permanent reconstruction. It has a raised floor, lockable doors for security, open space in walls for insulation, and is built from materials that give it a lifespan much longer than other options. It was also designed to be constructed by unskilled labor with minimal tools, and the pieces sized to efficiently fit in a shipping container.

More information can be found at www.shelter20.com

MATERIALS:

There are 3 material thicknesses used in the Shelter2.0 design.

- $\frac{3}{4}$ " All the framework parts and the floor panels are cut from sheet material that's nominally $\frac{3}{4}$ ". Most sheet goods like plywood that are sold as $\frac{3}{4}$ " are actually thinner, usually 0.72", but the slots are sized so that material up to 0.75" will work fine. All these file names start with "threequarter_"
- $\frac{1}{2}$ " The side panels and end walls are cut from nominal $\frac{1}{2}$ " material. All these file names start with "half_"
- $\frac{1}{8}$ "- $\frac{1}{4}$ " You'll need one 48" x 96" sheet of material for window inserts. We use $\frac{1}{8}$ " acrylic, but you can use whatever you want. A full sheet is enough to cut 6 window inserts which is more than you need...you can either cut the extra ones as spares or save the extra material for another project.

For the $\frac{3}{4}$ " material we use [Advantech](#) from Huber and really like it...it's stable, stays flat for easy CNC cutting, is environmentally sound, and is strong and weather resistant. Plywood would work as long as it's flat enough to cnc cut and the edges are sealed.

We've experimented with OSB and REALLY wanted it to work because it's really cheap, but it just doesn't have the strength or stability needed for long-term use. Your mileage may vary.

LAYERS:

These dxf files are created with layers for the various cutting depths. The layers for the frame

parts are:

- **THROUGH_CUT.** This is for lines that are completely cut through the material, and are the actual edge of the part. Part profiles need to be toolpathed to the outside, and holes in those parts will be toolpathed to the inside. The parts on this layer are **BLACK**
- **CUT_HALFWAY_THROUGH.** This layer is for the half-depth pockets where the pieces for the stringers, sleepers, ribs, and fascia connect. and are already offset for a $\frac{3}{8}$ " bit so the parts should be toolpathed to cut ON the line. When creating toolpaths the cutting depth should be set to $\frac{1}{2}$ of the accurate material thickness..for instance 0.36" if your material is actually 0.72" thick. The parts on this layer are **RED**
- **RECESS_FOR_SCREWS.** This layer is for shallow recesses to mark the location of screws. Set the depth of cut to 0.03" or so below the material face. The parts on this layer are **BLUE**
- **MARKS_ON_FACE.** This layer is for features that are shallowly engraved on the face of the pieces. They are marks for identifying pieces for easy assembly. Set the depth of cut to 0.03" or so below the material face. The parts on this layer are **GREY**
- **MARKS_IN_POCKETS.** This layer is for features that are shallowly engraved in the pocket cuts, and are used to identify the parts for assembly. Set the cut depth to 0.03" below the surface of the pockets, so if the cut depth for the pockets is 0.36" these cuts should be 0.39" deep. The parts on this layer are **GREEN**

There are some special layers in the door, trim, and windows pieces.

- **POCKETS_FOR_HINGES:** In the door and trim layouts are pockets for 3" hinges that should be cut 0.125" deep. They have already been offset for a $\frac{3}{8}$ " bit and are a continuous polyline so should be toolpathed to cut ON the line. The parts on this layer are **CYAN**
- **POCKETS_FOR_WINDOWS:** On the windows and gauge stick sheet there are pockets for the glazing material you select. We usually use $\frac{1}{8}$ " acrylic but you can choose whatever works for you. They have already been offset for a $\frac{3}{8}$ " bit and are a continuous polyline so should be toolpathed to cut ON the line. The parts on this layer are **ORANGE**
- **HINGE_BARREL:** The barrels for hinges have to be cut a little deeper than the flat leaves, so in the door and trim sheets are lines that are cut 0.25" deep to allow for that. They should be toolpathed to cut ON the line. The parts on this layer are **MAGENTA**
- **LAYER1, 0, or DEFAULT:** If you see these they should be empty layers that are created by default by your CAD or toolpathing software. They should be double-checked to make

sure they are empty, but are almost always safe to delete

DRAWING NAMES:

The name of each drawing include the material thickness, the parts in that drawing, and the number of times that that sheet should be cut. In the download they are in folders according to the material thickness, to help keep cutting organized.

BITS:

We tend to cut everything we can with a $\frac{3}{8}$ " bit so these files are created for that diameter bit. You can re-toolpath for a different bit, but unless you have a strong philosophical issue with $\frac{3}{8}$ " bits we recommend sticking with that. If you still want to use a different size bit there are two issues to be aware of.

- The lines on the CUT_HALFWAY_THROUGH layer and the hinge pockets in the Door and Trim sheets are offset for the $\frac{3}{8}$ " bit already, so if you use a different bit you'll need to re-offset them.
- The bolt holes and "dogbones" in the corners are sized for the $\frac{3}{8}$ ". You can cut with a smaller bit without a problem, but if you want to cut with a larger bit they will have to be resized.

TOOLPATHING:

We use the excellent [Vectric](#) products for toolpathing and highly recommend them, but anyone with a CNC tool should have CAM software capable of generating toolpaths from dxf files. We use a homebrew vacuum holddown system to hold our sheets using central vac blowers from [Central Vacuum Motors](#), but sheets can be held in place with carefully placed screws and tabs to hold parts in place.

We suggest using a ramp-in in your toolpaths to ease the startup friction on your bits and help with holding parts, but we very rarely use tabs. The exception is in the narrow pieces in the "door and trim" and "window and spacer stick" sheets...they are too narrow for vacuum to hold safely and we find that some tabs help to keep them from chattering and moving.

The 3/4" Advantech is only available with tongue-and-groove edges on the long sides and these sheet layouts account for that, but if you decide to redo the layout just keep that in mind.

COLOR CODING:

To make the assembly easier we color-code the pieces, using markers or paint in the recesses cut in the MARKS_IN_POCKETS and MARKS_ON_FACE layers.

- Red circles: Sleepers
- Blue circles: Wall stringers
- Green circles: Floor stringers
- Red dots: Ribs
- Blue dots: Fascia

