Unit 2 Engineered Panels

Unit Objectives

After completing this unit, the student should be able to describe the composition, kinds, sizes, grades, and several uses of:

- Plywood
- Oriented strand board
- Composite panels
- Particleboard
- Hardboard (high-density fibreboard)
- Medium-density fibreboard
- Softboard (low-density fibreboard)

Key Terms

Composite panels—A reconstituted wood core with veneers of wood laminated to both sides.

Hardboards or **HDF** (high-density fibreboard)**—**Waste wood chips reduced to fibres and pressed together with natural lignin as the adhesive; sometimes coated with oil and baked to temper the board.

MDF (medium-density fibreboard)**—**Waste wood chips reduced to fibres and pressed together with the natural lignin as the adhesive, but not pressed as tightly as the HDF board.

Oriented strand board—Non-veneered panel composed of small oriented wood pieces coated with liquid resins, formed into a mat of three or more layers of systematically oriented wood fibres and pressed under high temperature to form a dense panel.

Panel—A large sheet of building material.

Particleboard—A building product made by compressing wood chips and sawdust with adhesives to form sheets.

Plywood—A building material in which thin sheets of wood are glued together with the grain of adjacent layers at right angles to each other.

Softboards or LDF (low-density fibreboard)**—**Waste wood chips reduced to fibres and pressed together with natural lignin as the adhesive, but not pressed as tightly as the MDF board; it contains tiny air spaces.

Tempered—Involves hot-pressing under high temperatures to form a dense panel.

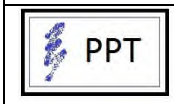
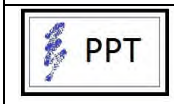
Chapter 3 Structural (Rated) Panels

PPT Slides 3-2 to 3-4	**A. Engineered Panels** 1. Large reconstructed wood sheet panels. 2. The tree has been taken apart and redistributed into sheet or panel form. 3. Wood waste products are generally used to construct the sheet panel products. 4. Construction processes are reduced with the use of large sheet panels. 5. More attractive in appearance and gives more protection to a surface than solid lumber.
PPT Slides 3-5 to 3-6 Also, NBCC 9.3.2.4, OSB Waferboard and Plywood Markings	**B. APA-Rated Panels** 1. This stamp appears only on products manufactured by APA member mills and CANPLY member mills. 2. The CERTIWOOD™ Technical Centre tests the quality of composites and oriented strand boards in Canada. 3. CANPLY and the APA are concerned with quality supervision and testing. 4. Tests are performed on plywood (cross-laminated wood veneer), composite (veneer faces bonded to reconstructed wood cores), and non-veneered panels commonly known as OSB (oriented strand board).
***Teaching Tip**	*Have samples of various types of plywood for students to see and handle. There are many videos showing the steps required to make panel-type products; seek out several and present them to the class after watching them first to ensure quality and accuracy.*
PPT Slide 3-7	**C. Plywood** 1. Plywood is made up of sheets of veneer called plies. 2. Plies are arranged in layers and bonded under pressure with glue. 3. The plies are glued together at right angles to each other, a process called cross-laminating. Cross-laminating allows plywood manufacturers to take advantage of the lumber strength in both directions. This also allows for greater product stability. 4. Usually contains an odd number of layers, so the face grain on both sides runs the long dimension of the panel. 5. Softwood plywood used in for framing and rough carpentry is made with three, five, or seven layers utilizing mostly spruce and fir species. 6. Plywood is stable with changes of humidity and is more resistant to shrinking and swelling.

PPT Slides 3-8 to 3-9	**D. Manufacture of Veneer Core Plywood** 1. Veneer is made from peeler logs turning on a lathe. This peeling process is known as rotary cutting, and produces rotary cut veneers. 2. Paper-thin layers are peeled off the log. 3. Veneer is cut into desired widths, sorted, and dried to a moisture content of 5 percent. 4. Dried veneers are uniformly coated with glue. 5. Large presses bond the veneer sheets under controlled heat and pressure. 6. The sheets are either left unsanded, touch-sanded, or smooth-sanded. 7. Resulting panels are cut to size, inspected, and grade-stamped. 8. Plywood is cut to 4′ × 8′ sheets. This 4 × 8 dimension works with typical on-centre spacing of framing members.
PPT Slide 3-10	**E. Veneer Grades** 1. In declining order, the letters A, B, C plugged, C, and D indicate the appearance quality. 2. Grade stamp includes a letter for each side of the panel. 3. Grade-stamp letters indicate the extent of the finish: smooth-sanded, touch-sanded, or unsanded.

Veneer Grades

	A	Smooth, paintable. Not more than 18 neatly made repairs—boat, sled, or router type, and parallel to grain—permitted. Wood or synthetic repairs permitted. May be used for natural finish in less demanding applications.
	B	Solid surface. Shims, sled, or router repairs, and tight knots to 1 inch (25 mm) across grain permitted. Wood or synthetic repairs permitted. Some minor splits permitted.
	C Plugged	Improved C veneer with splits limited to $^1/_8$-inch (3 mm) width and knotholes or other open defects limited to ¼ × ½ inch (6 × 12.5 mm). Wood or synthetic repairs permitted. Admits some broken grain.
	C	Tight knots to 1½ inch (38 mm). Knotholes to 1 inch (25 mm) across grain and some to 1½ inch (38 mm) if total width of knots and knotholes is within specified limits. Synthetic or wood repairs, discoloration, and sanding

		defects that do not impair strength permitted. Limited splits allowed. Stitching permitted.
	D	Knots and knotholes to 2½-inch (63 mm) width across grain and ½ inch (12.5 mm) larger within specified limits. Limited splits are permitted. Stitching permitted. Limited to Exposure 1 or interior panels.
 Slide 3-11	**F. Strength Grades** 1. Softwood veneers are made from many kinds of wood. 2. Wood strengths are classified by groups.	
***Teaching Tip**	*Show samples of the various types of strand board and composite panels. For more about plywood, visit the Canadian Wood Council website,* ***http://cwc.ca/wood-products/panel-products/plywood/****. Visual aids are key with this subject. Have samples on hand. Reference the NBCC for requirements for subflooring, and wall and roof sheathing.*	
 Slide 3-12	**G. Oriented Strand Board (OSB)** 1. A non-veneered performance-rated structural panel composed of small strand-like wood pieces. 2. Specially selected species are debarked and sliced into strands that are between $^{25}/_{1000}$ and $^{30}/_{1000}$ of an inch (0.635 and 0.762 mm) thick, ¾ to 1 inch (19 to 25 mm) wide, and between 2½ and 4½ inches (63 to 114 mm) long. 3. The small strand-like wood pieces are dried and coated with liquid resins. 4. The wood pieces are formed into a mat consisting of three or more layers of systematically oriented wood fibres. 5. The mat is pressed under high temperature to form a dense panel. 6. OSB panels now have up to 200-day exposure ratings. This means the panel can be exposed to the elements for up to 200 days without swelling or delaminating.	
	H. Composite Panels 1. Veneers of wood are bonded to both sides of reconstituted wood panels. 2. Panels rated by the American Plywood Association are called COM-PLY. 3. Manufactured in three or five layers. 4. A five-layer panel has a wood veneer in the centre as well as on both sides.	

PPT Slide 3-13 Also, NBCC 9.3.2.7, Panel Thickness Tolerances 9.23.14.2, Material Standards for Subflooring 9.23.14.4, Direction of Installation of Subflooring Tables 9.23.14A and B, Subflooring Thickness or Rating 9.23.15.1 to 9.23.15.7, Requirements for Roof Sheathing 9.23.16.1 to 9.23.16.2A Requirements for Wall Sheathing	**I. Performance Ratings** 1. A performance-rated panel meets the requirements of the panel's end use. 2. The three end uses for which panels are rated are floors, roofs, and concrete formwork. 3. Designated end use names are EASY T&G ROOF, EASY T&G FLOOR, and COFI FORM. 4. Panels are tested in areas of resistance to moisture, strength, and stability.
PPT Slide 3-14	**J. Exposure Durability Classifications** 1. CERTIWOOD™ rates its CANPLY plywood according to its end use or typical application. 2. Exterior panels are made from Douglas fir (DFP), Canadian softwood (CSP), aspen, or poplar. 3. Panels are either medium-density overlaid (MDO) or high-density overlaid (HDO).
***Teaching Tip**	*Have students explain span ratings back to you. It is important to check for understanding.*

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Also, NBCC 9.23.15.7 A and B

K. Span Ratings

1. A span rating is stamped on sheathing to indicate the recommended spacing of supports when the panel is used.
2. Rating numbers appear as imperial or metric.
3. The left number denotes the maximum recommended support spacing for roof or wall sheathing.
4. The right number denotes the maximum recommended support spacing for subfloor sheathing.
5. The long dimension of the panel must be placed across three or more supports.

Imperial-Metric Conversion Chart

¼″	5/16″	11/32″	3/8″	7/16″	15/32″	½″	19/32″	5/8″	23/32″	¾″	1″	1 1/8″
6 mm	8	9	9.5	11	12	12.5	15	16	18	19	25.4	28.5
24/16 OC		32/16 OC		20 OC		48/24 OC		16″	19.2″	24″	48″	
600/400		800/400		500 mm OC		1200/600		406 mm	488 mm	610 mm	1219 mm	

CANPLY's load-span information for DFP and CSP is based on load limits determined by deflection, bending, and shear. It rates the different thicknesses of plywood according to the face-grain orientation and the spacing between the framing members.

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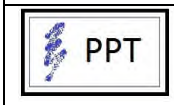
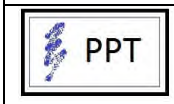
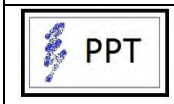
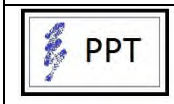
Slides 3-16 to 3-17

Summary

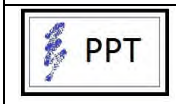
Plywood is rated by the American Plywood Association and the Canadian CERTIWOOD™ Technical Centre. They test for quality of composites. Plywood is made up of sheets of veneer. Veneer comes in several grades and strengths. Oriented strand board is a non-veneered structural panel. Composite panels rated by the APA are called COM-PLY. Panels are rated for performance, exposure durability, and span. Today, standard panel size for floor, wall, and roof sheathing is 4 feet wide (1220 mm) by 8 feet long (2440 mm). The on-centre spacing for framing members is determined by dividing 8 feet (2440 mm) by 4, 5, 6, and 8.

Chapter 4 Non-Structural Panels

***Teaching Tip**	*Have students look at the plywood panels again, and try to have samples of particleboard and fibreboard available. Have students explain the differences in the boards.*
 Slides 4-2 to 4-4	**A. Hardwood Plywood** 1. Includes sanded and touch-sanded plywood panels. 2. Available with hardwood face veneers. 3. Hardwood plywood is used in the interior of a building for things such as wall panelling, built-in cabinets, and fixtures.
***Teaching Tip**	*Have students discuss which of the boards discussed in this chapter would be used in various applications.*
 Slides 4-5 to 4-6	**B. Particleboard** 1. A reconstituted wood panel made of wood flakes, chips, sawdust, and planer shavings. 2. The wood particles are mixed with adhesives and pressed into sheet form. 3. Kind, size, and arrangement of the wood particles determine the quality of the board. 4. Highest quality is made with large wood flakes in the centre. 5. Softer and lower-quality boards have the same size particles throughout.
 Slides 4-7 to 4-9	**C. Particleboard Grades** 1. The quality is indicated by its density, which ranges from 28 to 55 pounds per cubic foot. 2. Non-structural particleboard is used to construct kitchen cabinets, countertops, and the core for veneered doors.
 Slides 4-10	**D. Fibreboards** 1. Manufactured as HDF (high-density), MDF (medium-density), and LDF (low-density).
 Slides 4-11 to 4-12	**E. Hardboards** 1. High-density fibreboards are called hardboards and are commonly known as Masonite, regardless of manufacturer. 2. Hardboard is made from waste wood chips reduced to fibres and pressed together with lignin as the adhesive. 3. Some panels are tempered (coated with oil and baked to increase hardness, strength, and water resistance).

F. Sizes of Hardboard

1. Hardboard thickness range from $\frac{1}{8}$ to $\frac{3}{8}$ inch (3 to 9.5 mm)
2. Standard sheet size is 4 feet by 8 feet (1.2 by 2.4 m), but can be ordered to practically any size.



Slides 4-13 to 4-14

G. Classes and Kinds of Hardboard

1. Hardboard is available in three different classes: tempered, standard, and service tempered.
2. May be obtained as smooth-one-side (S1S) or smooth-two-sides (S2S).
3. Available in many forms, such as perforated, grooved, and striated.

Kinds and Thicknesses of Hardboard

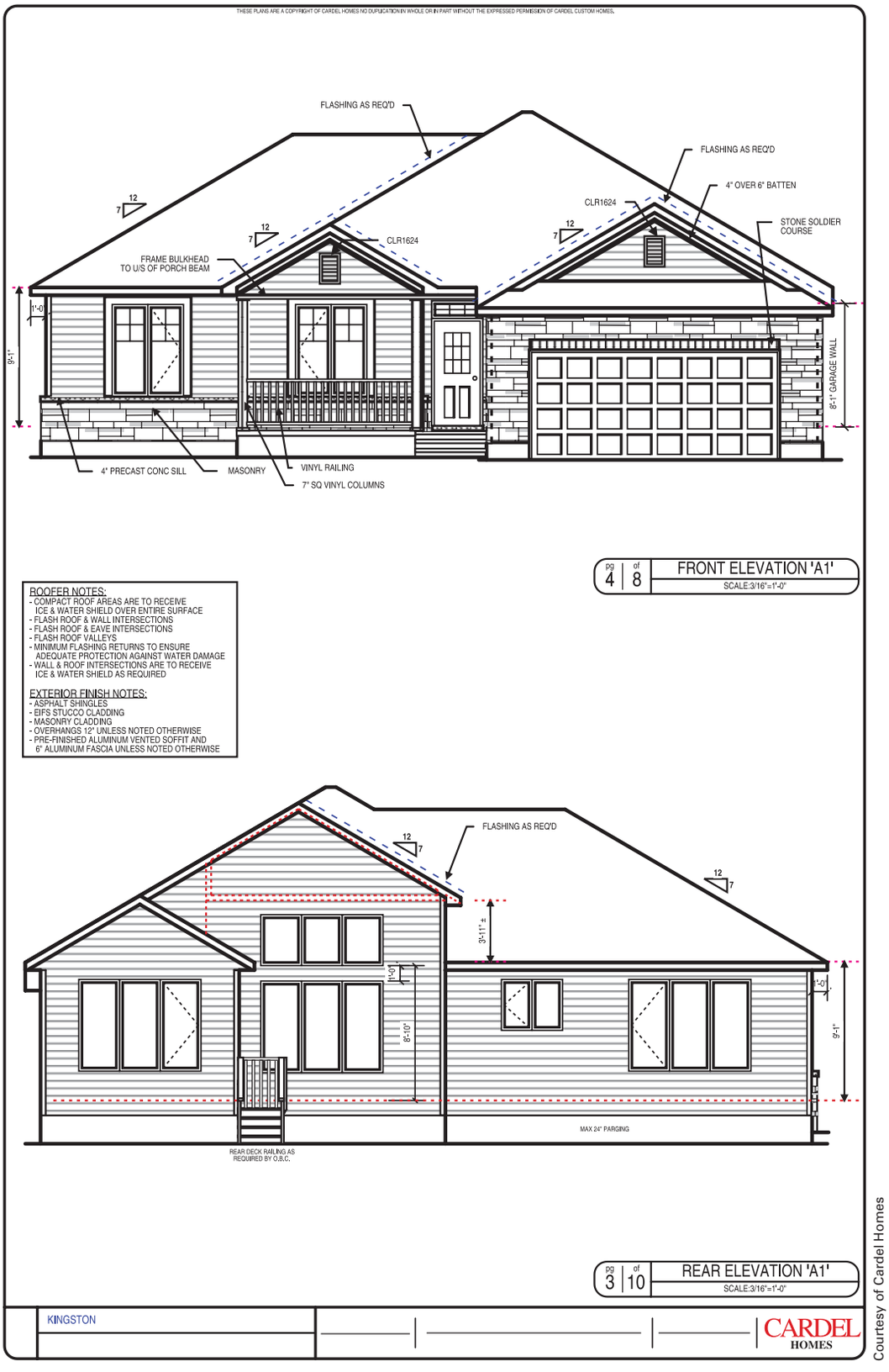
Class	Surface	Nominal Thickness (in.)
1 Tempered	S1S and S2S	$\frac{1}{8}$ ¼
2 Standard	S1S and S2S	$\frac{1}{8}$ ¼ $\frac{3}{8}$
3 Service tempered	S1S and S2S	$\frac{1}{8}$ ¼ $\frac{3}{8}$

Slide 4-15

H. Uses of Hardboards

1. Have interior or exterior uses, such as exterior siding, interior panelling, cabinet backs, and drawer bottoms.
2. Used where a dense hard panel is required.
3. Important to ensure all sides are sealed when used for an exterior application.
4. Hardboard can be sawn, routed, shaped, and drilled with standard woodworking tools.
5. Can be securely fastened with glue, screws, staples, or nails.

PPT Slide 4-16	**I. Medium-Density Fibreboard** 1. Waste wood chips are reduced to fibres and pressed together with lignin as the adhesive, but not pressed as tightly as the HDF board. 2. Fine-textured homogenous board with an exceptionally smooth surface. 3. Densities range from 28 to 65 pounds per cubic foot. 4. Available in thicknesses from $^{3}/_{16}$ to 1½ inch (4.8 to 38 mm). 5. Available in widths of 4 and 5 feet (1.2 and 1.5 m) and lengths from 6 to 18 feet (1.8 to 5.5 m). 6. MDF is used for case goods, drawer parts, kitchen cabinets, cabinet doors, signs, and some interior wall finishes.
	J. Softboard 1. Low-density fibreboard is called softboard. 2. Lightweight and contains many tiny air spaces. 3. Thickness ranges from ½ to 1 inch (25 to 12.5 mm). 4. Standard sheet size is 4 feet by 8 feet (1.2 by 2.4 m), but can be ordered to practically any size.
PPT Slide 4-17	**K. Uses of Softboard** 1. Used primarily for insulating and sound control. 2. Used as suspended ceiling tiles. 3. Can be used as exterior wall sheathing as long as it has a special coating or is impregnated with asphalt (known as tentest board). 4. Can easily be cut with a knife, handsaw, or power saw. 5. Depending on the type and use, softboard can be fastened with wide-head nails, staples, or adhesives.
***Teaching Tip**	*The preceding chapters have been limited to engineered wood panels and boards. It is recommended to have your students review the Sweet's Architectural File. The Sweet's catalogues can be found on the web at www.sweets.com.*
PPT Slide 4-18	**Summary** Plywood is available with hardwood veneers and can be used for wall panelling, built-in cabinets, and fixtures. Particleboard ranges from high quality to low quality. Fibreboard ranges from high density to low density and is used in a number of different applications and finishes.



A

(Continued)

FIGURE 20–10 (A) Front and rear elevations (scale 3/16″ = 1′ 0″). (B) Side elevations (scale 3/16″ = 1′ 0″)