

Selecting and Using Plywood Forming Panels

To use the best structural wood forming panel for the job, evaluate the various plywood types, classes, grades, and overlays

BY BRUCE CORDOVA AND FULTON DESLER

Contractors typically need to evaluate structural wood forming panels to properly construct job-built forms and use prefabricated forming systems. Versatile and economical, job-built forms can be used for projects ranging from small residential walls to large domed structures (see lead photo). And because of the efficiency of mass production, prefabricated plywood forming systems such as ganged forms, slipforms, jump forms, and flying truss systems can be used to save material and labor costs.

Evaluating formwork design issues and choosing between job-built and prefabricated formwork, however, are not the only important considerations contractors face. When selecting structural wood forming panels, contractors must also decide which plywood

type, class, grade, overlay, and texture will impart the best, most economical concrete finish for the job.

Plywood Types, Classes, and Grades

The typical plywood forming panel consists of a substrate of 5, 7, or 9 cross-laminated plies (also called layers) of wood veneer joined with waterproof adhesive under heat and pressure. The standard 4x8-foot panel is available in nominal thicknesses of $1\frac{1}{32}$, $\frac{1}{2}$, $1\frac{1}{32}$, $\frac{3}{8}$, $2\frac{1}{32}$, and $\frac{3}{4}$ inch. It is strongest in the 8-foot direction (parallel to the face grain).

All plywood forming panels manufactured to the specifications of *Voluntary Product Standard PS 1-83 for Construction and Industrial Plywood* are exterior-type plywood. Virtually any exterior-type plywood panel or Exposure 1-type plywood panel (an interior panel

with exterior glue) can be used for formwork. Use of Exposure 1 plywood, however, is not recommended if contractors want to reuse the form panels because it contains D-grade veneer, which may lead to greater localized swelling on the panel faces. Exterior plywood, however, contains veneer grades of C or better (A is the highest). If final concrete appearance is important, use of unsanded exterior-type panels is not recommended, unless a special architectural effect is desired.

For most general forming uses, the following classes and veneer grades of plywood panels are recommended:

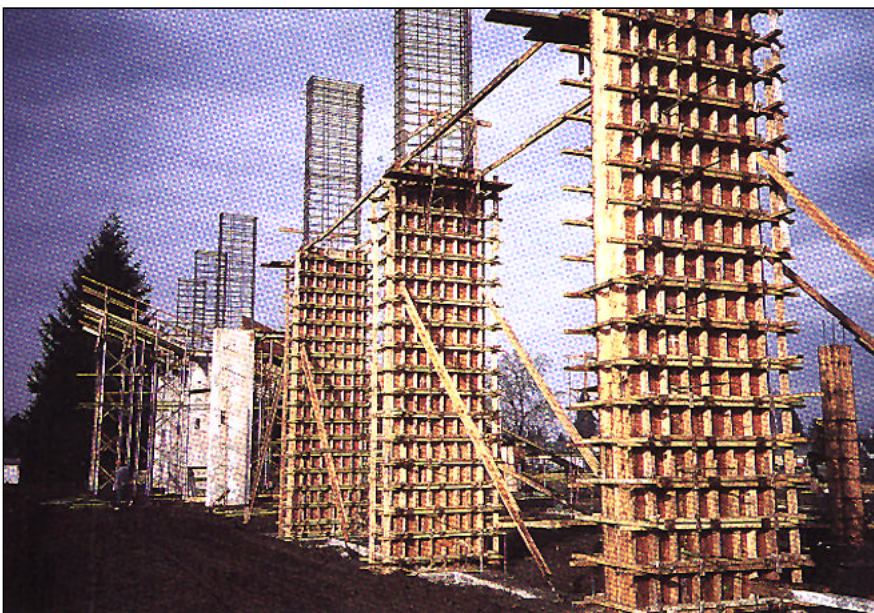
- Class I plywood forming panels: nonoverlaid B-B, medium-density overlaid (MDO), and high-density overlaid (HDO)
- Structural I Class I plywood forming panels: nonoverlaid B-B and HDO

See the table below for more information.

Nonoverlaid B-B Plywood Forming Panels

The various species of wood used in U.S. plywood are classified into five groups, numbered 1 through 5, according to strength. Group 1 species, such as Douglas-fir and Southern yellow pine, are the strongest and stiffest.

Both the face and back of Class I B-B plywood forming panels have Group 1 wood species and B-grade veneer. The panels can have Group 2 crossbands, and in the interior plies, the wood species can be as low as Group 4. When properly cared for, B-B plywood forming



Versatile and economical, plywood forming panels can be used to build a wide variety of structural members, including the columns shown here.

panels (the most common forming panels available) are reported to provide five to 10 reuses.

Structural I Class I B-B plywood forming panels have Group 1 plies throughout and are specifically designed for engineered forming applications. This gives Structural I panels greater bending strength and stiffness than regular Class I plywood, primarily when the forming panels are installed with the face grain parallel to supports. Installed with the face grain perpendicular to the supports, there is little difference in the bending strengths and stiffnesses between Class I and Structural I. Shear strength, which is important when the panel spans are short and the loads are high, is significantly greater for Structural I forming panels both parallel and perpendicular to supports.

Overlaid Plywood Forming Panels

Overlays add dimensional stability to the panel and provide smoother, more durable forming surfaces. Overlaid plywood (HDO

or MDO) consists of resin-impregnated fiber sheets bonded to the plywood face and/or back with high heat and pressure during panel production. Ordered on either one or both sides of the panel, overlays can be high-density or medium-density, depending on the resin content of the overlay. For example, HDO plywood has a minimum resin content by weight of paper of 45%, concrete-forming-grade MDO plywood has a minimum resin content of 35% to 40%, and regular-grade MDO has an even lower minimum resin content. (Regular-grade MDO panels are not recommended for concrete forming.)

HDO plywood panels have a hard, slick, semi-opaque surface of thermoset, resin-impregnated material that forms a durable, continuous bond with the plywood. Because the overlay is hard and abrasion-resistant, HDO plywood is often specified when the smoothest possible concrete finish is desired. It can impart a nearly

polished surface to the concrete. With reasonable care, HDO plywood form panels will often produce 20 to 50 reuses, and some concrete forming specialists can achieve more than 200 reuses.

Only special concrete-forming grades of MDO should be used for concrete forming. (Regular MDO is intended for use as a paint surface.) Concrete-forming-grade MDO panels are typically overlaid on only one side, although they can be produced with MDO on both sides if specified. MDO panels are not as abrasion- and moisture-resistant as HDO panels, and the surface of MDO forming panels creates a smooth, matte (dull) concrete finish.

Specialty plywood forming panels with proprietary overlays are also available. Overlay materials include laminated plastic, epoxy resin, metal, and glass-fiber-reinforced plastics (fiberglass). The metal and fiberglass overlays may also add stiffness and strength to the panel. Users of these proprietary panels should check with

GRADE-USE GUIDE FOR PLYWOOD FORMING PANELS*

Panel Class	Description	Veneer Grade		
		Faces	Inner Plies	Backs
Structural I**	Especially designed for engineered applications. All Group 1 wood species. Stronger and stiffer than Class I plywood. Recommended for high pressures where face grain is parallel to supports. Also available with HDO faces.	B	C or C-plugged	B
B-B, Class I**	Specifically manufactured for concrete forms. Many reuses. Smooth, solid surfaces. Mill-treated unless otherwise specified.	B	C	B
HDO, Class I**	Hard, semi-opaque resin-fiber overlay, heat-fused to panel faces. Smooth surface resists abrasion. Up to 200 reuses. Light application of releasing agent recommended between pours.	B	C-plugged	B
Special overlays, proprietary panels, and MDO plywood specifically designed for concrete forming**	Produce a smooth, uniform concrete surface. Generally mill-treated with form release agent. Check with manufacturer for specifications, proper use, and surface treatment recommendations for greatest number of reuses.			
B-C exterior	Sanded panel often used for concrete forming where only one smooth, solid side is required.	B	C	C

*Commonly available in 1/2-, 5/8-, 23/32-, and 3/4-inch panel thicknesses (4x8-foot size).

**Check with dealer for availability in your area.

the manufacturer for design specifications and surface treatment recommendations.

Using Plywood Formwork

Panels are typically used in two ways: as forming panels or as form liners. Forming panels not only impart the desired texture and pattern to the concrete surface but also provide the structural strength and stiffness to hold the fresh concrete in place. Form liners can only impart the desired texture and pattern to the concrete; a backing panel carries the load of the concrete.

Using plywood panels to create special effects usually requires attaching various objects (such as wood or rubber strips) to the surface of the panels or using surfaces that are rougher or more irregular than the surfaces of B-B, HDO, and MDO plywood forming panels. Attaching objects to the plywood, however, usually damages the panel surface, and an irregular panel surface (such as grooved siding) cannot be stripped from the concrete as cleanly as standard forming panels. With a little imagination and effort, virtually any concrete texture or pattern can be created, but such nonstandard usage often limits the number of times that a forming panel can be reused.

Maintaining Plywood Formwork

To increase plywood forming panel longevity, regular maintenance—both before and after the placement of concrete—is important. Proper upkeep and repair can ensure a longer service life and a stronger formwork structure.

Applying release agent. Unless otherwise specified, forming panels are treated with form release agents at the mill. If desired, panels can also be edge-sealed at the mill. Such treatments help to prolong panel service life. Careful evaluation of the form panels before use is still necessary, however. Even panels such as MDO concrete-forming panels, normally treated with a release agent and edge-sealed at the mill to prevent water

absorption, should be treated with a release agent prior to first use and between each pour.

For reused panels or new panels not freshly mill-treated, a liberal amount of form release agent, applied before using the forms and then wiped down so that a thin film remains, will prolong the life of the plywood forming panel, enhance its release characteristics, and minimize the potential for staining the concrete. For best results, apply the release agent a few days before using the forms. Treatment between each pour helps to preserve the plywood surface and facilitate easy stripping.


If edge sealer is not mill-applied, it is important to apply a top-quality edge sealer before the first pour. The edges are where forming panels start to swell due to absorption of moisture. Seal any cut edges with two coats of polyurethane paint or varnish. Manufacturers of prefabricated systems extend the service life of the panels by protecting the edges.

A chemically reactive release agent gives overlaid panels the longest life and should be applied prior to the first pour. Diesel oil and motor oil degrade HDO and MDO severely and should never be used on overlaid panels. Even some concrete additives can degrade overlays.

Stripping and storing. Do not use metal bars or pries when stripping plywood forms because they will damage the panel edge and surface—especially a textured surface. Instead, crews should use wood wedges, tapping gently when necessary.

Soon after being removed, plywood forms should be inspected for wear, cleaned (with a hardwood wedge and a stiff fiber brush rather than a metal brush), repaired, spot primed, refinished, and lightly treated with a form release agent before reusing. Filmlike coatings, such as lacquer, polyurethane, or epoxy, can also be used under a release agent to make stripping easier.

After crews strip and clean the forms, the panels can be stacked

face-together to slow the drying rate and minimize face checking. During storage, keep the plywood panels out of the sun and rain, or cover them loosely to allow air circulation without heat buildup. Exercise care during handling to prevent panel chipping, denting, and corner damage. The forms should be carefully piled flat, face-to-face and back-to-back, for hauling. 

Bruce Cordova is a market development specialist and Fulton Desler is senior engineer at APA—The Engineered Wood Association, headquartered in Tacoma, Wash. For additional information and various publications from APA, call the association at 206-565-6600.

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