Woodworking Tips

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Shelving Spans for Bookcases

If you're designing a cabinet or a bookcase, what's the greatest length (span) a shelf can be without an objectionable sag? There are four factors to consider: 1) how the load is distributed, 2) the expected load, 3) the shelf material, 4) the method of reinforcement.

LOAD DISTRIBUTION. For the tests we conducted to create our recommendations (see below), we wanted to determine the worst possible situation for the distribution of load. So we use six bricks (42 pounds) and placed them right in the centre of the shelf. However, in a normal situation, the weight would probably be distributed over the entire shelf.

EXPECTED LOAD. Another factor used to determine maximum span is the total expected load -- the longer the shelf, the more books (and weight) it has to hold. A running foot of average sized books weighs about 20 pounds. So a three-foot shelf filled with average sized books would have to support 60 pounds. Records albums (does anyone use these anymore) and encyclopaedias would weight more, paperback books less.

SHELF MATERIAL. The third factor used to determine maximum span is the type of material used -- particle board, plywood, solid wood. Each has a different stiffness.

REINFORCEMENT. Finally, if you want to increase spans, you can add reinforcement to reduce the amount of sag.

GUIDELINES. Taking the four factors into consideration, the chart shows some general guidelines for the maximum span for shelves to avoid objectionable sag. Note: The most practical approach is to use 4/4 stock or plywood with reinforcement. This will produce shelves with minimum sag and the best visual appearance.

MAXIMUM SPAN FOR 10" WIDE SHELF FULL OF BOOKS

Shelf Material	Maximum Span
3/4" Particle Board	24"
3/4" Plywood	30"
4/4 (13/16") Solid Stock	36"
6/4 (1	

3/4" Plywood Reinforced with:	
1-1/4" wide face strip on edge	36"
1-1/4" wide face strip on side	32"
Aluminium strip underneath	36"
Moulding strips underneath	36"

Workbench Height

Does your back start to ache after you've been working at your workbench for a while? Have you ever tried to hand plane a board and decided it was just too much work?

The height of the work surface of your workbench can make a difference. It should be the right height to fit you and the way you work. If you already have a workbench, you can use these guidelines to modify your bench height to make it more comfortable. If you're building a new bench, use these guidelines to determine how high to make it.

On most benches, the working surface is somewhere between 33" and 36" high. If you're average height (between 5'9" and 6'0"), that's usually a comfortable height. But even a change of 1" up or down can make a big difference in how easy it is to work at the bench.

We've used a lot of methods to determine the best height for a bench. But one simple method seems to give the best results. Just measure the distance from the floor to the crease on the inside of your wrist. When I did this, the measurement was 34". So that's the height I used on my bench.

Increase or decrease the length of the legs on your workbench to adjust the height of the work surface to match your wrist crease measurement. If you're 5'10" or taller, you may find a wrist crease measurement of 35" to 37". This may seem too high for a bench -- especially considering the old standards. But those standards were developed and valid when the general population was shorter than it is today.

Plastic Runners for Woodworking

Every season the humidity in our shop changes -- and the wood in our shop changes with it. One of the first places we notice this is when pushing a shop-built jig across the table saw. Many of our jigs -- like our sliding cut-off table -- have wooden runners on the bottom that slide in the mitre gauge slot.

The problem is that for accuracy, we've made these runners fit fairly tight. But when the wood swells or shrinks with changes in humidity, the fit becomes too tight or too loose in the slot.

PLASTIC RUNNERS. Recently, we've been replacing the wood runners with strips of 1/4" Plexiglas. You'll find Plexiglas at a local plastic distributor or hobby shop. (Look under "Plastics" in the Yellow Pages.) Plexiglas can be cut on a table saw and sanded like wood (we use 400-grit wet-dry sandpaper for final sanding). Then simply countersink and screw the strip to the bottom of the jig.

Another good plastic for runners is UHMW (ultra high molecular weight) plastic. It's a lightweight, dense white plastic that's very slick.

And finally there's phenolic (the stuff we make our router table inserts out of). Both of these last two can be worked with regular woodworking tools, and are available under "Plastics" in the Yellow Pages in most cities.

OTHER OPTIONS. There are other options. One is Masonite or hardboard. It's stable, and can be easily worked with woodworking tools. Though it doesn't stand up to abrasion as well as Plexiglas, it's a good alternative to solid stock.

We've also had good luck with medium density fibreboard. MDF is also strong, stable, and easy to work with woodworking tools. We've been using scraps left over from other projects. It's too expensive to go by a sheet just for this purpose.

:Figuring Board Feet

Unlike softwoods, which are sold in standardized dimensions, hardwoods are sold in random widths and lengths. So to tell how much wood hardwood boards contain, they are measured in board feet. "Board Feet" is a volume measurement. One board foot equals 144 cubic inches.

Often, a board foot is illustrated as a board 1"-thick x 12"-wide x 12"-long, but you'll rarely find lumber in those dimensions. Any board containing a total of 144 cubic inches of wood equals one board feet, regardless of its proportions.

To calculate the number of board feet in a piece of lumber, multiply the board's thickness by its width, then its length, all in inches. Then divide by 144:
(thickness x width x length)/144

For example, a 1" x 9" x 96"-long board equals six board feet (1x9x96=864/144=6). If this board were 1-1/2"-thick, it would contain 9 board feet (1.5x9x96=1296/144=9).

For these purposes, a 3/4"-thick board is considered to be a full inch thick.

Thinner stock is not typically described in board feet. Also, hardwood thickness is expressed differently than softwood -- in quarters of an inch. A 4/4 (say "four-quarter") board is 1"-thick. A 1-1/2"-thick board is expressed as 6/4. This often reflects the rough-sawn thickness. Surfaced lumber will be slightly thinner.

Softwood Plywood Grades

In years past, it was easy to find cabinet quality softwood plywood at just about any lumberyard or home improvement center. But not anymore. Today, with the high cost of lumber, all they usually stock are construction grades. To find a higher grade, you'll need to do a little legwork.

GRADES. But before you do, it's a good idea to be familiar with softwood plywood grades. The most common are A, B, C, and D. With the A and B grades, large knots are replaced with football-shaped patches. Small knots and slight gaps are filled with a synthetic wood filler, and voids along the edges are common.

In the lower grades of plywood (C and D), there's more patching and filling -- even open gaps and defects are allowed. For shop use, we'll generally stick with a BC (utility) grade of plywood (around $25 for a 3/4" thick sheet). But if we're building a piece of furniture, we move up to a higher quality plywood.

HIGHER QUALITY. Here in Des Moines, Iowa, we can buy quality, high-grade AA and AB softwood plywood from a national lumber dealer -- one with with stores all over the US -- and from a local lumberyard that caters to the professional cabinet shops in the area.

If you have trouble finding dealers like these, try looking in the Yellow Pages under cabinets and cabinetmakers, or millwork shops. Then give them a call and ask where they're buying their softwood plywood.

FACE VENEER. When you do find some, take a close look at it. We've noticed that there's a wide range in quality -- even within a grade. For example, at one local lumberyard, we can buy two 3/4"-thick sheets of AB plywood that are both produced by the same manufacturer. One sheet has five plies with wild grain on the "A" face ($45). Knots have been removed and patched. Other surface imperfections have been filled. And since interior plies are a lower grade, there's a good chance the sheet will be riddled with voids.

The other sheet is a different product manufactured to a higher standard ($48). Instead of five plies, there are seven. The grain and colour on the "A" face is straighter and clearer. There are no knots or patches. And with higher quality interior plies, the sheet is free of voids.

It's our experience that even though you'll have to pay a few dollars more for this type of softwood plywood (and do some extra legwork to find it), it's well worth it.

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