Specification & Construction Of Custom Stile & Rail Doors

Copper Beech Millwork
A Division of Amherst Woodworking & Supply, Inc.
Custom wood doors can offer a wide variety of functional and aesthetic advantages. They allow a great deal of latitude in design. There are certain construction basics of which you should be mindful, so that your goals will be met in a fashion that delivers your design vision along with functional practicality.

What follows is a discussion of some of the different methods employed in door construction. Doors must be designed and fabricated to withstand use and abuse as well as seasonal fluctuations in their environment. No other item of architectural woodwork receives as much physical wear & tear as a door. Quality construction is of paramount importance.

The effort to achieve original design often leads designers away from traditional standards. The standards of tradition have generally been derived from practical experience, so, in your efforts to push the frontiers of design be mindful of the lessons of those that have gone before.

Location Conditions

The first consideration in specifying a wood door is the environment in which it will be placed. The principal source of problems with wood doors is moisture, either an excess, or an extreme lack thereof. Wood is a hydroscopic material; meaning that it’s moisture content will change in reaction to its surrounding environment. As it picks up moisture it will expand, when it gives up moisture it will shrink. In most cases, it is the “rapid” change of moisture content that causes problems. A piece of wood, or wood door, that picks up moisture more on one face than another, will expand more on that face; i.e. it will warp. Proper finishing, as will be discussed later, slows down the process of moisture exchange, and can therefore limit its effects. No finish can make a door completely impervious to the effects moisture changes in its environment.

It is the constantly changing nature of wood that prompted the evolution of the Panel & Frame, or Stile & Rail, method of construction. Essentially all of the dimensional changes, due to moisture fluctuations in a piece of wood, occur across the grain. The changes in length are so small as to be considered immeasurable. Stile & rail construction utilizes the lengthwise stability of wood to greatest advantage through alternation of grain directions, minimizing overall door size change. (See illustration at left)

Interior Wood Door design criteria is principally driven by aesthetics, structural considerations, and environment as related to Relative Humidity. The most common environmental problem for interior doors is excessive dryness.
Exterior Wood Doors require the same considerations along with weather factors. Wood doors function best when protected from direct weather exposure. The most common environmental problem for exterior doors is excessive wetness.

Note: Most manufacturers stipulate a minimum of a 4’ overhang to protect the door from direct rain and excessive direct sunlight. An exterior door should be expected to easily withstand occasional precipitation contact, such as from a blowing storm. It is unreasonable to expect a wood door to endure routine soakings from regular rain or snowfalls. It can be noticed that buildings having withstood the test of time, have their wood doorways well recessed from weather exposure.

Exterior doors are, in fact, usually defined as doors subjected to differentials in temperature of more than 20°, or humidity of more than 10%, between the two faces, at any time. This means that many applications, such as a bathroom or a garage/house door, would be considered as exterior even though they have no exposure to weather. The exterior designation affects choice of materials and warranty term.

Wood Species

The choice of wood for Exterior Doors is more critical than for interior. Exposure to the elements is very hard on any wood, but there are some with better weathering characteristics.

Mahogany, Pine, & Spanish Cedar do well for exterior doors, because of good stability and weathering characteristics.

Cypress is commonly used in the Southeast, where it is native, but does not perform as well in dryer, northern climates. It has not exhibited good stability and can be subject to grain lifting, a condition where the growth rings separate.

Douglas Fir has good stability & strength and fair weather resistance, making it inadvisable to use in a location with direct weather contact.

Western Red Cedar & Redwood have excellent stability and weathering characteristics, but are very soft, limiting their wear resistance and structural strength. Redwood’s availability is extremely limited. The western lumbers (Fir, Cedar, Redwood) are not commonly available in sufficient thickness for solid wood doors, making laminated construction necessary.

Oak, Cherry, Maple, and most other hardwoods do not withstand direct exposure to sunlight & rain very well. They can make a satisfactory exterior door with proper construction methods and protection from the elements, such as a location inside a porch or deep overhang.

Wood selection for Interior Doors is primarily an aesthetic choice, making the governing factors cost and availability. As we will see, specie selection can have an impact on choice of construction methods.
Elevation Details

**Stile** width of interior doors should be a minimum of 4-1/2”. The Architectural Woodwork Institute (AWI) recommends an exterior minimum of 5-1/2”, although we have found 5” to work well.

**Intermediate or Mullion Stiles** are generally ~80-100% of the width of the Stiles.

The width of **Muntin Bars** is usually determined by the rabbet required for the glazing. Single glazed muntins can run as narrow as 5/8”, more commonly being 3/4”. Insulated glazed muntins generally require a minimum width of 1-1/8”, more commonly being 1-3/8”-1-1/2” wide. See further discussion under **Panels - “Glazing”**

The **Top Rail** is usually the same width as the stiles. This provides an aesthetic as well as structural balance. **Bottom, Lock & Cross Rails** are generally the same width or wider, progressing in width as you get closer to the floor.

Door components need to be sized to:
1. Provide sufficient structure to the door to withstand usage and resist sagging.
2. Provide sufficient stability to resist warpage.
3. Provide adequate area for mounting of hardware without compromising the above two factors.

Component sizing requirements are heftier for **commercial & institutional** doors because they bear heavier traffic than residential doors. A 3/4” muntin bar on a commercial door is not a good idea. Commercial doors generally require heavier hardware, which needs larger stiles & rails than residential doors. Mortise locks generally require stiles with a minimum width of 5 to 5-1/2”. Some closers require 7” top rails for proper mounting. Cross rail placement can be critical if there is a panic bar exit device used.

Section Details

The **Stiles & Rails** can either be constructed of solid lumber or laminated for enhanced stability.

**Solid Lumber** construction is advisable only for a few species of lumber, among them; Pine, Mahogany, Spanish Cedar, and Basswood (interior only). Most hardwoods, Poplar included, do not have sufficient stability for effective use as solid wood components in the manufacture of quality doors. Any wood selected for solid components should be straight grain carefully dried to 6-8% moisture content (MC).
**Stave Core** construction of stile & rail components provides for superior stability and straightness. The core is laminated using a stable, low-density lumber such as Basswood or Pine. The faces are covered with a 1/8” veneer of the appropriate specie, while the edges get 5/8” of the same. Commodity doors use face veneers of 1/32-1/16” thickness. Poplar faces for paint grade doors work well because the stable core limits the Poplar’s movement.

Stability in the construction of door components is not just an issue of warpage. It also affects the tightness of the joints over time, through seasonal fluctuations.

Stave core construction is also an excellent means to be selective about grain & color on natural or stain finish doors such as Cherry, Walnut, Maple, or Oak. In addition it can allow the use of different species on each face of the door, for the purposes of matching different woodwork in different rooms. The use of different species usually voids warranties against warpage and should, therefore, be done with care. (See discussion under Maintenance & Warranty - "Balanced Construction")

Stave Core construction works equally well for interior and exterior applications.

**Joinery**

**Mortise & Tenon** is the preferred method of joining stile & rail components. A method as old as the construction of the first panel door, it is still the strongest, and most durable over time.

The tenon, machined from the end of the rail, fits into the mortise, a pocket cut into the stile. The joint is machined to a close tolerance, allowing for the proper spread and penetration of adhesive throughout the joint.
Dowel construction is common among stock, or “commodity”, doors. Both the stile and rail are bored to receive two or three dowels per joint. The dowels are typically 1/2” or 5/8” diameter by 2-1/2” or 3” long. Some architectural grade interior doors are fabricated with doweled construction. Because of the advances in adhesives, doweled joinery can produce a good quality door. Doweled doors are less costly and provide a good alternative where service requirements do not demand, or budgets do not allow mortise & tenon doors.

**Adhesives**

While there are many types of chemical adhesives used in woodworking, three types have practical application in door fabrication. There are two particular concerns with adhesives used in door fabrication. Water resistance and “creep”. Creep happens when the bond between two pieces of wood holds, but the pieces shrink or swell differentially. This results in joint separation, such as at the meeting point of a stile and rail.

**Polyvinyl Acetate (PVA)** adhesives are assembly glues, including such retail brands as Titebond™ and Elmer’s Carpenter’s Glue™. They have very low water resistance, moderate creep resistance, and are satisfactory for edge gluing door components such as solid wood panels for interior doors. **Crosslinking PVA** adhesives can achieve a Type I waterproof bond, but still only have moderate creep resistance. These differ from regular PVA’s by the addition of a catalyst to cure the bond.

**Urea Resin Glue**, also known as **Plastic Resin Glue**, is available as a powder mixed with water, or a liquid resin mixed with a powder or liquid catalyst. These offer very good to excellent water resistance, and excellent creep resistance. They are easy to mix properly. The Urea Resin Glue used by Amherst Woodworking misses a Type I rating because of failing the boiling test. Boiling doors voids the warranty.

**Resorcinol Adhesives** are also catalyzed. They will give a Type I waterproof bond with excellent creep resistance. They can be very tricky to mix, being prone to over or under catalyzing, resulting in weak bond. They are also very temperature sensitive while curing.
Stile & Rail Sticking/Molding

Wood doors offer a wide variety of possible molding and panel profiles. Note: Exterior doors, with direct weather exposure, need the profiles designed to facilitate the shedding of water. Doors without direct precipitation contact, such as inside a porch, do not share that concern.

Bead & Cope sticking provides the greatest structural integrity along with the lowest cost. The molded pattern is integral to the stile & rail, providing the most solid panel retention as well as being an integral component of the stile & rail joint. Most manufacturers have a “Standard Sticking” that is used as a default pattern unless a specific detail is drawn and requested. Custom manufacturers usually offer a variety of sticking patterns as well as the capability of reproducing existing patterns with a tooling charge.

Applied Moldings can provide a higher level of detail, but are more costly in material and labor. Being applied, and not integral, they do not provide as high a level of structural integrity as bead & cope sticking. Application of the moldings generally involves face nailing which requires puttying/filling.

As illustrated, applied moldings can either be Inset or a Bolection Molding.

Bead & Cope w/Applied Molding gives some of the best of both worlds. The higher level of detail from applied moldings can be achieved while retaining the structural advantages of Bead & Cope sticking. Applied moldings on stiles & rails or panels should be applied to both faces in exactly the same pattern to avoid warpage. (See discussion under Maintenance & Warranty - "Balanced Construction")
Integral Moldings can provide a higher level of detail, while avoiding the need to face nail in fastening. This provides a greater degree of structural integrity in panel retention, similar to that of a bead & cope. It also avoids the need to putty nail heads which is more pleasing aesthetically. This method is, however, the costliest method of door construction because of the greater precision required in fitting and fabrication. Selection of molding profiles can also be more limited.

The Sizing of the molded section, whether bead & cope or applied, is a function of the joinery. In mortise & tenon construction, the thickness of the tenon is the same as the tongue of the panel, leaving the balance of the door thickness available for molding. The thickness of the tenon should be ~30-40% of the thickness of the door. We most commonly use a 5/8” tenon for a 1-3/4” door.

This also holds true for glass panel doors with a bead & cope on one face and an applied stop on the other. (See further discussion under Glazing.)

Panels

Panels are not a structural component of the door. Panels should “float” in the rabbet or dado that retains them. This allows the panels to change dimensionally independent of the stile & rail changes. This prevents the introduction of stresses between the panels and stiles & rails that might cause the door to warp or force joints apart.

Flat Panels can be made with solid lumber, plywood, or composite materials.

Solid lumber flat panels should be kept to 14” or less in width across the grain. This is because of dimensional variation due to seasonal fluctuations in humidity.

Plywood or Veneered flat panels provide superior dimensional stability. A wide variety of veneer species are available for interior use. Exterior use of plywood panels is generally limited to painted panels utilizing MDO (Medium Density Overlay) plywood, or the few species that are commonly available in a marine Grade Plywood; Mahogany & Teak. The commonly available plywoods with decorative veneers are interior grades. Almost anything can be specially laid up in the way of plywood, but the cost factors will double to quadruple, and lead-time will be greatly extended.
Composite (MDF - Medium Density Fiberboard) panels are appropriate for interior paint grade construction. Medex® is an exterior grade MDF board that offers the advantage of a consistent core for shaping an edge, or vee-grooving. It is subject to swelling under consistent high humidity conditions, and is, therefore, not recommended for direct weather contact.

Raised Panels can be made with either solid lumber, veneered panels rim-raised with solid lumber edges, or composite materials.

Solid lumber raised panels, as with flat panels, should be kept to 14” or less in width across the grain.

Rim-raised panels utilize solid wood mitred and applied “picture frame” around a composite panel. The panel is either pre-veneered, displaying a ~1/8” border around the veneered section, or veneered after application of the edge, eliminating the appearance of a border. This allows for the stability of veneered construction with the beauty of shaped solid wood. Rim-raised panels are much more labor intensive than solid lumber and, as such, are more costly.

The use of rim-raised panels for exterior doors is limited by the availability of exterior grades of plywood as discussed under flat panels above. The sandwiched nature of panel construction can allow for the inclusion of an insulation board in the center of the panel, greatly improving the R-value of the panel.

Composite (MDF - Medium Density Fiberboard) panels are appropriate for economical, interior, paint grade construction. The panel raise (edge shape) can be cut directly into the MDF board. This gives a panel with excellent dimensional stability and the economy of MDF. The disadvantage is that, without the proper priming of the shaped edge, it will take paint differently from the flat center surface of the panel.

As with sticking patterns, most manufacturers have a standard Panel Raise Pattern. Custom manufacturers usually offer a variety of panel raises as well as the capability of reproducing existing patterns with a tooling charge.

Panel raise profiles can also be enhanced with the addition of an applied molding.

Glazing

Custom doors can accommodate a variety of glazing styles. All glazing for passage doors is required by code to be safety glazing, either tempered, laminated, wire, or acrylic. Some states have “Art Glass” exemptions for stained glass or similar products. It would be advisable to thoroughly investigate any such exemptions prior to specifying anything that does not qualify as safety glazing.

Tempered lights can be manufactured with or without the small logos in the corner. Some residential projects prefer lights without logos for aesthetic reasons, especially on ADL doors where 15-20 logos would be very apparent. This leaves verification of compliance to purchasing receipts when required. Commercial and Institutional projects are best supplied with the logos due to yearly inspection of facilities by building authorities.
**Insulated Glass** requires a sufficient rabbet depth to hide the spacer used to fabricate the glass light. Insulated lights are available, from a few specialty manufacturers, with spacers or “sightlines” as narrow as 5/16”. This allows a rabbet depth of 3/8”. It becomes an issue with **Authentic Divided Light (ADL)** doors requiring insulated glazing. A muntin bar width as narrow as 1-1/8” can be achieved with two 3/8” glass rabbets and 3/8” left in the center for the tenon. Insulated lights for 1-3/4” doors are typically 1/2 - 9/16” overall thickness.

A typical ADL Insulated muntin bar would be 1-1/2” wide, with glass rabbets of 1/2” and a 1/2” wide tenon. The wider muntin bar affords greater strength, a consideration for commercial & institutional doors, and the use of standard insulated lights.

**Single Glazing** is usually 1/8 - 1/4” thick. It can be accommodated with a rabbet depth as shallow as 1/4” allowing for narrow (3/4”) muntin bars on ADL doors. As shown in the illustration, a single glass panel will not be located at the center of the thickness of the door. It is bedded in a sealant against the sticking bead at one face of the door, with the stop taking up the balance of the door thickness. Single glazing is usually retained by the use of a **wood stop**, as shown in the illustration. **Putty Glazing** is not generally used on doors because modern putties remain soft & elastic, providing a superior seal to earlier putty. The softness does not work well on a door application, being subject to handling.

**Leaded Beveled or Stained Glass**, sometimes referred to as **Art Glass**, requires special treatment, and is best handled by an art glass specialist.

Leaded glass panels, wider than ~12”, require support bars anchored to the surrounding frame. The bars help the individual panes resist loosening over time. This is true with static windows, so it is particularly applicable to a door that is subject to slamming.

Greater energy efficiency can be attained through the use of an exterior clear insulated light, and then mounting the leaded panel spaced to the inside. Accommodating the insulated panel, 1/2-3/4” space, leaded panel, and support bars will likely require a door thicker than the standard 1-3/4”. Use of a single thickness, clear, outer light would save on required door thickness, but would risk condensation problems between it and the leaded panel.

There are pre-manufactured panels available that incorporate a leaded light sandwiched inside of a clear, tempered, insulated unit. These can also be custom made. They do not have any provision for support bars or heat dissipation, an important consideration for stained glass. The darker panes of the stained glass, absorbing sunlight, can heat up and crack in a sealed unit.
The 1997 code in Massachusetts seems to allow the use of “Assemblies of leaded glass or faceted glass and items of carved glass used for decorative purposes . . .” (780 CMR 2405.2-9-2) without safety glass panels. Any contemplated use non-safety glass should be cleared with governing inspectors.

Acrylic Glazing can meet the requirements for safety glazing, but it’s tendency to scratch easily gives it a poor appearance in a relatively short time period.

**Plank and Board & Batten Doors**

**Plank Doors**, typical in some Gothic and Tudor buildings, do not offer the dimensional stability of Panel & Frame construction as discussed earlier.

Traditionally constructed Plank Doors are, essentially, large panels of solid wood. They are generally fabricated with multiple boards, splined or tongue & grooved (T&G) together. Having a unidirectional, vertical grain orientation, they are subject to large width fluctuations, and a tendency to wrack. This can be a particular problem for exterior doors.

An adaptation of plank construction is **Plank on Frame**, which utilizes a mortise & tenon frame (typically 1-1/4” thick), over which is applied T&G boards (1/2” each face). The frame provides structure and dimensional stability. The boards are applied individually, without edge gluing to each other, allowing them to move independently, minimizing width change and wracking tendency. The spaces between frame members can be filled with insulation board, improving R-Value, or deadening sound for interior applications.

A Plank on Frame door will never equal a Stile & Rail door for weather-tightness. It is a good compromise where the original appearance needs to be maintained. Nor are they generally warranted to the same tolerances.

**Board & Batten Doors**, typical of the Colonial Period, have similar problems to Plank doors. The width fluctuations are largely controlled by the individual application of boards, not edge glued, to the battens. There is, however, very little resistance to wracking, given the absence of a frame. The informal nature of this type of door generally means an imperfect fit to the frame is not a problem for an interior application. One should not expect a typical warranty for this type of door either.
Finishing

One of the most important points in upholding the terms of any door manufacturer's warranty is the finishing. An interior or exterior door needs to be promptly and properly finished on all six sides, protecting it against the elements. Proper finishing slows down the process of moisture exchange. The slower the exchange, the greater the chance that all the components of a door will be able to react to the change equally.

**Exterior Doors** require protection from the sun and moisture. The trick in maintenance of the finish on an exterior door is keeping the sun’s UV rays from attacking the wood. This is accomplished in two ways.

One is by pigments, which block the rays. **Paint** is the most effective UV inhibitor, and the best finish for any door. A painted finish gives the most complete protection and requires the least maintenance.

Where a **stained or natural finish** is desired, much greater attention needs to be given to the finishing. The best systems are either Marine finishes, or those derived from Marine systems. Sikkens™ manufactures a finishing system involving 1-2 pigmented coats, followed by 2-3 clear coats. The pigmented coats act like a stain, aesthetically, while providing a certain amount of UV blockage. The use of pigmented coats also has an advantage with woods such as Mahogany & Spanish Cedar, which have a wide range of natural color variation. Also, direct exposure to sunlight bleaches color from wood. Pigments in the finish can help to maintain the “natural” look of the wood.

The second method of protection is through UV absorbers in the clear coats. Depending on the manufacturer, anywhere from 3 to 7 coats may be recommended. The highest quality Marine (Spar) and Millwork exterior varnishes have higher proportions of these absorbers. Manufacturers technical data sheets will list the proportion of solids, which is a very good starting point for determination of product quality. There is, however, no commonly listed percentage of UV absorbers. The best exterior varnishes are generally to be had through Marine Supply houses.

There are several high quality Marine varnishes on the market. The Resources page, in the Appendix, has contact information.

A clear-finished wood door with heavy sunlight exposure will require maintenance of the finish every 2-5 years, depending on the quality of the initial finish and the degree of exposure.

As discussed, paint requires less maintenance and provides better protection than a clear finish. If, for example, a Cherry door is desired to match the interior woodwork, consideration should be given to painting the exterior for maximum protection, and clear finishing the interior where the aesthetics are a premium consideration.

The text of an article, from “Woodshop News”, on finishing of wood doors is included in the Appendix. It gives a good overview of the considerations involved in this very important final step of door manufacture & installation.

**Painted doors** can first be effectively **preservative treated** by brush or dipping, after fabrication. Industry Standards for preservative treatment of finish millwork are specified by the National Wood Window and Door Manufacturers Association (NWWDA) in their bulletin “NWWDA I.S.4-94 Water Repellant Preservative Non-Pressure Treatment for Millwork”. Information for contacting the NWWDA is given under “Resources”. It is also covered briefly under 100-S-10 of the Architectural Woodwork Quality Standards Illustrated.
Quality Standards

The Architectural Woodwork Institute (AWI) establishes the quality standards that are applicable to architectural millwork, custom stile & rail doors included. AWI details the requirements of its three grades, Economy, Custom, & Premium in the Architectural Woodwork Quality Standards Illustrated (QSI). These grades cover quality of machining and joinery, as well as permissible characteristics of materials including color & grain matching, sapwood & heartwood, etc. (For information on AWI Publications see Resources page.)

One should expect a higher level of “fit & finish” on a custom door than a commodity door. Finish sanding will still be required prior to application of the finish. The degree of sanding required will depend on the grade of door specified. A copy of the page covering section 1400-S-10 “Smoothness of Exposed Surfaces”, in the AWI QSI is included in the Appendix.

While AWI covers the standards for the manufacture of custom doors, the National Wood Window & Door Association (NWWDA) (see “Resources”) addresses issues of storage & handling, finishing, installation, and maintenance. A copy of NWWDA’s “How to Store, Handle, Finish, Install, and Maintain Wood Doors” is included in the Appendix. NWWDA’s members primarily engage in the manufacture of “commodity” type doors.

Maintenance & Warranty

A copy of Amherst Woodworking’s door warranty is included in the Appendix.

Probably 95% of all door failures are caused by improper care of the door or installation in an improper environment. Properly constructed, installed and finished wood doors can be expected to give a long service life.

Relative Humidity (RH)

Wood doors should not be subjected to sustained RH levels below 25% or above 55%.

Northern climates are very dry in the winter heating season. Indoor environments, without humidification, can easily drop below the 25% RH level. At this level there is risk of warpage and joints pulling apart, even when properly finished.

Conversely, excessive RH can cause warpage and joints to be pushed apart.

By slowing the exchange of moisture, proper finishing allows a door to withstand the effects of temporary humidity extremes, as experienced in the months of February and August.

Balanced Construction

Doors, and any other wood panel for that matter, need to be constructed and finished in balance. The same type and number of coats, of finish should be applied to both faces. Decorative moldings applied to one face should be applied to the other, in the same pattern. Doors with different wood species on each face cannot be warranted against warpage because woods react differently to changes in humidity. Practically, doors with different faces will usually work fine, as long as the two species are similar in their density and stability characteristics. Likewise, many exterior doors have a painted exterior face and a transparent finished interior. These function well if the thickness of the finish film is the same on both faces.
Appendices

Historical Design Illustrations 7 pages
Exterior Finish Article 2 pages
AWI Section 1400 sample page 1 page
Sample Door Warranty 1 page
NWWDA Bulletin 2 pages

How to store, handle, finish, install and maintain Wood Doors

Resources & Bibliography 2 pages
Historical Design Appendix

The following pages have reproductions of drawings from the National Park Service’s Historical American Buildings Survey (HABS). Represented are sections & elevations of doors from various periods of American architecture, along with section details from Copperbeech Millwork’s (CBM) inventory of sticking, applied molding, and raised panel patterns.

1700-1765 Early Georgian
   One HABS drawing, two CBM patterns

1765-1835 Late Georgian & Federal
   Three HABS drawings, five CBM patterns

1830-1860 Greek Revival
   One HABS drawing, five CBM patterns

1840-1910 Victorian - Gothic, Italianate, 2nd Empire, Stick, Queen Anne
   Period catalogue elevations & sections.

1905-1930 Craftsman
   One HABS drawing, three CBM patterns

www.cr.nps.gov/habshaer/

The Historic American Buildings Survey (HABS) and the Historic American Engineering Record (HAER) document achievements in architecture, engineering, and design in the United States. As of March 1998, the collection contained more than 363,000 measured drawings, large-format photographs, and written histories for more than 35,000 historic structures and sites dating from the seventeenth to the twentieth century.
1700-1765 Early Georgian

**Configuration:** 4, 6, & 8, usually rectangular, panels

**Sticking:** Ovolo (w/o quirk), also called “thumb bead”

**Panels:** Feather edge raised

**Materials:** Pine, usually painted

**Notation:** Entrances featured elaborately molded surrounds.

Selections below are appropriate to period from Copperbeech Millwork patterns.
1765-1835 Late Georgian & Federal

Configuration: 4, 6, & 8, usually rectangular, panels

Sticking: Ovolo, ogee, or applied moldings. Sometimes carved.

Panels: Flat, sometimes adorned with an astragal mold. Raised panels/late Georgian.


Notation: Entrances featured sidelights & fan light transoms, sometimes elaborately grilled. Decorated w/carvings & tracery applications.

Sticking & molding patterns shown might be considered as reasonably replicating period details.
1830-1860 Greek Revival

**Configuration:** 4, 5, & 6 rectangular panels

**Sticking:** Square edge, slightly beveled, or Grecian (elliptical) ovolo or ogee applied moldings.

**Panels:** Flat, or raised w/square rebated edge.

**Materials:** Pine, painted. Some interior use of Mahogany.

**Notation:** Entrances featured rectangular sidelights & transoms

Possible Copperbeech patterns for Greek doors. CB 7856 panel raise not truly authentic due to bevel.
Selections from the Combined Book of Sash, Doors, Blinds & Mouldings, Rand McNally & Co., 1898

1840-1910 Victorian - Gothic, Italianate, 2nd Empire, Stick, Queen Anne

Configuration: Multiple panels & lights. Usually selected from catalogues.

Sticking: Standard catalogue sticking patterns for simple interior doors to deep profile bolection moldings for entries & primary rooms.

Panels: Flat, raised, carved, & applied ornamentation.

Materials: Painted Pine, Fir, Yellow Pine, Birch, Oak, Mahogany, Walnut

Notation: Wider use of glazing as it became less expensive. Clear, colored, etched, leaded.
1905-1930 Craftsman

Configuration: Tall narrow panels or lights.

Sticking: Square edge.

Panels: Flat.


Notation: Styling is achieved through stile & rail configuration. Sometimes ornamented with applied “brackets”.

CB 7916 & CB 7924 sticking patterns below should be considered “in the style of”, not necessarily historically accurate.
Protecting Exterior Doors
Sunlight and Rain are Formidable Opponents

Wooden exterior doors made of high quality woods and finished with a clear finish are very popular. There's no question that many of these doors are stunningly beautiful. The problem is finding a reliable way to finish them so they hold up to sun and rain without a great deal of maintenance - which most people are unwilling to perform.

Effects of the sun

Light is the principal enemy of paints and finishes. Over a period of time, ultraviolet (UV) rays from light, especially from sunlight, break down paints. You can see this on cars and buildings that have been exposed to the sun for many years. The paint has dulled and begun to chalk. If you catch the paint before the damage has gone all the way through, you can often rub off the dullness with abrasives and expose paint that looks shiny and new.

UV rays also break down clear finishes. But most peel before dulling and chalking become problems. They peel because the UV rays penetrate the film and cause the wood underneath to deteriorate. The lignin that glues the cells of cellulose together loses its strength, and the surface cells separate from the rest of the wood. When this happens, the finish, which is bonded to these surface cells, peels.

The best sun-blocking agent, and thus the best UV protector for finishes applied outdoors, is pigment. Pigment blocks UV rays, so the wood underneath doesn't deteriorate. But it also hides the wood, which defeats the purpose of using beautiful woods in the first place.

The next best locking agent is a chemical that absorbs UV light. These chemicals are much like the sunscreen agents used by beach-goers. They convert ultraviolet light energy to heat energy that dissipates. UV absorbers don't hide wood, and they are fairly effective at preventing wood deterioration under a finish.

The problem with UV absorbers is that they are very expensive, and a significant amount has to be included in the finish to be effective. It isn't enough to add a few drops to a vat and claim that the product contains UV absorbers. The products need to contain at least 1 to 3 percent by weight, and this increases the cost of the finish considerably.

The most common finishes that contain sufficient UV absorbers are marine varnishes. These varnishes cost from $50 to $100 a gallon. Unless you buy them mail order, they are difficult to find, except in coastal areas.

Effects of moisture

Moisture also causes finishes to peel. But, in order to do so, it has to get between the finish and the wood. There are two ways moisture can do this:

• by penetrating the finish film;
• by penetrating a crack in the film and working through the cells behind the finish.

There are several finishes, for example, oil, shellac, and to some degree, lacquer, that do not resist moisture penetration well. If it should rain on a door finished with one of these finishes, it won't
be long before the finish begins to peel (or simply disappear, in the case of oil).

Two-part finishes, like catalyzed lacquer, conversion varnish, epoxy, and polyester, resist moisture penetration well, but they cure too hard to keep up with wood movement outdoors. Rain doesn't cause the initial problem. It is cracking due to the hardness of the finish. Then rain can get through and cause the finish to peel.

Other finishes, especially varnishes, also resist moisture penetration well, and they can be made very flexible so they keep up with wood movement outdoors. When made flexible, these varnishes are often called spar or marine varnish.

The best of these varnishes are made with phenolic resin and tung oil. They don't crack as quickly as those made with polyurethane resin, but they do dull a little quicker.

Limitations

Even the best marine varnishes have limitations on exterior doors. Most of these doors are frame-and-panel construction, and no finish is flexible enough to keep up with the expansion and shrinkage of the panels. As soon as a crack opens up where the panels slide into the frame, water can get in, work its way under the finish, and cause it to peel.

Every time this happens, the loose finish will have to be scraped or sanded off and fresh coats applied. If the water has stained the wood, the stain can be bleached out with oxalic acid.

Marine varnishes have several downsides as well:

- They are very glossy finishes, glossier than most people want on their exterior doors. They can be dulled by rubbing with an abrasive like steel wool, or by adding a flatting agent. But rubbing is extra work and it is difficult to get an even sheen on such a soft finish. Flatting agents reduce the durability of the finish.
- Many coats of marine varnish are required to achieve sufficient UV blockage. Boat owners commonly apply eight or nine coats. Few homeowners are willing to do this, or pay for someone else to do it.
- As the film dulls, the deteriorated surface layer should be sanded off and replaced with fresh coats. (UV absorbers block penetration through a film, but they don't keep the film itself from deteriorating.) This should be done every year or two depending on how much the door is exposed to the sun. This amount of maintenance is more than most people want to do.

The best solution

There is only one really sure solution for keeping a clear finished exterior door in good shape for many years. This is to protect the door from exposure to sun and rain. On the north side of buildings where the sun is not a problem, all that might be needed is a storm door. Where the sun does contact the door, the solution is to build an overhang. The overhang has to be large enough to shield the door completely from contact with sun and rain.

Even with a storm door or overhang, the door should be finished with a flexible spar varnish, however, because the door will shrink and expand a lot due to humidity changes. But UV absorbers won't be needed in the finish.
1400-T-11

Smoothness of Exposed Surfaces (Minimum Requirements)

In the absence of specifications, the following sanding standards will apply.

<table>
<thead>
<tr>
<th>Smoothness Table</th>
<th>Premium</th>
<th>Custom</th>
<th>Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent</td>
<td>Opaque</td>
<td>Transparent</td>
<td>Opaque</td>
</tr>
<tr>
<td>Sharp edges (Arris)</td>
<td>Laid with fine abrasive</td>
<td>Laid with fine abrasive</td>
<td>Mill option.</td>
</tr>
<tr>
<td>Top flat surfaces</td>
<td>150 grit</td>
<td>120 grit</td>
<td>100 grit</td>
</tr>
<tr>
<td>Moulded surfaces</td>
<td>120 grit</td>
<td>minimum 20 KCPI</td>
<td></td>
</tr>
<tr>
<td>Shaped surfaces</td>
<td>120 grit</td>
<td>minimum 20 KCPI</td>
<td></td>
</tr>
<tr>
<td>Turned surfaces</td>
<td>120 grit</td>
<td>100 grit</td>
<td></td>
</tr>
<tr>
<td>Sanding cross scratches</td>
<td>None allowed</td>
<td>Not to exceed 6.4 mm [0.25&quot;]</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: No tears, knife sinks, or hit or miss finish allowed. No knife marks allowed where sanding is required.

Surface variations as a result of multiple tool passes treated as turned surfaces above. Glue and filler, if used, must be incompressible and sanded as smoothly as the surrounding surface. Sanding before final stain and/or finish should be a consistent grit and scratch pattern, as it influences blend of color and sheen between components. Top Flat Surfaces are those which can be sanded with a drum or wide belt sander. Turnings are customarily sanded on the lathe, and will exhibit cross scratches.

Before finishing, all exposed portions of architectural woodwork shall have hanging marks or effects of exposure to humidity or moisture removed by a thorough uniform final sanding. The sanded surface shall then be cleaned and dust free, prior to proceeding with the first step in the finishing process. Veneer sand-through, with veneer sanded to the point where cross hanging or core is visible, and/or core telegraphing (variation from a true plane in excess of 0.25 mm [0.010"] in any 76 mm [3"] span) is not allowed in any Grade.

1400-T-12

Tightness of Plant Assembled Joints

<table>
<thead>
<tr>
<th>Plant Assembled Joint Table</th>
<th>Premium</th>
<th>Custom</th>
<th>Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior</td>
<td>Exterior</td>
<td>Interior</td>
<td>Exterior</td>
</tr>
<tr>
<td>Maximum gap: Test A</td>
<td>0.4 mm [0.015&quot;] wide by 20% of joint length</td>
<td>0.6 mm [0.025&quot;] wide by 30% of joint length</td>
<td>1.3 mm [0.050&quot;] wide by 30% of joint length</td>
</tr>
<tr>
<td>Maximum gap: Test B</td>
<td>0.4 mm [0.015&quot;] x 76 mm [3&quot;] and no gap may occur within 1829 mm [72&quot;] of a similar gap</td>
<td>0.6 mm [0.025&quot;] x 152 mm [6&quot;] and no gap may occur within 305 mm [12&quot;] of a similar gap</td>
<td>1.3 mm [0.050&quot;] x 203 mm [8&quot;] and no gap may occur within 600 mm [24&quot;] of a similar gap</td>
</tr>
<tr>
<td>Maximum gap: Test C</td>
<td>0.4 mm [0.015&quot;]</td>
<td>0.6 mm [0.025&quot;]</td>
<td>1.3 mm [0.050&quot;]</td>
</tr>
</tbody>
</table>

Maximum gap between fixed components shall be tested at points designed to join, where members connect or touch.

Flushness Variation: 0.03 mm [0.001"] to 0.06 mm [0.0025"]

Test Locations - Figure 1400-18

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Amherst Woodworking & Supply, Inc.     PO Box 718     30 Industrial Dr.     Northampton, MA 01061

Door Warranty

Doors manufactured by Amherst Woodworking & Supply, Inc. (AWW), or its subsidiary Copper Beech Millwork, are warranted to be free of defects in material and workmanship which would render them unserviceable or unfit for ordinary recommended use.

Interior doors are warranted for a period of two years from the date of delivery.

Exterior doors are warranted for a period of one year from date of delivery. Exterior doors are doors subjected to differentials in temperature of more that 20º, or humidity of more than 10%, between the two faces, at any time.

All doors must be inspected immediately upon receipt, and should a door be suspected of being defective, AWW must be notified in writing within 30 days of shipment by the original purchaser. No machining, fitting or alteration of any kind should take place until AWW can inspect the door. Any alteration that takes place before the inspection may void the warranty. Should a door be determined by AWW to be defective, we will at our option, either:

A) Repair the door without charge.
B) Replace the door (in the same state of fitting/ finishing in which the door was originally supplied), without charge.
C) Refund the original price of the door.

If AWW elects either option B or C: The door will be shipped to us at our expense and under our instructions, and the refund/replacement will be made upon receipt of the door by AWW.

Any incidental costs incurred, such as removal of the original door, fitting and rehanging of the replacement door, or re-machining or re-finishing of the replacement door (in doors not originally supplied in that state), are not the responsibility of Amherst Wood Working and are not covered by this warranty.

Doors must be handled, stored, installed, finished, and maintained in accordance with “How to Store, Handle, Finish, Install and Maintain Wood Doors” as published by the National Wood Window and Door Association (NWWDA).

Wood is a hydroscopic material, and under normal conditions, some movement will occur. Due to the natural movement in wood, any slight surface checking or minor cupping shall not be considered a defect. This movement in properly constructed raised panel doors may show up in expansion or contraction of the panels with normal environmental changes. This is not considered to be a defect.

Warped doors will not be considered defective unless the deflection exceeds 1/4” in any 3’0”x7’0” section. Warp is any distortion in the door itself as opposed to it’s relationship to the jamb, or the adjoining door in double units. The amount of warp shall be determined by placing a straight edge corner to corner across the concave face of the door and a measurement taken at the maximum point.

If a door is determined to be defective due to warping, Amherst Wood Working may elect to allow the door to remain on site for a period of up to 12 months after installation, in order to allow the door to fully acclimate to the location’s environmental conditions.

Proper sealing of doors that have been sold as unfinished is the responsibility of the purchaser. Failure to properly seal the door will void the warranty. All doors must be sealed on all surfaces including edges, and glass and hardware cut-outs. An exterior finish must be used on any exterior door, and any improperly maintained door will not be covered.

Exclusions
This warranty does not cover:
1. Any improperly installed door.
2. Doors that are improperly handled at the site including: not being stored flat, or being exposed to extreme changes in the environment without protection.
3. Natural variations in wood color, texture, character, or cut.
4. The appearance of field finished doors.
5. Normal wear & tear including wear through of finish.
6. Incompatibility of hardware with a particular door construction.
7. Doors with stiles less than 4” wide.
8. Doors not of traditional stile & rail construction such as “Plank on frame” style doors.
9. Failure to supply adequate overhead protection four feet from the face & edge of the door.

This warranty is applicable only to doors manufactured by Amherst Woodworking & Supply, Inc. AWW also sells doors purchased from other manufacturers. Those doors are covered by the individual manufacturers warranties, copies of which are available from AWW on request.

As warranty terms are subject to change, project information requested below is required for warranty to be valid.

Project ___________________________  Sold to ___________________________

Location ___________________________  Delivery Date ________________________

AWW Representative ___________________________

DOORWAR1.DOC  11/30/2003  p.1
WHY ARCHITECTS AND HOMEOWNERS CHOOSE WOOD DOORS

BEAUTY, STYLE, PERFORMANCE AND ADAPTABLE FEATURES ARE SOME OF THE REASONS WHY ARCHITECTS AND HOMEOWNERS CHOOSE WOOD DOORS. TO PRESERVE THE FINESSE QUALITIES OF THESE DOORS AND A WIDE RANGE OF SUPERIOR SERVICES, PROPER STORAGE, HANDLING, FINISHING AND INSTALLATION ARE IMPORTANT. THE FOLLOWING GUIDELINES WILL HELP TO MAINTAIN THE HIGH QUALITY PRODUCTS SUPPLIED BY WOOD DOOR MANUFACTURERS.

STORAGE AND HANDLING

1. Store doors flat on a level surface in a dry, well-ventilated building. Doors should not come in contact with water. Doors should be kept at least 3-1/2" off the floor and should have protective coverings under the bottom door and the top. Covering should protect doors from dirt, water and snow but allow for air circulation under and around the stack.

2. Avoid exposure of interior doors to direct sunlight. Certain species (e.g., cherry, mahogany, walnut, teak) in an unfinished state are more susceptible to discoloration if exposed to sunlight or some forms of artificial light. To protect doors from light damage after delivery, opaque wrapping of individual doors may be specified.

3. Do not subject interior doors to extremes of heat and/or humidity. Do not allow doors to come in contact with water. Prolonged exposure may cause damage. Buildings where humidity and temperature are controlled provide the best storage facilities. Recommended conditions are 25%–55% RH and 50°F to 70°F.

4. Do not install doors in buildings that have wet plaster or cement unless they have been properly finished. Do not store doors in buildings with excessive moisture content. HVAC systems should be operating and balanced.

5. Doors should always be handled with clean hands or while wearing clean gloves.

6. Doors should be lifted and moved when being moved, not dragged across one another.

FINISHING

1. Wood is hygroscopic and dimensionally influenced by changes in temperature and humidity. To assure uniform moisture exposure and dimensional control all surfaces must be finished equally.

2. Doors should not be considered ready for finishing when initially received. Before finishing, remove all handling marks, raise grain, scuffs, burnishes and other undesirable blemishes by block sanding all surfaces in a horizontal position with 120, 150 or 180 grit sandpaper. Solid core flush doors due to their weight naturally compress the face veneer grain while in the stack. Therefore, sanding of the overall surface will be required to open the veneer grain to receive a full applied finish evenly. To avoid cross grain scratches, sand with the grain.

3. Certain species of wood, particularly oak, may contain extractives which react unfavorably with foreign materials in the finishing system. Eliminate the use of steel wool on bare wood, rusty containers or other contaminants in the finishing system.

4. A thinned coat of sanding sealer may be applied prior to priming to start forming a uniform finish and avoid sharp contrasts in color or a blotchy appearance. Door manufacturers are not responsible for the final appearance of field finished doors. It is expected that the finishing contractor will make adjustments as needed to achieve desired results.

5. All exposed wood surfaces must be sealed including top and bottom rails. Cutouts for hardware in exterior doors must be sealed prior to installation of hardware and exposure to weathcr.

6. Dark colored finishes should be avoided on all surfaces if the door is exposed to direct sunlight, in order to reduce the chance of warping or veneer checking.

7. Water-based coatings on unfinished wood may cause veneer splits, highlight joints and raise wood grain. If used on exterior doors, the coating should be an exterior grade product. When installed in exterior applications, doors must be properly sealed and adequately protected from the elements. Please follow the finish manufacturer's recommendations regarding the correct application and use of these products.

8. Be sure the door surface being finished is satisfactory in both smoothness and color after each coat. Allow adequate drying time between coats. Desired results are best achieved by following the finish manufacturer's recommendations. Do not finish doors until a sample of the finish has been approved.

9. Certain wood fire doors have fire retardant salts impregnated into various wood components that make the components more byroscopic than normal wood. When exposed to high moisture conditions, these salts will concentrate on exposed surfaces and interfere with the finish. Before finishing the treated wood, reduce moisture content below 11% and remove the salt crystals with a damp cloth followed by drying and lint brushing. For further information on fire doors, see the NFWDA publication regarding Installing, Handling & Finishing Fire Doors.
INSTALLATION

1. The utility or structural strength of the doors must not be impaired when fitting to the opening, in applying hardware, in preparing for lights, tovers, pilat-tons or other detailing.

2. Use two hinges for solid core doors up to 60 inches in height, three hinges up to 90 inches in height and an additional hinge for every additional 30 inches of height or portion thereof. Interior hollow core doors weighing less than 50 pounds and not over 72" in height may be hung on two hinges. Use heavy weight hinges on doors over 175 lbs. Hinge hardware may be used in lieu of hinges. Consult hinge or pivot hardware manufacturer with regard to weight and size of hinges or pivots required.

3. Clearances between top and hinge door edges and door frame should be a minimum of 1/8" (3.2 mm). For a single door latch edge the clearance should be 1/8" (2.2 mm). For a pair of doors the meeting edge clearance should be 1/16" (0.6 mm) per leaf. The amount edge should be 3/16" (19 mm) maximum from the top of a non-combustible floor and 3/8" (10 mm) maximum from the top of a non-combustible sill.

4. All hardware locations, preparations and methods of attachment must be appropriate for the specific door construction. Templates for specific hardware preparation are available from hardware manufacturers or their distributors.

5. When light or lower cuts are made for exterior doors, they must be protected in order to prevent water from entering the door core.

6. Pilot holes must be drilled for all screws that act as hardware attachments. Threaded to the head screws are preferable for fastening hardware to non-rated doors and are required on fire-rated doors.

7. In fitting for height, do not file top projection edge by more than 3/4" inches unless accommodated by additional blocking. Trimming of fire-rated doors must be in accordance with NFPA 80.

8. Doors and door frames should be installed plumb, square and level.

CLEANING AND TOUCHUP

1. Inspect all wood doors prior to hanging them on the job. Repair noticeable marks or defects that may have occurred from improper storage and handling.

2. Field repairs and touchups are the responsibility of the installing contractor upon completion of initial installation. Field touchup shall include the filling of exposed nail or screw holes, re-finish of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleaning of finished surfaces.

3. When cleaning door surfaces, use a non-abrasive commercial cleaner designed for cleaning wood door or paneling surfaces, that do not leave a film residue that would build up or effect the surface gloss of the door finish.

ADJUSTMENT AND MAINTENANCE

1. Insure that all doors swing freely and do not bind in their frame. Adjust the finish hardware for proper alignment, smooth operation and proper latching without unnecessary force or excessive clearance.

2. Review with the owner/renter's representative how to periodically inspect all doors for wear, damage and nature deterioration.

3. Review with the owner/renter's representative how to periodically inspect and adjust all hardware to insure that it continues to function as it was originally intended.

4. Finishes on exterior doors may deteriorate due to exposure to the environment. In the interest of protecting the door it is recommended that the condition of the exterior finish be inspected at least once a year and re-finished as needed.

HALLMARK CERTIFIED WOOD FLUSH DOORS

NWWDIA certifies firms which have demonstrated the ability to manufacture wood flush doors according to NWWDIA Standard for Wood Flush Doors 15-1. Each NWWDIA certified manufacturer's plant is inspected by NWWDIA to determine if their production facilities and procedures conform to the Standard including all adhesives used to meet the requirements of a Type I (exterior) or Type II (interior) adhesive in accordance with the NWWDIA Test Method T.M. 1. The Hallmark provides door manufacturers, purchasers, and specifiers with an easily recognizable means of identification.

QUALITY NATIONAL WOODWORKING AND DOOR ASSOCIATION CERTIFIED

WOOD Flush Doctor
CONFORM TO NWWDIA 15-1

The NWWDIA Hallmark identifies manufacturers who meet all the requirements of the NWWDIA Hallmark program for wood flush doors according to NWWDIA Industry Standard 15-1 for Wood Flush Doors.
RESOURCES

The Architectural Woodwork Institute (AWI)
1952 Isaac Newton Square W
Reston, VA
703-733-0600  FAX 703-733-0584
www.awinet.org

Amherst Woodworking & Supply, Inc.
Copper Beech Millwork (div.)
PO Box 718  30 Industrial Dr.
Northampton, MA  01061
413-584-3003  FAX 413-585-0288
800-532-9110  www.copperbeech.com
E-mail:  amwooco@copperbeech.com
Manufacturers of Architectural Millwork including cabinets, doors, windows, moldings, and monumental fabrications. The Copper Beech Millwork Book of Moldings, contains 44 pages of full scale molding profiles. It is supplied free on request.

National Wood Window & Door Assoc. (NWWDA)
Des Plaines, IL
847-299-5200  FAX 847-299-1286
www.nwwda.org
Sets standards relative to the manufacture of “stock” type doors & windows. Custom and hardwood doors are better specified under the stricter quality standards of the Architectural Woodwork Institute.

Forest Products Laboratory (FPL)
Madison, WI
608-231-9200  FAX 608-231-9592
www.fpl.fs.fed.us
Research laboratory for the US Forest Service. An excellent resource for technical data on North American lumber species.

Forest Products Research Society (FPRS)
Madison, WI
608-231-1361  FAX 608-231-2152
www.forestprod.org
Forest Industry trade research group.

Woods of the World - CD-ROM
Tree Talk, Inc.
Burlington, VT
800-858-6230  FAX 802-863-4344
wow@together.net
www.woodwed.com/~treetalk/home.html
This is a CD-ROM detailing “information on up to 910 wood species and products, covering 95% of all the wood in trade. Common names, uses, distribution, environmental profile, physical & working properties, and mechanical values. Covering all the important species in North America, Europe, Africa, Latin America, and Asia. Full-color pictures. As many as 3,500 species’ distribution maps. Products sectors of the more than 135 countries featured on the maps. Searching capability.”

www.cr.nps.gov/habshaer/
The Historic American Buildings Survey (HABS) and the Historic American Engineering Record (HAER) document historical architecture in the United States. The collection contains more than 363,000 measured drawings, large-format photographs, and written histories for more than 35,000 historic structures dating from the 17th to the 20th century. Am effective way to search for period examples is to use a date as a keyword.

Marine & Exterior Finish Manufacturers

Epifanes North America Inc.
Thomaston, ME
800-269-0961  FAX 207-354-0387
www.epifanes.com
Manufacturers of Epifanes Yacht Coatings.

Kop-Coat Marine Group
Rockaway, NJ
800-221-4466  FAX 973-625-8303
www.kop-coat.com
Manufacturers of Woosey Z-Spar and Petit Marine Varnishes.

Sikkens Decorative Wood Finishes
Troy, MI
800-833-7288
sikkensnam@aol.com
Manufacturers of Sikkens Cetol finishing systems for Marine and Millwork applications.
A Select Bibliography

Classical Architecture, Robert Adam
An excellent guide to The Orders and theories of classical architecture, well illustrated.

The American Vignola, William Ware
Dover reprint of the 1903 edition, 1994
A guide to classical architecture used by many neo-classical, early 20th century Architects.

A Building History of Northern New England, James Garvin
A close look at the details of early Colonial, Georgian, Federal, and Greek Revival building styles.

A Field Guide to American Houses, Virginia & Lee McAlester
Alfred A. Knopf, 2000
A style manual for American architecture, mostly referencing exterior details.

The Elements of Style, Stephen Calloway editor
Simon & Schuster, 1996
A general overview of architectural details in British & American styles from the 15th through the 20th centuries.

Handbook of Building Crafts in Conservation, Jack Bowyer
Van Nostrand Reinhold, 1981

The Theory of Mouldings, C. Howard Walker
JH Jansen, Cleveland, OH, 1926
A detailed examination of origins, profiles, combinations, materials, architectural styles.

Colonial Interiors, Colonial and Early Federal, 1st series 1923
Colonial Interiors, 2nd series 1930
Colonial Interiors, Federal and Greek Revival, 3rd series 1938
Bonanza Books, William Helburn, NYC
Interior photos, some line drawn elevations & sections

The Architectural Heritage of the Piscataqua, JM Howells
An excellent survey of the Portsmouth NH area, with interior & exterior photos, drawings and sections of Georgian & Federal architecture.

The American Builder’s Companion, Asher Benjamin

The Architect or Practical House Carpenter, Asher Benjamin
Dover 1988 reprint of 1830 work on Greek Revival style. Detailed elevations & sections.

Practice of Architecture, Asher Benjamin

Woodward’s National Architect, Woodward & Thompson

Victorian Architectural Details, Cummings & Miller
The American Life Foundation, 1980
Reprint of two pattern books (1868 & 1873) for Mansard, Italianate, & Bracketed style houses.

Palliser’s Late Victorian Architecture, Palliser & Palliser
The American Life Foundation, 1978
Reprint of two pattern books (1878 & 1887) for late Victorian style houses.

Cabinetmaking and Millwork, John Feirer
Charles Bennett Publisher, 1967 original
A practical manual for machine use, compound miter settings, etc.

www.abebooks.com
www.alibris.com
www.abaa.com
All resources for out-of-print books.
Presenters

David Short is President of Amherst Woodworking & Supply, Inc. in Northampton, MA. He received a BA in Fine Arts from Hampshire College in 1975 having studied Sculpture and Furniture Design. In the Fall of that year he started making furniture and small woodworking projects, under the name of The Amherst Wood Company, located in a 600 sf. Workshop in North Amherst, MA. David was President of the New England Chapter of the Architectural Woodwork Institute (AWI) in 1992-93, and current serves on the Board of Directors as a Past President.

Karen LaVerdiere is Vice President of Amherst Woodworking & Supply, Inc. Ms. LaVerdiere received a BS from The University of Massachusetts, and a Masters from Springfield College. She started her own construction business in 1985, building residences and light commercial projects. Karen joined Amherst Woodworking in 1993 as a sales associate, becoming Sales Manager in 1994, and Vice President in 2001. She is a member of the Board of Directors of the Home Builder’s Association of Western MA.

Amherst Woodworking & Supply, Inc. is comprised of two operating divisions. The Copper Beech Millwork division specializes in supply of competitively priced, high quality, architectural woodwork components for clients managing their own millwork needs. Projects requiring complete management services such as shop drawings, field dimensioning, and coordination with other trades are run by the Amherst Woodworking division.

The Company occupies a 33,000 sf. facility, manufacturing moldings, doors, cabinets, windows, columns, and ornamental fabrications. They work on projects for Academic, Corporate, Medical, and Residential clients throughout the Northeast. Restoration & Reproduction work is a specialty.

The Copper Beech Millwork division publishes a 45 page Book of Moldings featuring approximately 350 of their over 3000 molding patterns. An electronic file is available with approximately 1400 patterns. It is based in AutoCad. Also available is a 24 page Contractor’s Price Book with inventory listings, product information and prices for stock moldings, hardwood & softwood lumber items, mantels, decking, and more.
Manufacturers of Fine Wood Doors, Moldings, and Architectural Woodwork

800-532-9110