[Wood Products Council. 1999. Wood used in new residential construction –1998 and 1995. Tacoma, WA: APA-The Engineered Wood Assoc. 14 p.]

WOOD USED IN NEW RESIDENTIAL CONSTRUCTION 1998 AND 1995

Prepared for the

Wood Products Council

Sponsors:

APA - The Engineered Wood Association

Canadian Wood Council

Forintek Canada Corporation

Southern Forest Products Association

United States Forest Service

Western Wood Products Association

by

NAHB Research Center, Inc.
400 Prince George's Boulevard
Upper Marlboro, Maryland 20774

December, 1999

Price: $600.00

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I. INTRODUCTION

The new home market has been and continues to be of major importance to the wood products industry. The Wood Products Council with funding from the APA - The Engineered Wood Association, Western Wood Products Association, Southern Forest Products Association, Canadian Wood Council, U.S. Forest Service, and Forintek Canada Corporation commissioned the NAHB Research Center, Inc. to conduct a study of wood product usage for new homes built in 1998. The Research Center also revised previously issued 1995 data on new residential usage in the United States so its definition of single- and multifamily housing match the definitions used in 1998. The revised 1995 study and this 1998 study use the same methodology and the same use factors to calculate wood and panel usage. Comparisons of these two years show a clear trend towards greater use of engineered lumber, with use per single-family dwelling increasing 78 percent over the three-year period.

Data for new construction in the United States was gathered through the Research Center's annual Builder Practices Survey, a comprehensive, syndicated study of builder construction practices. Approximately 2,000 responses were received to a 1998 survey that was mailed to builders across the United States. Data for Canada was gathered by Forintek Canada Corporation through a similar mailing, and data for HUD-Code Manufactured Housing[1] was gathered by the APA through a mailing to the manufactured housing plants. Volumes of material were calculated using formulas to convert key general characteristics of new homes to linear feet of exterior and interior wall and footprint of house and roof. Key general characteristics include such information as:

- square footage of floor area,
- number of stories,
- price-point and size of house,
- number and location of garage spaces,
- roof overhang, and
- inclusion and size of porches.

Wood use factors were then applied to square feet of floor, roof, and linear feet of wall to determine volumes of material used. The wood use factors were developed for the 1995 study by the Research Center based on practical experience in construction and on studies of blue prints. The wood use factors were updated for the 1998 report (and revised 1995 report) in response to comments made on the 1995 study by industry experts. Adjustments to the wood use factors included accommodations for temporary structures, finished basements, and increased amounts of waste lumber. These adjustments, which increased wood usage, were offset by the definitional changes to housing, with the net result of reducing 1995 lumber usage 1.8 percent from the data originally reported in 1996.

In addition to these two studies, the Wood Products Council sponsored a similar study of 1988 usage. Although the two methodologies differ, results of the studies are fairly consistent. Caution should be used, however, in comparison of the two later studies with the earlier study.

[1] HUD-Code Manufactured Housing, also known as Manufactured Housing, refers to factory-built structures built in conformance to the Federal Manufactured Home Construction and Safety Standards. In the past these homes were referred to as Mobile Homes.

II: EXECUTIVE SUMMARY

New home construction, including Manufactured Housing, accounted for 22.7 billion board feet of softwood lumber or 38.0 percent of the 59.9 billion board feet used in North America in 1998. In addition, new home construction accounted for 18.0 billion square feet (3/8 inch basis) of structural panel usage in North America or 48 percent of the 37.4 billion square feet consumed in North America.

Usage includes all softwood lumber in the construction of new homes, including applications from Permanent Wood Foundations™ to finish moldings. Not only are lumber and panel uses taken into consideration in calculating wood usage in new homes, but wood products such as wood stiles and rails in steel and fiberglass doors are included in this study. Wood usage for the various applications are detailed in the appendices for each of the following markets:

- new residential construction in the United States,
- new residential construction in Canada,
- Manufactured Housing in the United States.

In the United States, new residential construction includes single- and multifamily homes. In this study, single-family homes include single-family detached and single-family attached units (townhouses). Multifamily homes represent apartments only. Manufactured homes are built to HUD specifications in licensed factories, shipped to sites on integral chassis, and "placed" on temporary or permanent foundations. Manufactured Housing placements are not included in residential housing starts except in the state of Maine. In Canada, new residential construction includes single- and multifamily homes as in the United States. However, single-family includes only single-family detached, and multifamily includes townhouses and apartments.

WOOD USAGE

The table below shows the total amounts of lumber and panels used in the United States for 1998, 1995, and 1988 and for Canada for 1998 and 1995. Volume changes are largely the result of increased numbers of housing starts.

TABLE 1
WOOD PRODUCT USE BY HOUSING TYPE

United States		Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions SF Panels (3/8" basis)					Softwood Plywood	Oriented Strand Board	Total	
Single-family	1998	17,592	516	1,681	4,547	9,543	14,090	3,166
	1995	14,213	404	802	4,557	6,953	11,511	2,396
	1988	16,777	na	221	7,498	1,653	9,151	3,227
Multifamily	1998	1,636	56	194	464	760	1,224	454
	1995	1,243	42	93	394	503	897	383
	1988	2,519	na	95	1,191	214	1,405	510
Manufactured Homes	1998	2,073	25	32	547	1,038	1,585	909
	1995	1,530	18	0	123	1,663	1,786	418
	1988	725	na	0	110	402	512	515
TOTAL U.S.	1998	21,300	595	1,907	5,557	11,341	16,898	4,530
	1995	17,076	469	894	5,076	9,177	14,253	3,564
	1988	20,021	483	316	8,800	2,269	11,068	4,252
Canada								
Single-family	1998	1,063	37	163	373	415	788	136
	1995	838	35	41	210	286	496	61
Multifamily	1998	315	7	69	118	150	268	86
	1995	220	4	14	63	106	169	28
Total Canada	1998	1,377	44	231	492	564	1,056	222
	1995	1,058	39	58	273	392	665	90

(1) Engineered Wood Conversion to board foot equivalent: I-joist linear feet X 2; Others, cubic volume X 16.

Table 2 below disaggregates total wood usage by six applications:

- exterior and interior wall systems, including finished basements and garages;
- floor systems inside the finished house;
- roof systems, including garages and porches;
- millwork, including cabinets, flooring, moulding, doors, windows, siding, and roofing;
- foundations, including temporary structures and treated wood foundations; and
- outdoor structures, including decks, porches (except roofs), fences and walls.

Because the data comes from many sources, there may be some discrepancies in definition. For instance, the 1998 data for porch roofs is included in roof framing and sheathing rather than with outdoor structures. Nevertheless, the tables provide a comparison of the three years of data for the United States and the two years of data for Canada.

TABLE 2
WOOD PRODUCTS USED BY APPLICATION
INCLUDES SINGLE-FAMILY, MULTIFAMILY AND MANUFACTURED HOUSING

United States – 1998	Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions of SF Panels (3/8" basis)				Softwood Plywood	Oriented Strand Board	Total	
Floor Systems	3,297	0	1,602	2,462	2,665	5,127	930
Wall Systems	7,460	0	158	857	3,225	4,082	586
Roof Systems	6,888	0	147	1,945	5,276	7,221	67
Millwork	2,175	595	0	264	175	439	2,947
Foundations	342	0	0	29	0	29	0
Outdoor Structures	1,138	0	0	0	0	0	0
Total	21,300	595	1,907	5,557	11,341	16,898	4,530

United States – 1995	Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions of SF Panels (3/8" basis)				Softwood Plywood	Oriented Strand Board	Total	
Floor Systems	2,406	0	693	1,866	1,750	3,616	1,028
Wall Systems	6,201	0	112	906	3,090	3,996	440
Roof Systems	5,276	0	89	2,018	4,103	6,121	0
Millwork	1,952	469	0	263	234	497	2,096
Foundations	281	0	0	23	0	23	0
Outdoor Structures	960	0	0	0	0	0	0
Total	17,076	469	894	5,076	9,177	14,253	3,564

(1) Engineered Wood Conversion to board foot equivalent: I-joist linear feet X 2; Others, cubic volume X 16.

United States – 1988	Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions of SF Panels (3/8" basis)				Softwood Plywood	Oriented Strand Board	Total	
Floor Systems	3,837	0	265	3,208	626	3,834	1,092
Wall Systems	8,453	0	43	2,003	520	2,523	1,295
Roof Systems	5,513	0	8	3,378	1,113	4,491	173
Millwork	1,062	483	0	94	0	94	1,674
Foundations	230	0	0	80	0	80	0
Outdoor Structures	926	0	0	37	9	46	18
Total	20,021	483	316	8,800	2,269	11,068	4,252

Canada – 1998	Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions of SF Panels (3/8" basis)				Softwood Plywood	Oriented Strand Board	Total	
Floor Systems	210	0	211	202	190	392	59
Wall Systems	590	0	11	93	216	309	8
Roof Systems	322	0	9	179	154	333	0
Millwork	157	44	0	17	4	21	155
Foundations	33	0	0	1	0	1	0
Outdoor Structures	65	0	0	0	0	0	0
Total	1,378	44	232	492	565	1,056	222

Canada - 1995	Softwood Lumber	Hardwood Lumber	Engineered Wood (1)	Structural Panels			Non-Structural Panels
Millions of BF Lumber and Engineered Wood (1) Millions of SF Panels (3/8" basis)				Softwood Plywood	Oriented Strand Board	Total	
Floor Systems	218	0	56	109	153	262	13
Wall Systems	432	0	1	21	135	156	0
Roof Systems	221	0	1	134	103	237	0
Millwork	133	39	0	9	1	10	77
Foundations	14	0	0	0	0	0	0
Outdoor Structures	40	0	0	0	0	0	0
Total	1,058	39	58	273	392	665	90

(1) Engineered Wood Conversion to board foot equivalent: I-joist linear feet X 2; Others, cubic volume X 16.

HOUSING STARTS AND GENERAL CHARACTERISTICS

According to the U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau, 1.271 million single-family and 346 thousand multifamily homes were constructed (started) in 1998 for a total of 1.617 million dwellings. This is a 19.4 percent increase in the number of housing starts reported in 1995 when 1076 thousand single-family and 278 thousand multifamily units were started. Single-family starts increased 18.1 percent, and multifamily starts increased 24.3 percent. From the increase in housing starts alone, wood usage would be expected to increase between 18 and 19 percent in new residential construction, provided usage rates remained the same. In 1988, there were 1,081 thousand single-family starts and 407 thousand multifamily starts.

In Canada, 86 thousand single-family detached and 51 thousand townhouses and apartments were constructed in 1998 for a total of 137 thousand dwellings. This is a 23.4 percent increase in the number of housing starts reported in 1995. Canada reported 64 thousand single-family detached starts and 47 thousand townhouses and apartments in 1995. Single-family increased 34.4 percent, and multifamily increased 8.5 percent. From the increase in housing starts alone, wood usage in Canada would be expected to increase between 29 and 31 percent in new residential construction, provided usage rates remained the same.

Table 3 below shows housing starts, Manufactured Housing placements, average finished floor area, and average price.[2] Data shown is for all single-family and multifamily apartments in the United States as defined above. Housing start data is as reported by the Bureau of Census for 1 unit, 2 units, 3 and 4 units, and five plus units.

TABLE 3
HOUSING CHARACTERISTICS
UNITED STATES HOUSING

U.S. Housing Starts[2] (Thousands)	1995	1996	1997	1998
Single-family	1,076.2	1,160.9	1,133.7	1,271.4
Multifamily	277.9	315.9	340.3	345.5
Total	1,354.1	1,476.8	1,474.0	1,616.9
Manufactured Housing	319.4	338.4	338.1	369.0
Grand Total	3,027.6	3,292.0	3,286.1	3,602.8
Change		4.3%	.5%	9.6%

[2] Data on starts, placements, average floor area of manufactured homes, and average price of Manufactured Homes and single-family comes from the Bureau of the Census except for the average price of single family homes in 1998. This data and the average floor area of single- and multifamily housing comes from the NAHB Research Center's Builder Practices Survey.

House Size, (Square feet of floor area)	1995	1996	1997	1998
Single-Family	2,021	1,972	1,999	2,075
Multifamily	1,020	1,007	1,024	1,061
Manufactured Housing	1,355	1,380	1,420	1,450

Average Price ($1,000)	1995	1996	1997	1998
Single-Family	$158.7	$166.4	$176.2	$189.2
Manufactured Housing	$36.3	$38.3	$41.1	$43.8

The most important factor in the demand for wood in residential construction is the number and mix of housing units being constructed during a given year. Second to that, the demand for wood products is driven by the size of the units being built. Not only was 1998 an excellent year for starts, it was the first year that the Research Center recorded an increase in the average size home since 1994. This increase was due to luxury homes capturing a larger part of the housing market. Typically, in a year with average housing starts, luxury homes capture between 12 and 13 percent of the single-family detached housing market. In years in which starts are down as they were in the early 1990s, the share of luxury homes will increase. Conversely, in good years such as 1998, the share of luxury homes will typically drop below 12 percent as the share of starter homes increases. However, in 1998, a good year for housing starts, luxury homes captured 15.4 percent of the single-family detached market, an increase of about 33 thousand homes. This uncharacteristic increase is generally attributed to the rising stock market and investors' cashing in some of their profits to build larger and more expensive new homes.

Single-family house size increased 2.7 percent from 2,021 SF in 1995 to 2,075 SF of finished floor area in 1998. Multifamily home size increased 4.0 percent from 1,020 SF in 1995 to 1,061 SF of finished floor area in 1998. Previous studies have shown that larger houses use proportionally more materials. Amenities such as dormer windows in the roof, turned gables, finished basements, larger eaves (overhangs), and porches also have significant influences on the amount of materials required to build a house.

WOOD PRODUCTS USE PER HOUSE

The amount of lumber used to build an average single-family house increased 4.8 percent between 1995 and 1998 and 5.8 percent for the average multifamily dwelling. Considering that during the same three-year period, wood I-joist usage increased 50.2 percent, mostly at the expense of dimension lumber, the increase in dimension lumber usage is significant. Much of the increase came from steeper roofs, larger eaves, and more dormers and turned gables. Porches also increased in size. In addition, there was an increase in raised wood floor construction in the South (8%) and West (12%) resulting in more use for floor framing per dwelling unit in 1998 compared to 1995.

Table 4 shows the average amounts of wood used per house in 1995 and 1998, and the percentage change between the two years. Although softwood lumber use declined for single-family homes in Canada, there was extremely high usage of wood I-joists for flooring. The sum of engineered wood and softwood lumber show an increase in the total amount of wood used in new construction.

TABLE 4
WOOD PRODUCT USAGE PER HOUSING START

United States Single-Family	1995	1998	PERCENT CHANGE
Softwood Lumber, BF	13,206.9	13,836.8	4.8%
Hardwood Lumber, BF	375.8	405.6	7.9%
Engineered Wood, BF equiv. (1)	744.8	1,322.8	77.6%
Softwood Plywood, SF 3/8" basis	4,234.6	3,576.7	-15.5%
Oriented Strand Board, SF 3/8" basis	6,461.1	7,505.9	16.2%
Non-structural Panels, SF 3/8" basis	2,226.3	2,490.3	11.9%
Starts, (000)	1,076.2	1,271.4	18.1%

United States Multifamily	1995	1998	PERCENT CHANGE
Softwood Lumber, BF	4,474.4	4,733.7	5.8%
Hardwood Lumber, BF	150.3	157.9	5.1%
Engineered Wood, BF equiv. (1)	334.1	560.7	67.8%
Softwood Plywood, SF 3/8" basis	1,416.8	1,343.0	-5.2%
Oriented Strand Board, SF 3/8" basis	1,811.5	2,198.9	21.4%
Non-structural Panels, SF 3/8" basis	1,379.7	1,313.0	-4.8%
Starts, (000)	277.9	369.0	24.3%

Canada Single-Family Detached	1995	1998	PERCENT CHANGE
Softwood Lumber, BF	13,012.0	12,295.5	-5.5%
Hardwood Lumber, BF	549.2	422.7	-23.0%
Engineered Wood, BF equiv. (1)	666.0	1,880.3	182.3%
Softwood Plywood, SF 3/8" basis	3,260.5	4,311.9	32.2%
Oriented Strand Board, SF 3/8" basis	4,442.6	4,804.1	8.1%
Non-structural Panels, SF 3/8" basis	497.2	1,572.2	216.2%
Starts (000)	64	86	34.4%

(1) Engineered Wood Conversion to board foot equivalent: I-joist linear feet X 2; Others, cubic volume X 16.

Canada **Townhouses and Apartments**	1995	1998	PERCENT CHANGE
Softwood Lumber, BF	4,726.3	6,173.9	30.6%
Hardwood Lumber, BF	78.9	143.3	81.6%
Engineered Wood, BF equiv. (1)	360.2	1,354.9	276.2%
Softwood Plywood, SF 3/8" basis	1,360.3	2,320.1	70.6%
Oriented Strand Board, SF 3/8" basis	2,284.2	2,938.5	28.6%
Non-structural Panels, SF 3/8" basis	606.0	1,688.9	178.7%
Starts (000)	47	51	8.5%

(1) Engineered Wood Conversion to board foot equivalent: I-joist linear feet X 2; Others, cubic volume X 16.

MAJOR CONSTRUCTION MATERIALS

Most important to the long term demand for lumber and engineered wood is the market share that these products have in such applications as exterior and interior walls, floor structures, and roof structures. Changes in demand for wood-based construction materials based on the size and number of homes built can easily be overshadowed if market share is lost to steel, concrete/ masonry, or some new, composite material.

Table 5 reports market shares for wood, steel, and concrete/masonry floors, exterior walls, interior walls, and roofs. Single-family and multifamily data has been combined to show total U.S. demand in millions of square feet. Structural wall demand is in million linear feet of wall. Structural floor demand is in million square feet of floor area. Of the many homes built on slab foundations, the structural material of the ground floor is assumed to be concrete. The structural roof demand is in million square feet of roof footprint. The roof footprint is the horizontal projection of the area covered by the roof. The roof footprint includes not only the ceiling area under the roof, but also the area over the garage (if applicable), porches, overhangs and cantilevers.

TABLE 5
USE OF WOOD, STEEL, AND CONCRETE / MASONRY
IN U.S. RESIDENTIAL CONSTRUCTION

Single and Multifamily		1995	Percent	1998	Percent
Floor Structure MM SF	Wood	1,538.3	62.3%	2,095.2	69.4%
	Steel	17.7	0.7%	12.8	0.4%
	Concrete / masonry	915.0	37.0%	910.3	30.2%
Exterior Wall Structure MM Linear Feet	Wood	289.9	86.2%	356.6	87.8%
	Steel	1.2	0.4%	2.1	0.5%
	Concrete / masonry	45.4	13.5%	47.6	11.7%
Interior Wall Structure MM Linear Feet	Wood	258.6	97.5%	309.6	94.7%
	Steel	6.3	2.4%	15.6	4.8%
	Concrete / masonry	0.2	0.1%	1.8	0.6%
Roof Structure MM SF	Wood	2,628.1	99.8%	3,143.4	99.7%
	Steel	5.2	0.2%	8.7	0.3%

Steel has doubled its small, but significant share of interior wall framing since 1995. Interior, non-load bearing steel studs offer a low-cost alternative to wood with no chance of shrinking to cause nail pops in the drywall. Exterior and load bearing interior walls may not enjoy a first cost advantage over wood studs because heavier gauge steel is used. In addition to problems fastening drywall to heavier gauge studs, exterior steel walls may require extra or different insulation strategies to overcome thermal bridging. Using steel roof framing makes attaching the sheathing not only more difficult but adds the element of safety risk during fastening. At this time, wood appears to be most vulnerable to steel in the interior walls.

Concrete and masonry walls are used primarily in southern Florida due to building code requirements in high wind areas, and much of the variation in market share depends on the strength of the housing market in southern Florida. The new wall systems that have been developed using concrete are not cost competitive, especially outside markets with a plentiful supply of non-union masons.

Concrete slabs-on-grade are the low cost alternative to framed floors over crawl spaces and basements. They are primarily used in the South, where they are most cost effective because expansive soils and high water tables there may make other types of foundations prohibitively expensive, but slab technology can be, and is used throughout North America. Although basements cost more than slabs, historically buyers, especially in the North, prefer them. Furthermore, as land values increase, basements become competitive with the cost of building comparable storage space above ground. Wood floor systems could lose market share, depending on home buyer preferences, but there is no indication of an erosion of wood's market share in structural floors.

Table 6 shows the type of foundation in new single-family homes in the United States, by regions[3].

TABLE 6
FOUNDATION TYPES OF SINGLE-FAMILY HOMES BUILT IN 1998
THOUSANDS OF UNITS

Single-Family Homes	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
Full basement	295.2	110.5	34.0	439.7	34.6%
Partial bsmt. and crawl space	38.1	11.3	23.7	73.0	5.7%
Partial basement & slab	12.7	11.6	4.8	29.2	2.3%
Crawl space, continuous wall	11.6	82.6	56.5	150.7	11.9%
Slab	36.2	329.9	177.7	543.7	42.8%
Piers	1.1	27.9	6.2	35.2	2.8%
TOTAL	394.9	573.8	302.8	1,271.5	100.0%

Although precast concrete floors are occasionally used for upper floors of residences, wood remains the material of choice for these floors. Clearly the size of the upper floor market is dependent on the number of multi-floor homes. Table 7 shows the number of homes built with one, two, three, and four stories by region. Note the strong correlation between the popularity of slab foundations and the number of one-story homes. The most affordable home is a one-story home built on a slab. However, such homes require significantly larger lots, and in areas where land values are high, the construction costs saved by building one-story homes on slabs is less than the cost of land.

TABLE 7
SINGLE-FAMILY STARTS BY NUMBER OF STORIES -- 1998 HOMES
THOUSANDS OF UNITS

Single-Family Homes	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
One	134.3	325.5	149.9	609.8	48.0%
Two	259.1	232.5	149.8	641.4	50.4%
Three	5.1	20.1	5.7	31.0	2.4%
Four	0.2	1.1	0.1	1.4	0.1%
TOTAL	394.9	573.8	302.8	1,271.5	100.0%

[3] A map depicting these regions is provided at the end of the Executive Summary.

Tables 8 and 9 compare structural materials of floors for single-family homes in the United States between 1998 and 1995 by region. These tables are similar to Table 5 but provide more comprehensive detail on the types of wood floors by region for single-family homes. The data provided is the average amount of material used per house.

TABLE 8
SQUARE FEET OF ABOVE GRADE FINISHED FLOOR
BY STRUCTURAL MATERIAL
OF THE AVERAGE SINGLE-FAMILY HOUSE
BUILT IN 1998

SF of Floor per Home	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
Concrete	109.9	854.4	805.7	611.6	29.5%
Steel (all types)	4.3	3.9	19.7	7.8	0.4%
Lumber joists	1,281.2	715.1	430.0	823.0	39.7%
Wood I-joists	542.8	358.8	567.8	465.7	22.4%
Open-web wood truss	151.6	162.1	180.0	163.1	7.9%
Structural insulated panels	1.0	0.1	0.6	0.5	0.0%
Other wood	1.2	3.8	3.5	2.9	0.4%
TOTAL	2,091.9	2,098.0	2,007.3	2,074.5	100.0%

TABLE 9
SQUARE FEET OF ABOVE GRADE FINISHED FLOOR
BY STRUCTURAL MATERIAL
OF THE AVERAGE SINGLE-FAMILY HOUSE
BUILT IN 1995

SF of Floor per Home	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
Concrete	126.3	1,006.4	1,020.2	734.1	36.3%
Steel (all types)	45.5	3.3	1.6	16.1	0.8%
Lumber joists	1,345.6	679.1	376.6	1815.2	40.3%
Wood I-joists	338.0	138.7	544.5	297.3	14.7%
Open web wood truss	209.7	112.4	114.9	143.4	7.1%
Structural insulated panels	0.2	0.3	0.8	0.4	0.0%
Other wood	10.1	16.4	10.7	13.1	0.6%
TOTAL	2,075.5	1,956.7	2,069.2	2,020.5	100.0%

Between 1995 and 1998, the square feet of above grade, finished floor increased 2.7 percent from 2,020.5 in 1995 to 2,074.5 in 1998. Furthermore, it shows that wood I-joists usage per house increased 56.6 percent from 297.2 SF to 465.7 SF. Open web wood joists also increased from 143.4 SF to 163.1 SF. Steel's usage per house declined from 16.1 SF in 1995 to 7.8 SF in 1998. Concrete's share declined from 734.1 SF in 1995 to 611.6 SF in 1998. Dimension lumber usage per house remained almost constant.

TABLE 10

SQUARE FEET OF FOOTPRINT OF ROOF
BY STRUCTURAL MATERIAL
OF THE AVERAGE SINGLE-FAMILY HOUSE
BUILT IN 1998

SF of Roof Footprint	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
Rafters	664.5	1,110.1	262.1	769.8	33.5%
Trusses	1,033.3	913.1	1,360.2	1,056.9	46.0%
Truss / rafter combination	482.2	276.3	719.2	445.8	19.4%
Structural insulated panels	1.7	2.2	1.2	1.8	0.1%
Beam & purlin	3.7	30.0	9.0	16.8	0.7%
Other	0.0	14.0	3.8	7.2	0.3%
TOTAL	2,185.4	2,345.7	2,355.6	2,298.2	100.0%

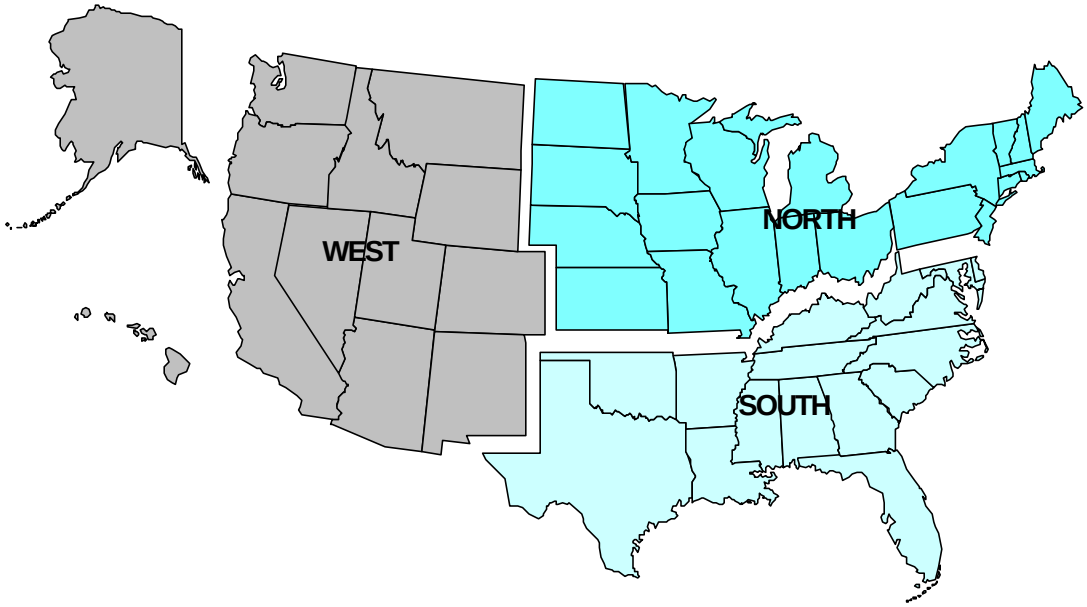
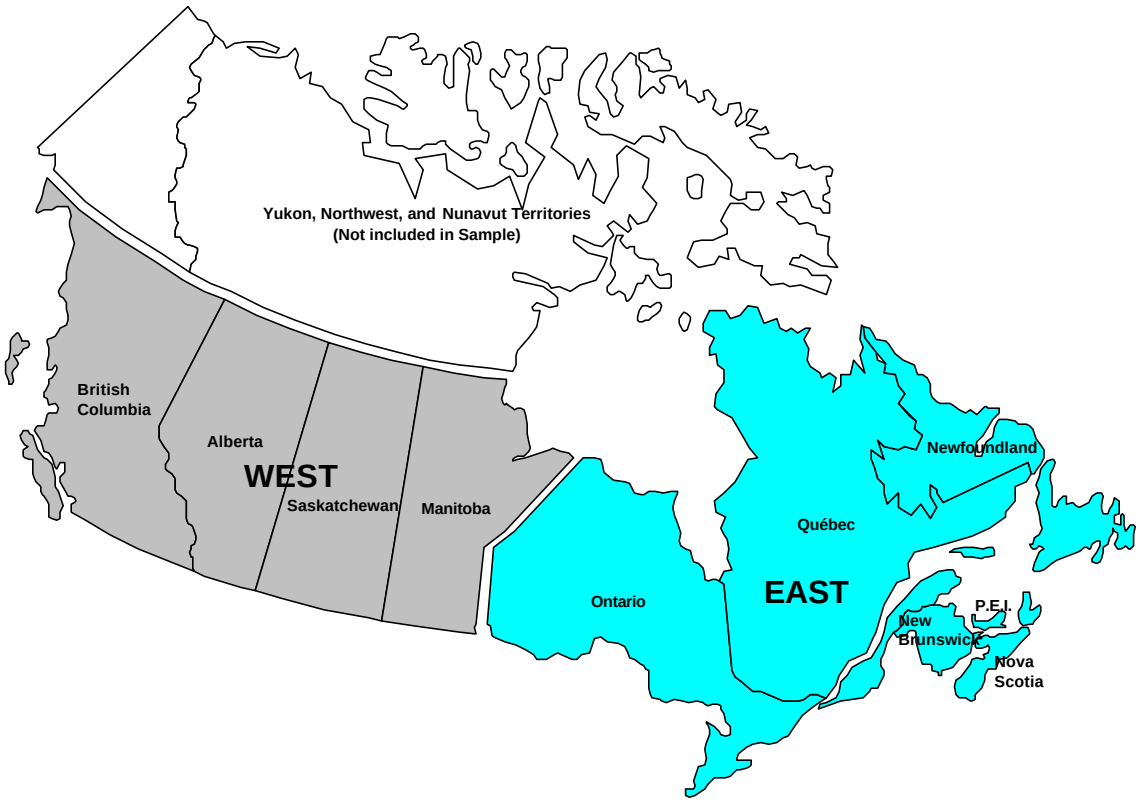
TABLE 11
SQUARE FEET OF FOOTPRINT OF ROOF
BY STRUCTURAL MATERIAL
OF THE AVERAGE SINGLE-FAMILY HOUSE
BUILT IN 1995

SF of Roof Footprint	NORTH	SOUTH	WEST	U.S.TOTAL	SHARE
Rafters	729.4	1,105.5	186.5	769.7	33.6%
Trusses	1,125.6	965.0	1,778.1	1,208.4	52.8%
Truss / rafter combination	304.4	168.5	522.1	295.0	128.9%
Structural insulated panels	1.7	0.5	11.7	3.6	0.2%
Beam & purlin	6.9	4.2	6.2	5.5	0.2%
Other	10.1	4.3	2.6	5.7	0.2%
TOTAL	2,178.2	2,248.0	2,507.2	2,287.8	100.0%

According to tables 10 and eleven, the footprint of the roof increased slightly from 2,287.8 SF in 1995 to 2,298.2 SF in 1998. The most significant change has been the increased use of rafters and trusses. Although it may appear that truss use is down significantly, in fact it is down only 1.1 percent because over 80 percent of truss/rafter combinations are trusses. In larger homes, rafters are frequently used in combination with trusses, and the increase in starter homes explains the increase in truss/rafter combination.

GEOGRAPHIC REGIONS

Usage data for the United States is given for three regions in this report. The North includes the U.S. Census regions for the Northeast and Midwest.



Usage data for Canada is given for two regions: the East and the West. The east in comprised of the four Atlantic Provinces, Quebec and Ontario. The West is comprised of British Columbia and the three Prairie Provinces.