

Timber products used to build U.S. single-family houses in 1988

David B. McKeever
Robert G. Anderson

Abstract

Large volumes of lumber and panel products are used annually to build new single-family houses in the United States. In response to the need by government and industry for new, detailed information on this important market for timber products, a study was conducted by the USDA Forest Service, Forest Products Laboratory, and the Wood Products Promotion Council. Results of this study estimate that the 1,085,000 single-family houses built in the United States in 1988 required 17.2×10^9 board feet ($4.1 \times 10^7 \text{ m}^3$) of lumber, $9.2 \times 10^9 \text{ ft}^2$ ($8.3 \times 10^8 \text{ m}^2$), 3/8-inch (9.5-mm) basis, of structural wood panels, and $3.2 \times 10^9 \text{ ft}^2$ ($2.9 \times 10^8 \text{ m}^2$), 3/8-inch (9.5-mm) basis, of nonstructural wood panels. Regionally, lumber and nonstructural panel consumption was highest in the South; structural panel consumption was highest in the North. Consumption of all timber products in the West was much less than that of other regions primarily due to fewer housing completions in the region. In addition, estimates of lumber, structural panels, and nonstructural panels used in floor, wall, and roof systems, in garages, porches, decks, and in millwork in houses built in the North, South, and West regions of the United States are presented.

New residential construction, which includes single-family, multifamily, and manufactured housing, is an important market for timber products. More than a third of the lumber and structural panel products and more than a fourth of the nonstructural panel products are consumed annually for building U.S. housing units, with more than three-fourths of these amounts used in single-family houses (6). Therefore, the new residential construction market, particularly the new single-family construction market, is important to both forest resource planners and the timber products industry.

To enumerate and evaluate timber products consumption in a variety of end uses, including new single-family residential construction, studies have

been conducted at irregular intervals by the USDA Forest Service, other public agencies, and private organizations (3). Recently, studies of new single-family construction have gathered data from either specific subsets of houses such as single-family detached houses that have been inspected by the Federal Housing Administration (5) or from specific timber products such as structural panels (2). Sometimes this information was not publicly available. Much information being used today is based on extrapolation of trends from these studies.

This paper presents results from a cooperative study conducted by the USDA Forest Service, Forest Products Laboratory, and the Wood Products Promotion Council. The types and quantities of timber products used to build all styles of new single-family houses in the United States in 1988 are estimated by region, building system and application, and wood product. This information was collected from builder surveys, materials use data from recently completed housing blueprints, and housing completions data from the U.S. Department of Commerce. Details of the procedures used to collect this information and the methodology used to estimate consumption in this study are available (1). In addition, estimates are presented of lumber, structural panels, and nonstructural panels that are used in floor, wall, and roof systems, in garages, porches, and decks, and in millwork and miscellaneous uses for new single-family houses built in the North, South, and West regions of the United States.

Building style and applications

Timber products consumption for new single-family residential construction is dependent not only on the number of houses built but also variations in the

The authors are, respectively, Research Forester, USDA Forest Serv., Forest Prod. Lab., One Gifford Pinchot Dr., Madison, WI 53705-2398; and Forest Industry Consultant, 6912 Citrine Ln., S.W., Tacoma, WA 98498. This paper was received for publication in August 1991.
Forest Products Research Society 1992.
Forest Prod. J. 42(4):11-18.

building styles and characteristics and the variations in building applications. Some important building styles and characteristics that affect timber products consumption are foundation type, number of stories, and relative house size. Specific building applications that affect timber products consumption are type, size, and spacing of framing members, type of decking, sheathing and siding materials, and materials for garages, carports, porches, and decks. Information on the number of houses built by U.S. region according to each of the three building characteristics mentioned previously are available from the U.S. Department of Commerce, Bureau of the Census (7.8). Information

on the frequency of building application use and wood products use per application was collected specifically for this study. Details of the procedures used to collect this information and the methodology used to estimate consumption in this study are available (1).

Unless indicated, lumber was measured in board feet (BF (1 BF = 0.0024 m³)); structural and nonstructural panels were measured in square feet (1 ft.² = 0.09 m²), 3/8-inch (9.5-mm) basis.

Timber products consumption

The 1,085,000 single-family houses completed in the United States in 1988 required an estimated 17.2

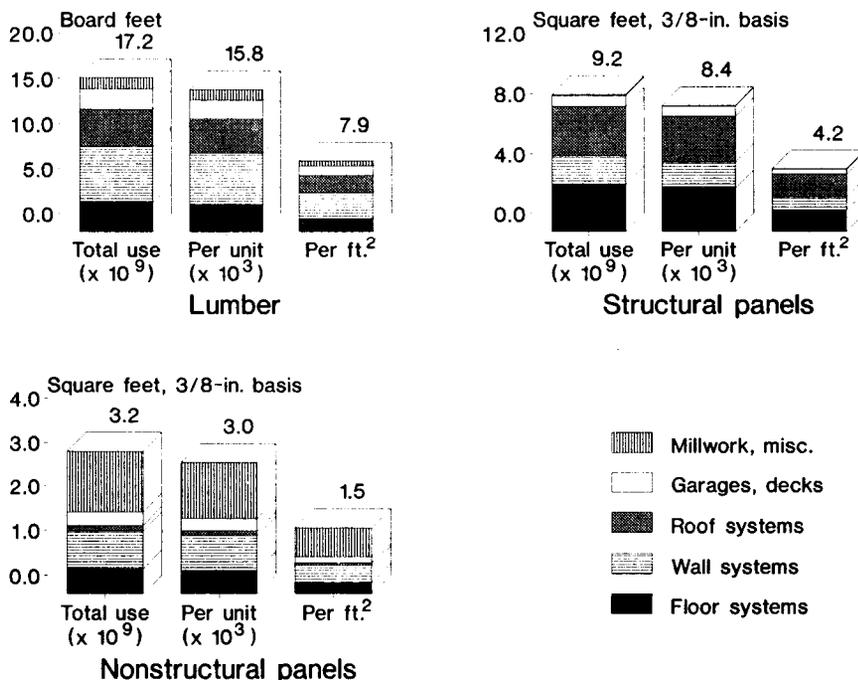


Figure 1. — Timber products used in 1988 for new single-family residential construction. One BF = 0.0024 m³; 1 ft.² = 0.09 m²; 1 inch = 25.4 mm.

TABLE 1. — Timber products used to build U.S. single-family houses in 1988, by region^a

| U.S. region | Lumber and panels, excluding millwork and miscellaneous uses | | | Lumber and panels, including millwork and miscellaneous uses | | |
|-----------------------------------|--|---|----------------------|--|---|----------------------|
| | Lumber (BF) | Structural panels --- (ft. ² , 3/8-in. basis) --- | Nonstructural panels | Lumber (BF) | Structural panels --- (ft. ² , 3/8-in. basis) --- | Nonstructural panels |
| North | | | | | | |
| Total use (× 10 ⁶) | 6,066.9 | 3,140.5 | 413.5 | 6,494.6 | 3,164.1 | 887.4 |
| Use per unit | 15,965.4 | 8,264.6 | 1,088.0 | 17,091.0 | 8,326.6 | 2,335.3 |
| Use per square foot of floor area | 7.94 | 4.11 | 0.54 | 8.50 | 4.14 | 1.16 |
| South | | | | | | |
| Total use (× 10 ⁶) | 6,381.8 | 2,972.7 | 568.7 | 6,873.2 | 3,001.8 | 1,154.8 |
| Use per unit | 13,964.4 | 6,504.8 | 1,244.5 | 15,039.8 | 6,568.5 | 2,526.8 |
| Use per square foot of floor area | 7.03 | 3.27 | 0.63 | 7.57 | 3.31 | 1.27 |
| West | | | | | | |
| Total use (× 10 ⁶) | 3,379.5 | 1,583.0 | 310.5 | 3,724.7 | 1,599.1 | 639.3 |
| Use per unit | 13,626.9 | 6,382.9 | 1,252.1 | 15,019.1 | 6,448.0 | 2,578.0 |
| Use per square foot of floor area | 6.83 | 3.20 | 0.63 | 7.52 | 3.23 | 1.29 |
| United States ^b | | | | | | |
| Total use (× 10 ⁶) | 15,904.0 | 9,081.8 | 1,837.9 | 17,168.4 | 9,150.6 | 3,226.7 |
| Use per unit | 14,658.1 | 8,370.3 | 1,693.9 | 15,823.5 | 8,433.7 | 2,973.9 |
| Use per square foot of floor area | 7.34 | 4.19 | 0.85 | 7.92 | 4.22 | 1.49 |

^aOne BF = 0.0024 m³; 1 ft.² = 0.09 m²; 3/8 inch = 9.5 mm.

^bIncludes applications without regional data.

TABLE 2. — Timber products used in new single-family houses in 1988, by major use area.^a

| Major use area | Lumber (× 10 ⁶ BF) | Structural panels (× 10 ⁶ ft. ² , 3/8-in. basis) | Nonstructural panels |
|-------------------------|----------------------------------|---|----------------------|
| Floor systems | 3,276.6 | 3,155.2 | 573.6 |
| Wall systems | 6,251.9 | 1,915.6 | 843.9 |
| Roof systems | 4,119.5 | 3,307.7 | 121.3 |
| Garages, porches, decks | 2,255.9 | 703.3 | 299.0 |
| Total | 15,904.0 | 9,081.8 | 1,837.9 |
| Millwork and misc. uses | 1,264.4 | 68.8 | 1,388.8 |
| Total | 17,168.4 | 9,150.6 | 3,226.7 |

^a One BF - 0.0024 m³; 1 ft.² - 0.09 m²; 3/8 inch - 9.5 mm. Data may not add to totals because of rounding.

× 10⁹ BF of lumber, 9.2 × 10⁹ ft.² of structural wood panels, and 3.2 × 10⁹ ft.² of nonstructural wood panels (Table 1, Fig. 1). The average house required 15,824 BF of lumber, 8,434 ft.² of structural panels, and 2,974 ft.² of nonstructural panels. Use per square foot of floor area averaged 7.92 BF of lumber and 4.22 and 1.49 ft.² of structural and nonstructural panels, respectively.

In this paper, lumber includes both softwood and hardwood lumber; structural wood panels include softwood plywood and oriented strandboard and waferboard (OSB-waferboard); nonstructural wood panels include particleboard and medium density fiberboard (MDF), hardboard, fiberboard (insulation board), and hardwood plywood. These estimates include the volume of timber products required to build the houses plus the volume contained in products installed in the houses but premanufactured elsewhere. Products like kitchen cabinets, doors, windows, and trim are made in industrial plants and shipped to the job site in finished or semifinished form. As such, these millwork products are often accounted for in reports of industrial wood use or manufacturing (4). Because these wood products are ultimately used in new residential construction, we included volume estimates for completeness. However, separate totals that include and exclude millwork and miscellaneous uses are reported in the tables.

Wall systems were the largest use area for lumber in new houses in 1988, followed by roof systems; floor systems: garages, porches, and decks; and millwork and miscellaneous uses (Table 2). Nearly 6.3 × 10⁹ BF of lumber was used for walls, greater than 50 percent more than was used for roofs and nearly 100 percent more than for floors. Nearly one third of the structural panels consumed in 1988 was used for roofs and another third for floors. More than half the remaining volume was used for walls. Small volumes of structural panels, about 15 percent of total use, were used for garages, porches, decks, and millwork. About 40 percent of nonstructural panels was consumed for millwork and miscellaneous uses. The remaining volume was used mostly in walls as exterior sheathing. Additional details on timber products use in each major use area are presented in this paper.

The largest volume of total lumber and nonstructural panel consumption was in the South in 1988: the largest volume of structural panel consumption

TABLE 3. — Timber products used for single-family floor systems in 1988, by region and application.^a

| U.S. region | Treated-wood foundations | Floor framing ^b | Floor decking | Total floor applications |
|---|--------------------------|----------------------------|---------------|--------------------------|
| Lumber (× 10⁶ BF) | | | | |
| North | n.a. | 1,495.3 | 90.6 | 1,585.9 |
| South | n.a. | 1,036.9 | 17.9 | 1,054.9 |
| West | n.a. | 543.8 | 16.1 | 559.9 |
| Total | 75.9 | 3,076.0 | 124.6 | 3,276.6 |
| Structural panels (× 10⁶ ft.², 3/8-in. basis) | | | | |
| North | n.a. | 27.7 | 1,499.3 | 1,527.0 |
| South | n.a. | 22.6 | 1,061.2 | 1,083.9 |
| West | n.a. | 19.3 | 444.4 | 463.8 |
| Total | 80.6 | 69.6 | 3,004.9 | 3,155.2 |
| Nonstructural panels (× 10⁶ ft.², 3/8-in. basis) | | | | |
| North | -- | 0.4 | 217.5 | 217.9 |
| South | -- | 0.3 | 215.4 | 215.7 |
| West | -- | 0.2 | 139.8 | 139.9 |
| Total | -- | 0.9 | 572.7 | 573.6 |

^a One BF - 0.0024 m³; 1 ft.² - 0.09 m²; 3/8 inch - 9.5 mm. Data may not add to totals because of rounding; n.a. - data not available by region; -- - no use in that area.

^b Includes interior stairways.

was in the North (Table 1). Consumption of all timber products in the West was much less than that in the North and South as a result of fewer housing completions. Timber products use per house (and use per square foot of floor area) was very similar between the South and the West for each product, about 15,000 BF of lumber, 6,500 ft.² of structural panels, and 2,500 ft.² of nonstructural panels. In comparison, houses in the North used about 17,000 BF of lumber, 8,300 ft.² of structural panels, and 2,300 ft.² of nonstructural panels.

Floor systems

Floor systems include treated wood foundations, floor framing, floor decking, and panel types. Lumber used for finished floor covering is included with millwork and miscellaneous uses.

Seventy-five percent of all houses completed in 1988 had conventional wood floor systems, with most using lumber framing and panel decking. We included all houses with full or partial basement or crawl-space foundations and all multistory houses with wood floor systems for the upper stories.

An estimated 3.3 × 10⁹ BF of lumber, 3.2 × 10⁹ ft.² of structural panels, and 0.6 × 10⁹ ft.² of nonstructural panels was used for floor systems in 1988 (Table 3). Floor framing was by far the single largest use area for lumber; floor decking was the single largest use area for structural and nonstructural panels.

The North used more lumber and panels than did the South or West region for floor systems, primarily because less than 6 percent of all houses had nonwood (concrete slab) floor systems. More than a third of all houses in the South and West had nonwood floor systems.

Treated wood foundations

Overall, about 2 percent of the houses completed in 1988 were built on treated wood foundations, requiring an estimated 1.75 BF of lumber and 1.86 ft.²

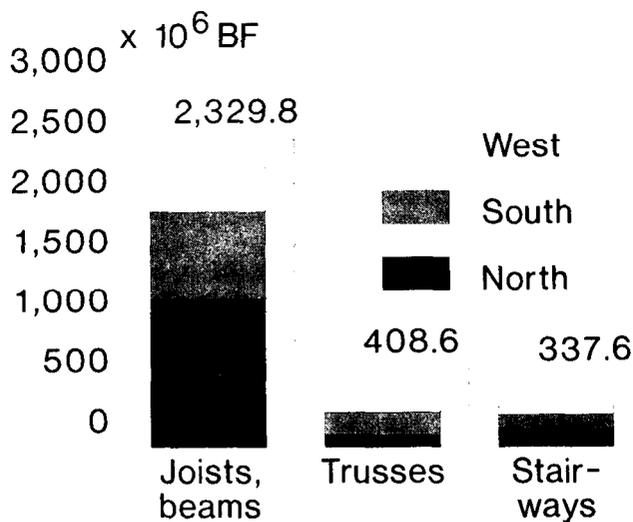


Figure 2. — Lumber used in 1988 for floor framing, by type. One BF = 0.0024 m^3 ; $1 \text{ ft.}^2 = 0.09 \text{ m}^2$; 1 inch = 25.4 mm.

of structural panels per square foot of floor area. An estimated $75.9 \times 10^6 \text{ BF}$ of lumber and $80.6 \times 10^6 \text{ ft.}^2$ of structural panels was used in 1988 for treated wood foundations (Table 3).

Floor framing

Floor framing is the single largest use area for lumber in floor systems. In 1988, an estimated $3.0 \times 10^9 \text{ BF}$ of lumber was consumed in floor joists, beams, bracing, lumber floor trusses and associated framing, and interior stairways (Table 3). Of this, $2.3 \times 10^9 \text{ BF}$ was for joists, beams, and bracing; $0.4 \times 10^9 \text{ BF}$ for trusses and associated framing; and $0.3 \times 10^9 \text{ BF}$ for interior stairways (Fig. 2). In addition, $69 \times 10^6 \text{ ft.}^2$ of structural panels was used for plywood webbed trusses, wood I-beams, other structural panel-framing members, and interior stairways; less than $1 \times 10^6 \text{ ft.}^2$ of nonstructural panels was used for interior stairways. Seventy percent of all houses completed in 1988 had lumber-framed floors, with 12 percent of these being lumber trusses. Overall, 9 percent of all houses had lumber-floor trusses and 3 percent had plywood-webbed trusses or other structural panel-framing members.

Regionally, the North used much more lumber and structural panels for floor framing than did the South or West. This was largely due to the high proportion of basement and crawl-space foundations used in the North compared to that of the other regions.

Floor decking

Floor decking is the single largest use area for structural and nonstructural panels in floor systems but only a minor use area for lumber. More than $3 \times 10^9 \text{ ft.}^2$ of structural panels and more than $0.5 \times 10^9 \text{ ft.}^2$ of nonstructural panels was used for floor decking in 1988 compared to just $125 \times 10^6 \text{ BF}$ of lumber (Table 3).

Floor decking reflects the types of finished flooring to be used. Single-layer floor decking is commonly

used in areas to be carpeted. Areas such as kitchens, baths, and entry halls are frequently finished with materials other than carpeting, such as resilient floor coverings. Here, a multilayer floor decking consisting of a subfloor and an underlayment is often used. The underlayment provides a good base for the resilient floor covering. Ceramic tile, wood-strip or parquet finished flooring, or other finished floor materials can be installed over either a single-layer floor or a multilayer floor system.

More than a third of the structural panel floor decking was used for single-layer floors, 35 percent for multilayer subfloor, and 25 percent for multilayer underlayment. When nonstructural panels are used for floor decking, they are most frequently used as multilayer underlayment. More than 70 percent of the nonstructural panels used for floor decking was underlayment. Lumber use was almost equally divided between single-layer and multilayer floor decking.

The North led all regions in the use of wood as a floor decking material in 1988. Nearly three-fourths of the lumber, half of the structural panel, and more than a third of the nonstructural panel floor decking were used in the North.

Panel types

Of the $3.2 \times 10^9 \text{ ft.}^2$ of structural panels used for floor systems in 1988, 85 percent, or $2.7 \times 10^9 \text{ ft.}^2$, was softwood plywood and $0.5 \times 10^9 \text{ ft.}^2$ was OSB-waferboard. Little variation was evident in the percentage used between regions. Particleboard, hardboard, and hardwood plywood were the nonstructural panels used in floor systems. A total of $573.6 \times 10^6 \text{ ft.}^2$ of nonstructural panels was consumed. Nearly $565 \times 10^6 \text{ ft.}^2$ (98%) of this was particleboard; the remaining material (2%) was hardboard and hardwood plywood.

Wall systems

Wall systems include exterior and interior wall framing and furring strip, exterior wall sheathing and siding, and interior shear wall sheathing. Interior shear walls are interior walls designed to provide additional shear strength to wood-framed structures. Interior shear walls are desirable in areas of the country with frequent seismic activity or high wind loads. Interior finished wall coverings such as hardwood plywood paneling, lumber paneling and wainscoting, or decorative wall moldings and millwork are included in the Millwork and miscellaneous uses section.

An estimated $6.3 \times 10^9 \text{ BF}$ of lumber, $1.9 \times 10^9 \text{ ft.}^2$ of structural panels, and $0.8 \times 10^9 \text{ ft.}^2$ of nonstructural panels was used for wall systems in 1988 (Table 4). Wall systems accounted for about 40 percent of total lumber use, 20 percent of structural panel use, and 25 percent of nonstructural panel use in new single-family construction. Exterior wall framing was the single largest use for lumber and exterior wall sheathing was the single largest use for structural panels. Nonstructural panel use was almost equally divided between exterior wall sheathing and exterior siding.

TABLE 4. — Timber products used for single-family wall systems in 1988, by region and application.^a

| U.S. region | Wall framing | | Exterior wall sheathing | Exterior wall siding | Total wall applications |
|---|--------------|----------|-------------------------|----------------------|-------------------------|
| | Exterior | Interior | | | |
| Lumber (× 10⁶ BF) | | | | | |
| North | 1,194.3 | 888.4 | 6.6 | 209.4 | 2,298.7 |
| South | 1,243.8 | 1,030.3 | 15.5 | 213.1 | 2,502.7 |
| west | 798.5 | 545.3 | 18.1 | 88.7 | 1,450.6 |
| Total | 3,236.6 | 2,464.0 | 40.1 | 511.2 | 6,251.9 |
| Structural panels (× 10⁶ ft.², 3/8-in. basis) | | | | | |
| North | -- | -- | 390.1 | n.a. | 390.1 |
| South | -- | -- | 399.3 | n.a. | 399.3 |
| west | -- | -- | 255.2 | n.a. | 255.2 |
| Total | -- | -- | 1,045.5 ^b | 870.1 | 1,915.6 |
| Nonstructural panels (× 10⁶ ft.², 3/8-in. basis) | | | | | |
| North | -- | -- | 102.8 | n.a. | 102.8 |
| South | -- | -- | 220.0 | n.a. | 220.0 |
| West | -- | -- | 97.6 | n.a. | 97.6 |
| Total | -- | -- | 420.4 | 423.5 | 843.9 |

^a One BF = 0.0024 m³; 1 ft.² = 0.09 m²; 3/8 inch = 9.5 mm. Data may not add to totals because of rounding; n.a. = data not available by region; -- = no use in that area.

^b Total Includes 0.9 × 10⁶ ft.², 3/8-inch basis, of structural panels used for interior shear walls.

Overall, more timber products were used in the South for wall construction than in the North or West. This is due primarily to the larger number of houses built in the South than in the other regions. Differences in building applications, such as the increased use of nominal 2- by 6-inch (standard 38- by 140-mm) framing in the North compared to the South, resulted in larger volumes of framing lumber used per house in the North. However, the larger number of houses completed in the South made that region the leading user of timber products for walls.

Wall framing

Nearly all houses built in the United States have wood-framed exterior walls. Even many houses that appear to be masonry are in fact wood framed with a masonry veneer. Not surprisingly, wall framing is the single largest market for lumber in new single-family house construction. More than 3.2 × 10⁹ BF of lumber was used for exterior wall framing and 2.5 × 10⁹ BF for interior wall framing in 1988 (Table 4). Exterior wall framing exceeded interior wall framing by about 30 percent. Small amounts of structural panels were also used as spacers in door and window headers. These amounts are included with wall sheathing.

The volume of lumber used to frame walls depends on both the number of houses built and the frequency of stud size and spacing. Houses built with nominal 2- by 4-inch (standard 38- by 89-mm) studs spaced 16 inches (406 mm) on center require more lumber than those built with 2 by 4's spaced 24 inches (610 mm) on center. Similarly, walls framed with 2 by 4's require less lumber than walls framed with 2 by 6's with equal spacing. Therefore, stud size and spacing are important determinants of lumber use. Figure 3 summarizes the incidence of framing size and spacing in houses built in 1988.

Nominal 2 by 4 dimension lumber is the preferred wall framing material in the United States. Overall, 73 percent of all exterior walls and 97 percent of all

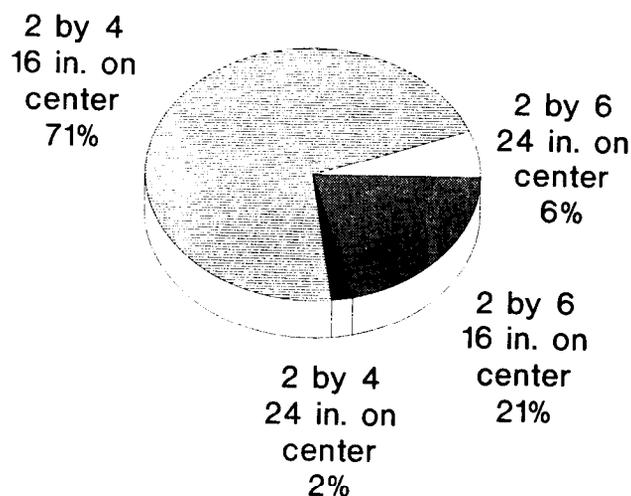


Figure 3. — Exterior wall stud size and spacing used in 1988. One inch = 25.4 mm.

interior walls were framed with 2 by 4's. The use of 2 by 6 framing was greatest in the North where thicker walls aid energy conservation measures. When 2 by 6 framing is used, it is most often spaced 16 inches on center, not 24 inches as expected. This reluctance to change to 24-inch spacing may be an attempt by builders to satisfy consumers' perceptions of good building practices.

Regionally, more lumber for wall framing was used in the South than was used in the North or West. The increased use of 2 by 6 framing lumber in the North and West tended to increase use for exterior walls, making the gap between the use of exterior and interior wall framing greater than that in the South.

Wall sheathing

In 1988, more than 1 × 10⁹ ft.² of structural panels was used for exterior wall sheathing in new single-family houses (Table 4), of which nearly 1 × 10⁶ ft.² was

for interior shear walls. An additional 0.4×10^9 ft.² of nonstructural panels was also used. Overall, nearly 1.5×10^9 ft.² of panels was used for exterior wall sheathing. Regional patterns of consumption closely followed regional housing completion patterns, with the South leading all regions, followed by the North and West.

Many different types of materials are used for exterior wall sheathing. Wood products, including lumber, softwood plywood, OSB-waferboard, and fiberboard, as well as nonwood products, including unfaced and foil-faced foamed plastic panels, are commonly used. The volume of timber products used for wall sheathing is dependent on the frequency of use of these wall sheathing materials. Figure 4 shows the incidence of products used for exterior wall sheathing in 1988.

Exterior siding

An estimated 511×10^6 BF of lumber siding, 870×10^6 ft.² of structural panel siding, and 424×10^6 ft.² of nonstructural panel siding was used for new single-family houses built in 1988 (Table 4). Additional

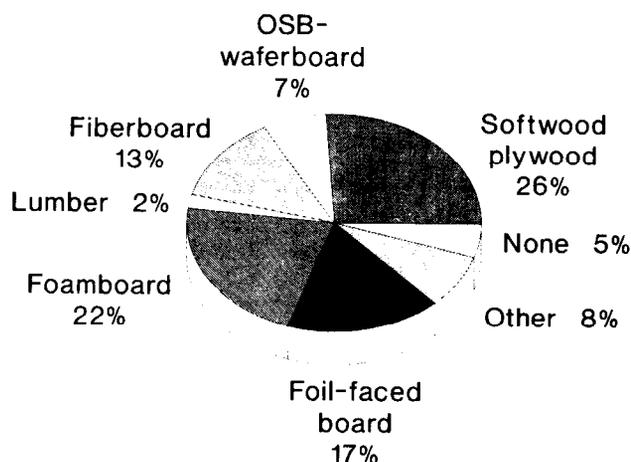


Figure 4. — Exterior wall sheathing used in 1988, by type.

volumes of siding were used for fascia, soffits, and trim on the house, as well as for garage and porch siding and trim. These additional volumes are discussed later in this paper.

Like wall sheathing, many different types of materials are used for exterior wall sidings and facings. These include various wood, metal, plastic, cement, and masonry products. More than one exterior facing is often used on the same house. For example, 17 percent of all houses built in 1988 used lumber siding exclusively, and 9 percent used lumber plus other siding materials. Overall, wood-based siding accounted for more than half of the wall area sided in 1988.

Panel types

Seventy-eight percent of the $1,046 \times 10^6$ ft.² of structural panels used for wall sheathing was softwood plywood in 1988; 22 percent was OSB-waferboard. This amounts to 815×10^6 ft.² of plywood and 230×10^6 ft.² of OSB-waferboard. Information on panel types for structural panel siding was not available. Regional differences in panel types used are discussed in the previous Wall sheathing section.

Nonstructural wall sheathing panels were almost exclusively fiberboard, and nearly all nonstructural panel siding was hardboard.

Roof systems

Roof systems include roof and ceiling framing, roof sheathing, fascia, soffits, and other trim. Structures attached to the roof such as gables and chimneys are also included.

In 1988, an estimated 4.1×10^9 BF of lumber, 3.3×10^9 ft.² of structural panels, and 0.1×10^9 ft.² of nonstructural panels was used in roof systems (Table 5). Roof framing was by far the leading use for lumber with nearly 90 percent of all lumber being used. Roof sheathing was the single largest use area for structural panels at 2.6×10^9 ft.² or 80 percent of total use. Nonstructural panel use was small and almost equally divided between sheathing and fascia, soffits, and trim.

TABLE 5. — Timber products used for single-family roofs systems in 1988, by region and application.^a

| U.S. region | Roof framing | Roof sheathing | Fascia, soffits, and trim | Total roof applications |
|---|--------------|----------------|---------------------------|-------------------------|
| Lumber ($\times 10^6$ BF) | | | | |
| North | 1,235.0 | 9.4 | 90.1 | 1,334.4 |
| South | 1,733.7 | 70.7 | 132.7 | 1,937.1 |
| West | 712.2 | 34.8 | 100.9 | 848.0 |
| Total | 3,681.0 | 114.9 | 323.7 | 4,119.5 |
| Structural panels ($\times 10^6$ ft.², 3/8-in. basis) | | | | |
| North | 57.0 | 926.8 | 65.3 | 1,049.1 |
| South | 111.7 | 1,098.9 | 132.7 | 1,343.2 |
| West | 62.7 | 618.3 | 50.4 | 731.4 |
| Total | 231.4 | 2,644.0 | 432.3 ^b | 3,307.7 |
| Nonstructural panels ($\times 10^6$ ft.², 3/8-in. basis) | | | | |
| North | -- | 35.7 | 10.6 | 46.3 |
| South | -- | 22.1 | 28.2 | 50.3 |
| West | -- | 10.8 | 13.9 | 24.7 |
| Total | -- | 68.7 | 52.6 | 121.3 |

^a One BF = 0.0024 m³; 1 ft.² = 0.09 m²; 3/8 inch = 9.5 mm. Data may not add to totals because of rounding; --- no use in that area.

^b Total includes 184×10^6 ft.² of structural panel siding use.

Roof framing

Roof framing is the single largest use area for lumber in roof systems and is second only to wall framing in total lumber use. In 1988, an estimated 3.7×10^9 BF of lumber was used for roof framing (Table 5). This includes ceiling joists, roof rafters, roof trusses and associated framing, and miscellaneous roof structures. In addition, 0.2×10^9 ft² of structural panels was used for laminated beams and truss gussets.

Two types of roof-framing systems are commonly used in single-family houses—rafter-joist framing and truss framing. In 1988, trusses were used in nearly 62 percent of all houses built, accounting for about half the framing lumber used; rafters were used in nearly 38 percent of the houses, accounting for another half of the lumber used. Less than 1 percent of new houses had steel or other types of roof-framing systems.

In 1988, although nearly twice as many truss-framed roofs were built than were rafter-joist-framed roofs, the volume of lumber used was nearly equal. This is because trusses are nearly always spaced 24 inches on center and rafters and joists are spaced 16 inches on center more than half the time. This reduces the number of trusses required and, therefore, lumber use. Also, materials other than lumber are used in trusses, such as structural panel webbing, reducing further the lumber requirement.

Substantial differences existed in roof-framing methods by region. All regions used trusses more frequently than traditional rafter-joist systems. However, the South used rafters in 45 percent of the houses, compared to 35 percent in the North, and just 29 percent in the West. In terms of spacing, the North was the most conservative with 69 percent of rafters and 8 percent of trusses being 16 inches on center, and the West was the most liberal with 34 percent of rafters and 4 percent of trusses being 16 inches on center. The South was intermediate in rafter spacing. These regional differences in roof type and spacing reflect differences in architectural design and climatic differences in snow- and wind-load conditions.

Roof sheathing

Structural panels are the preferred roof-sheathing material, with 91 percent of all roofs having structural panel sheathing. In 1988, lumber was used for just 6 percent of the roofs: a small percentage of nonstructural panel sheathing was used. These percentages translate to 2.6×10^9 ft² of structural panels used in 1988, 0.1×10^9 BF of lumber, and less than 0.1×10^9 ft² of nonstructural panels (Table 5). When lumber sheathing was used, the boards were spaced 19 percent of the time and unspaced 81 percent.

Regional variations in roof sheathing use do exist but are not of major importance. As expected, structural panel consumption was greatest in the South, based on the number of units built (Table 5). The North was a close second, followed by the West. Lumber sheathing was used twice as often in the South as in the West, the second-largest user. Little lumber sheathing was used in the North, only 1 percent of all

roofs. About 8 percent used lumber for roof decks in the South and the West.

Fascia, soffits, and trim

Fascia, soffits, and miscellaneous trim use substantial volumes of lumber and panel products, despite recent product development by metal and plastic trim companies. Lumber has about 61 percent of the fascia market and 20 percent of the soffits market, structural panels 11 and 43 percent, and nonstructural panels 8 and 7 percent, respectively.

In 1988, 0.3×10^9 BF of lumber, 0.2×10^9 ft² of structural panels, and less than 0.1×10^9 ft² of nonstructural panels was used for fascia, soffits, and trim (Table 5). In addition, 0.2×10^9 ft² of structural panel siding was used for fascia and soffits. The West had a greater volume of lumber use for both fascia and soffits than did the other regions.

Panel types

Overall, 80 percent of the $3,307 \times 10^6$ ft² of structural panels used for roof systems was softwood plywood in 1988; 20 percent was OSB-waferboard. This amounts to $2,643 \times 10^6$ ft² of plywood and 664×10^6 ft² of OSB-waferboard. About 75 percent of the structural panel sheathing, 99 percent of the fascia and soffits, and 93 percent of roof-framing structural panels were softwood plywood. The North tended to use more OSB-waferboard as a proportion of all structural panels for roofs than did other regions. Slightly more than one fourth of the structural panels used in the North were OSB-waferboard, compared to 18 and 20 percent in the South and West, respectively.

Nonstructural panels were about half fiberboard and half hardboard on a 3/8-inch basis. However, on a surface measure only about 20 percent of the nonstructural panels were fiberboard.

Garages, carports, porches, and decks

Garages, carports, porches, and decks are becoming an increasingly important market for lumber and panel products. An estimated 2.3×10^9 BF of lumber, 0.7×10^9 ft² of structural panels, and 0.3×10^9 ft² of nonstructural panels was used for these applications in 1988 (Table 6). A larger proportion of lumber than panels was used for porches and decks.

Garages and carports

An estimated 1.4×10^9 BF of lumber, 0.4×10^9 ft² of structural panels, and 0.2×10^9 ft² of nonstructural panels was used to build garages and carports in 1988 (Table 6). This includes both detached garages and carports and that portion of attached garages and carports that were not directly attributable to the house. These estimates assume framing and sheathing characteristics of garages and carports to be the same as that of the houses, and as such, the percentage use of specific panel types reflect those of the houses.

Porches and decks

Porches and decks are another area where additional volumes of wood products are used. The renewed

TABLE 6. — Timber products used for single-family garages, carports, porches, decks, and millwork and miscellaneous uses in 1988. by region and application.^a

| U.S. region | Garages, carports, porches, and decks | | | Total | Millwork and miscellaneous uses |
|---|---------------------------------------|-------------------|------------------|---------|---------------------------------|
| | Garages and carports | Porches and decks | Siding | | |
| Lumber (× 10⁶ BF) | | | | | |
| North | 482.8 | 365.1 | (b) ^b | 847.9 | 427.7 |
| South | 535.4 | 351.7 | (b) | 887.1 | 491.4 |
| West | 376.4 | 144.6 | (b) | 521.0 | 345.3 |
| Total | 1,394.5 | 861.4 | (b) | 2,255.9 | 1,264.6 |
| Structural panels (× 10⁶ ft.², 3/8-in. basis) | | | | | |
| North | 160.1 | 14.3 | n.a. | 174.3 | 23.5 |
| South | 130.9 | 15.5 | n.a. | 146.3 | 29.1 |
| West | 120.2 | 12.4 | n.a. | 132.6 | 16.2 |
| Total | 411.1 | 42.2 | 250.0 | 703.3 | 68.8 |
| Nonstructural panels (× 10⁶ ft.², 3/8-in. basis) | | | | | |
| North | 42.9 | 3.5 | n.a. | 46.4 | 473.9 |
| South | 72.7 | 10.0 | n.a. | 82.6 | 586.0 |
| West | 44.2 | 4.1 | n.a. | 48.3 | 328.8 |
| Total | 159.8 | 17.5 | 121.7 | 299.0 | 1,388.8 |

^a One BF - 0.0024 m³; 1 ft.² - 0.09 m²; 3/8 inch - 9.5 mm. Data may not add to totals because of rounding; n.a. - data not available by region.

^b (b) - siding included with specific application.

popularity of porches and decks in the past few years has made them an important application for wood use. Although lumber is the major product used, substantial amounts of panels are used as well (Table 6).

Siding

In addition to the panel volumes previously reported for garages, carports, porches, and decks, 0.3 × 10⁹ ft.² of structural panels and 0.1 × 10⁹ ft.² of nonstructural panel siding was used in 1988 (Table 6). Lumber-siding volumes are included with the volumes reported for garages and porches.

Millwork and miscellaneous uses

Millwork and miscellaneous uses add substantial volumes of timber products to new houses. In 1988, an estimated 1.3 × 10⁹ BF of lumber, 0.07 × 10⁹ ft.² of structural panels, and 1.4 × 10⁹ ft.² of nonstructural panels was used for millwork and miscellaneous uses in new single-family houses (Table 6). These uses include windows, doors, kitchen and bathroom cabinets, mouldings, trim, interior wall coverings, and finished flooring. Details of the procedures used to develop these estimates and a summary of use by type of application can be found (1).

Conclusions

The amount of timber products consumed for new single-family residential construction is dependent on the number of houses built, variations in overall building styles and characteristics of these houses, and variations in specific building applications and wood products used in each application. In 1988, 1,085,000 single-family houses were built in the United States. These houses required an estimated 17.2 × 10⁹ BF of lumber, 9.2 × 10⁹ ft.² of structural wood panels, and 3.2 × 10⁹ ft.² of nonstructural wood panels to build. The average house required 15,824 BF of lumber, 8,434 ft.² of structural panels, and 2,974 ft.² of nonstructural panels. Use per square foot of floor area

averaged 7.92 BF of lumber and 4.22 and 1.49 ft.² of structural and nonstructural panels, respectively.

In total, more lumber was used to build new houses in the South than in any other region, although houses in the North used more lumber per unit and per square foot of floor area. Houses in the West used less lumber in total, per unit, and per square foot of floor area. Structural panel use was greatest in the North in total, per unit, and per square foot of floor area, followed by the South and West, respectively. Although nonstructural panel use was greatest in the South in total, the West led all regions in use per unit and per square foot of floor area.

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