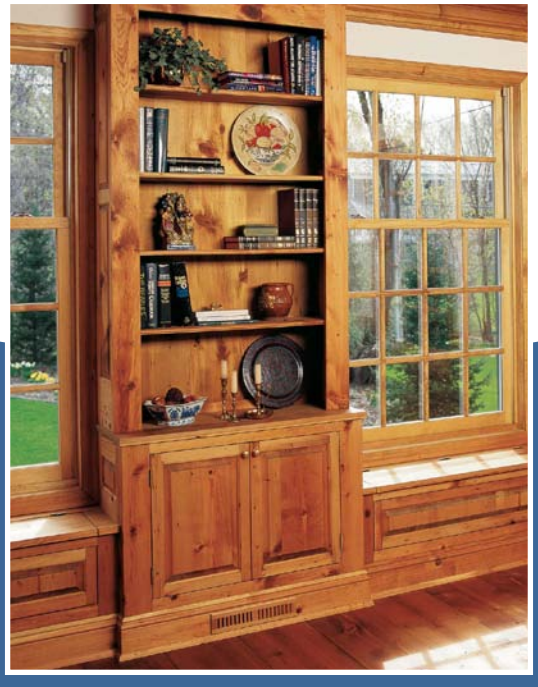
Wood Types

Your Guide to the Lumberyard



LUSTING FOR LUMBER

Sometimes the hardest part of working with wood is simply finding it. Here are the strategies we use to keep our wood racks full.

Like many legendary lumber tales, our story begins with a farmer and an old barn out in the middle of nowhere.

You see, there was this farmer out in the middle of nowhere, and about 25 years ago a storm blew down the biggest walnut tree on his land. The farmer had a friend at a sawmill cut up the tree, and the old guy put the wood in his barn to use someday.

Someday never came. The farmer died, one of his relatives called us and we went out to this secluded hamlet with visions of 24"-wide clear planks in our heads.

But like many lumber tales, ours ended when we scaled up to the barn's hayloft. Up there we found a mound of moldy, rotting, bug-infested, unstickered wood that wasn't even good enough to burn.

Finding lumber off the beaten path has both risks and rewards. For every time we've bought black cherry for $1 a board foot (kiln-dried but ungraded), we've probably had three or four times when we came up empty-handed. Or worse, we bought wood that looked good to us as we loaded the truck, but it turned out to be junk.

Because we can't always rely on foraging for wood, we're also regular customers at commercial lumberyards. Sure, the price can be a bit higher, but the lumber is graded, so you know what you're going to get. And the supply is more predictable than hunting for the old barn in the woods.

No matter who you are, unless you own a sawmill, finding the best material for your projects is going to be a challenge. Even professional cabinetmakers are constantly foraging for new sources for wood.

But it is possible to find quality lumber – no matter where in the country you

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

Photo by Tim Grondin

Editor and Publisher Steve Shanesy pulls out one of his monster walnut boards. The lumber, all 1,100 board feet, came free from a neighborhood tree. A number of boards were up to 30'' wide. Steve hired a Wood-Mizer sawmill operator to cut the logs.

live. To verify this, we tracked down several woodworkers from relatively hardwood-deprived states such as Florida, Arizona and Texas (all of whom belonged to a woodworking club by the way). According to these wood scroungers, it is possible to find quality lumber. You just have to know where to look.

And when you do find some wood, you need to figure out if it's worth buying. This means you have to get familiar with the lumberyard lexicon. There are lots of terms you need to know so you can ask for (and get) exactly what you need. To help you on that point, we've included a glossary of the common terms and expressions you'll hear at the lumberyard ("The Language of Lumber" on page 53).

Once you've boned up on the lumberyard-ese, it's time to start your search. Here are the strategies we use to keep the racks in the *Popular Woodworking* shop (and at home) full of good wood.

Commercial Lumberyards

Believe it or not, you might not be aware of all the lumberyards that carry hardwoods in your area. Some are small family operations that rely more on word of mouth than marketing. Your first step should be to check the Yellow Pages (look under "lumber, retail") and visit the WoodFinder web site (woodfinder.com), which can help you find suppliers within a 200-mile radius.

Some lumberyards deliver even small loads, and others are worth

the drive, so don't discount the stores that are out of town. If you're still not having luck finding basic hardwoods such as red oak and poplar, call a local cabinetshop and nicely ask where you can find hardwoods locally.

And don't forget to look for lumber mills if you live near hardwood forests. Some of these mills sell direct to the public, and the prices can be pretty good.

Wood by Mail

It might seem nuts to buy lumber through the mail, especially when you consider that you're buying it sight-unseen and have to pay for shipping. But many of the big mail-order lumber suppliers actually are quite competitive in price, and the wood is of a high quality.

Editor Steve Shanesy recently visited Steve Wall Lumber Co. (walllumber.com or 800-633-4062) in North Carolina and was impressed by what he saw in the racks. Wall offers special 20-board-foot bundles of lumber in 3' to 5' lengths that ship via UPS. Here are some recent prices for 4/4 S2S lumber: mahogany for $5 a board foot, cherry for $5.50, soft maple for $3.95. And those prices include all shipping costs.

Woodcraft (woodcraft.com or 800-225-1153) sells domestic and exotic woods by the board or in bundles. Paxton (paxtonwood.com or 800-325-9800) sells wood by the bundle, and so do many other large lumberyards. Woodfinder (woodfinder.com) lists many other mail-order companies, too.

Join the Club

Of course there are ways to make the search easier. Perhaps the best way is to join your local woodworking club or guild.

Almost every club seems to have a resident wood scrounger who is more than happy to point you to places that are off the beaten path. Some clubs even organize purchases of lumber for their members – buying in volume drives down the price. And if you're looking for a small quantity of a particular species, it's likely that one club member will have a few

How much lumber did you need? Commercial lumberyards and mills are an excellent source of consistent, graded lumber with few surprises.

A LOG IN EVERY PORT

In 1992, Donald Boudreau and his wife, Carol, sold everything they owned, bought a teak 49' sailboat, named it Domicile and began fulfilling their dream of sailing around the world.

While in Rio Dolce, Guatemala, Boudreau wanted to make a cutting board that also would cover the top of his stove. A local gave him some wood to use for the project. Later, Boudreau realized it was goncalo alves (tigerwood). It was Bourdreau's first experience with exotic wood. He soon began collecting exotic wood wherever they docked.

Six years and many islands later, the couple was in New Zealand with an expensive wood collection and grandchildren waiting for their return back home. So they sold the boat and shipped the wood to South Florida where they planned to make their new home near Ft. Lauderdale.

Once in Florida, Boudreau put his exotic wood collection aside and spent three years building every piece of furniture for their new home. With the home furnished, Boudreau began building award-winning boxes using the exotic wood he purchased on his trip and has since been collecting.

Donald Boudreau and his wife sailed this sailboat around the world, collecting tropical hardwoods in Central America, South America and the South Pacific.

At any given time his shop is filled with 50 to 60 different species of wood totaling several hundred board feet. While he has found several Florida dealers who import Latin American wood, Boudreau says he also buys 4/4 hardwood flooring, shops on the Internet and, when necessary, hops on a plane to make a purchase.

— Kara Gebhart

FANCY (AND FREE) FIREWOOD

Three years ago in Moscow, Ohio, Steve Koller and his father, Eugene, were loading a pickup truck with odds and ends from a pallet company – wood they would use to heat their homes. Steve began noticing the dark color of some of the pallet wood. So he took a piece of it to his shop and cut it in half. At that moment Steve realized he and his father had just brought home an entire truckload of walnut. While there were some small pieces, others ranged in size from 18" to 24" long, 6" wide and 3" thick.

The next week, Steve and his father went to the pallet company for some more firewood, only to discover they had brought home a pickup truck full of cherry. But their luck soon ended. According to Steve, since then, the pallets have been the norm: oak and poplar.

— KG

You need a few things to move logs: cant hooks, a strong back and lots of friends (all shown at right). It's grueling work, but it's worth it.

extra board feet of that species to sell. They'll probably offer it to you at a great price, too.

Don't know if there's a club in your area? Go to betterwoodworking.com/woodworking_clubs.htm to find one near you. We highly recommend joining a club.

Mobile Mills

There are, of course, thousands of board feet of lumber outside every window. And whenever Mother Nature is roused, the downed trees in your neighborhood are a potential gold mine of wide, clear stock. It's just a matter of first moving the "bole" – the straight part of the trunk below the branches that yields clear and stable wood. Moving the bole is perhaps the most difficult task.

Then you have to find someone to mill the logs into suitable thicknesses for drying. Luckily, this is pretty easy. Wood-Mizer Products Inc., which manufactures portable band-saw mills, maintains a list of sawyers who perform custom-cutting. Contact Wood-Mizer at woodmizer.com or 800-553-0182. In addition to Wood-Mizer owners, there are probably other sawyers in your area who will do the job. Check with your local woodworking club (another good reason to join).

Finally, you have to learn how to properly sticker your green wood for seasoning. It's not rocket science, but there are some rules to follow. For the basics, check out the "Select Articles" area of our web site.

Farmers with Barns

There are farmers out there with barns full of lumber. And there are garages stacked high with premium wood left behind by de-

STAIRCASE SLIP-UP

Duncan Alldis (now retired) and a friend had a workshop in Croydon, Surrey, England. One day, a friend of his son stopped by and asked if Alldis would be interested in the parts from an old three-flight mahogany staircase. The young man had been hired to remove and dispose of the staircase, and he thought Alldis might like to buy the parts he salvaged from the job.

Alldis often used mahogany in his shop. So he calculated its value and told the (now smiling) young man how much he could offer.

The next day the young man arrived at Alldis's workshop with a pile of stairs. Alldis took one look at the wood and knew it wasn't mahogany. Closer examination verified this fact and the young man, noticing Alldis's frown, asked if he still wanted the wood.

Alldis said he would take the wood but also said that the price would have to be recalculated. The young man told Alldis that any money would be appreciated. You can imagine the young man's surprise when Alldis handed him the original payment and told him he would need a few days to work out an additional payment.

Once cleaned, each of the handmade staircase's treads amounted to a beautiful 2" x 8" x 32"-long piece of 100-year-old Burmese teak. The "mahogany" staircase quickly became the most glorious stack of Burmese teak Alldis had ever seen.

— KG

HARDWOOD LUMBER GRADES: THE BASICS

When you buy wood at a lumberyard, it has been graded – essentially separated into different bins based on how many defects are in each board. The fewer the defects, the more expensive the board. Grading hardwood lumber is a tricky skill with rules set by the National Hardwood Lumber Association. (Grading softwood is different; these rules do not apply.)

Here are some of the basic guidelines graders follow as they classify each board.

FIRSTS: Premium boards that are at least 6" wide, 8' long and 91⅔ percent clear of defects.

SECONDS: Premium boards are at least 6" wide, 8' long and 81⅔ percent clear of defects.

FAS: The two grades above are typically combined into one grade called FAS, or "firsts and seconds," which must be at least 81⅔ percent clear of defects.

FAS 1-FACE: One face must meet the minimum requirements of FAS; the second face cannot be below No. 1 common.

SELECTS: While not an "official" grade, this refers to boards that are at least 4" wide, 6' long and with one face that meets the FAS 1-FACE requirements. Essentially, these are good clear boards that are too narrow or too short to fit in the above grades. This and the FAS grades are good choices for nice furniture.

No. 1 COMMON: Boards that are at least 3" wide, 4' long and 66⅔ percent clear of defects.

No. 2 COMMON: Boards that are at least 3" wide, 4' long and 50 percent clear of defects.

NOTE: There are exceptions to these rules. For example: walnut, butternut and all quartersawn woods can be 5" wide instead of 6" wide and still qualify for FAS.

ceased woodworkers. But how do you get your hands on it?

Basically, it's a matter of putting the word out among your friends, relatives and co-workers that you're a woodworker and on the prowl for wood. Tell enough people, and you'll eventually hear from the friend of a friend who wants to dispose of some boards. Sometimes you get lucky. We once bought a garage full of impressive lumber that one woodworker (who could not take it with him to the afterlife) had amassed over several decades.

Classified Ads, Auctions & Offcuts

There are a few somewhat surprising ways to find wood. Believe it or not, wood shows up pretty regularly in the classified ads of the daily newspaper and local free shopping papers.

And while you're poring over the classifieds, keep an eye out for auctions at farms and cabinet shops. When these places go under, there can be good deals on wood (and machines). Bear in mind that haunting auctions is both time-consuming and addictive.

Some people buy lumber through eBay.com, an online auction web site. Shipping can be a real killer ($1 a pound), so tread cautiously and do the math before you buy from online auctions.

Finally, for the true bottom-feeder, there's always the waste stream. Find out if there's a pallet factory, furniture manufacturer, veneer mill or construction site in your area. Their waste might be perfect for your woodworking.

We've cut up pallets made from mahogany, ash and other desirable species. In fact, most of the projects in "Building the Perfect Tool Chest" (Popular Woodworking Books) were built in our shop using wood discarded from pallets. A cabinet shop that built a lot of face frames once sold us their falloff, which was the perfect size for chair spindles. All you have to do is ask.

And speaking of asking, make sure that when you climb up to that hay loft to check out that wood in the barn that you ask if there are any hornets' nests waiting up there. There's more than one way to get stung when hunting for lumber. **PW**

STICKER SHOCK

Twenty five years ago Gene Nurse, from Darmouth, Nova Scotia, Canada, went to the lumberyard on his lunch break to buy some wood for a mahogany desk he wanted to build. When he arrived, the man who usually worked the desk wasn't there and a young teenager was in his place.

The sticker price on the pile of undressed mahogany indicated that the lumber was a typical $3 (Canadian) a board foot. Nurse said the young man, not knowing the difference between dressed and undressed lumber, said that the sticker "must be a mistake for that crappy stuff. They must have meant 30 cents a board foot."

After trying to dissuade the guy several times, Nurse loaded up his truck with 500 board feet of mahogany. Price: $150.

Feeling guilty, Nurse went back and explained what had happened to the man who usually worked the desk. The man thought the story was funny, said it was their mistake and let Nurse keep the wood. But next time, the man said, Nurse should deal with him personally.

— KG

Straight from the woods, this pile of cherry is being stickered as we go. When complete, we painted the ends with a special paint (which is wax suspended in a water-based emulsion) to retard end checking.

BYOB: Bring your own bole. All over the country, independent sawyers such as Ed Motz can mill the logs you find into rough slabs. Moving it and drying it usually is up to you.

The Language of Lumber

These boles are waiting to be de-barked, milled and dried to become prime hardwood.

A

air-dried lumber: Wood that has been dried from its freshly cut state by stacking it (usually outside) with stickers between. Air-drying reduces the moisture content to about 12-15 percent. Wood for interior use needs to be dried further.

B

board foot: A piece of wood that is 1" thick x 12" wide x 12" long in the rough – or its cubic equivalent.

C

chatter mark: A defect caused when the board was surfaced at the mill and the knives mar the surface.

cupped: A board with edges higher than its middle. The cup is always to the sap side of the board.

D

defect: An imperfection in the board that will change how it is graded (and its price).

dimensional lumber: Lumber that is surfaced on all four sides (S4S) to specific thicknesses and widths: 1 x 4s, 2 x 8s, etc. Note that with this lumber the finished thickness and width are less than the stated size. For example, a 1 x 4 typically will measure $\frac{3}{4}$" X $3\frac{1}{4}$".

E

end check: Separation of the wood fibers at the end of a board, almost always a result of drying.

F

flitch: When a log is sawn into veneer and the sheets are stacked in the same order as they came off the log. Good for bookmatching.

G

green lumber: Wood that has been freshly cut from the tree, typically with a moisture content of 60 percent or higher.

H

heartwood: The part of the tree between the pith (the very center) and the sapwood (the whitish outer layer of wood).

honeycomb: A separation of the wood fibers inside the board during drying – it might not be evident from the face of the board.

K

kiln-drying: An artificial way to reduce the moisture content of wood using heat and forced air.

knot: A circular woody mass in a board that occurs where a branch or twig attached to the tree.

L

lineal feet: A measurement of wood that's 12", regardless of the board's width or thickness – usually used to refer to mouldings.

M

mineral streak: A typically green or brown discoloration, which can be caused by an injury to the tree.

moisture content: The percentage of a board's weight that is water.

P

pitch: A resinous, gummy substance typically found between the growth rings of softwoods.

pith: The small and soft core of a tree that the wood grows around. It's undesirable for woodworking.

plain (flat) sawn: A method of milling a log that results in the growth rings intersecting the face of the board at an angle less than 45°.

Q

quartersawn: A method of cutting a log at the mill that results in the growth rings intersecting the face of the board at more than 45°. Quartersawing wastes more wood and there is more effort. But quartersawn wood is more stable.

R

random widths & lengths: While softwoods and cabinet woods such as red oak and poplar can be found as dimensional lumber, many hardwoods cannot. These hardwoods are cut in different widths and lengths to get the best grade.

rift sawn: A method of cutting a log that results in the growth rings intersecting the face of the board at an angle between 30° and 60°. More stable than plain-sawn wood; less stable than quartersawn.

rough: A board as it comes from the sawmill; not surfaced or planed.

S

SLR1E: The acronym for "straight-line ripped one edge," meaning the board has one true edge.

S2S: Planed on two faces; the edges are rough.

S3S: Planed on two faces and one edge; one edge is rough.

S4S: Planed to a smooth finish on all four long edges of a board.

sapwood: The lighter colored wood between the heartwood and bark – typically weaker than the heartwood.

shake: A split that occurs before the tree is cut – typically from the wind buffeting the tree.

shorts: High-quality lumber that is less than 6' long.

sound knot: A knot that is solid across the face of the board and shows no sign of decay.

straight-line rip: A perfectly straight edge that is suitable for gluing.

surface check: A shallow separation of the wood fibers.

T

twist: Where the board has warped into a spiral.

W

wane: The presence of bark on the edge or corner of a piece of wood.

warp: A general term for a distortion in a board where it twists or curves out of shape.

worm holes: A void in the wood caused by burrowing insects (killed during kiln-drying).

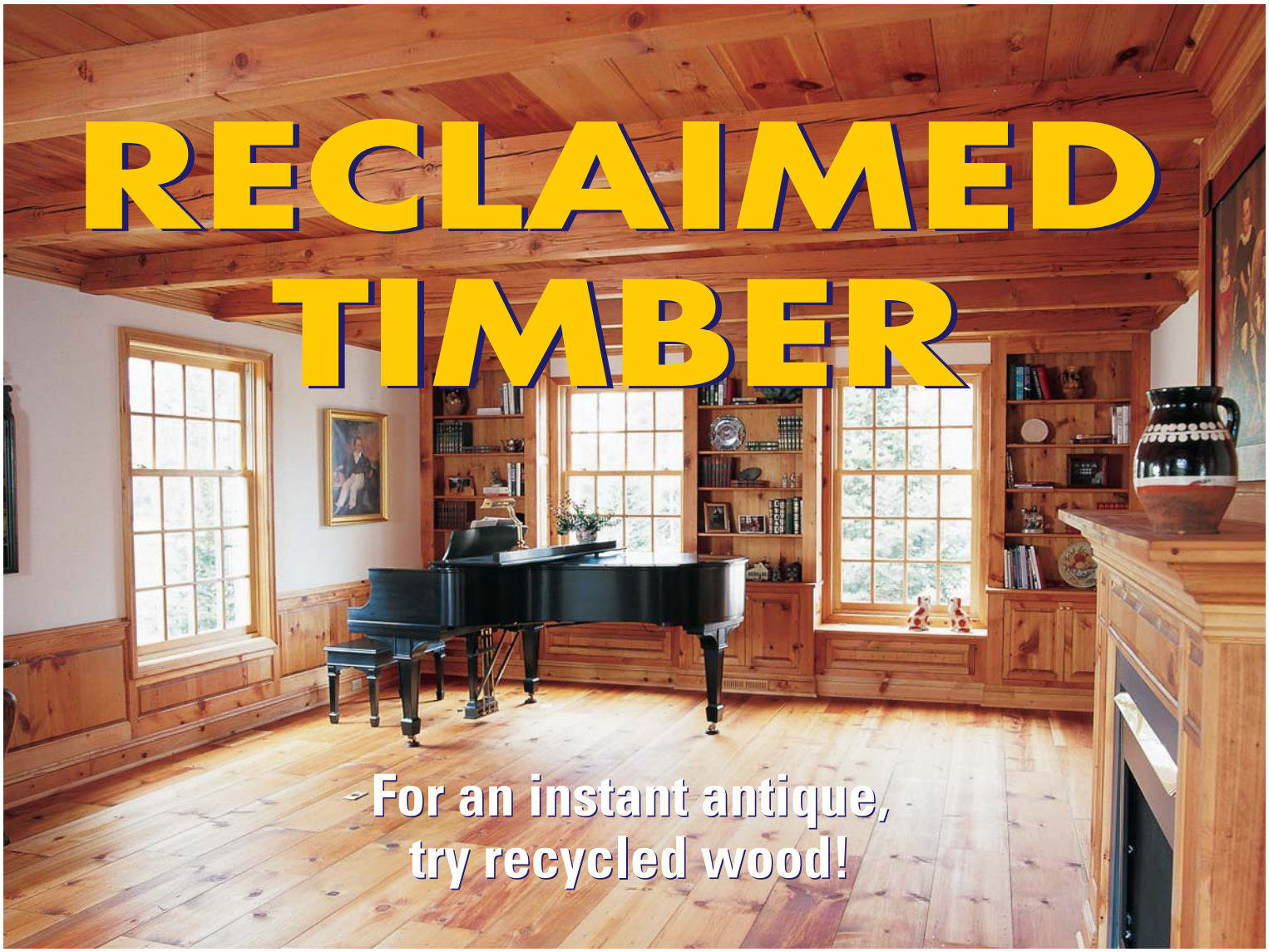
Thanks to Paxton, The Wood Source for assistance with this glossary.

LUMBER IS MEASURED IN QUARTERS

For new woodworkers, one of the most confusing aspects of buying lumber is figuring out the terminology for thicknesses. Rough lumber (which has not been surfaced) is sold in "quarters." Each quarter represents $\frac{1}{4}$" of thickness in its rough state. So four-quarter lumber (written as 4/4) is 1" thick in its rough state; 5/4 is $1\frac{1}{4}$" and so on. When the lumber is surfaced by the mill it loses thickness. That's why 4/4 lumber is $\frac{3}{4}$" thick when it's surfaced. Here's a chart that you can use as a quick reference:

If you ask for	Rough thickness	Finished thickness
4/4	1"	$\frac{3}{4}$"
5/4	$1\frac{1}{4}$"	1"
6/4	$1\frac{1}{2}$"	$1\frac{1}{4}$"
8/4	2"	$1\frac{3}{4}$"
10/4	$2\frac{1}{2}$"	$2\frac{1}{4}$"
12/4	3"	$2\frac{3}{4}$"

RECLAIMED TIMBER



For an instant antique, try recycled wood!

Bird's Eye Pine

Douglas Fir

ART DIRECTION: BARBARA PEDERSON • PHOTOGRAPHY: MIKE HABERMANN

By George Vondriska

Wood doesn't just grow on trees, you know. It also comes from barns, warehouses, factories and railroad trestles that are being torn down. This wood, called reclaimed timber, just might be an alternative material you can use.

Reclaimed timber offers some unique opportunities. Because of its original application, the boards probably have a lot of "character." This means nail, screw and even bolt holes. Instead of trying to work around and eliminate them, you might try using them to give the project a unique look.

The wood itself is different, too. This lumber was almost always cut from old-growth trees. These trees grew very slowly in dense forests. The resulting growth rings are close together, making the wood more dense and stable. In addition, today's softwoods are dried to around 12- to 14-percent moisture content, making it unsuitable for cabinets and furniture. This old stuff is generally drier than that.

Most suppliers are able to attach a history to the reclaimed timber they sell. Not only can you create a unique piece, you'll also be able to identify what building, city and era it came from.


COLD MOUNTAIN
THE BEATLES

Salvage wood from old buildings is primarily softwood. You'll find southern yellow pine, redwood, Douglas fir, ponderosa pine, incense cedar, oak and even bird's eye pine, to name a few. Species availability varies, because the salvage companies take whatever they can find.

In its first life, the wood may have been used for anything from flooring to shelving to structural beams. Metal detectors are used to find and remove hardware. Timber coming from flooring and shelving, commonly 4/4 to 8/4, is generally abrasive planed (sanded to thickness) and sold by the board foot in random length and width lots. Large beams may be sold as beams, or resawn to a customer's specifications.

It's a good idea to let the supplier do the abrasive planing for you. Lead-based paint was used in the United States until 1978, and having the planing done by the supplier keeps any potentially toxic waste out of your life. Once you have the wood in your shop, using standard dust control procedures should be adequate.

You might find reclaimed timber more brittle than other wood. You'll also want to keep an eye out for hardware and fasteners, even if you had the supplier do this for you. Other than that, it works like any other material you're accustomed to.

Southern Yellow Pine

Ponderosa Pine

Prices on reclaimed timber can range tremendously, from 50 cents to $12 per board foot. Price fluctuations are caused by the logistics of salvaging the wood, its condition after salvage and supply and demand. Material selection, quantity purchased and shipping charges also affect your final cost.

Reclaimed timber marries the old to the new. It's reasonably priced and gives you the opportunity to creatively work with, not around, the wood's rich history.

AW

Sources

This list is just a jumping off point. Try searching the internet, using "reclaimed timbers" as a category. Suppliers have various materials available, as well as minimum order and shipping requirements.

American Timbers Co.
Maryland (800) 461-8660

Banducci and Evenson
California (707) 629-3679

Traditional Woodworks
Wisconsin (800) 882-2718

Trestlewood
Utah (877) 375-2779

Vintage Log and Lumber
West Virginia (888) 480-4372

Southern Yellow Heart Pine

Choose the Right Plywood

We cut through the confusion and seek out the good stuff.

There are few things a woodworker will ever face that are as confusing as plywood. It seems simple: I want to build some cabinets out of oak, so I'll get a few sheets of ¾"-thick oak plywood and get started. But when I go to buy it, the storm clouds come rolling in. Where do I buy it? What do I ask for? Do I want rotary cut or plain sliced? What grade? What core? How much thinner than ¾" will it be this time? Will the edges split if I try to put screws in it? Will the veneer be so thin that I sand through it with the first pass of the sander? Should I try the imported stuff? Can I remember the name of the imported stuff that I bought last time?

Is it just me, or does plywood get a little worse every time I buy it?

The first question to answer is this: Are you looking for something that looks like it belongs in a piece of fine furniture, or is utility your main concern? Plywood that looks nice, in a species such as cherry, oak or walnut, is graded and priced mainly on the quality and thickness of the face veneer. Hardwood plywood is considered to be an appearance product, as opposed to softwood plywood, which is considered a structural material. Different rules and grades are used for each type of plywood.

Hardwood plywood has a distinct face and a distinct back. In a cabinet door, for example, you want the best appearance possible on the outside. On the inside, you still want it to look good, but small areas of burl, mineral streaks or sap wood won't be the distractions they would be on a surface that is always exposed.

For hardwood plywood, the grading system for the face veneer is designated by letters: A is

PHOTO BY AL PARRISH

We thought we understood plywood until we put 11 different samples through a variety of tests. We found some surprising facts about quality and materials.

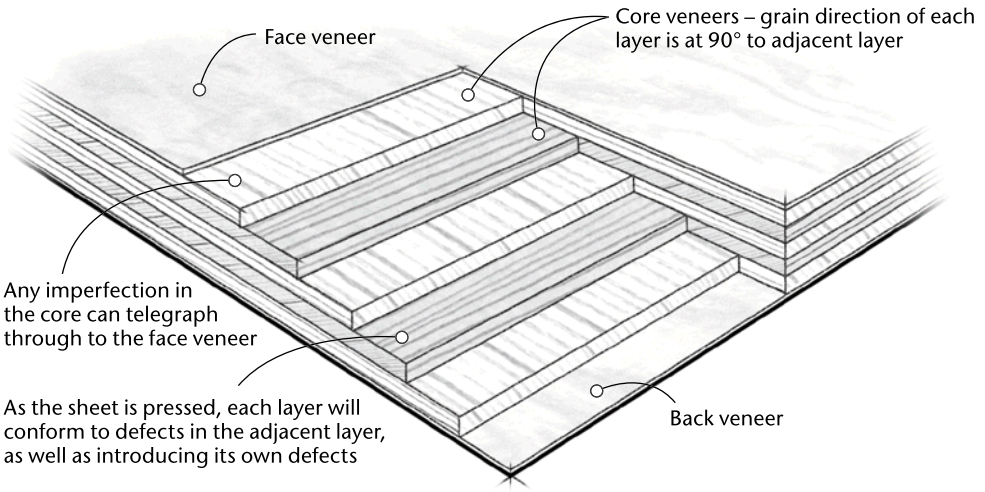
the best and D is the worst. There is a different standard for backs: 1 is the best and 4 is the worst. A1 or A2, with plain-sliced veneer, is usually the best grade available for work that will receive a clear finish. Grades B and lower for faces, and 3 and lower for backs, are generally considered only suitable for paint-grade work. Rotary-cut veneer will look like plywood, rather than solid wood. You can probably get away with using rotary-cut veneer for something such as the interior of a cabinet, but it won't look right on an exposed surface next to solid wood.

The grade should be stamped on the side of the sheet but it is often missing in imported plywoods. Expect to pay $75 or more for a 4' x 8' sheet of A2 plywood with plain-sliced veneer. The oak and birch plywood the big home-improvement stores had in stock (about $40) at the time of writing this was graded C3. The difference in price is mostly in the difference in the veneer. In addition to being a lower grade, the face veneer on inexpensive plywood can be as thin as 1/100" compared to about 1/40" on better material.

Core Material: The Inside Story

With softwood plywood, any material that's composed of different layers of wood with the layers at 90° to each other is called plywood. With hardwood plywood, any material can be between the face and back veneers and still be called plywood. The core material is specified separately from the face, so you can have maple plywood with a veneer core (which is similar to construction-type plywood) or with a particleboard or medium-density fiberboard core.

With softwood, plywood is plywood and particleboard is particleboard. In cabinetmaking, you refer to veneer core if you want material manufactured similar to construction plywood.



The inner cores of veneer-core plywood are much thicker than true veneer. In 3/4"-thick material, the thickness of the core layers can range from about 1/8" on seven-ply material (five core layers plus the two face veneers) to less than 1/16" in 13-ply material.

Particleboard core or MDF (medium density fiberboard) core are the other common types in use. In professional cabinetmaking, they are the preferred materials for quality work because they're flat and of a consistent thickness. In fact, the Architectural Woodwork Institute Quality Standards prohibit using veneer-core plywood for specific items like cabinet doors in the higher construction grades. As we look at how plywood is made, and the material it's made from, we begin to understand why.

Twenty-five years ago, if you bought a piece of birch plywood, or any other hardwood plywood for that matter, the core would be birch. Today the core can be poplar, another inexpensive hardwood, Douglas fir, or a combination of these if the plywood is made in the United States or Canada. A lot of plywood is now manufactured is Asia, Africa or South America, and the core material

Numbers and Equivalents

.004" = slightly less than this page
.008" = slightly thicker than this magazine cover
.012" = thickness of a quality business card
.016" = 1/64"
.031" = 1/32"
.047" = 3/64"
.063" = 1/16"
.709" = 18mm
.750" = 19.05mm

Thickness Variations Chart

SOURCE	FACE SPECIES	CORE	PLIES	AVG THK (INCHES)	AVG DEV (INCHES)*	TOT DEV (INCHES)**	#<.004†	%<.004‡	$/SHEET
Paxton	Baltic birch	Birch	13	.693	.002	.009	18	100%	33.14 (60" x 60")
Bob's garage	Oak	Luan	7	.700	.002	.010	11	85%	N/A
Paxton	Poplar	Poplar	7	.738	.003	.011	13	72%	65.91
Home Depot	Red oak	Fir	7	.727	.003	.016	11	61%	39.99
Lowe's	Red oak	Fir	7	.707	.003	.008	10	56%	39.99
Home Depot	Birch	Unknown	13	.699	.004	.013	9	50%	37.95
Paxton	Luan-Marine	Luan-Marine	11	.732	.004	.015	8	44%	75.59
Paxton	Red oak	Fir/aspen	7	.732	.004	.015	8	44%	70.00
Paxton	Hard maple	Poplar	7	.731	.004	.022	6	33%	71.82
Lowe's	Birch	Fir	7	.710	.005	.018	5	28%	37.95
Lowe's	Aljoma	Unknown	9	.726	.005	.012	1	6%	39.95

*avg dev=average deviation in thickness among small samples measured.
**tot dev=total variation in thickness among all samples, difference between thickest and thinnest measurements.
†#<.004=number of samples that had a variation of .003" or less within the sample (note, old red oak had fewer samples than rest of group).
‡%<.004=percentage of samples that had a variation of .003" or less.

can be anything that grows in abundance near the plywood mill.

Wherever plywood is made, the trees used for core material are fast-growing and have little or no value as solid wood or as face veneer. Depending on the quality consciousness of the manufacturer, these cores can vary tremendously. The biggest problem is variation in thickness, but uneven or incorrect moisture content can also cause sheets that are warped, bowed or twisted. Poorly manufactured plywood also has a tendency to split or delaminate, especially when nails or screws are driven into the edges.

Many woodworkers object on principle to using anything but veneer-core plywood. One of the big drawbacks to veneer-core plywood often won't appear until finishing. If the veneer is thin, and the core uneven, this unevenness will telegraph through and appear in the face veneer. Because the veneer is so thin, this cannot be sanded out. MDF and particleboard cores, in spite of being weaker structurally, are flatter and more consistent. If you can work around the structural issues, and overcome your prejudice, you can achieve much better finishes, and easier joinery if you use MDF or particleboard cores.

Hard-working Plywood

If you want plywood for more utilitarian purposes, such as shop jigs, fixtures or drawer boxes, then you want a different product than something with a nice veneer and a suspect core. Baltic birch plywood, with 13 layers in a nominal ¾" thickness, was the first such product available for this use. Appleply is an American-made version made from birch and alder. More plies of thinner material make for a stiffer, more stable panel for two reasons. Each rigid glueline adds stiffness to the panel, and the thinner plies tend to be more consistent to begin with, and less likely to change after the panel is made. Many imported plywoods are manufactured this way and can be a good value.

Imported plywoods also have different grading rules. Baltic, Russian and other European birch plywood faces are graded by the letters B (best), BB, CP and C (worst) for both the face and the back. These plywoods usually have a consistent void-free core of the same species as the face. Generally B/BB is the best grade that is available. Some plywood from South America and Asia is graded on a similar system, but much of this material is not graded.

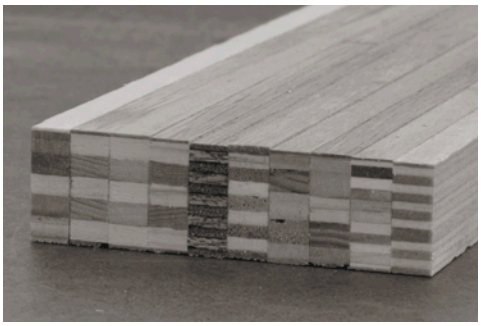
The species used in imported plywood can also be a mystery. The names the material is sold under are not the names of specific species. From Luan to Chen-Chen, the names given are trade names for groups of species, which may or may not have similar properties. These names may also change from time to time. If one imported name gets a bad reputation, the same product may be sold under a new name, and people will try it, hoping that it will be better. Sometimes material from one continent will be sold using the name of a successful product from another. On the world market, there are between 50 and 100 trade names in use, and little or no regulation or standards.

How Our Samples Measured Up

We went shopping for plywood in our area, and picked 10 samples from three sources – Lowe's, Home Depot and our local hardwood supplier, Paxton Lumber. We also included a piece of red oak plywood with a Luan core that had been stored in my garage for 10 years. We made tests on our samples to see what the differences were between the "good stuff" and the "cheap stuff."

First we checked the thickness. We knew that ¾" plywood is always undersized and that the thickness can vary throughout the sheet. What surprised us is how much variation there is, even in a small sample. We began with a 24" x 24" square of each type and cut that into 18 pieces that were 3⅞" x 7⅞". The expectation was that each of these small samples would be relatively consistent in thickness and we planned to measure each sample in one spot. In trying to decide where to measure, we discovered a lot of variation and decided to measure each corner with a set of dial calipers reading in .001" increments. The results are listed in the Thickness Variations Chart on page 7. The differences in core materials and thicknesses can be seen in the photo above.

Only three of 193 samples measured the same thickness at each corner. Two were from the piece of Baltic birch plywood. But one was .005" thinner than the other. The total variation within the Baltic birch samples was .009". All 18 samples of the Baltic birch varied .003" or less, making this the most consistent material we tested. Right behind it were the 10-year-old samples of oak with a Luan core. Only two of these samples varied more than .003". Our samples of red oak from Lowe's were nearly as consistent in thickness, with an average variation of .003" in each small sample and a variation of .008" within the sample group. Only 10 pieces, however, were under .003" variation within those samples.



This block was glued from 10 of the 11 samples we measured for thickness. Note the variety of core materials and thicknesses.

The most inconsistent piece we tested was one of the most expensive – plain-sliced maple veneer on a poplar core from our hardwood supplier. The total variation was .022", with an average of .004" among the small samples. Only six of 18 pieces showed .003" or less variation within the samples. The only two samples with a larger average variation, .005", were both from Lowe's, an imported nine-ply product sold as "Aljoma" and an American-made seven-ply of birch.

Why the Inconsistency?

When plywood is made, the alternating layers of core veneers are glued together with heat and pressure. During this process, there is some degree of compression in the core layers. Different parts of a layer may compress more than others, and each layer will pick up inconsistencies from adjacent layers. Manufacturers maintain that this compression is unpredictable. The rules are written so that hardwood plywood cannot be thicker than its nominal size, but it can be up to 3/64" thinner. The reasoning is that an undersized panel will still fit in a groove cut at the nominal size, but an oversized panel would not. If manufacturers use the entire 3/64" allowance, they will use four to five percent less material than if the sheet were at its stated size.

The practical impact of this comes when you make joints. Exactly how do you get a nice-fitting dado joint in an inconsistent, undersized panel? Router-bit manufacturers offer cutters sold as plywood bits, usually 1/64" or 1/32" less than the

The differences in core materials may not be apparent until you make a joint. The fir core at left chipped severely while the hardwood core at right had a smooth surface.

nominal size of ¾" or ½". This sounds sensible, but buying a bit to match every thickness of plywood you might come across will only gain you a collection of bits that almost work.

If you really want a good-fitting joint, the practical solution requires extra steps. You need to mill the plywood edge that fits in the dado of your project. The easiest way to do this is to cut the groove to a smaller dimension and then mill a shallow rabbet on the board's mate to match the width of the groove.

The Rabbet Test

We cut ¼"-deep by ¾"-wide rabbets in one end of our sample pieces with a stack dado set on the table saw. We then screwed pairs of samples together with two #6 x 1⅝" drywall screws. Using our drill press, we placed a clearance hole and countersink ⅝" in from each edge of the sample, and centered in the rabbet. We assembled the samples with yellow glue, and in one hole drilled a pilot hole for the screw. The other screw was driven without pre-drilling. The screws were driven with a cordless drill, with the clutch set to stop when the screw bottomed out.

This also gave us a good look at the core materials. In the samples with hardwood cores – poplar, birch and the imported wood – the rabbets were smooth. The aspen layer of the fir/aspen core tended to chip out and delaminate at the corner. In the fir core samples, many were very uneven and rough. Examples of the cuts are seen at left.

The Core Integrity Chart (below) shows the number of samples that split while driving the screws. We deliberately placed the screws close to the edge, and we don't recommend driving screws without drilling a pilot hole. The results indicate the quality of the core material itself and the quality of the glue bond between the core layers. The samples with the highest number of core layers were most resistant to splitting. The hardwood cores, and the samples with nine or more plies, tended to split only the layer that contained the screw, and the splits were ½" to 1" long.

In the seven-ply samples, the splits were much longer, and in the worst cases were several inches long. Several samples not only split the layer containing the screw, but pushed apart the glue joint between layers. The poplar core was most resistant to splitting among this group.

Our next test consisted of butt joining corners with two finish nails and no glue to see how well each type of core held the nails. The joints were then knocked apart to see if the nails pulled away with the face pieces, or remained in the end of the core being nailed. None of the samples split, and the differences seem to be in the grain structure of the core. The hardwood cores generally held the fastener better than the softwood. The results are seen in the Core Integrity Chart.

How to Buy the Good Stuff

The market for plywood is constantly changing as new sources come to the market, and we suspect there is pressure on all manufacturers to keep prices low. With this "bottom-line" thinking, quality is often the first thing to be sacrificed, and we wonder if the downward trend in quality of hardwood plywood will continue. Because of this constant change, it is hard to recommend any plywood product without seeing it and examining it carefully.

There are three things to consider when examining plywood for purchase. The first of these is the face veneer, if it is to be exposed. The grain should look like several pieces of solid wood, 6" to 8" wide. Every other piece should be a mirror image of the next one. This is bookmatched, plain-sliced veneer. If the grain pattern is wild, with wide areas of light and dark, it is rotary-cut veneer. Expect to pay a premium for plain-sliced, bookmatched veneer. Good veneer can easily double the price of a sheet of plywood.

The second consideration is the overall flatness of the sheet. Despite its reputation for flatness, plywood sheets will usually have some degree of bow, but this should be minimal. Pull a sheet off the stack and sight down a long edge. If the sheet is badly warped or twisted, there is likely a problem in the core layers and conditions won't improve as the sheet is cut up.

The third thing to examine is the edge. More plies are generally better, and hardwood cores are better than softwood. Look at the joints between the layers. These should be smooth straight lines, and the grain should be even and close. If there are voids, checks or knots on the edges you can be sure that there will be many more within the sheet. Also, take a close look at the edge of the face veneer to see how thick it is. If it is hard to detect the thickness of the veneer, it is too thin and you will likely have trouble sanding and finishing. The thinnest veneers are very easy to sand through and often will telegraph any unevenness of the core layers to the finished surface.

Lastly, don't be afraid to ask your supplier what they mean by the terms and grades they use. "Shop Grade," "Cabinet Grade," "Stain Grade," and "Utility Grade" are commonly used terms that aren't defined by any industry-wide standards. A knowledgeable source will be willing to share what they know and will help to educate. A seller who can't explain what they have to sell might best be avoided. WM

— Robert W. Lang

Fasteners driven in the edges of plywood can cause an inferior core to split, often delaminating adjacent layers.

Core Integrity Chart

SOURCE	FACE SPECIES	CORE	PLIES	SPLITS/PILOT*	SPLITS/NO PILOT**	NO SPLITS†	NAIL % HELD‡
Lowe's	Birch	Fir	7	2	7	1	8%
Paxton	Maple	Poplar	7	4	8	0	25%
Paxton	Poplar	Poplar	7	1	1	6	67%
Home Depot	Red oak	Fir	7	1	4	3	33%
Paxton	Red oak	Fir	7	2	6	2	58%
Lowe's	Red oak	Fir/aspen	7	6	7	0	8%
Lowe's	Aljoma	Unknown	9	0	2	6	75%
Paxton	Luan	Luan	11	0	4	4	42%
Paxton	Baltic birch	Birch	13	0	7	1	50%
Home Depot	Birch	Unknown	13	0	2	6	100%

Eight corners of each sample were assembled, first with screws as described in text, and then with nails.
*splits/pilot=number of samples that split when a screw was driven in with a pilot hole (out of 8).
**splits/no pilot=number of samples that split when a screw was driven with no pilot hole (out of 8).
†no splits=number of samples that did not split, whether or not a pilot hole was drilled (out of 8).
‡nail % held=After assembling corner with finish nails, (#16 ga. x 1¾") corners were then knocked apart. Number reflects the percentage of samples with the nail remaining in the end grain of part being nailed. The ability to hold a fastener can affect the integrity of the joint over time.

MDF and Particleboard

How two versatile woods can be both a blessing and a curse

Cheap, plain and definitely not wood. That's how many woodworkers describe particleboard and MDF (medium-density fiberboard), but think these words instead: inexpensive, uniform and stable.

• **Inexpensive.** MDF and particleboard panels run $25 to $35 a sheet (oversized at 49 in. by 97 in. so you can cut off a dinged edge).

• **Uniform.** Collectively called composite wood, MDF and particleboard panels don't have the irregularities of veneer-core plywood, such as voids on the inside and patches on the outside.

• **Stable.** Composite wood doesn't shrink and swell across the grain or warp to the same degree as solid wood.

Composite wood has a few significant drawbacks: it's heavy, easily damaged and not very stiff. In addition, it doesn't hold screws as well as solid wood, swells when it gets wet and creates clouds of obnoxious sawdust.

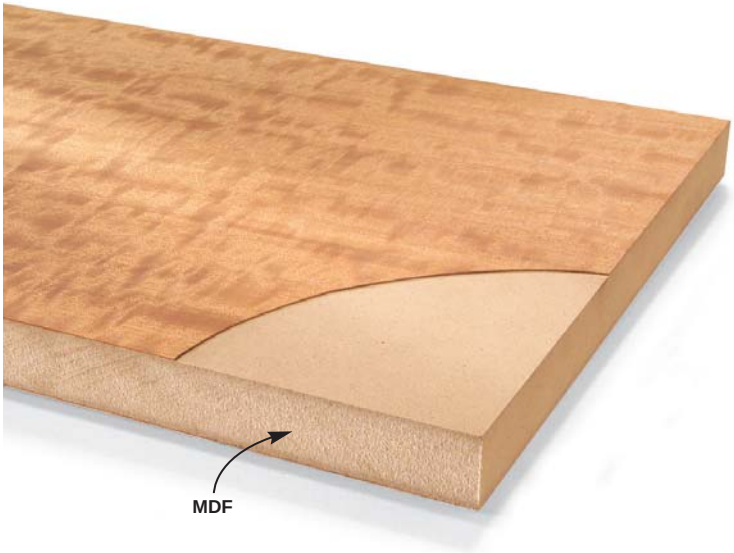
Particleboard is fine for utilitarian work, but MDF is preferred for furniture projects. MDF is smoother, takes better detail, holds screws better and paints very well once its edges are sealed. Whichever one you choose, use only carbide cutters, because the binders in the wood are very abrasive. Even carbide will wear more quickly than normal.

Here we'll only cover the basics, but a wealth of free technical information on different grades of composite wood is available from The Composite Wood Council. You can download entire pamphlets at www.pbmdf.com or call (301) 670-0604.

MDF takes a much crisper edge than particleboard. MDF is made of very small wood fibers, almost like flour, while particleboard is made from larger, coarser fibers. Particleboard has a tendency to chip out when routed. If you want sharply defined edges with particleboard, glue on a solid wood strip.

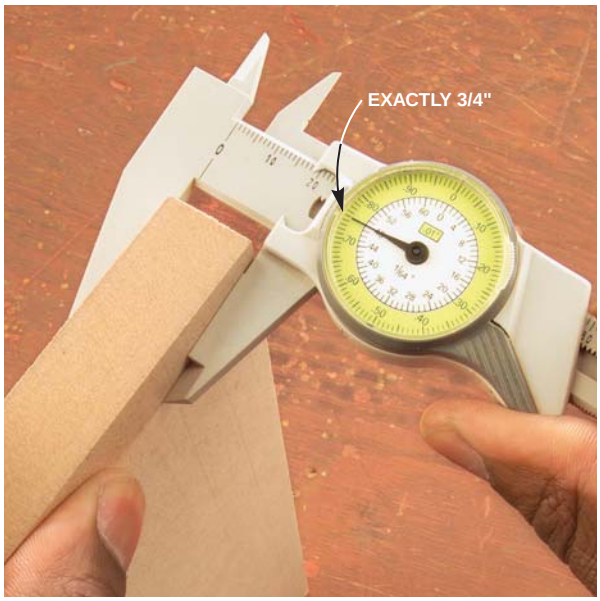
Man, this stuff is heavy! Projects made from MDF and particleboard can weigh a ton. A full sheet of 3/4-in. MDF is 97 lbs. A sheet of particleboard typically weighs 85 lbs. A sheet of veneer-core birch plywood, by comparison, comes in at 60 lbs. Extra weight means joints in moveable furniture have to be extra strong.

EDITOR: TOM CASPAR • ART DIRECTION: DAVID FARR AND EVANGELINE EKBERG • PHOTOGRAPHY: MIKE KRIVIT



MDF and particleboard are extremely flat. They're perfect for veneering because there are no lumps or ripples to show through extra-thin sheets of veneer. Glue veneer on both sides to keep the panel from distorting.

It may be flat, but it's not stiff. Look familiar? MDF and particleboard shelves are notorious for drooping, even from their own weight, unless they have additional support. Shelves that are 10-in. deep should be no more than 24-in. long.

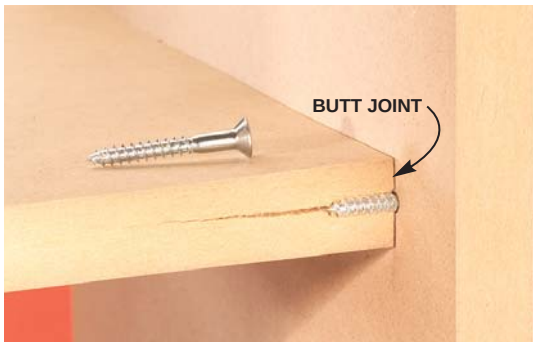


MDF's thickness is usually right on the money. Unlike plywood, which is generally undersized, MDF and particleboard often fit right into standard-sized grooves. Material that's 3/4-in. thick will swell by 1/64 in. or more if stored in damp conditions, however, so it's a good idea to keep it in a dry place.

MDF is ideal for jigs. It's flat, smooth, equally stable in length and width, made in precise thicknesses, and cuts and shapes without chipping. In addition, you can drill precisely located holes in it because there are no fibers to deflect the bit. This jig is used to sharpen chisels with sandpaper on a drill press, and was featured in AW #98, January 2003, page 62.

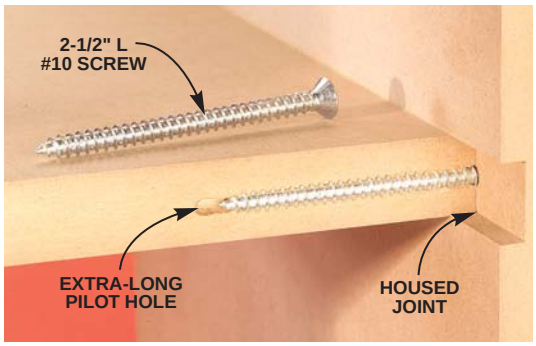
Thin MDF is handy for making patterns. MDF comes in 1/4 in. and 1/2-in. sheets, although you may have to order them through a lumberyard. MDF is easy to sand, particularly when it's thin. 1/4-in. MDF is a better material than plywood for patterns because its edges are smoother, but it's not strong enough to make long, thin patterns.

Router templates made from MDF have durable edges. 1/2-in.-thick MDF works best. It has more bearing surface than 1/4-in. stuff and is easier to sand to shape than 3/4-in. material. Here's where a perfectly smooth edge on the template really helps to make duplicate parts that require little sanding.



Cracks start easily in composite wood if you cut corners and don't drill a pilot hole for a screw. This spells trouble for a load-bearing butt joint. From tiny cracks come big failures! Short, shallow-threaded wood screws don't hold well in the edge of composite wood.

Long screws and housed joints are best for shelves. Deep threads on the screws are a must. Drill an extra-long pilot hole that's the same diameter as the solid shaft of the screw. Add glue to make a really strong and durable joint. (Use plenty because edges soak up lots of glue!)



Wet basement or garage floors wreak havoc with MDF and particleboard. The fibers in both woods soak up water and expand like a sponge. However, when the material dries out, it doesn't shrink back. Instead, tiny cracks develop, weakening the wood. If this piece is moved, the bottom edge will crumble.

Raise the case above a wet floor with solid-wood feet. Here we used pressure-treated lumber (so the feet won't rot even if they stay damp) and glued and screwed them to the case with a water-resistant yellow glue. The glue barrier prevents the case from soaking up water.

Are MDF and Particleboard Hazardous to Your Health?

Formaldehyde and dust are significant concerns with composite wood. The strategies listed here can limit your exposure to both problems.

Formaldehyde is used in the glues and binders of composite wood and is slowly emitted from the entire panel as a gas. Many manufacturers have reduced formaldehyde emissions in the last few years, but some people have allergic reactions to even small amounts.

There are three things you can do about formaldehyde emissions:

• Buy low-formaldehyde panels (see Source, at right, for one such product).

• Air out composite panels in your garage or shed for a few weeks.

• Seal in the formaldehyde by coating all the surfaces of your project with paint, varnish or a laminate.

As woodworkers know all too well, composite wood creates giant clouds of very fine wood and binder dust. MDF is the worst offender. This dust is not only annoying, but prolonged exposure can lead to respiratory problems.

Protect yourself with three levels of dust control:

• Collect the dust at the source with whatever kind of vacuum hose you can rig up.

• Always wear a mask. Look for NIOSH N95 masks with two straps and a nose clip for a tight seal.

• Keep the dust from settling over your shop and home by trapping it in an overhead air scrubber. *AW*

Source

Dow BioProducts Ltd., (800) 441-4DOW
www.dow-bioproducts.com
Wood Stalk fiberboard
(low formaldehyde).

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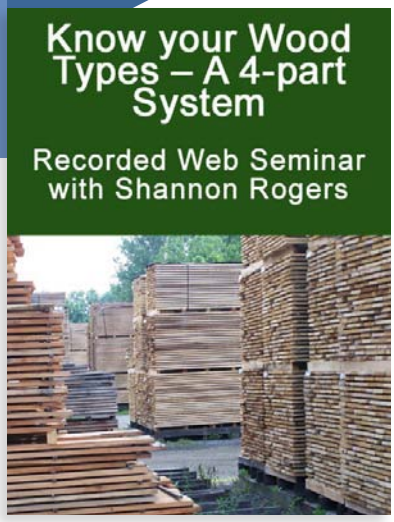

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