

Lofty Lair

Elevator pitch

A simple, easily constructed twin-sized bed frame made from 2"x4"s, .5" plywood sheets, and construction screws. It'll hold an 8" twin mattress 2' from a 91" tall ceiling. A desk/bookshelf is tucked behind its ladder.

Broad constraints

- **Simple** - Made from the fewest pieces - and none should ever require complicated cuts.
- **Functional** - Should hold a large number of books on bookshelves behind the ladder steps.
- **Thin knees** - Bracing supports can be made from flat panels instead of angled studs.
- **Fit a twin bed** - And must fit in a 44.5" x 85" footprint and be no closer than 2' from the ceiling.
- **Ladder on side** - Do not position the ladder at the end of the bed (it would obstruct the closet door.)

Inspiration



Plan

Design in CAD - within constraints

I started by creating walls, the ceiling, and the floor in my CAD program. Then, 24" from the ceiling, I added a 8" x 38" x 75" cube and added a bevel to make it look like a mattress. Under that, I added a panel with 5/32" x 38" x 75" dimensions for the mattress pad. I knew that I wanted this panel to rest on 2x4s so I created 1.5" x 3.5" "spines" and "ribs" positioned underneath. This frame would be screwed to the legs around each corner which are positioned so that only the wider face is visible facing outward.

I knew that I wanted the ladder to be sloped so I positioned the steps first. The top step is about as far down from the mattress top as each step is from the next. (None of them actually overlap the footprint of the last.) 4 steps, placed 13" (and 3.5") apart, results in a 15° ladder that looks like I want. At this point I realized that the ceiling is 91" above the floor and 91 is divisible by 13. So I moved everything down so the top of the mattress would end up 26" from the ceiling & the desk surfaces match the ladder's first 2 steps.

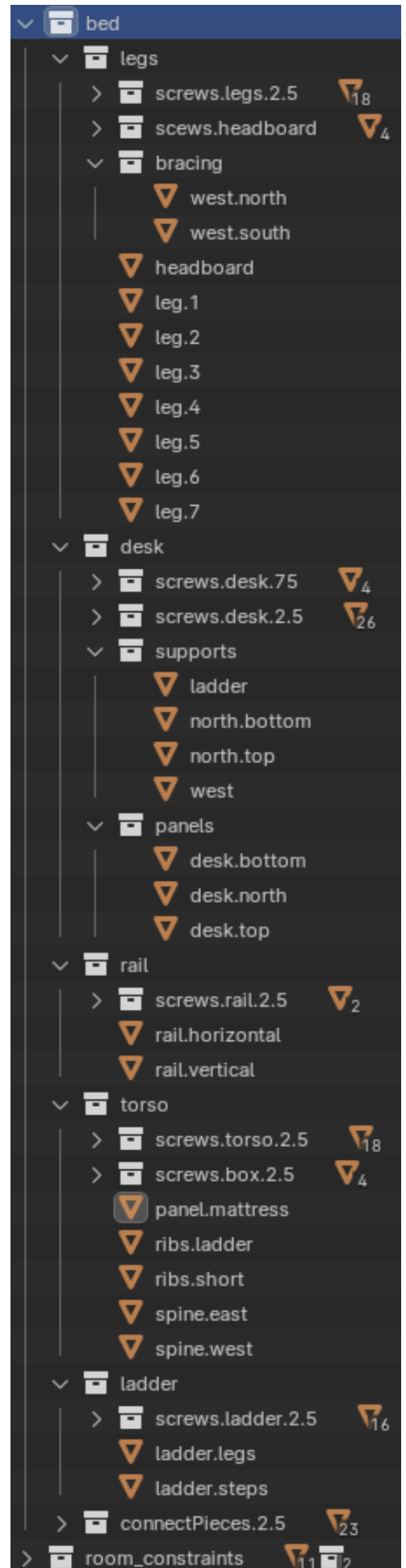
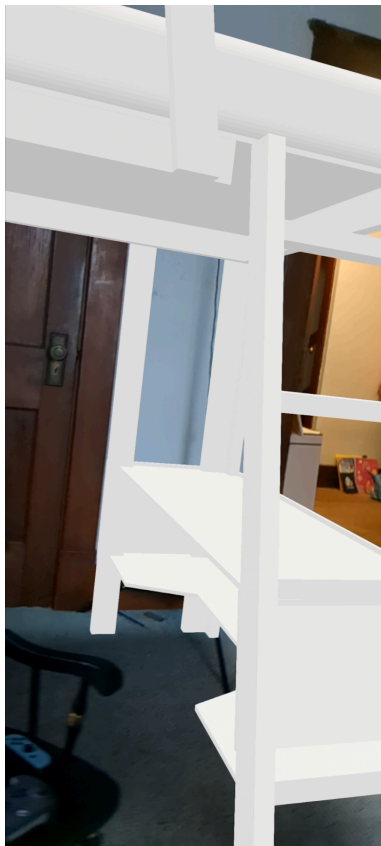
Your own design, built within your own different constraints and preferences would definitely end up different.



I placed my “constraint” objects in their own collection and positioned them on the other side of the axes from the design so that all the parts’ dimensions can easily be based off of a 0 origin. I used keyboard shortcuts for most of the transformations. (Keying G > Y > 1.5 or R > X > 15 will result in more precisely positioned parts than moving and rotating by hand.) I chose Blender for my CAD program because it is free and works well for visualizing projects.

If you export your design as a GLTF or GLB file (and design everything with accurate units) and use an Android phone, you can preview your design through the phone’s camera in augmented reality! Upload your file to an internet location accessible to your phone and point your phone’s browser to a link like the following:

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intent://arvr.google.com/scene-viewer/1.0?file=[file_location]&
mode=ar_preferred&resizable=false&title=Project+Preview#Intent;
scheme=https;package=com.google.android.googlequicksearchbox;
action=android.intent.action.VIEW;S.browser_fallback_url=https://
developers.google.com/ar;end;
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Measure & cut lumber

After you're happy with the design, inspect each piece and note the important dimensions in the item properties. Organizing the scene collection (and renaming objects as they're created) helps this process.

For the 2x4s, this is the resulting list for my design:

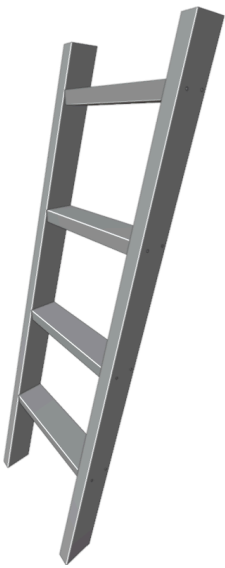
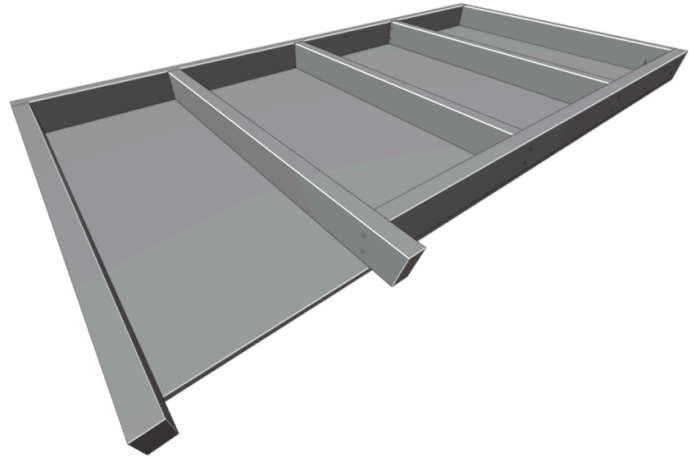
- For the **legs**:
 - (4) 71.5"
 - (2) 64"
 - (1) 56.5"
- For the **mattress frame**:
 - (1) 75"
 - (1) 57.5"
 - (2) 39.7"
 - (3) 35"
- For the **ladder**:
 - (2) 59.4"
 - (4) 14.5"
- For the **rail**:
 - (1) 52.5"
 - (1) 19.3"
- For the **braces**: (I just used cutoff pieces.)
 - (2) 20"
- For the **desk supports**:
 - (1) 52"
 - (1) 48.5"
 - (2) 16.5"
 - (2) 14.5"

For the panels, this is the resulting list:

- For the **mattress frame**:
 - 38" x 75"
- For the **headboard**:
 - 38" x 16"
- For the **desk**:
 - 16" x 48.5" (with leg area cutout)
 - 16" x 45"
 - 18" x 47.8" (15° cut off the end)

Partially assemble

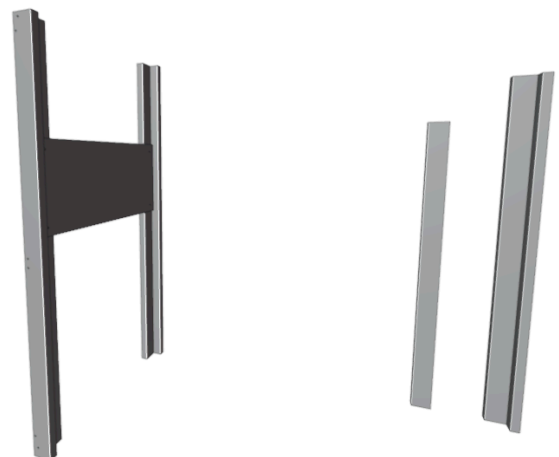
The good news for me is that I already had a majority of the lumber I needed for the project! First, we assembled the mattress frame. We used clamps to pull any twisted boards into “plumb” and used squares to confirm squareness. We attached the 3 shorter rafters/ribs first, and then attached the first longer rib (the rib that will connect with the top left corner of the ladder.) Next, we measured opposite corners to see how “out of square” we were so far. We were within $\frac{1}{8}$ ” so then we attached the 38” x 75” twin mattress board. Lastly, we attached the final “rib” to the mattress panel and the longer “spine.”



Setting the mattress frame aside, we next assembled the ladder. We knew that we wanted each step to be 13” above the last and this means that each is positioned 13.46” along the ladder railings from the last. We marked the railings with that spacing and then held the upper, forward corner against that mark while screwing together the ladder.

For all the assembly, we used around 100 $2\frac{1}{2}$ ” #8 construction screws with star drive heads and about 25 $1\frac{3}{4}$ ” #8 construction screws with star drive heads. Even though I carefully planned the placement of screws in the design and expected to drill pilot holes, the use of construction screws meant in the actual construction, we could just drive the screws wherever made most sense in the moment.

The legs were pretty easy. As long as we didn’t yet have preference for which end was “up,” it didn’t matter which 2x4 was screwed into the other. We just screwed pairs of the legs together and then carried all these assembled sections to the bedroom where the loft would end up.



Assemble in situ

First, we marked on the legs where we want the mattress frame to end up. Then we lifted the mattress frame and clamped the frame to the legs near to the mark. (The clamp only needs to be strong enough to hold it temporarily while we position the other legs.)

Because the ladder is the least forgiving of the legs in regards to the mattress height (placing it poorly will result in the feet of the angled ladder to not rest flat across the floor, or the points at the top to not match with the exposed ribs on the mattress frame.) We held the mattress frame so it matched with the top of the ladder and the ladder feet were flat and screwed the pieces together. Then we just went around to each remaining leg and, while consulting a bubble level resting on the mattress panel, raised the mattress frame until it was level and the leg was plumb vertical and then screwed the legs to the mattress frame. Finally, we simply screwed the 45° offcuts as braces on the inside of the legs, under the mattress frame.



Next, we screwed the supports for the desk into the legs (and ladder.) The angled braces, the headboard, and this non “square” shape at the end lends surprising strength to the loft even before we add the remaining panels to the desk. We also attach the 2x4s for the railing with plentiful screws.

Finally, we cut the panels for the horizontal surfaces for the desk and the “front” panel and attach them to the supports.

Sand sharp corners

This design will result in a few sharp corners. Use an orbital sander or belt sander on (or hand sand if you prefer) any corner you anticipate will cause discomfort or injuries. Then touch every edge with a cursory sanding. Wipe everything with a damp cloth to remove remaining sawdust and then let it dry before painting the loft.



Paint with primer

To protect the bed frame, paint the entire loft with primer paint. Depending on how thick the primer is, you may need several coats of paint. Put down a drop cloth and prop the loft up on blocks so that when you paint the loft it doesn't damage or stick to the floor.



Encourage recipient to decorate/personalize

We hope that with every new design our daughter adds to the loft, the more she feels like this loft is hers.

