

INSIDE Interior Doors



Why choose a traditionally made solid lumber door over one with an engineered core? The average manufacturer's response can be distilled to this: It's an affair of the heart. Some consumers simply won't settle for less than the "Real McCoy," and they're willing to pay extra to get it. As a builder, you're likely to assist with the task of interior door selection. Consider that these doors are not only a focal element of interior design, but also a tactile, constantly used, hard-working feature of a home.

by **Dave Holbrook**

In the case of an upgrade remodel, replacing inexpensive hollow-core doors with new solid-core doors makes a notable difference. A solid-core door feels more substantial, closes with less rattle, insulates against sound more effectively, and withstands hard use more readily. However, a solid-core door costs considerably more than its hollow cousin and, in a tight budget, may have to give way. If the client wish list includes 20 hardwood, raised-panel interior doors at an average cost of \$350 each, you have a \$7,000 cost item to scrutinize. But if the doors are getting painted along with the trim, you can use molded panel doors instead of true

Identifying the right door for the job is a matter of style, function, and budget

stile-and-rail construction. This can cut the item cost by as much as 75%, while the difference in appearance may be negligible. You might save a few more dollars by using hollow-core doors in less critical areas, like closet openings.

Raised-Panel Construction

A genuine wooden stile-and-rail door is subject to movement at every joint in the frame, as well as within the floating panels, which expand, shrink, and occasionally crack from the stress if they're stuck to the frame after painting. Solid lumber stiles, if not carefully selected and oriented in the door assembly, can twist or bow, forcing the door out of plane. The horizontal top and bottom rails may swell beyond the limits of the vertical stiles, causing the door to rub at the head jamb or threshold. In the big picture, though, these are minor complaints and will never diminish the popularity of a raised-panel stile-and-rail door — it remains a good-looking, time-tested, and versatile method of construction.

Veneer facings. Door makers seek to diminish warping, joint failure, and other perceived defects in a number of ways. By combining traditional stile-and-rail assembly with engineered lumber, manufacturers remove the stresses stored in solid lumber to make a door that is much less prone to warp, even while using primarily lower-grade lumber. When overlaid with premium-grade wood veneer and solid wood edging, the result is a door almost indistinguishable from its solid lumber prototype. It can even be argued that a door made this way is superior to the pure form in terms of performance. The glue behind the veneer facing actually serves as a moisture barrier, maintaining the core material at a relatively stable moisture content — typically around 6% to 8% at the time of manufacture. Makers of solid lumber doors will slice, reverse, and reglue lumber onto itself to cancel out inherent movement but, if not properly sealed, the individual pieces in a solid lumber door may still cup in response to changes in humidity and remain susceptible to warping.

Economical construction. A 2'6"x6'8" six-panel oak-veneered door slab with a finger-jointed lumber core may cost a builder \$330, while the same door in solid oak can cost \$375 to \$475. The labor to make either type of door is more or less equal, but the composite door maker can get enough veneer to face twenty doors out of the same amount of select material required to make one solid-lumber door. And, assuming an equal level of maintenance, there's no reason to expect a solid door to outlast the engineered version.

Molded Doors

It doesn't make a lot of sense to paint a solid wood door. A "paint-grade" specification is nearly always a signal that lower-grade materials may be used, as the paint will determine



Solid pine panels and a solid cedar frame highlight the classic construction of a frame-and-panel door (left). Select-grade veneer over a core of lower-grade glulam lumber uses lumber economically while producing a more dimensionally stable door (right).



Appearance-grade lumber cut, reversed on itself and reglued, helps to cancel out the stile's tendency to warp (far left). Door rails and panels are commonly constructed of solid or laminated lumber. "Bladder" construction uses wood veneer over a particleboard or composite lumber core to make a panel with improved stability (near left). Both of the samples shown here are manufactured by Morgan.



Solid-lumber raised panels and select-grade oak face veneer with a solid oak “ME” (matching edge) cap strip on the stile lend the look of solid hardwood to the softwood core of this Kolbe & Kolbe door.



Dowels add strength to a hard-working glued joint in these doors from Combination Door (near right) and Simpson (far right). One manufacturer, Lag Design, substitutes a steel lag bolt — exposed for clarity — for multiple wood dowels in its solid-lumber door (above). Molded and flush doors eliminate the need for elaborate joinery, relying on the facing to hold the internal frame together.



the final appearance. In the case of interior doors, a unique generation of product steps up to the plate.

Molded face panels, or “skins,” imitate the look of a frame-and-panel door without the use of classical joinery. Instead, fabricators laminate a molded hardboard skin to a perimeter frame and an engineered core material — which may be particleboard, fire-resistant mineral (gypsum) board, or a softboard core — to absorb acoustical vibration and reduce sound transmission. A hollow-core door uses minimal polystyrene, cardboard, and solid wood blocking to keep costs way down.

Loose layup. Residential hollow- and solid-core doors are assembled by hand in a process known as “loose layup.” Starting with a skin, or face panel, on the assembly table, the assembler runs all of the interior components through a direct-roll-coater, or glue spreader, and arranges the individual stile, rail, and blocking or solid-core pieces on the skin. Capped with another skin, the completed sandwich is stacked with others in a pile 30 to 60 units high. The stack goes into a cold press, where the components are firmly bonded. The resulting doors are finally trimmed to finished size. With no creeping joints and no solid lumber twisting out of shape, these doors all but eliminate seasonal movement and warping. A primary benefit of this technology is the availability of a panel-look door at a much lower cost to the consumer. A 2'6"x6'8" molded-panel solid-core door slab can be had for as little as \$89.

For best effect, look for a molded door with sharply defined panels and sticking profiles. Jeld-Wen’s Doorcraft molded doors do a fairly convincing job. As an option, manufacturers offer hardboard facings with an embossed three-dimensional wood grain pattern. To my eye, embossing calls attention to the molding process, while a smooth facing better mimics a well-prepped paint-grade wood surface. Careful brushwork that implies a change of direction in the wood grain looks more authentic than the exaggerated embossing. You don’t have to settle for a painted finish, though; hardboard door facings are also embossed to imitate clear-stained natural wood.

Flush Doors

In a certain sense, contemporary design has returned to its ancient roots in the form of the flush door, which boasts all the geometry of a basic wide plank. Flush doors make up the bulk of commercial installations and are typically used in a residential setting to complement contemporary styling, or simply to provide an economical way to fill the hole in the wall. Interior flush doors have a smooth hardboard or wood veneer facing, which can receive a clear finish or be painted. Flush doors with plastic laminate skins are also available.

Core construction. A residential-grade solid-core flush door typically has a core of medium-density particleboard and a solid wood frame. Some fabricators use a hardboard filler for the top and bottom rails with solid wood stiles for the hinge screws. Usually, in residential lines, the outer frame is not bonded to the core but only glued with the core to the face-veneer or hardboard facing. While this method simplifies construction, it compromises the strength of the door somewhat. Commercial door manufacturers often bond the frame and core together first, then abrasively plane the unit before the face is glued on.

Stave lumber cores were commonly used before the advent of improved particleboard manufacturing. Boards are cut into staves, or strips, no more than 3¹/₂ inches wide and glued together with the growth rings reversed to cancel out movement. Staving makes a rugged core, although individual board cupping may still telegraph through the facing. Dense and stable particleboard provides a reliable and more economical foundation for most solid-core flush and molded doors. However, because of its density, particleboard adds considerable weight to a door, which in turn places added strain on the hinges. Some flush and molded doors have a core of low-density fiberboard that is sufficiently stiff, strong, and stable, yet is 25% lighter than particleboard.

Hollow core. You could say that beauty is only skin deep in a hollow-core flush or molded door; instead of a solid-core material, a cardboard honeycomb grid separates and stiffens the thin wood veneer or hardboard skins. Solid wood, particleboard, or polystyrene lock blocks provide rigidity at the lockset location. Hollow-core doors often have wider top and bottom rails and vertical stiles than solid-core doors, which improves their structural integrity. The heaviest thing about a hollow-core door may be your wallet — a 2'6"x6'6" slab will set you back about \$31, and you can carry one in each hand.

Defects

Delamination of the facing can occur in any laminated door — veneered stile-and-rail or flush and molded — if the fabricator skimps on adhesive or uses an unsuitable adhesive.



These two Premdor samples show that low-density softboard core (above left) offers the properties of a solid-core door with 25% less weight than a particleboard core (left). When installed in a gasketed jamb, these doors can provide good sound-insulating performance. Door facings are also available in an embossed clear wood finish, such as this one from Craftmaster (above right).



A 1³/₄-inch-thick flush fire door with a particleboard core has a 20-minute fire-rating. Commercial-grade models achieve higher ratings by using a core of gypsum with a concrete perimeter. The samples shown here are from Vancouver Door.

A hollow-core door is a sandwich construction, built on a 1¹/₈-inch-thick solid wood or fiberboard perimeter frame, like the Premdor sample shown here. A cardboard “honeycomb” provides stiffness by connecting the two 1/8-inch-thick hardboard or wood-veneer face panels across the interior void. The skin is bonded to the core assembly with PVA glue.



PREMDOR



MADAWASKA

The once-standard stave lumber core of a solid flush door, like this one from Premdor (left), has been widely replaced by particleboard, which provides a more economical and stable assembly. However, a stave core is easily machined for any detail and offers superior screw-holding strength. One manufacturer, Madawaska, takes stave construction to the decorative level with a custom-made stile-and-rail door (right).

Look for warranted compliance with the WDMA Industry Standard I.S.1-87 Series for assurance that the door will maintain its integrity. The WDMA (Window & Door Manufacturers Association) promotes a fairly rigorous testing standard in this series, known as the Type II adhesive bond test, for interior door glue-ups. To pass, samples cut from a randomly selected door must endure three cycles of prolonged, full immersion in room-temperature water followed by thorough mechanical drying. After the final cycle, a probe is inserted into any adhesive joint to determine whether delamination has occurred. If there is any single delamination greater than 2 inches in length and more than 1/8 inch deep, the sample will not pass. Fabricators whose doors pass the voluntary testing for compliance are likely to offer one- to five-year warranties on their doors for manufacturing defects.

Painting. Manufacturers caution against the use of water-based sealers or prime coats, which may raise the face grain or cause wrinkling and delamination of the face veneer. Don't use water-based top coats unless the surface has been completely sealed with an oil-based primer or sealer. It's not uncommon to see the top and bottom edges of doors left unfinished after installation and painting. However, industry standards specify that all six faces and all hardware recesses must be sealed with a surface finish to ensure stable performance of the door.

Prefinishing is a good option for residential applications. Concerns about dust and proper drying and curing are eliminated. Plus, the high-tech conversion finishes offered by many manufacturers are more durable than site-applied finishes.

Not perfect. Modern door-making technology goes a long way toward eliminating problems with an interior door after installation. Even so, it's worth knowing that industry standards permit small deviations from perfection. For solid-core doors, the door face may not vary from a true plane in excess of 1/100 inch in any 3-inch span. Allowable warp, including cup, bow, and twist, may be no more than 1/4 inch at its maximum variance from true when checked against a straight-edge. Cup is a deviation from flat across the width of the door, bow is a deviation from flat along the length, and twist is when any one corner is out of plane with the other three. Even a 1/4-inch deviation may cause problems such as hinge binding or a latching failure, especially when the door is hung on a prerabbeted jamb. One way to accommodate an “acceptable” warp is to use an applied stop that can be adjusted to follow the door's plane.

Making Modifications

Manufacturers may undersize their standard doors by ⁵/₃₂ to 1/4 inch from nominal dimension and apply a 3-degree bevel to the edge of the vertical stiles to provide clearance in a stock jamb opening.

Although it's sometimes necessary to cut a door down in height or width, cutting beyond specified tolerances — typically no more than 3/4 inch off the top and bottom rails, and lesser amounts cut equally from both vertical stiles — will jeopardize

the structural integrity of the door and may make it difficult or impossible to install a standard lockset. How much you can alter the dimensions of a frame-and-panel door will depend on its construction, whether it's made up of laminations or solid lumber, where the dowels or tenons are located, and so on. Some doors can tolerate as much as 3 inches deducted from the bottom rail.

According to WDMA I.S.1.5-87, the stiles and rails of wood-flush doors may be reduced in width to varying limits, depending on the type of door and its construction. For example, if the stiles and rails are securely bonded to solid-core material, they may be cut down to a minimum $\frac{3}{8}$ inch thickness. A solid-core door without bonded stiles and rails can be reduced only to a point where the following minimums are maintained: a lock stile $\frac{13}{16}$ inch wide, a hinge stile 1 inch wide, and top and bottom rails $\frac{13}{16}$ inch wide. Stile width for hollow-core doors is the same as for nonbonded solid-core doors, but the top and bottom rails should be reduced no more than will result in a final width of $1\frac{1}{4}$ inches. It's wise to check with the individual manufacturer before altering its door. Many manufacturers offer custom-size doors by special order.

Cutouts may be made in solid-core flush doors, provided that you observe specified limits. Stave-core doors are particularly well suited to modification. When doors are cut for lites or louvers, the portion between the cutout area and the edge of the door should be no less than 5 inches wide, and the cutout should not exceed 40% of the door's face area. The cutout should also be no greater than half the height of the door.

When most of the surface of a flush door is cut out, as in the case of a full-lite glass door, manufacturers may use a structural composite lumber (SCL) core, because the cross-laminated layers provide strong integral corners that eliminate the possibility of frame settling or separation.



Associate Editor **Dave Holbrook** was a builder in N. Eastham, Mass., for 20 years.

Door Manufacturers

Combination Door

1000 Morris St.
P.O. Box 1076
Fond du Lac, WI 54936
920/922-2050
www.combinationdoor.com

Eggers Industries

P.O. Box 88
Two Rivers, WI 54241
920/793-1351
www.eggersindustries.com

Jeld-Wen Doors

3250 Lakeport Blvd.
P.O. Box 1329
Klamath Falls, OR 97601
800/535-3462
www.jeld-wen.com
(Morgan, Nord, Doorcraft)

Kolbe & Kolbe Millwork

1323 S. 11th Ave.
Wausau, WI 54401
800/477-8656
www.kolbe-kolbe.com

Madawaska Doors

P.O. Box 850
Bolton, ON L7E 5T5
Canada
800/263-2358
www.madawaska-doors.com

Masonite

One S. Wacker Dr., Suite 3600
Chicago, IL 60606
800/405-2233
www.masonite.com

Panelfold

10700 N.W. 36th Ave.
Miami, FL 33167
305/688-3501
www.panelfold.com

Circle #355

Pinecrest

2118 Blaisdell Ave.
Minneapolis, MN 55404
800/443-5357
www.pinecrestinc.com

Premdor

1600 Britannia Rd. East
Mississauga, ON L4W 1J2
Canada
800/663-3667
www.premdor.com

Simpson

400 Simpson Ave.
McCleary, WA 98557
800/952-4057
www.simpsondoor.com

Southwood Door

206 W. Donald St.
Quitman, MS 39355
800/323-3699

Vancouver Door

P.O. Box 1418
Puyallup, WA 98371
800/999-3667
www.vancouverdoorco.com

VT Industries

1000 Industrial Park
Holstein, IA 51025
800/827-1615
www.vtindustries.com

Woodfold-Marco

Box 346
Forest Grove, OR 97116
503/357-7181
www.woodfold.com

Woodharbor

3277 Ninth St. S.W.
Mason City, IA 50401
641/423-0444
www.woodharbor.com