



solutions for sagging shelves

Strong & Sturdy Shelving

Build plywood shelves that not only look great but will stand up to heavy-duty loads for the long haul — without sagging.

Most of the storage and cabinet projects I build have at least a couple shelves. The shelves are used to store everything from odds and ends to heavy books and electronics. And nothing's more disappointing than seeing a shelf sag as soon as you start loading it up.

The amazing thing is how little sag it takes before you begin to notice it. All it takes is a sag of about $\frac{1}{32}$ " for each foot of shelf length before it stands out like a sore thumb.

So any time you build a project with shelves, it's important to keep strength in mind. And one of the

first things to consider is the material you use to build the shelves.

MATERIALS. For most of my projects, I'll either use solid wood or plywood over particle board or medium-density fiberboard (MDF). And nine times out of ten, plywood will be my first choice.

Now don't get me wrong. There's nothing wrong with solid wood shelves. They look great and they're strong. But using only solid wood can be expensive. Plus, solid wood expands and contracts — just another thing to think about when designing a project.

PLYWOOD SHELVES. To avoid these problems, I turn to plywood. But like other materials, even plywood has its limitations. You can find out how much a plywood shelf will sag using an interesting program, called *The Sagulator* (see Plywood Shelving

Plywood Shelving Fast Facts:

- Always consider the expected load for a shelf when designing a project
- The total load, how it's arranged, and how the shelf is reinforced all affect the strength of a shelf
- You'll start to notice sag once it measures $\frac{1}{32}$ " for each foot of shelf length
- The maximum shelf length to consider without any reinforcement is about 30"
- The main ways to increase the strength of a shelf:
 - Widening (deepening) the shelf
 - Shortening the shelf
 - Adding a hardwood strip on edge (roughly triples the strength)
 - Doubling the thickness (increases shelf strength by four)
- You can calculate the approximate sag of a shelf by use an online program: *The Sagulator* at www.woodbin.com

Fast Facts at left). This program considers the material, size and loading of a shelf and gives you a rough idea of how much a shelf will sag. So what if you find your shelf isn't up to the task?

STRENGTHENING A SHELF. One of the simplest ways to minimize sag is to make shorter shelves or make them deeper. But that's not usually an option since it affects the overall design and look of a project that I may not want to change.

GIVING PLYWOOD AN EDGE. Instead, I look for ways to give my plywood a better "edge." What do I mean by that? Well, I almost always have to cover up the edge of plywood with thin strips of hardwood to hide the plys. You can see what I'm talking about in the top photo at right.

But hardwood edging doesn't always have to be thin and narrow. With a little thought and extra work, you can make that edging strip do so much more — it can really add strength to the shelf.

To do this, but still maintain the look of a "thin" shelf, I'll often use a wider hardwood strip. Gluing on a wider strip can be a challenge. So when I do this, I like to

use a tongue and groove joint, like you see in the second photo from the top. The tongue and groove provides a mechanical "lock," so it's easy to keep the strip aligned with the face of the shelf. For many shelves, this simple addition may be all it takes to eliminate any noticeable sag.

TURN IT ON EDGE. But the best way to ensure a strong shelf is to simply take that strip, widen it just a bit, and turn it on edge, like you see in the main photo on the opposite page. Now there are a couple ways you can add a strip on edge (see lower two photos at right).

The first way is to cut a rabbet in the hardwood strip and glue it in place. The other is to join the edging to the shelf with a tongue and groove joint. Both ways will triple the strength of a shelf. Even though the tongue and groove joint is a little more work, it ensures the edging and shelf are aligned perfectly without much effort.

HEAVY-DUTY DESIGNS. There are times when strength is what matters most. To see a couple different ways to make a really strong shelf, check out the box below. **W**

Heavy Loads: Beefing it Up



Super-Strong Shelves. For very heavy loads, like encyclopedias and electronics, you might want to consider the shelves shown above. They add more strength than what's shown in the margin.

Adding a pair of strips under the shelf along with an edging strip (left) helps reduce the sag to a fourth of a plywood shelf the same size. Want a simpler look with less joinery? You can get the same strength by doubling the thickness of the shelf and then gluing on a wide edging strip (right).

How-To: Add Strength

GOOD



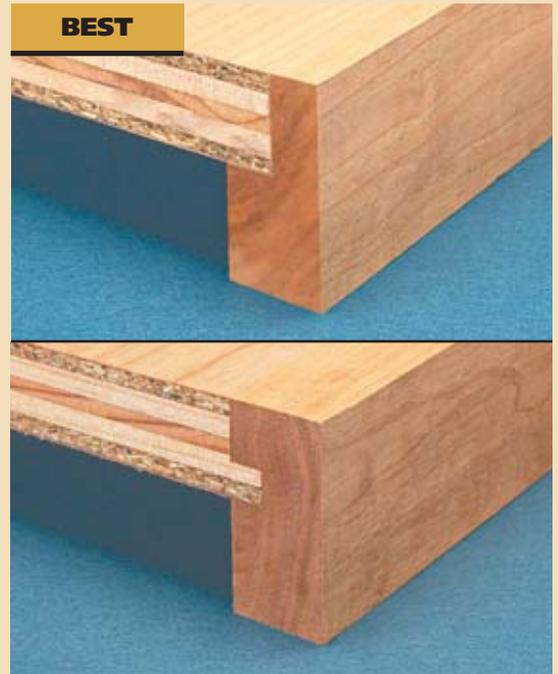
Simple Edging. Although it adds a small amount of strength, the main purpose of a strip of thin edging is to cover up the plywood edges.

BETTER



Wide Hardwood Strip. To add strength, but still maintain a "thin" edge, use a tongue and groove joint to add a wide hardwood strip to the shelf.

BEST



Turn it on Edge. Taking a wide hardwood strip and turning it on edge (top photo) significantly strengthens the shelf without requiring a lot of additional work. Adding a tongue and groove joint (bottom photo) adds just as much strength, but the joinery makes aligning the edging and shelf a snap.