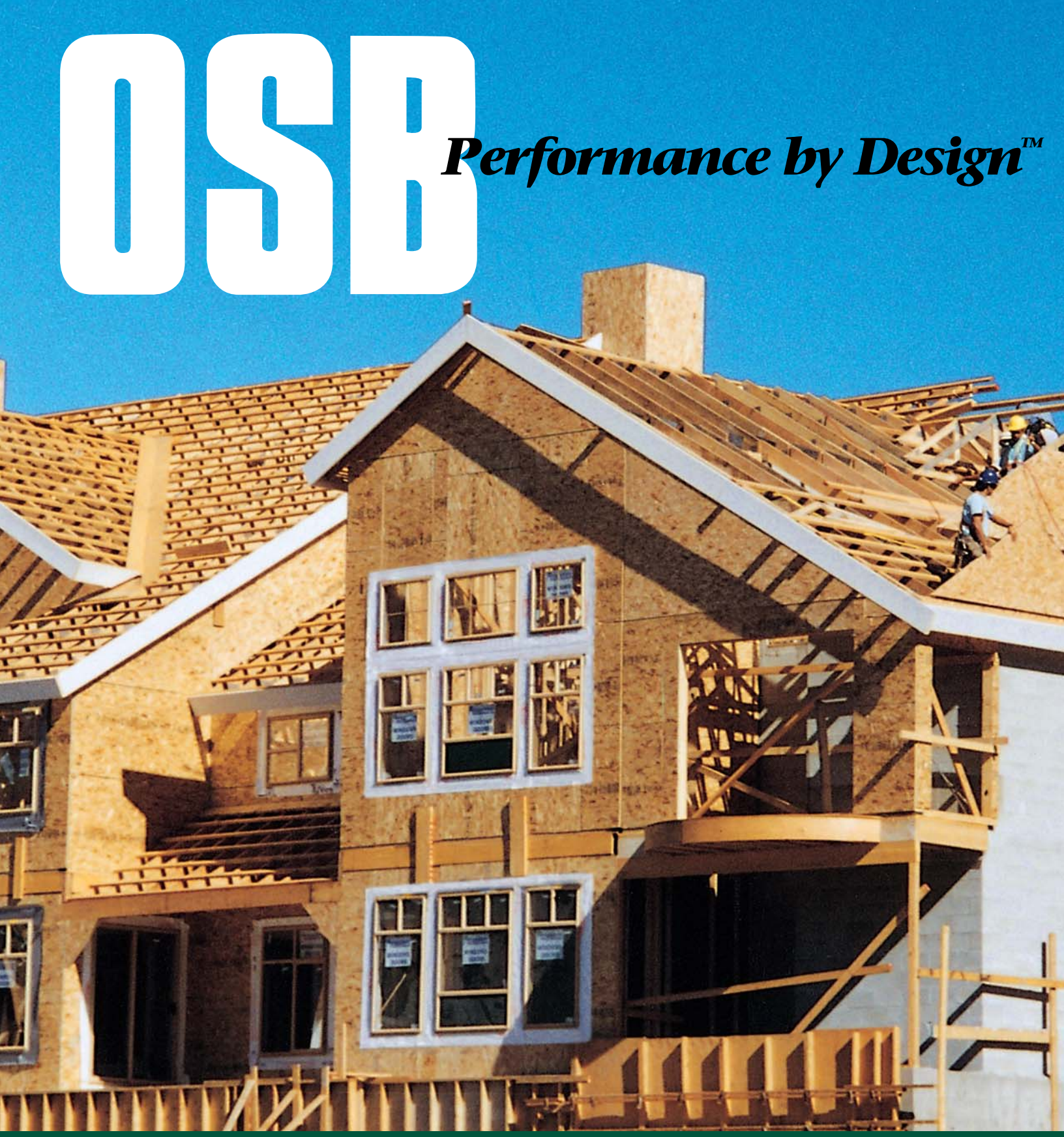
OSB

Performance by Design™



OSB IN WOOD FRAME CONSTRUCTION

U.S. EDITION 2005

Structural Board Association
Representing the OSB Industry

OSB Performance by Design™

Oriented Strand Board in Wood Frame Construction

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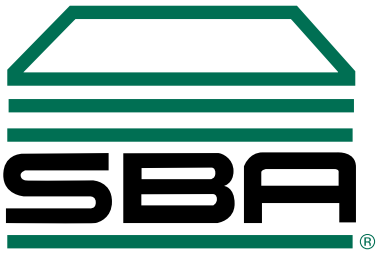

Structural Board Association

Representing the OSB Industry

ABOUT THIS MANUAL

This Manual has been developed to provide the designer, specifier, builder and home buyer with as complete a source of information as possible on the specification and use of oriented strand board (OSB). Now in its fifteenth printing, it has been updated to reflect recent code changes, new standards, new information and new products. It also reflects the growth of the Structural Board Association as the leading voice of the OSB Industry.

WAIVER OF RESPONSIBILITY

Every effort has been taken to ensure that the information published in this manual is accurate and as complete as possible. The Structural Board Association does not, however, assume responsibility for errors or omissions in this publication, nor for any designs or specifications based on it. It is the specifier's and/or user's responsibility to obtain the necessary approvals and inspections from the local building officials.

ACKNOWLEDGEMENT

SBA committed its technical resources and engaged the services of Quaile Engineering Ltd., and Marcom Group Inc. We would also like to acknowledge the participation of several industry reviewers who ensured the completeness of this manual. Cover photos courtesy of Cloverdale Truss Co. Ltd. (Surrey, BC) and Weyerhaeuser Canada Ltd. (Edmonton, AB).

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TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Oriented Strand Board

Oriented Strand Board (OSB) is a structural panel suitable for a wide range of construction and industrial applications. It is a mat-formed panel made of strands sliced in the long direction from small diameter, fast growing round wood logs and bonded with an exterior-type binder under heat and pressure.

OSB's predecessor random waferboard has been commercially available since 1962. OSB became available in 1981 and has now replaced waferboard. However, waferboard rated sheathing panels that meet U.S. codes are still available from one manufacturer in Canada. OSB as a performance based structural-use panel is recognized by all the major U.S. Model Code agencies through the adoption of the US Department of Commerce Voluntary Performance Standard PS 2 "Performance Standard for Wood Based Structural Use Panels". OSB and waferboard are recognized by the National Building Code of Canada.

The OSB industry is well established and still growing. To the end of 2004 the North American industry had grown to 64 mills (40 U.S., 24 Canadian) with a combined productive capacity of 27 billion square feet (3/8" basis). Additional mills are under construction and in the planning stage in the US, Canada and offshore. It is anticipated that by 2007 there will be over 80 mills worldwide.

1.2 Research Program

Over the years the SBA has been a major participant in the direction, coordination and funding of a market driven research and development program. Its purpose is to enhance the OSB products manufactured by its members, as well as to optimize the manufacturing process. This program, conducted by an alliance of reputed research organizations and universities in the U.S. and Canada, led to several achievements including but not limited to: optimization of log yard management and pressing operations, development of OSB products with improved physical and mechanical properties, OSB product stewardship, process modeling, and development of OSB engineering properties.

2.0 MANUFACTURING PROCESS

2.1 Basic Steps

Figure 1 illustrates the typical sequence in the manufacturing of OSB (see center spread). OSB is made from freshly harvested aspen poplar, southern yellow pine or other mixed hardwood and softwood logs. The logs are debarked and cut to shorter lengths before being processed in the strander. The fines and bark become fuel for the mill's energy system.

The strander slices the logs into strands along the direction of the grain. Strand dimensions are predetermined for the process and have a uniform thickness. The majority of Association mills use a combination of strands ranging in length from 3-1/2" to 6" and approximately 1" wide.

The strands are then dried and sorted. Before forming, the strands are mixed with wax and a waterproof exterior-type binder (generally phenolic or isocyanate resin binder).These waterproof and boil-proof resin binders will provide the panel with internal strength, rigidity and moisture resistance.

During forming the strands are oriented in layers. The strands on the panel surface are generally aligned in the long direction of the panel for superior bending strength and stiffness in this direction (see Figure 2). The two or three inner layers are usually cross-aligned to the surface layer like plywood.

After forming, the mat of strands is pressed at a high temperature and pressure to form a rigid, dense structural panel. OSB has considerable bending strength that comes from the uninterrupted fibre, interweaving of the long strands and orientation of strands in the surface layers.

The panels are then cooled, cut to size, grade stamped, edge coated and stacked in bundles for shipping.

2.2 Performance by Design™

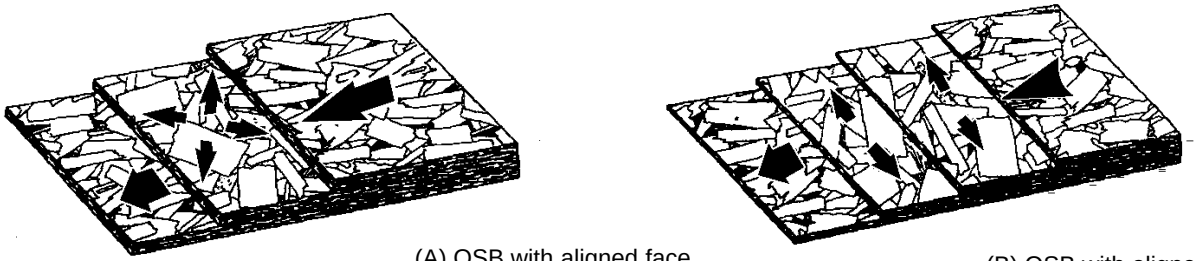
Oriented Strand Board structural wood panels are often designed in the manufacturing process to meet specific end uses required by the customer. This flexibility in manufacturing provides superior performance with economical cost to give excellent value to the end user.

2.3 Quality Assurance

The quality of OSB is the responsibility of the individual producer. Each SBA mill has a program of in-plant quality control to ensure the finished product meets or exceeds the grade required in the applicable standard and the mill specification. Third party quality assurance and audit programs back up the mill programs.

The SBA suggests that its producer members adopt a "Total Quality" concept. This starts with the cutting of trees in the forest to the shipping of finished product from the mill to the customer's satisfaction. State-of-the-art computer process control equipment, which is uniquely designed for each plant, greatly helps the implementation of in-mill quality control by monitoring and adjusting the process variables on a continuous basis. Plant quality control staff oversee the process monitoring, paying particular attention to selection of logs by species, size and moisture content; strand geometry and thickness; strand moisture content after drying;

Figure 2 OSB Lay-up



(A) OSB with aligned face and random core

(B) OSB with aligned face and oriented core

consistent blending of strands with resin binder and wax; uniform forming of the mat entering the press; the press temperature, pressure, closing speed, density and thickness control.

Quality control personnel regularly inspect panel faces, edges, dimensions after trimming and the physical appearance of the finished panel. They also undertake physical testing of the panels according to standard test procedures as necessary to verify that production conforms to the applicable standard and mill specification. Besides company process and quality control, manufacturers contract with an independent inspection and certification agency such as APA, TECO, or PSI/PTL for independent appraisal and verification of quality.

2.4 OSB and the Environment

Oriented Strand Board is generally manufactured from aspen poplar in the northern part of North America and southern yellow pine in the South. However, other hardwood and softwood species or combinations may also be used. Aspen poplar and northern hardwoods are harvested from naturally regenerated self-sustaining stands. Southern yellow pine is harvested from managed private stands and includes thinnings. The manufacturing process uses 90% of the log and modern mills typically convert the remaining bark, saw trim, and sawdust into energy.

Modern mills are scientifically designed to meet or exceed the strict quality standard for air emissions by using collectors, precipitators, scrubbers or regenerative thermal oxidation units to remove particulate and volatile organic compounds from the discharge gases released into the atmosphere. Where log soaking ponds are used, the pond water is filtered, the ponds cleaned regularly and the sludge burned as fuel. The mills are designed to be self sufficient in terms of heat energy with all bark, screenings, sawdust and panel trim recycled as fuel for the dryer and the press heating system.

Like construction plywood, OSB panels are bonded under heat and pressure with phenol formaldehyde or isocyanate binders that become durable, insoluble heat-resistant polymers that resist age, moisture and chemical degradation. Regular tests confirm formaldehyde emissions from phenolic-bonded OSB panels are nonexistent or negligible. Due to excellent test performance, OSB panels are exempted from the HUD Manufactured Homes Construction and Safety Standard (MHCSS) rule regarding formaldehyde emissions from panel products.

SBA oriented strand board panels are registered in accordance with the New York State Smoke toxicity regulations. Contact SBA for specific details on this requirement.

SBA also provides a generic Material Safety Data Sheet (MSDS) for OSB and waferboard, and other technical information on the binder system. To comply with Occupational Safety and Health Administration (OSHA) manufacturers are also required to issue statements about wood dust. Consult with OSB manufacturers for wood dust labels or MSDS.

3.0 OSB PRODUCTS

3.1 Panel sizes and thicknesses

Performance OSB panels are specifically engineered for floor, roof, and wall sheathing purposes in wood frame construction. Panels are available in nominal 4'x8' sheets (1220x2440 mm) or cut to size dimensions. For industrial applications sizes up to 8'x24' (2440x7320 mm) and larger are available by special order. Some new mills manufacture master panels up to 12' (3660 mm) wide or other custom sizes from continuous presses.

The most common thicknesses are 1/4", 3/8", 7/16", 15/32", 19/32", 23/32". Other panel thicknesses including 7/8", 1-1/8" and 1-1/4" are available on special order. Panels 19/32" and thicker are manufactured either square-edged or tongue and grooved on the long edge. Most mills produce panels with textured surface treatments for improved traction on sloping roofs. Regular panels are either unsanded or rough (touch) sanded, however the product may be ordered smooth sanded on one or both sides for industrial or decorative uses.

3.2 OSB and the Building Codes

SBA members' OSB production is chiefly intended for use in both the United States and Canada. As a result OSB panels are manufactured to meet U.S. Department of Commerce Voluntary Performance Standard PS 2 "Performance Standard for Wood Based Structural Use Panels" and/or Canadian performance standard CSA O325 "Construction Sheathing". In Canada panels may also be produced to meet CSA Standard O437 "OSB and Waferboard".

The voluntary standard PS 2 was a joint development of the U.S. and Canadian wood panel industry to harmonize the performance standards under the U.S./Canada Free Trade Agreement.

The standard was promulgated by the U.S. Congress in August 1992. A second edition was published in 2004. PS 2 covers OSB, plywood, and composite panels and was initially recognized by the National Building Code (BOCA), the One and Two Family Dwelling Code (CABO), the Standard Building Code (SBCCI), the Uniform Building Code (ICBO) and more recently by the International Building Code and the International Residential Code (ICC). These new model I-codes recognize the following major uses of PS 2 certified OSB panels:

- combined subfloor underlayment (single layer floors)
- roof sheathing
- soffits
- subfloors
- underlayment
- wall sheathing

Panels qualified to PS 2 are often called "Performance Based" or "Rated". Several certification agencies may carry out this work including APA, TECO or PSI/PTL.

Prior to the adoption of PS 2, performance based OSB panels were recognized as structural use panels by the National Evaluation Service of CABO as acceptable alternates to panels specified in the codes. The acceptance was covered by National Evaluation Report (NER) No. 108 (APA) and No. 133 (TECO). SBA's NER No. 322 was withdrawn after the code acceptance of PS 2.

HUD's materials bulletin (UM-40C) gives generic recognition to performance rated panels certified by a certification agency meeting its requirements. APA, TECO and PSI have been accepted by HUD as certification agencies.

The standard thicknesses of OSB are as follows:

English (in.)	1/4	5/16	3/8	7/16	15/32	1/2	19/32	5/8	23/32	3/4
Metric (mm)	6.0	7.5	9.5	11.0	12.0	12.5	15.0	15.5	18.0	18.5

3.3 PS 2 Grades and Classifications

Structural use panels evaluated according to PS 2 are assigned structural grades and glue bond classifications.

Structural Grades

PS 2 specifies performance tests for concentrated and uniform static loads under wet and dry conditions. Impact tests are also specified as well as racking performance and fastener holding capability. Three grades of sheathing are specified as follows:

- **Sheathing**

For use in construction applications as covering material for roofs, subfloors, and walls.

- **Structural 1 Sheathing**

This is essentially a Sheathing Grade panel that has met additional requirements for cross-panel strength and stiffness as well requirements for racking shear. These additional requirements are for use in panelized roof systems, diaphragms and shearwalls.

- **Single Floor**

For use as a combination subfloor and underlayment. The static load and deflection performance requirements for single floor panels are more stringent than for Sheathing Grade.

Glue Bond Classification

PS 2 classifies structural use panels into three exposure categories, which depend on raw material composition and adhesive bond durability. Most OSB panels are classified as **Exposure 1**. These panels are suitable for uses not permanently exposed to the weather and are intended to resist effects of moisture on their structural performance due to construction delays, or other conditions of similar severity. The bond classification is related to the moisture resistance of the glue bond under intended use, but is not related to the physical (ie. erosion, U.V. light) or biological (ie. mold, decay, insect) resistance of the panel.

3.4 Panel Marking

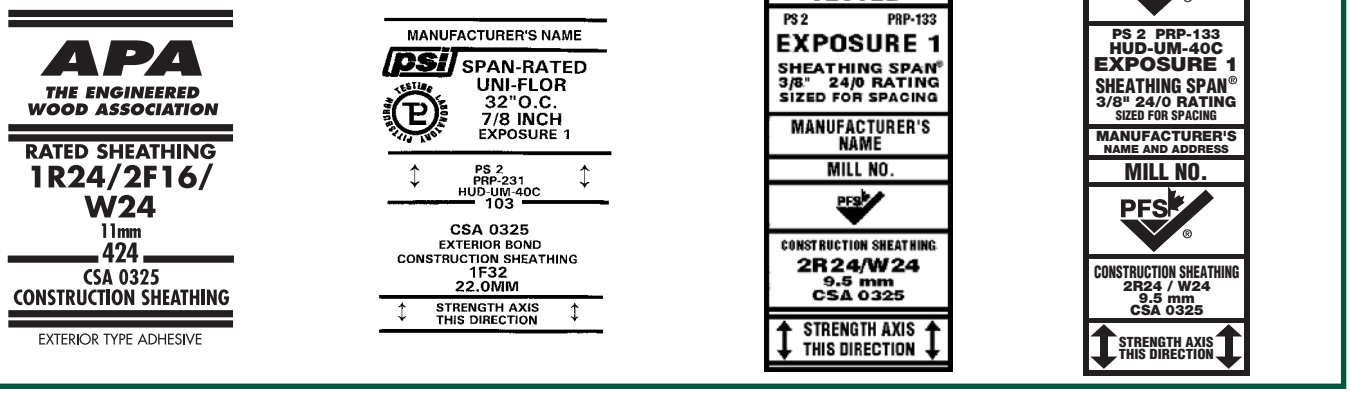
SBA members clearly mark all certified boards intended for use in construction with an approved agency certification mark (see Figure 3 for examples).

The certification agency stamp will show the following information for panel identification:

- Span rating (i.e. 24/16)
- Nominal thickness (i.e. 7/16")
- Bond classification (i.e. Exposure 1)
- Grade (i.e. Sheathing)
- Manufacturer's name or mill number
- Certification organization logo and performance standard (i.e. TECO PRP133)
- PS 2 symbol signifying conformance to the performance standard
- Direction of the surface strand alignment.

Canadian standard information may also be included as part of or on a separate stamp. (see Figure 3 for examples, or refer to our Technical Bulletin, TB107, Marking of OSB, available on www.osbguide.com)

Figure 3 Examples of Certification Marks



4.0 PROPERTIES

4.1 Physical and Mechanical

The physical and mechanical properties of performance based panels established by the certification agency are proprietary except the span rating. As a result the properties can vary from mill to mill. Some mills produce panels that have at least the minimum properties outlined in CSA Standard O437. Basic properties of grade O-2 properties are summarized in Table 1 along with the properties specified in PS 2. Property values of actual production panels are maintained by SBA members at levels superior to those shown in the table.

Table 1 Basic Properties of OSB

Property	PS 2[1]	CSA O437 (Grade O-2)
Thickness tolerance		
panels ≤ 13/16" (20.5 mm)	± 1/32" (0.8 mm)	± 0.03" (± 0.75 mm)
panels > 13/16" (20.5 mm)	± 5% of thickness	± 0.03" (± 0.75 mm)
Size tolerance (length and width)		
(maximum deviation from specified size)	+0, -1/8" (+0 mm, - 3.2 mm)	+0, -5/32" (+0 mm, - 4 mm)
Squareness tolerance		
(maximum deviation from square)	1/64 in/ft of diagonal (1.3 mm/m)	5/32" (4 mm)
Straightness tolerance		
(maximum deviation from straight line)	1/16" corner to corner (1.6 mm)	1/16" corner to corner (1.6 mm)
Minimum modulus of rupture[2]		
parallel	N/A (not applicable)	4200 psi (29.0 MPa)
perpendicular	N/A	1800 psi (12.4 MPa)
Minimum modulus of elasticity[2]		
parallel	N/A	800,000 psi (5500 MPa)
perpendicular	N/A	225,000 psi (1500 MPa)
Minimum internal bond[2]	N/A	50 psi (0.345 MPa)
Maximum linear expansion		
oven dry to saturated	N/A N/A	0.35% parallel 0.50% perpendicular
one sided wetting (or 50% to 90% relative humidity R.H.)	0.30% along major axis 0.35% across major axis	N/A N/A
50% R.H. to vacuum pressure soak	0.50%	N/A
Maximum thickness swell	25% (one sided wetting or R.H. exposure) (Single Floor only)	15% for 1/2" thick or less 10% for greater than 1/2" (24 hour soak)
Bond classification (minimum modulus of rupture)[2]		
single cycle test	see Table 6 of PS 2	N/A
six-cycle test	50 % retention	N/A
2 hour boil - parallel	N/A	2100 psi (14.5 MPa)
- perpendicular	N/A	900 psi (6.2 MPa)
Minimum lateral nail resistance[2]	see Table 3	400t lb (70t N) where t = thickness, in. (mm)

Notes:

[1] *PS 2 (or CSA O325 in Canada) panels are performance rated for each application (see Section 5.1)*

[2] *Strength and stiffness values are average ultimate test values, not working stresses for design purposes.*

4.2 Other Properties

Other properties of OSB may be summarized as follows:

Workability

OSB is easy to saw, drill, nail, plane, file or sand. It contains wood, fully cured waterproof and boil proof resin adhesive and a small amount of wax. Use normal carpentry tools, but carbide tipped blades are recommended for prolonged use. Wear appropriate safety protection and follow safe working procedures. As wood dust has been designated as a potential carcinogen, avoid overexposure to airborne dust particles and keep work areas free of dust build-up.

As full-size panels have a factory applied edge coating, job cut panels likely to be exposed to the weather should have uncoated edges protected by a field coat of paint or by sheathing paper to reduce moisture pick-up.

Nailability

The many interleaved layers create panels with good nail holding properties. Nails can be driven as close as 1/4" from the panel edges without risk of splitting or breaking out. However, the Association recommends an edge distance of 3/8" for structural applications. Extensive tests undertaken by research establishments show fastener performance is similar for all structural wood panels. In addition PS 2 specifies minimum nail holding capability for performance based OSB. When using power actuated nailers, wear eye protection, follow safe working procedures, and do not overdrive nails.

Gluability

OSB may be glued with any adhesive recommended for wood. For strong bonds, lightly sand the surfaces in the areas to be glued.

Paintability

OSB may be finished with any good quality paint system recommended for wood. For best results, the surface must be primed or sealed before painting.

For exterior applications, the best finish is a good quality exterior wood paint system (primer and top coat) applied according to the paint manufacturer's directions. Solid color paints provide the best weather protection for the panel surface and the strands show a pleasing texture. A top quality acrylic latex exterior paint and companion primer specifically designated by the manufacturer as 'stain blocking' or 'stain resistant' are recommended. OSB also takes all kinds of stain finishes as well. However, stains do not offer as much surface protection from the weather as paints and the lifting of an occasional strand may occur. Stains are therefore more suited to fences, summer cottages and other applications that accept a more rustic appearance.

Sanded panels present a marble-like appearance and they are less textured than unsanded panels. As varnishes, stains and paints penetrate the sanded panels more quickly than the unsanded, two coats of primer or sealer are recommended before application of the finish system. When applying paint or varnish, sand the surfaces lightly between coats; do not sand stained surfaces.

Weight

The approximate weight of OSB panels is shown in Table 2. These values are based on a density of 40 pcf. Density may vary depending on the manufacturer, and moisture conditions at the time of shipment.

Thermal Resistance

The thermal coefficient of resistivity "R" of a material is a measure of the resistance it offers to the passage of conducted heat at a steady rate. It is proportional to the density and thickness of the material. Table 2 provides R values for various thicknesses of OSB.

Permeability

The permeability of a wood panel is the rate that moisture passes through the panel under stated conditions of moisture vapor pressure. It is inversely proportional to the density, degree of orientation and thickness of the panel. Values for OSB panels are given in Table 2.

Fire Performance

OSB has been tested to determine fire endurance and flame spread ratings by both SBA and APA. These tests have been undertaken by third party agencies using recognized fire test laboratories. The test results show that OSB panels, like plywood, may be used as exterior sheathing on outside walls required to have a fire rating. However, code authorities may require that stud spaces be filled with non-combustible insulation such as rock wool when structural wood panels are used on these walls. Structural wood panels are permitted to be installed between the framing and the fire-resistive covering in walls provided the length of the fastener used to attach the fire protection is increased by an amount at least equal to the thickness of the wood panel.

Flame spread rating tests have also been conducted on OSB panels, and it has been determined that an uncoated OSB panel and a panel having one coat of acrylic latex interior household paint will meet the requirement of a 150 flame spread rating. (see Table 2)

Moisture Performance

OSB like all wood products reacts to changes in moisture and humidity conditions. OSB is required by North American Standards to maintain its strength and stiffness performance under normal humidity conditions, also referred to as “standard conditions”, which are represented by a temperature of 68 degrees fahrenheit and 65 percent relative humidity. This condition is typical of protected construction. In addition, OSB is required to maintain its strength and stiffness performance when exposed to weather during long construction delays.

Table 2 Physical Properties of OSB

Nominal panel thickness (in)	Weight (psf)	Thermal resistance R (ft^2.hr. °F/Btu)	Vapor permeance (perms)	Flame Spread Rating[1]	Smoke Developed Index[1]
3/8	1.25	0.45	2.55	148	137
7/16	1.46	0.51	1.95	148	137
1/2	1.67	0.62	1.55	148	137
5/8	2.08	0.74	1.1	148	137
3/4	2.5	0.91	1.1 [2]	148	137

Notes:

[1] *These numbers are average test values obtained by APA, The Engineered Wood Association on several thicknesses of OSB. All test results fell in the range of Class 3 or C, depending on the building code, for interior finish material.*

[2] *Panel thicknesses greater than 5/8" were not tested, but can be assumed to provide a permeability resistance equal to or better than that of 5/8" panels. Vapor permeance values are given for 50% relative humidity (R.H.), and increase slightly with increasing R.H.*

Table 3 Minimum Nail Resistance for Panels Meeting PS 2 [1, 2]

Loading	Application	Minimum ultimate load (lb) [3]	
		Dry	Wet/Dry
Lateral	roof and wall sheathing	120	90
	subfloors and single floors	210	160
Withdrawal	all sheathing	20	15

Notes:

[1] *Nails are 6d (2" or 51 mm) common smooth-shank nails for sheathing up to 1/2" (12.5 mm) thick, 8d (2 1/2" or 63 mm) for thicker panels.*

[2] *Comparison studies (University of Illinois) have shown the equivalent performance of OSB and plywood in lateral and withdrawal resistance of nails and staples.*

[3] *These values are not for design purposes.*

5.0 RESIDENTIAL AND LOW RISE COMMERCIAL INSTALLATION

The following sections present installation instructions for SBA performance based OSB sheathing in residential and low rise commercial construction. The information is applicable to all of the former U.S. Codes including the One and Two Family Dwelling Code (CABO), the Uniform Building Code (ICBO), the National Building Code (BOCA), the Standard Building Code (SBCCI) and the more recent International Building Code (ICC) and the International Residential Code (ICC).

5.1 Span Ratings

(a) PS 2 Panels

The span ratings shown on the OSB panels markings (see Figures 3, 4, 6, or 7) consist of two numbers separated by a slash e.g. 24/16. The left-hand number shows the maximum support spacing for roof sheathing and the right-hand number gives the maximum support spacing for floor sheathing in inches. Edge support is required when the panel is used at its maximum support spacing. The span rating system applies when the panel is applied with the strong axis perpendicular to the supports. The strong axis is shown by directional arrows on the grade mark and is the direction of the strands on the face of the panel, usually the long dimension of standard panels.

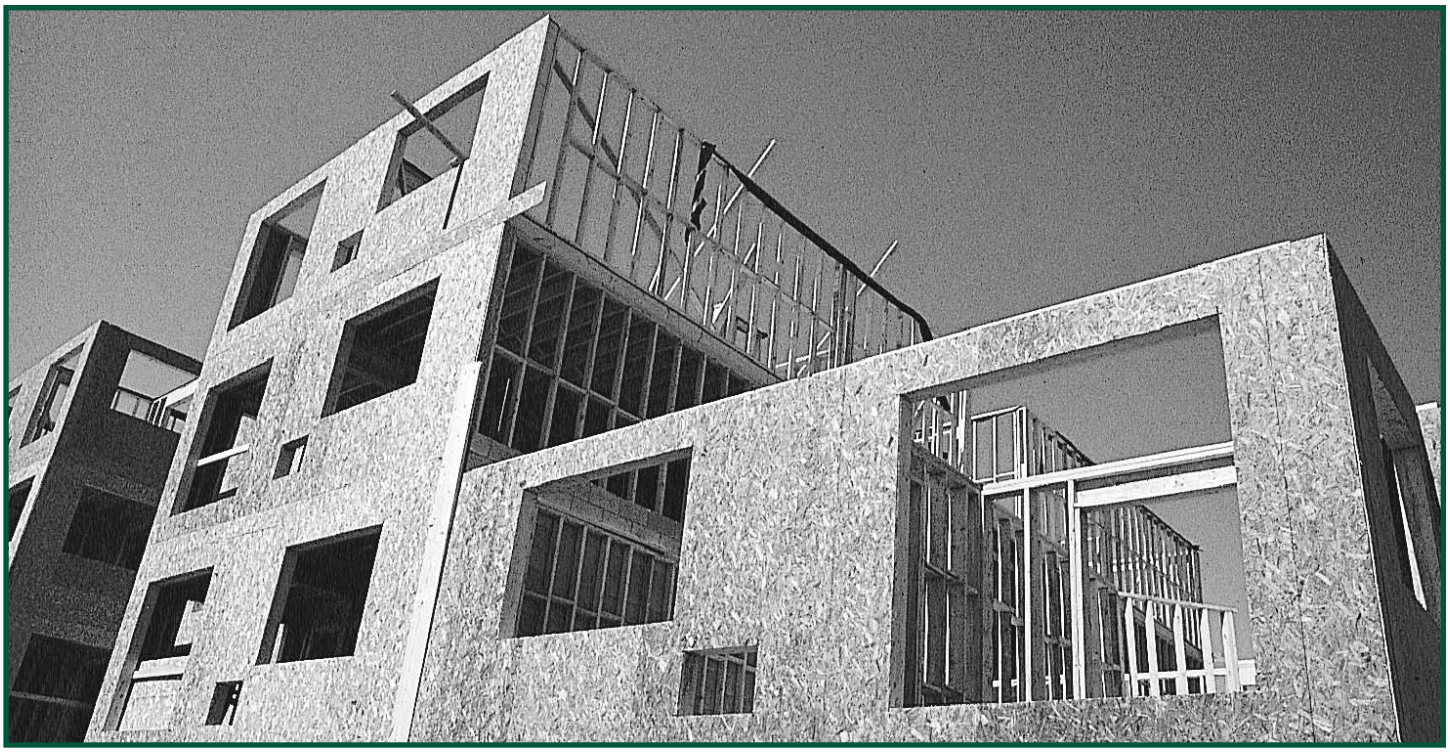
OSB rated panels for single floors (combination subfloor and underlayment) have a single number followed by the letters OC e.g. 20 OC. This means the maximum support spacing is 20" on center and edge blocking or tongue and groove edges are required. For wall sheathing, only one number denotes the span rating, i.e. Wall-24.

(b) CSA O325 Panels

The span ratings shown on the panel markings consist of an end use mark followed by a span mark, eg. 1F16. The end use markings are as follows:

Mark	Assumed End Use
1F	Subflooring
2F	Subflooring used with panel-type underlay
1R	Roof sheathing without edge support
2R	Roof sheathing with edge support
W	Wall sheathing

The number after the letter indicates the maximum center to center spacing of the supporting members in inches. Multiple panel marks may be used on panels qualified for more than one end use, e.g. 1R24/2F16.



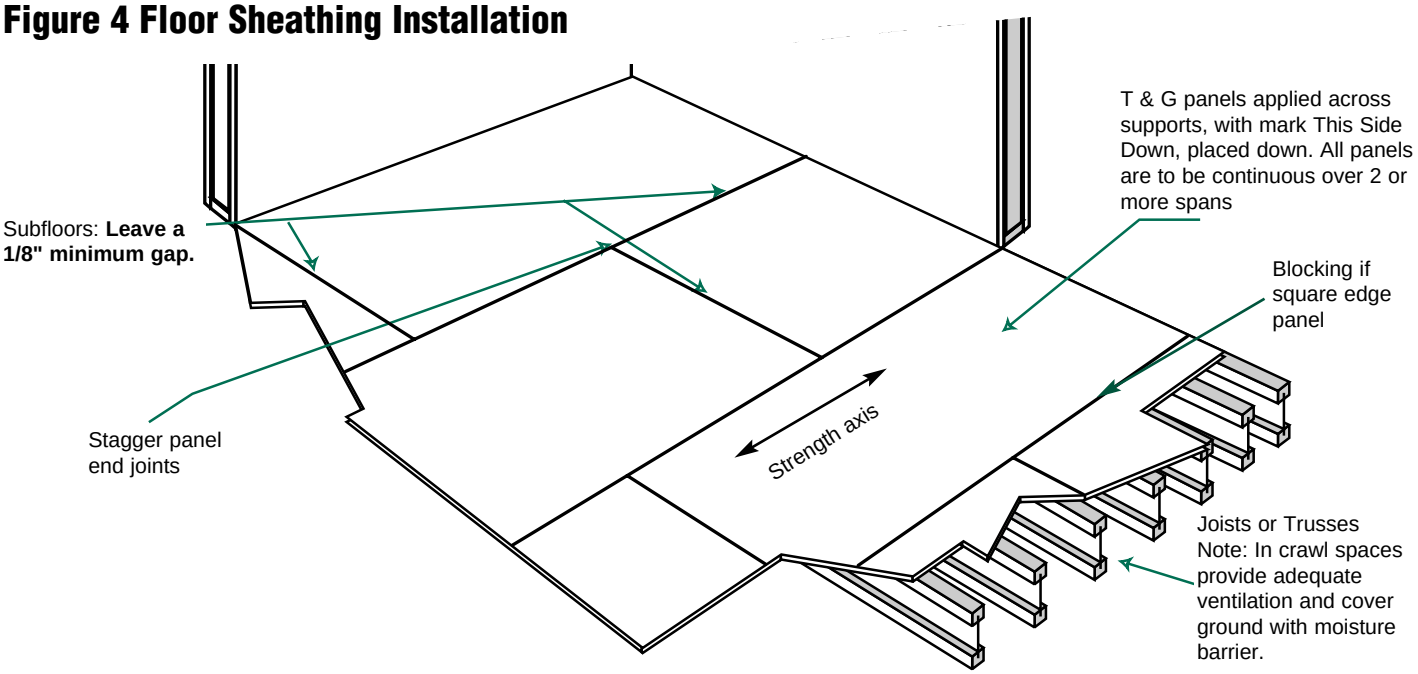
5.2 Floor Sheathing

Figure 4 provides the recommended installation details for floor sheathing along with the maximum support spacing for subfloors and combination subfloor and underlayment.

Sheathing grade subfloors are intended to have an additional layer of structural material such as an underlayment panel, wood strip flooring applied at right angles to the joists, or concrete topping. Single floor grade panels used as combination subfloor and underlayment do not require an additional layer (except as noted in the Figure). The edges of sheathing and single floor panels must have approved tongue and groove joints or be supported with blocking unless minimum 1/4" thick underlayment is installed with joints offset from subfloor joints, or 1-1/2" of approved cellular or lightweight concrete is installed, or if the finish floor is 3/4" wood strip.

Panels should be laid across three or more supports keeping the side marked “This Side Down” on the supports when using T&G panels. End joints must be made over the supports and should be staggered at least two supports. Sheathing panels should be gapped 1/8" on all sides and ends. Combination subfloor underlayment panels should have ends and edges lightly butted.

Figure 4 Floor Sheathing Installation



Subfloor - Sheathing and Structural 1 Sheathing Grades

Joist spacing (in.)	Span Rating (roof/floor)	Nominal thickness (in.)
16	24/16 32/16	7/16, 15/32, 1/2 15/32, 1/2, 5/8
19.2, 20	40/20	19/32, 5/8, 3/4
24	48/24 40/20 [2]	23/32, 3/4, 7/8 19/32, 5/8, 3/4

Combination Subfloor and Underlayment - Single Floor Grades

Joist spacing (in.)	Span Rating	Nominal thickness (in.)
16	16 oc	19/32, 5/8
20	20 oc	19/32, 5/8, 3/4
24	24 oc 20 oc [2]	23/32, 3/4 19/32, 5/8, 3/4
32	32 oc	7/8, 1
48	48 oc	1-1/8

Notes:

[1] *Unsupported edges shall have tongue and groove joints or shall be supported with blocking.*
[2] *Acceptable under 1" approved gypsum concrete, 1-1/2" cellular or lightweight concrete or 3/4" wood strip flooring*
[3] *Panels to be minimum 24" wide and continuous over at least two spans.*
[4] *For hardwood flooring refer to Section 5.2.4*

5.2.1 Fastening for floor sheathing

Table 4 contains the recommended fastening methods for OSB floor sheathing. Standard nail sizes and lengths are given in Table 5. Often power-driven nails are used to fasten the sheathing. This is acceptable as long as the nails are not over-driven so that they punch into the panel. Wood screws are also an acceptable method of fastening.

The performance of any floor system can be enhanced, if in addition to the normal nailing, the sheathing panel is glued to the supporting joists with an elastomeric adhesive and the tongue and groove edges are glued together. The glue creates composite action between the joists and the sheathing, which stiffens the floor and reduces vibration. In fact, many new engineered floor joist products such as I-joists can be installed on longer spans when the subfloor is glued. Use only solvent based glue conforming to APA specification AFG-01, or ASTM standard D3498.

Table 4 Fastening schedule for OSB sheathing

Application[1]	Fastener [2, 3, 4]	Number and Location[3]
Subfloor and Single Floor		
1/2" thick or less	6d common or deformed shank nails	6" o/c at panel edges 12" o/c along intermediate supports (10" for single floor)
19/32" to 3/4" thick	8d common or deformed shank nails	6" o/c at panel edges 12" o/c along intermediate supports (10" for single floor)
7/8" to 1" thick	8d nails	
Roof Sheathing		
1" thick or less	8d common or deformed shank nails	6" o/c at panel edges 12" o/c along intermediate supports
Wall Sheathing		
1/2" thick or less	6d common or deformed shank nails	6" o/c at panel edges 12" o/c along intermediate supports
19/32" to 3/4" thick	8d nails	6" o/c at panel edges 12" o/c along intermediate supports

Notes:

[1] *Nails should be 3/8" from panel edge*

[2] *Box nails, spiral nails, or staples can be used in lieu of common nails. Check with your local building inspector.*

[3] *Larger nails or closer spacings may be required in high wind or seismic areas.*

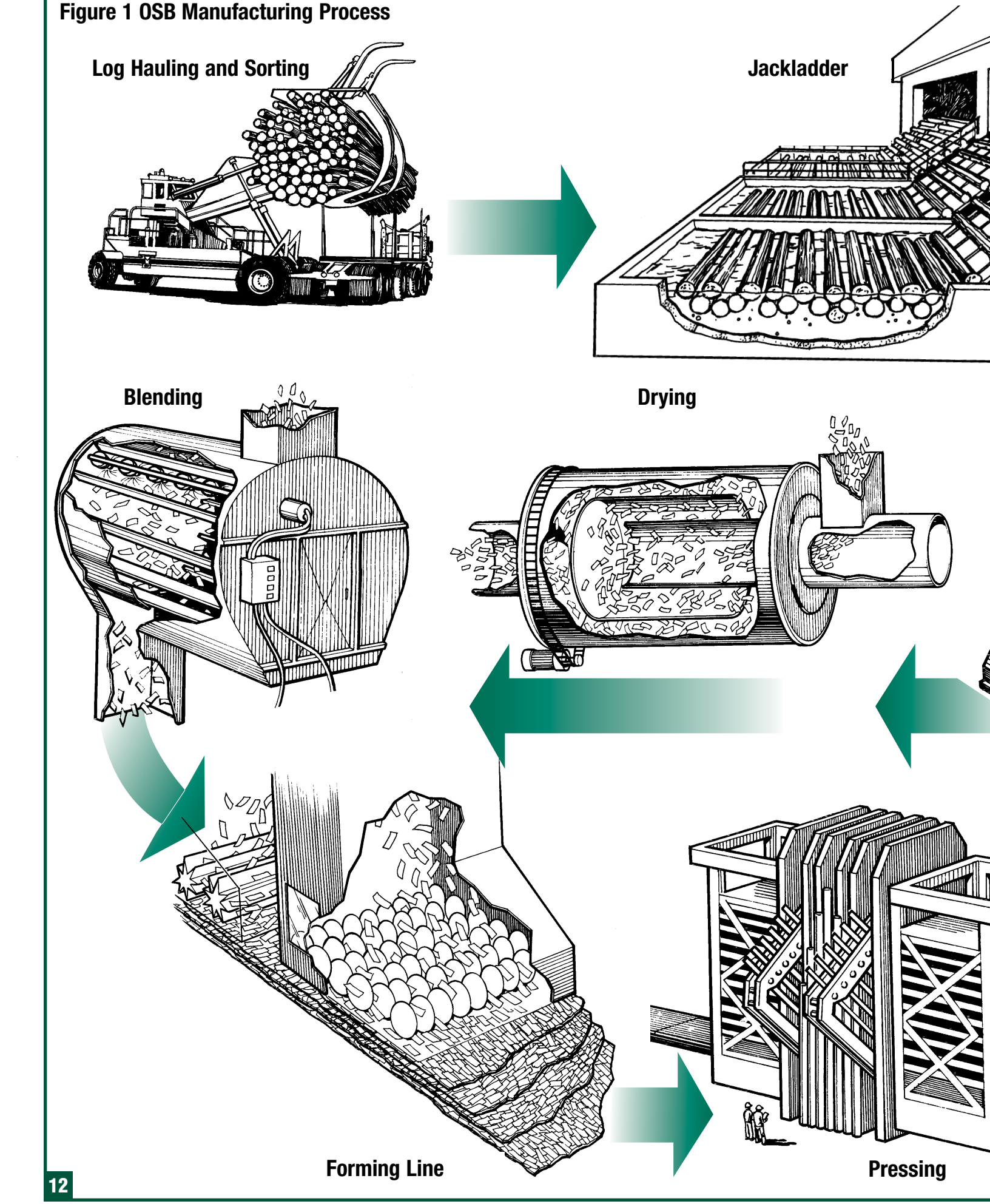
[4] *Schedule is per the 2000 International Building Code. For power driven nails or staples for use in all types of building construction, consult NER 272 issued by ICC-ES to ISANTA (www.icces.org).*

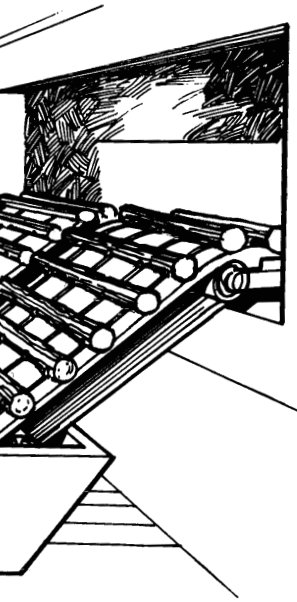
5.2.2 Installing finished flooring over combination subfloor and underlayment

After the building is closed in and heated and just before laying the finished floors, sweep and vacuum the panels. Carefully check the floor surface for protruding nail heads and make sure all panels are fully nailed. Adverse moisture conditions may have caused some panel edge swelling. Sand panel edges flush and ensure panels are dry before installing finished floor. Carpet and parquet flooring may be installed on top of the panels following good practice and the flooring manufacturer's directions.

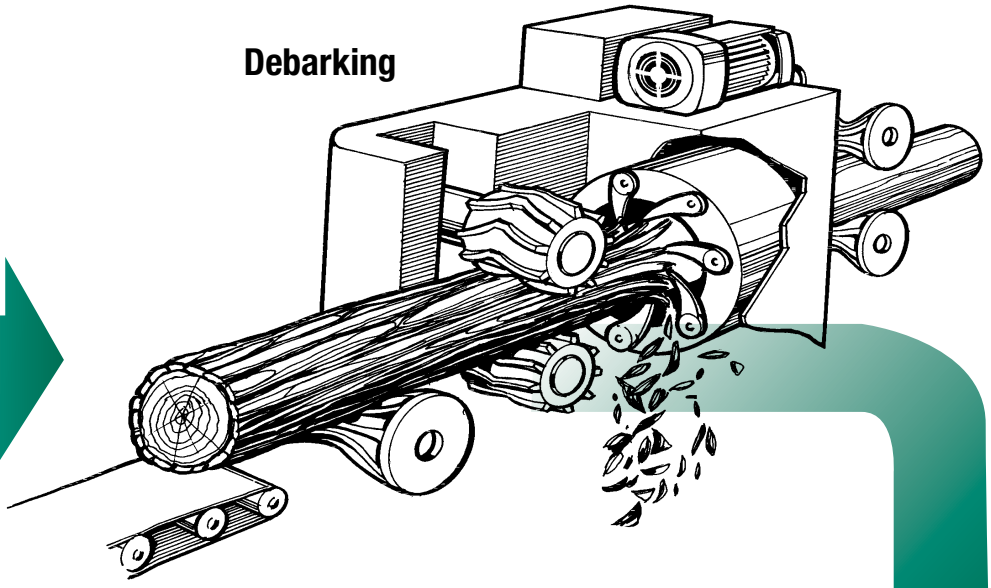
For adhesive applied resilient flooring a separate panel underlayment must be installed (see section 5.3). Use an adhesive recommended by the flooring manufacturer that is not rigid setting sulphite liquor or alcohol resin-based. Other resilient finish floor coverings are often suitable for installation directly over single floor grades. If the sheathing was subjected to severe moisture conditions during construction it may be necessary to level the entire surface with a light sanding.

Figure 1 OSB Manufacturing Process

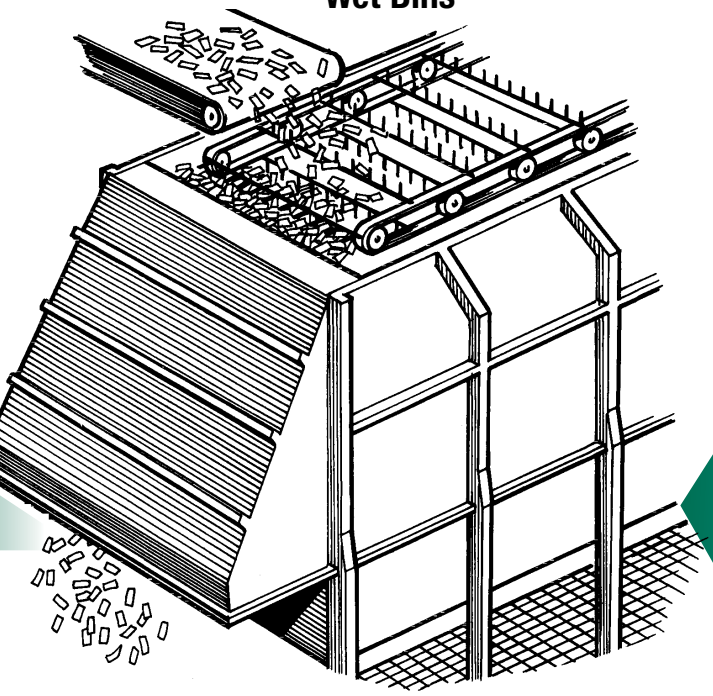




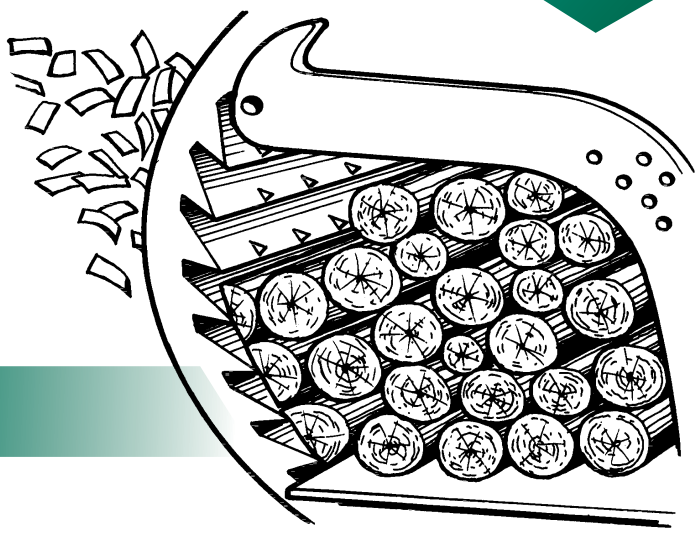
Debarking

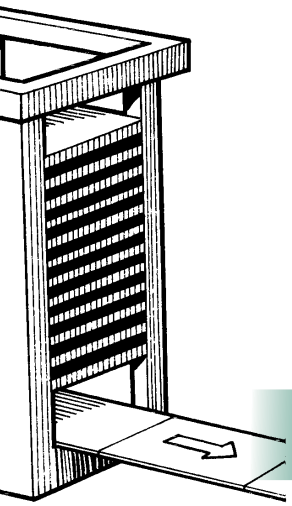


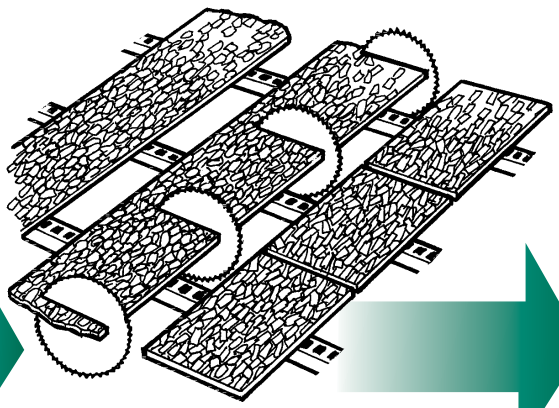
Wet Bins



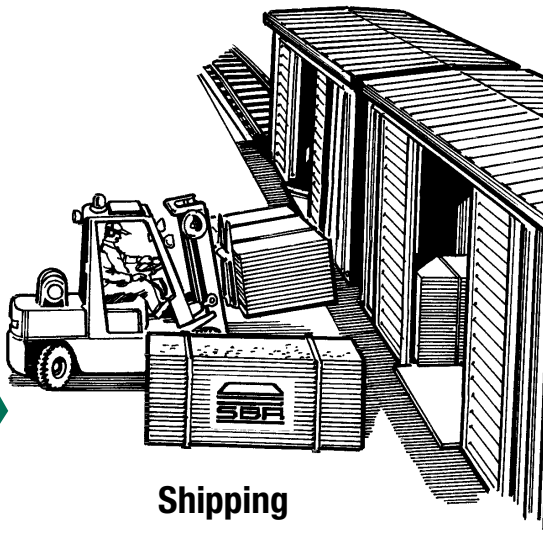
Stranding







Finishing Line



Shipping

Table 5 Nail Weight, Length and Gage

Sizes of bright, common wire nails

Size	Length (inches)	Diameter (inches)	No. per pound
4d	1-1/2	0.102	316
6d	2	0.113	181
8d	2-1/2	0.131	106
10d	3	0.148	69
12d	3-1/4	0.148	63
16d	3-1/2	0.162	49
20d	4	0.192	31

Sizes of helically and annularly threaded nails

Size	Length (inches)	Diameter (inches)
6d	2	0.102
8d	2-1/2	0.120
10d	3	0.135
12d	3-1/4	0.135
16d	3-1/2	0.148
20d	4	0.177

5.2.3 Concrete topping over OSB subfloor

Concrete toppings are often used over panel subfloors to increase the sound insulation properties and fire resistance of the floor system. Light-weight gypsum concrete manufacturers typically recommend using 3/4" of concrete poured directly over 3/4" tongue and groove subfloor with the joists spaced at 16" to 24" on center. However, 3/4" of concrete over 19/32" (40/20) subfloor with joists at 19.2" on center, or 1" of concrete for joists at 24" on center, is often acceptable to local building officials. The subfloor should be clean and free of contaminants before application.

5.2.4 Hardwood floors

The National Wood Flooring Association (NWFA) and the National Oak Flooring Manufacturers Association (NOFMA) recognize the use of 23/32" (3/4" nominal) OSB subfloor under hardwood flooring. Recommended support spacings are shown in Table 6. The subfloor should be glued-nailed to the framing with adhesives conforming to APA specification AFG-01. Tongue and groove or panel blocked edges should also be glued.

The thick panel provides good nail holding power and the reduced support spacings along with the gluing will create a stiff floor that will help reduce floor squeaks after hardwood floor installation.

It is important that the subfloor be dry when the hardwood is installed, otherwise buckling and squeaking of the hardwood floor will occur when the subfloor dries out. Should it become wet during construction it must be dried out and the moisture content checked with a moisture meter to assure that it is within limits acceptable to the hardwood manufacturer.

The subfloor should be level, especially the joints between panels. Any ridges at panel edges should be sanded smooth before hardwood installation using a heavy-duty floor sander and a moderately coarse grit sandpaper. Following sanding, any areas of the floor that squeak should be renailed.

For installation of the flooring, follow the recommendations of the manufacturer or the NOFMA or NWFA. Where possible, orient the hardwood strips perpendicular to the floor framing.

Table 6 Recommended Floor Sheathing for Hardwood Flooring

OSB rated floor sheathing	Recommended support spacing (in.)
40/20, 20 oc [1]	12
48/24, 24 oc	19.2
32 oc	24
48 oc	32

Note: *[1] 23/32" (3/4" nominal) thick panels are recommended for best performance.*

5.2.5 Ceramic Tile

Table 7 provides the minimum recommended floor sheathing systems for ceramic or other tiles. For good performance it is important that the floor system be as stiff as possible. Therefore, the use of thicker subfloor (i.e. 23/32" or 48/24 span rating) or underlayment along with reduced fastener spacing will enhance the performance of the floor. Prohibit traffic on the tile until the mortar or adhesive has set in order to avoid cracking.

Table 7 Recommended Floor Sheathing Systems for Ceramic Tile Flooring [1, 2]

Minimum subfloor Panel Thickness (in)[3]	Underlayment (in)	Tile Installation
19/32	min. 7/16 CBU [4, 5]	Dry-Set mortar or latex-portland cement mortar
19/32	none	Cement mortar (1-1/4") [7]
19/32	11/32 [8]	Organic adhesive
19/32	15/32 [6, 8]	Epoxy mortar

Notes:

[1] *Based on ANSI Standard A108 and specifications of the Tile Council of America for plywood.*
[2] *Joist spacing not to exceed 16" oc. Joists should be blocked with solid blocking on 4" centers in high traffic areas.*
[3] *OSB performance based sheathing with a span rating of 40/20 (19/32" thick)*
[4] *Bond cementitious backer units (CBUs) to subfloor with latex - Portland Cement or epoxy mortar prior to spreading mortar for setting ceramic or other tile.*
[5] *Leave 1/8" space at panel ends and edges. Fill joints with mortar.*
[6] *Leave 1/4" space at panel ends and edges; trim panels as necessary to maintain end spacing and panel support on framing. Fill joints with epoxy mortar when it is spread for setting tile. With single layer subfloor use solid blocking under all panel end and edge joints, including tongue and groove joints.*
[7] *Use No.15 asphalt felt or 4-mil polyethylene sheeting over subfloor. Reinforce mortar with wire mesh.*
[8] *Underlayment or Exterior grade plywood.*

5.2.6 Floor Vibration

Floor vibration or “bounciness” usually results from a combination of maximum floor joist span and spacing, with minimum subfloor thickness and other construction details. To increase floor stiffness and significantly improve overall floor performance, several options are available such as increasing the subfloor thickness beyond the minimum code requirements; nailing and field gluing the subfloor to the joists; reducing the joist spacing; reducing the joist spans to a smaller deflection limitation due to live load or installing improved bracing systems. Please consult with SBA for additional information.

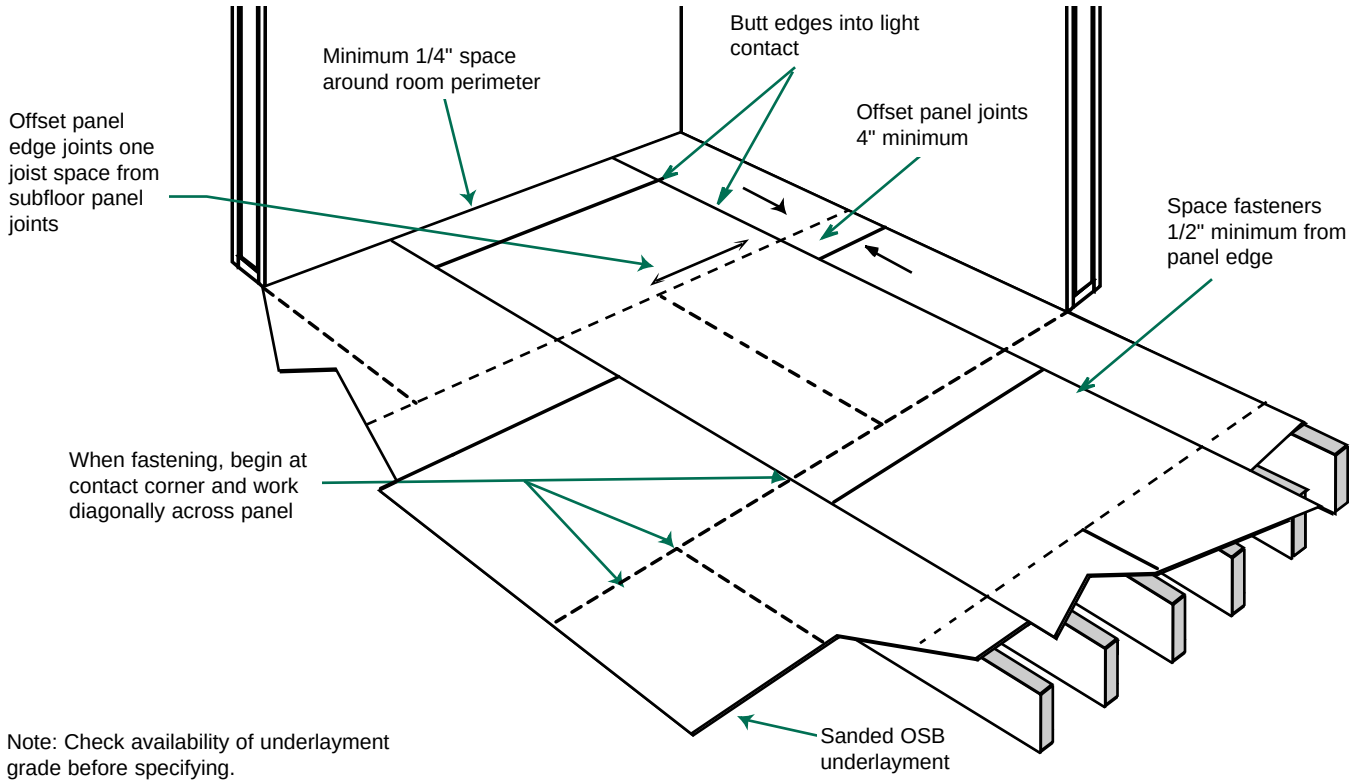
5.3 Floor Underlayment

Figure 5 provides the recommended installation details for OSB floor underlayment along with fastener size and types. Sanded OSB floor underlayment is suitable for use under many finished flooring products such as: felted synthetic fiber or carpet; embossed resilient flooring; smooth resilient flooring; cushion back resilient flooring; perimeter glued or loose lay resilient flooring. Before applying the underlayment thoroughly sweep or vacuum clean the subfloor. Reset all popped nails and re-nail any loose panels. When underlayment is applied over panel subfloors, apply the panels immediately prior to installation of the finished flooring.

When underlayment panels are applied over lumber board subfloors, apply panels parallel to joists if boards are perpendicular to joists. Underlayment panels may be applied in either direction if boards are at an angle less than 75° to joists.

To fasten, begin nailing or stapling at contact corner of underlayment panels and work diagonally across panels. Make sure the panels are in firm contact with the subfloor when driving the fasteners. Space nails at 4" o.c. on panel edges, and 8" o.c. in the center of the panel. Or use staples at 3" o.c. on panel edges, and 6" o.c. elsewhere. When gluing underlayment to subfloor use only solvent based glues.

Figure 5 Floor Underlayment Installation



Note: Check availability of underlayment grade before specifying.

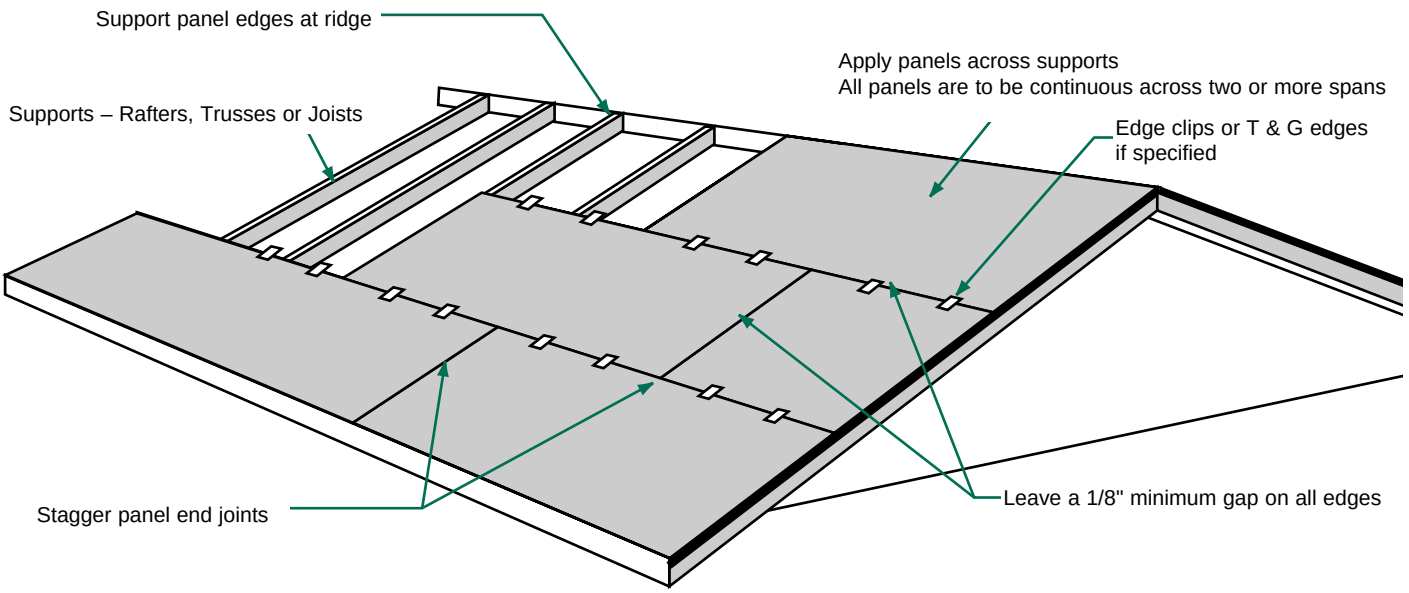
Sanded OSB Panel Thickness	Fastener Size & Type			
	Nail	Staple		
	Size/Type	Gage	Length	Crown Width
1/4"	3d Ring Shank	18	7/8"	3/16"
3/8"		16	1 1/4"	7/16"

5.4 Roof Sheathing

Figure 6 provides the recommended installation details for roof sheathing along with the maximum support spacing and minimum nominal thickness.

Before installing the sheathing the rafters or upper truss chord should be checked to assure that they are aligned, straight and even. Curved or uneven rafters or upper truss chords affect the finished roof.

Figure 6 Roof Sheathing Installation



Warning: Roof sheathing may be extremely slippery when wet, covered with frost, snow, ice or sawdust. Installers of roof sheathing should wear rubber-soled footwear and exercise caution, especially on roof slopes exceeding 4 in 12. Based on recent studies, soles of thermoplastic rubber provide the best traction of the sole materials tested. Place screened surface of panel face up.
Note: Panels that get wet should be allowed to surface dry before applying shingles. Protect uncoated edges from direct rain exposure.

	Edges Supported [1]		Edges Unsupported	
Support spacing	**Span Rating (roof/floor)**	**Nominal Thickness (in.)**	**Span Rating (roof/floor)**	**Nominal Thickness (in.)**
Sheathing Grade				
12	12/0	5/16	12/0	5/16
16	16/0	5/16, 3/8	16/0	5/16, 3/8
20	20/0	5/16, 3/8	20/0 24/0	5/16, 3/8 3/8, 7/16
24	24/0 24/16	3/8, 7/16, 1/2 7/16, 15/32, 1/2	24/0 24/16	15/32, 1/2 7/16, 15/32, 1/2
32	32/16	15/32, 1/2, 5/8	40/20	19/32, 5/8, 3/4
40	40/20	19/32, 5/8, 3/4		
48	48/24	23/32, 3/4		
Single Floor Grade				
24 or less	16 oc	19/32, 5/8	16 oc	19/32, 5/8
32	20 oc	19/32, 5/8, 3/4	20 oc	19/32, 5/8, 3/4
40	24 oc	23/32, 3/4		
48	24 oc	23/32, 3/4		

Notes:

[1] *Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports when span is 48"), tongue and groove panel edges, or other approved type of edges support.*

[2] *Panels to be minimum 24" wide and continuous over at least two supports.*

[3] *Panel thicknesses and span ratings apply for pitched or flat roofs; where flat roofs are used as walking decks, the requirement for floors shall apply.*

[4] *For enhanced performance SBA recommends a minimum 24/16 rating at 16" or 20" oc and minimum 32/16 at 24" oc.*

The panels should be installed textured side up with their long direction across the rafters or truss chords. Long panel edges should be supported or joined with edge clips where required. A 1/8" gap should be left at the panel edges and ends to allow for movement due to changes in humidity. Panels should be staggered at least two supports and end joints must lie over supports.
Table 4 contains the recommended fastening methods for OSB roof sheathing. The installer should stand over the rafter or truss when nailing. As roof sheathing may be slippery when wet, covered with frost, snow ice, or sawdust, installers should wear rubber soled footwear, use appropriate safety equipment and use extreme caution when working on sloping roofs.

5.4.1 High Wind Areas

Extra fastening and closer spacing is required in high wind or seismic areas. Other requirements may also apply. Check with the local building authority for these special requirements.

5.4.2 Ventilation of Attic and Roof Spaces

In order to minimize the impact of moisture build-up in attic spaces, it is essential that adequate ventilation be installed with 50% of the ventilation at the roof ridge and 50% at the soffit area. Building codes specify that the minimum unobstructed vent area equal not less than 1/300 of the total insulated ceiling area if a maximum 1 perm vapor retarder is installed on the warm side of the ceiling insulation. Otherwise the free vent area must equal not less than 1/150 of the insulated area. Vent roof as specified in the appropriate building code or as shown on the approved drawings. The roof should be dry prior to shingling and should be shingled as soon as possible after installation of sheathing.

5.4.3 Prevention of Ice Damming

Ice damming occurs in extreme cold climates and is due to heat transfer from the attic space to the shingles melting the snow during the day time period. At night, the snow melt freezes. Repeated cycles of freeze thaw cause a ridge of ice trapping the snow melt as it flows down the roof. The snow melt backs up under shingles and soaks the sheathing. A continuous layer of “ice shield” or other heavy waterproof material must be installed from the edge of the exterior wall 3 feet up the roof under the shingles to protect the roof sheathing.

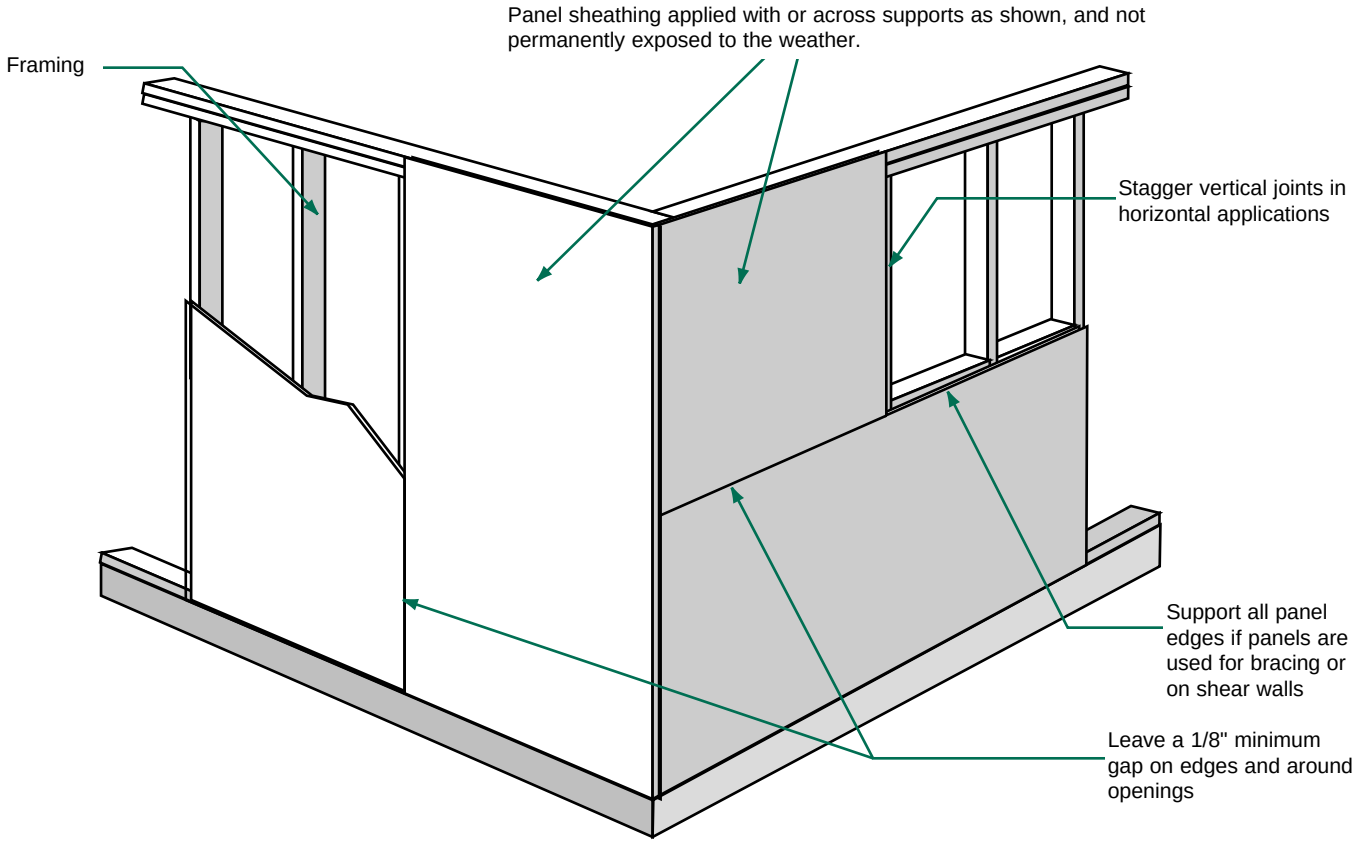
5.5 Wall Sheathing

Figure 7 provides the recommended installation details for wall sheathing along with the maximum support spacing. Where stucco is to be applied over the sheathing, codes often require that the sheathing panels be at least 1/2" thick unless the lath is fastened directly to the wall studs. However, SBA recommends a minimum 19/32" panel covered with a double layer of asphalt impregnated sheathing paper prior to stucco application.

Wall sheathing panels may be installed vertically or horizontally. A 1/8" gap should be left between panels and around openings for windows and doors. The required fastening for wall sheathing is shown in Table 4. Blocking or diagonal bracing is not required unless specified by the building designer or local building regulation.

Sheathing paper is generally not required over OSB unless stucco, non-wood siding or in some cases brick veneer is used for the exterior finish (consult the applicable building code).

Figure 7 Wall Sheathing Installation



Stud spacing[1] (in.)	Span Rating	Nominal thickness[2] (in.)
16	12/0	5/16, 3/8
	16/0	5/16, 3/8
	20/0	5/16, 3/8
	Wall - 16	5/16, 3/8
24	24/0	3/8, 7/16, 15/32, 1/2
	24/16	3/8, 7/16, 15/32, 1/2
	32/16	3/8, 7/16, 15/32, 1/2
	Wall - 24	3/8, 7/16, 15/32, 1/2

Table is valid for both cases where the sheathing is used as a siding base or where the siding is nailed to the framing studs.

Notes:

[1] *Panels to be minimum 24" wide typically. Minimum width to be 48" when used as bracing.*

[2] *For panel sheathing applied with strength axis parallel to the studs, the minimum thickness is 3/8" at 16" oc and 7/16" at 24" oc.*

5.6 Maximum loads for OSB panels

Table 8 provides the maximum allowable loads for SBA rated OSB roof sheathing panels. This table has been developed following extensive testing of these products in research facilities plus many years of successful application in construction.
In addition, the panels meeting PS 2 have been performance tested for a 35 psf loading with a deflection limit of L/240, where L is the spacing between supports.
OSB rated floor sheathing panels meeting PS 2 have been tested for a 100 psf uniform load with a deflection limit of L/360 for 16" to 32" support spacings. The 48" spacing panels are performance tested for 80 psf with the same deflection limit.

5.7 Moisture during Construction

OSB structural sheathing manufactured by SBA members meets the Exposure 1 durability requirements of PS 2. Sloped OSB roofs will allow rain water to run off. If ponding occurs on floors or other flat surfaces SBA recommends that a hole saw be used to drill several 1" (25mm) diameter holes in the ponding area to allow the water to drain.

5.8 Detailing and Good Construction Practice

OSB like other wood products should be protected from excess moisture. Ensure that sheathing paper or “house wrap” is properly installed under stucco, vinyl siding or brick veneer. Provide adequate flashing over openings in brick veneer walls so that the wall cavity will drain when moisture penetrates the brick. In addition, provide adequate flashing at all roof and wall openings and at changes in horizontal and vertical direction (for example inside corners, valleys, dormers).

5.9 Shipping, handling and storage

OSB is a wood based product. Reasonable care is required in warehousing and on the job site to protect panels from mechanical damage and lengthy exposure to adverse moisture conditions. For best results handle panels as little as possible. Ship in the original lift loads if possible. Use care in handling the panels to avoid damaging corners and edges. If storing SBA panels for long periods, store lifts indoors or under cover with enough supports that panels remain flat. Provide air circulation around panels by keeping covers open and away from sides and bottoms of lift loads.

Table 8 Maximum Allowable Loads for SBA OSB Rated Roof Sheathing [1]

Span Rating	Panel Thickness (in)	Maximum span (in) with edge support [3]	Maximum span (in) without edge support	Allowable live loads (psf) [2] spacing of supports center-to-center (in) 12	16	20	24	32	40	48
16/0	5/16, 3/8	16	16	55	30					
24/0	3/8, 7/16, 1/2	24	20 [4]	170	100	60	30			
24/16	7/16, 1/2	24	24 [5]	190	100	65	40			
32/16	15/32, 1/2, 19/32, 5/8	32	28 [5]	220	155	120	70	30		
40/20	19/32, 5/8	40	32		200	165	125	60	30	
48/24	23/32, 3/4	48	36			210	165	95	45	35

Notes:

[1] *Values are valid when long dimension is across supports and were provided from work done by APA.*

[2] *Values include an allowance for a dead load of 10 psf. If higher dead loads are used the live load should be reduced accordingly.*

[3] *Tongue and groove edges, panel edge clips (one between each support, except two between supports 48 in. on center), lumber blocking, or other.*

[4] *24" for 1/2" panels.*

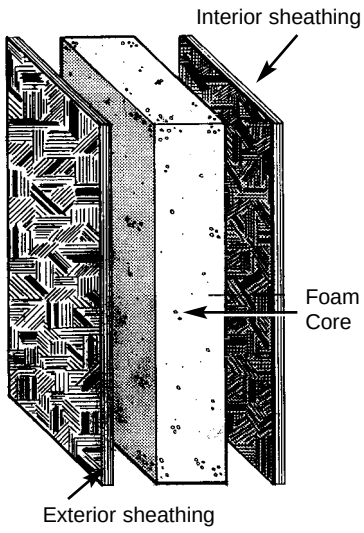
[5] *For enhanced performance SBA recommends a minimum 24/16 rating at 16" oc and minimum 32/16 rating at 24" oc.*

6.0 OTHER USES FOR OSB

6.1 Structural Insulated Panels

Structural Insulated panels (SIPS), also known as foam-core sandwich panels, are becoming increasingly popular for use as structural walls, roofs and floors (see Figure 8). These products provide an alternate solution for owners and builders concerned with energy efficiency and dwindling natural resources. These panels are manufactured in sizes from 4'x 8' to 8'x 24' and have quality certified OSB faces glued to either precast or foamed in place rigid foam cores. They are manufactured throughout the U.S. and Canada in modern quality controlled plants to fit a variety of home designs and can easily be erected on prepared foundations by trained installers. Individual manufacturers certify capacities for the panels in accordance with an ASTM Standard or an ICBO evaluation report. Individual manufacturers have National and local code approval under the National Evaluation System. For more information and a list of panel manufacturers, contact the Structural Insulated Panel Association (www.sips.org).

Figure 8 Typical structural insulated panel



6.2 Wood I-joists

Proprietary OSB is used extensively for the webs of prefabricated wood I-joists. Wood I-joists can be used for longer spans than conventional lumber, and because they are manufactured at a low moisture content greatly reduce performance problems such as nail pops and squeaky floors that sometimes occur with conventional lumber.

Individual I-joist manufacturers certify design values for their products under ASTM Standard D-5055 and also provide a wide range of design information for use by the specifier or builder. Wood I-joists can be cut to desired lengths either on the job site or by order from the manufacturer. Most joists are supplied with knockout ports for the installation of electrical or heating systems. These knockout ports are located within the joists so as not to affect strength performance. SBA recommends the use of min. 1" thick OSB rim joists equal in depth to the I-joist as part of the floor system for added strength and load-carrying capacity. (Refer to ICBO ES Report 124, Acceptance Criteria for Wood-Based Rim Board Products). SBA discourages the use of nailed in place ordinary OSB wall sheathing alone in load bearing rim joist applications. For more information contact the SBA or members of the Wood I-joist Manufacturers Association.

6.2.1 Engineered Floor Systems

Designers and builders are utilizing the superior load-carrying capability of the wood I-joist along with thicker (7/8" or 1") OSB subfloor panels to construct an engineered floor system that gives superior performance in terms of deflection and vibration. This system is very popular for long spans or under ceramic or marble tile finished floors. For more information contact the SBA or the I-joist manufacturer.

6.3 Renovation

OSB can be used in a variety of applications in renovation projects. In addition to sheathing, other applications include replacing or levelling original floors, closing exterior openings due to relocation of doors and windows, or modifying roofs to allow for construction of dormers or lofts. Solid OSB panels are often used to restrict entry to buildings being renovated or as a safety fence around the renovation site. The versatile panels also make excellent hidden forms for the construction of concrete platforms or exterior concrete stairs.

6.4 Industrial Applications

OSB panels are commonly used in industrial applications. The strength, workability, versatility, value and lack of formaldehyde emissions, make them excellent alternatives to plywood and solid wood. Panels specifically identified or rated for roof, wall, and floor applications in wood frame construction may be used directly, or SBA members can customize panel thickness, size or properties of OSB for specific applications. These advantages have been recognized by industrial buyers particularly for crating and packaging, materials handling and manufactured housing applications. More and more OSB is chosen for crating, pallets, bins, furniture frames, display racks and store fixtures.

6.5 Horizontal Diaphragms and Shearwalls

OSB sheathing panels can be used to create horizontal diaphragms and shearwalls in order to brace buildings for wind and seismic loads. Tables 9 and 10 contain the maximum allowable shear forces (plf) for shearwalls and diaphragms. Note that proper design of shearwalls and diaphragms include sizing the perimeter members for axial forces. Also, the connections between the diaphragm and shearwall must be engineered. The shearwall must also be adequately anchored to the supporting wall or foundation and the corners fastened down to prevent the wall from overturning under lateral loads. Please consult with your local building official for any specific requirements.

Alternatively shearwalls and diaphragms can be designed by principles of mechanics without limitations by using values for nails (or staples) strength and panel design properties.

6.6 Engineering Design

The ASCE Standard ASCE 16-95 “LRFD Design of Engineered Wood Construction” is referenced in the model U.S. building codes. The design procedure is known as load and resistance factor design and is an alternative to traditional allowable stress design. The standard combines requirements for solid sawn lumber, glued-laminated timber, structural-use panels and other engineered wood products under one cover. A companion design manual is available from the American Wood Council. APA and SBA have jointly developed a Structural-Use panel supplement for this manual that includes design capacities for OSB.

A second manual developed by the American Wood Council provides guidelines for allowable stress design procedures set forth in the 2005 National Design Specifications for Wood Construction. This manual now in its third revised edition contains two supplements with information on OSB structural use panels and shearwalls and diaphragms.

In Canada design values for OSB are given in the wood design standard CSA O86-01 for panels meeting CSA-O452 “Design Rated OSB” or CSA-O325 “Construction Sheathing”. Contact SBA for additional design information.

6.7 OSB Panels over Metal Framing

The use of OSB panels over metal framing members is possible with modern fastening methods such as self-drilling, self-tapping screws or screw-shank nails. These can be used to attach a wide range of panel thicknesses to steel flanges, or lighter members such as cold-formed steel sections. Construction adhesives recommended by the metal framing manufacturers should be used with hardened screw-shank nails.

Since threads extend only part way up the shank of screws or nails, it is important to specify a fastener length sufficient to engage the metal framing. Load-span recommendations are the same as for wood-frame systems described elsewhere in this manual. The prescriptive method for Residential Cold-Formed Steel Framing (referred by organizations such as AISI, USHUD and NAHBRC) allows OSB wall sheathing to be fastened to steel studs with #8 screws (bugle head, flat head or similar) with a minimum head diameter of 0.29" (8 mm), at every 6" on panel edges and 12" along intermediate supports. This applies only in high wind areas with less than 100 mph winds and in seismic zones 1, 2 or 3.

OSB shearwall panels over metal studs are referenced in allowable shear tables of the 1997 UBC and the 2003 IBC.

Table 9 Allowable Shear Forces (plf) for OSB Shearwalls with Douglas Fir-Larch or Southern Pine Framing [1, 2]

Panel Grade	Minimum nominal panel thickness	Minimum nail penetration into framing	Nail size [7] (common or galv. box)	Nail spacing at panel edges (in.) [3]			
				6	4	3	2 [4]
Structural 1	5/16"	1-1/4"	6d	200	300	390	510
	3/8"	1-1/2"	8d	230 [5]	360 [5]	460 [5]	610 [5]
	7/16"	1-1/2"	8d	255 [5]	395 [5]	505 [5]	670 [5]
	15/32"	1-1/2"	8d	280	430	550	730
	15/32"	1-5/8"	10d [6]	340	510	665	870
Sheathing	5/16"	1-1/4"	6d	180	270	350	450
	3/8"	1-1/4"	6d	200	300	390	510
	3/8"	1-1/2"	8d	220 [5]	320 [5]	410 [5]	530 [5]
	7/16"	1-1/2"	8d	240 [5]	350 [5]	450 [5]	585 [5]
	15/32"	1-1/2"	8d	260	380	490	640
	15/32"	1-5/8"	10d [6]	310	460	600	770
	19/32"	1-5/8"	10d [6]	340	510	665	870

Notes:

[1] *These values are for designs due to seismic loads, and are allowed to be increased by 40 percent for wind loading.*

[2] *All panel edges backed with 2" nominal or wider framing. Panels installed either horizontally or vertically. Space nails at 6" on center along intermediate framing members for 3/8" and 7/16" panels installed on studs spaced 24" on center and 12" on center for other conditions and panel thicknesses.*
Allowable shear values for framing members of other species may be obtained by multiplying the tabulated values by a specific gravity adjustment factor = [1 - (0.5 - SG)] ≤ 1.0. Consult the NDS for SG values.
Allowable shear values are valid when OSB is fastened directly to framing. For installation over gypsum sheathing, refer to applicable building code.

[3] *Where panels are applied on both faces of a wall and nail spacing is less than 6" on center on either side, panel joints shall be offset to fall on different framing members or framing shall be 3" nominal or thicker and nails on each side staggered.*

[4] *Framing at adjoining panel edges shall be 3" nominal or wider and nails staggered where nails are spaced 2" on center.*

[5] *The values for 3/8" and 7/16" panel may be increased to values shown for 15/32" panels, provided studs are spaced a maximum of 16" on center or panels are applied with long dimension across studs.*

[6] *Framing at adjoining panel edges shall be 3" nominal or wider and nails shall be staggered where 10d nails having penetration into framing of more than 1-5/8" are spaced 3" or less on center.*

[7] *Staples may be permitted in lieu of nails. Please consult with your local building code. Allowable shear values are given in the 2003 International Building Code.*

Table 10 Allowable Shear Forces (plf) for OSB Horizontal Diaphragms with Douglas Fir-Larch or Southern Pine Framing[1]

Panel Grade	Common Nail size[5]	Min. nail pen. into framing	Min. panel thick.	Min. nom. width of framing	Blocked Diaphragms Nail spacing at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 and 4) and at all panel edges (Cases 5 and 6)				Unblocked Diaphragms Nails spaced 6" max. at supported edges	
					6"	4"	2-1/2"[2]	2"[2]		
					Nail spacing at other panel edges				Case 1	All other configurations
					6"	6"	4"[2]	3"[2]		
Structural 1	6d	1-1/4"	5/16"	2"	185	250	375	420	165	125
				3"	210	280	420	475	185	140
	8d	1-1/2"	3/8"	2"	270	360	530	600	240	180
				3"	300	400	600	675	265	200
	10d[3]	1-5/8"	15/32"	2"	320	425	640	730	285	215
				3"	360	480	720	820	320	240
			23/32"[4]	3"		650	940			
				4"		755	1080			
Sheathing	6d	1-1/4"	5/16"	2"	170	225	335	380	150	110
				3"	190	250	380	430	170	125
			3/8"	2"	185	250	375	420	165	125
				3"	210	280	420	475	185	140
	8d	1-1/2"	3/8"	2"	240	320	480	545	215	160
				3"	270	360	540	610	240	180
			7/16"	2"	255	340	505	575	230	170
				3"	285	380	570	645	255	190
			15/32"	2"	270	360	530	600	240	180
				3"	300	400	600	675	265	200
	10d[3]	1-5/8"	15/32"	2"	290	385	575	655	255	190
				3"	325	430	650	735	290	215
			19/32"	2"	320	425	640	730	285	215
				3"	360	480	720	820	320	240
			23/32"[4]	3"		645	935			
				4"		750	1075			

Notes:

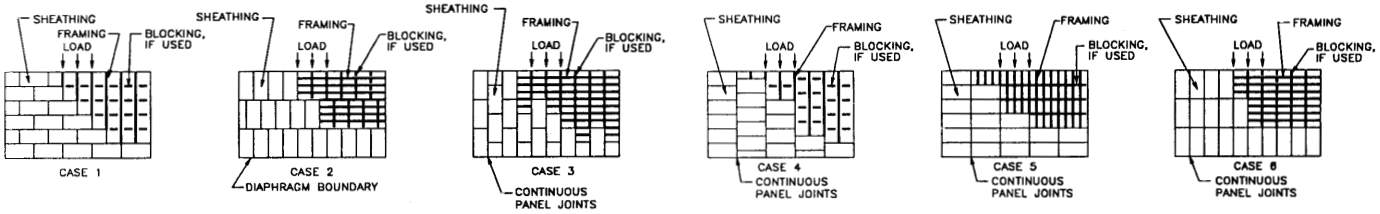
[1] *These values are for designs due to seismic loads, and are allowed to be increased by 40 percent for wind loading. Space nails 12" on center along intermediate framing (6" o.c. where supports are 48" apart). Allowable shear values for framing members of other species may be obtained by multiplying the tabulated values by a specific gravity adjustment factor = [1 - (0.5 - SG)] ≤ 1.0. Consult the NDS for SG values.*

[2] *Framing at adjoining panel edges shall be 3" nominal or wider and nails shall be staggered where nails are spaced 2" or 2-1/2" on center.*

[3] *Framing at adjoining panel edges shall be 3" nominal or wider and nails shall be staggered where 10d nails having penetration into framing of more than 1-5/8" are spaced 3" or less on center.*

[4] *Two lines of fasteners are required for 23/32" sheathing. Values do not apply to the Uniform Building Code, or IBC.*

[5] *Staples may be permitted in lieu of nails. Please consult with your local building code. Allowable shear values are given in the 2003 International Building Code.*



Note: Framing is permitted in either direction for blocked diaphragms

APPENDIX A - GLOSSARY OF TERMS

Deflection:
The amount a panel deflects between two supports when carrying a load. Maximum deflection for roof loads is usually L/240 for live load only or L/180 for total load. For floor loads, maximum deflection is usually L/360 for live load plus dead load.

Major axis (Strength axis):
The axis with the greater stiffness and strength in bending. For OSB, the direction of alignment of the strands in the face layers of the panel.

Minor axis:
The axis with the lesser stiffness and strength in bending. For OSB, the direction at right angles to alignment of the strands in the face layers of the panel.

Nominal thickness:
The trademark-specified thickness marked on the panel.

OSB:
An abbreviation for Oriented Strand Board; a type of mat-formed panel with oriented or aligned strands, resulting in directional properties. OSB conforms to standards such as PS 2, CSA O325 or other national standards.

Performance Rated (or Rated):
Panels which have been tested to meet specific loading and deflection conditions from impact, concentrated static, uniformly distributed and racking loads for panels intended to span two or more supports.

Strand:
A specialized knife cut wood flake of controlled thickness and a length along the grain orientation of at least twice and usually many times its width.

Thermosetting binder:
An adhesive or binder which when fully cured is not softened by heat, and will not break down in the presence of moisture.

Touch Sanded:
A process that removes material from the panel surface to provide a uniform thickness. Tongue and Groove panels are usually touch sanded.

Wafer:
A specialized knife cut wood flake having a controlled length of at least 1 1/4" (30mm) along the grain, a controlled thickness and a variable width.

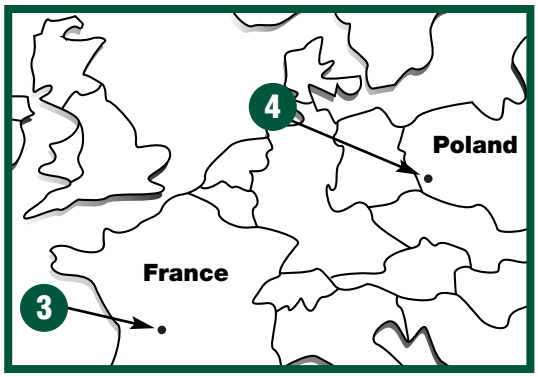
APA - The Engineered Wood Association:
An industry association of plywood, OSB, glulam and engineered wood manufacturers that supplied some information found in this manual. APA provides a quality assurance program for its member companies.

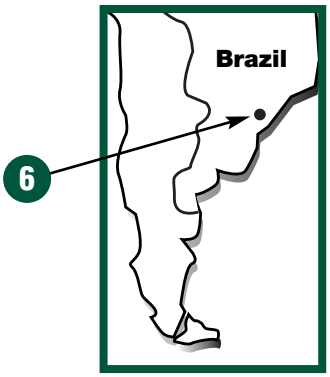
HUD:
The U.S. Department of Housing and Urban Development. HUD sets standards for government financed construction and manufactured homes.

PSI:
Professional Service Industries Inc, Pittsburgh Testing Laboratory; a compliance, assurance and inspection agency with wood products testing facilities in Eugene, OR.

TECO:
A U.S. national inspection and testing agency with wood products testing facilities in Madison, WI, Eugene, OR and Shreveport, LA.

APPENDIX B - SBA MEMBER PLANT LOCATIONS





SBA MEMBER COMPANIES

Member Companies	Address	Telephone and Fax Numbers (Sales Office)	Mill Locations	Map # Reference
Grant Forest Products Inc.	2233 Argentia Road Mississauga, ON Canada L5N 2X7	905-858-3200 905-858-3208	Englehart, ON Canada Timmins, ON Canada	1 2
ISOROY S.A. **(Sonae Industria)**	54-56 rue d'Arcueil, SILIC 135 Immeuble Amsterdam 94523 Rungis Cédex, France	33-1-56-30-20-00 33-1-57-02-12-71	Châtellerault, France	3
Kronopol Sp. z o.o. **(Krono Group Swiss)**	ul. Serbska 56 68-200 Zary, Poland	48-68-363-1100 48-68-363-1262	Zary, Poland	4
Langboard Inc.	P.O. Box 837, Hwy 84 East Quitman, GA U.S.A. 31643	229-263-8943 229-263-5535	Quitman, GA U.S.A.	5
MASISA U.S.A.	900 Circle 75 Parkway, Suite 720 Atlanta, GA, U.S.A. 30339	770-405-2617 770-405-2601	Ponta Grossa, Brazil	6
Panneaux Tembec OSB **(Tembec Forest Products Group)**	775, 122 Street St-Georges de Champlain, QC Canada G9T 5K7	888-343-0735 819-538-0595	St-Georges de Champlain, QC Canada	7

ASSOCIATE MEMBERS

BASF Corporation

Canadian Willamette Industries Inc.

Eugene Forest Systems Ltd.

Hexion Specialty Chemicals

Huntsman Polyurethanes

NGM International Inc.

Tembec Chemical Products Division

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Wilhelm - Klauditz Institut, Germany

AFFILIATED WITH

Alberta Research Council

American Wood Council

Canadian Wood Council

COMACO, Mexico

European Panel Federation

Forintek Canada Corporation

North American Coalition on Green Building

Sustainable Forestry Certification Coalition, Canada

Wood Panel Bureau, Canada

Wood Promotion Network, North America

Wood *WORKS!*, Canada

Structural Board Association

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The Wood Panel Bureau
Le Bureau du panneau de bois

TM420

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