REGIONAL VARIATIONS IN HOUSING CHARACTERISTICS AND WOOD PRODUCTS CONSUMPTION FOR RESIDENTIAL CONSTRUCTION IN THE UNITED STATES

Thomas C. Marcin

Abstract.--Important differences exist in the housing characteristics and wood products consumption for homebuilding for various regions of the United States. These differences are particularly pronounced for the North and the South because of the demands of climate and variations in architectural tradition. New housing construction has also fluctuated widely. Regional demands for timber products are significantly impacted by the variations in wood products demands for housing since homebuilding is the largest single market for many wood products.

This paper presents a summary of regional differences in housing characteristics, such as the type and number of units constructed, their size, type of foundation, etc., and the kinds and amounts of wood used. Overall estimates of consumption are presented for lumber and panel products by region.

Keywords: Housing, regional demand, wood products consumption, forest industries.

INTRODUCTION

This paper describes regional variations in housing characteristics and the use of wood products for the North, the South, and the West regions of the United States. These regional differences are important to the forest economy because residential construction is the largest single market for wood products in the United States. It accounts for more than half of all softwood lumber, plywood and waferboard/OSB panel consumption for the Nation, as well as substantial amounts of other wood products. Wide variations in production of new housing can create boom and bust conditions for forest products markets.

1Presented at the joint meeting of the Southern Forest Economists Workers and the Midwest Forest Economists, April 8-10, 1987, Asheville, North Carolina.

2Principal Economist, U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, Wisconsin.
This presentation focuses upon the major regions of the country as defined by the U.S. Census Bureau--Northeast, Midwest, South and West (Figure 1). The Midwest had previously been called the North Central Region by the Census Bureau and the names are still used interchangeably. The Northeast and Midwest are sometimes combined and simply called the North.

Figure 1.--U.S. census regions. (ML87 5405)

HOUSING INVENTORY AND PRODUCTION

Demographic and economic factors have combined to favor new housing production in the South and the West since the 1950's. The West has enjoyed a level of housing production disproportionate to its share of U.S. population since WWII because of continued migration to that region. Housing production and inventory shares in the South began to rise in the 1960's. It was aided by the advent of central air-conditioning. In the South, new houses with central air-conditioning installed rose from 25 percent in 1966 to 70 percent in 1983 (U.S. Department of Commerce 1986b). More importantly, the completion of the interstate highway system and the advent of jet airline travel provided
a transportation infra-structure which opened the South to growth. Migration increased to the South in the 1960's and its proportion of the Nation's population began to grow. Currently population growth has slowed for the region, but over the long term the Nation's population is expected to continue to shift to the South and West.

The proportion of the Nation's housing inventory has been gradually shifting to the South and West. For example, the Northeast's share of total housing units has fallen from 25.4 percent in 1960 to 21 percent in 1987, the Midwest from 28.8 to 26 percent, while the South and the West have risen from 29.4 to 33 percent and from 16.4 to 20 percent respectively.

There has also been a substantial change in the characteristics of housing types within regions. Urbanization in the South has been accompanied by a decrease in the share of single-family houses from 86.2 percent in 1960 to 72.5 percent in 1980. Over this period multi-family housing's share has risen from 12.5 to 19.8 percent with the mobile home moving from 1.7 to 7.7 percent (U.S. Department of Commerce 1983). The South and the West have substantially higher inventory shares of mobile homes.

The Northeast has relatively fewer mobile homes and a substantially higher share of multi-family housing units, while the Midwest has inventory shares similar to the national average. For the Nation, multi-family housing's share has risen from 23.7 percent in 1960 to 27.5 percent in 1980. This is a return to the historical share inventory for multi-unit housing of 28.4 percent in 1940, 29.7 percent in 1950 and 27.8 percent in 1970 (Marcin 1978). Mobile homes have gained a market share at the expense of single-family homes, rising from 1.3 to 5.6 percent nationally.

Housing starts have varied substantially by region since 1959. The South's share rose from about 33 percent in 1959 to 56 percent in 1982, before falling to 41 percent in 1986. The Northeast's share fell from 18 percent in 1959 to about 10 percent in the late 1970's and early 1980's before rising to 16 percent in 1986. The Midwest share fell from 24 percent in 1959 to 14 percent in 1982 before rising slightly to 16 percent in 1986. The West share was 24 percent in 1959 before falling to 17 percent in 1965, and then varying from 20 to 27 percent from 1965 to 1986 (U.S. Department of Commerce 1986a). The South's share of housing production--housing starts plus mobile home shipments--is higher when mobile homes are added because about two-thirds of all mobile home shipments are to the South.

For the 1980's, total housing production--housing starts plus mobile home shipments--ranged from 1.311 million units in 1982 to 2.051 million in 1986 (Figure 2). The South reached a high of 1.135 million in 1983 and low of 722,000 in 1981, with 889,000 units produced in 1986. The Northeast staged a dramatic housing recovery in the 1980's with its production rising from 130,000 units in 1982 to 314,000 units in 1986. Production in the Midwest also increased sharply, rising from 177,000 units in 1982 to 331,000 units in 1986. Housing production increased in the West from 243,000 units in 1982 to 517,000 units in 1986.
Figure 2.--Total housing production--housing starts and mobile home shipments--for the U.S. and regions, 1959-1986. (ML87 5403)

CHARACTERISTICS OF HOUSING

The characteristics of new housing units is important for determining wood products usage. The number of units in a structure is important as was cited above. Other important factors are: size of units, type of foundation, number of stories in the building, and type of parking facilities. These factors are discussed below for the United States and regions.

Size of Housing Units

The size of housing units is an important factor in wood products consumption. Since the 1950's, new house size increased dramatically for all regions as Figure 3 indicates, rising from 1,370 sq ft of finished floor area in 1963 to 1,785 sq ft in 1985 (U.S. Department of Commerce 1986b). The apparent size reduction from 1969 to 1972 was caused by special government programs to build small houses for lower income families. The average multi-housing unit has remained at about 1,000 sq ft throughout the period. Mobile homes have become more house like and have increased in size from about 600 sq ft in the 1960's to about 1,000 sq ft in 1985. Regionally, houses are generally larger in the North, with the largest in New England. Houses in the West varied in size but were near the national averages.
Figure 3.--Average finished floor area for single-family houses for U.S. and regions, 1963, 1975, and 1985. (ML87 5404)

Type of Foundation

The type of foundation used is a second factor which has an important bearing on the amount of wood products. Concrete slab foundations, which have no wood floor system, have become increasingly popular since WW II because of lower costs in many areas. For the United States, these foundations have risen from about 10 percent in 1950 to about 50 percent in the early 1980's, and back down to 48 percent in 1985 (Spelter 1985a). The South and the West have mostly concrete slab foundations nowadays, while the North has mostly basements and crawlspace. The type of foundation varies widely within regions. In 1985, about 90 percent of the North was basement or crawlspace, while 63 percent of the South and 59 percent of the West used concrete slab foundations.

Number of Stories

Another determinant of wood consumption for housing is the number of stories of the building. One-story buildings generally use more wood, if built with wood floor systems and gabled roofs, than similar two-story buildings of the same square footage of living area, because the two-story house has a common roof for both floors. In areas where there is a predominance of slab foundations the result is not too easily determined. Two-story houses have increased in popularity since 1950 when about 90 percent
of all new single-family houses constructed were one-story. In 1985, 52 percent of all single-family housing units completed were one-story, 48 percent two-story and 6 percent split level (U.S. Department of Commerce 1986b). The Northeast has the largest proportion of two-story houses with 70 percent while the South has the largest percentage of one-story with 60 percent in 1985.

Type of Parking Facility

The presence of a garage is another factor which is important in determining wood use for housing. The garage uses substantial amounts of wood products even though it is not included in the finished floor area. In 1985, the West and Midwest had the highest incidence of garages for single-family houses with 87 and 86 percent respectively. Seventy percent of the houses in the Northeast had garages in 1985, but only 57 percent of the houses in the South had garages.

INCIDENCES OF WOOD USE

For the purpose of analyzing wood products consumption in residential construction it is useful to consider the weather zones of the country, because construction practices change as one goes from the cold of the North to the warm southern climate. For example, basements are prevalent in cold climates where it is necessary to put in footings below the frostline. Architectural tradition and cultural differences also affect regional housing design. For example, New England has a tradition of two-story wood houses, brick is a traditional material in the South, and the Spanish adobe style is popular in the Southwest.

The use of wood products by housing unit varies by region, and is related to regional differences in architecture and housing characteristics. To organize the discussion of wood use, it is useful to look at the components of housing construction--foundations, floor systems, wall systems, and roof systems. Then to look at the various functional uses of wood--framing, sheathing, subflooring and underlayment, exterior siding and roofing. This section will briefly discuss these components and the differences in incidences of wood use and competing material use for single-family houses by region.

The type of foundation--basement, crawlspace, or concrete slab--is important for determining wood use because of wood floor systems with basement and crawlspace foundations. The concrete slab-on-grade system suffices as the first floor and there is no use of wood. Some recent developments have also provided additional prospects for wood use for foundations. First, the Permanent Wood Foundation (PWF) has led to possible inroads of this foundation system into the traditional concrete foundation system. The PWF uses treated lumber and plywood walls on a gravel base. Experts think that the PWF system could eventually be used in as many as 20 percent of new houses (Spelter 1985b). Prospects for potential future use are highest in the northern states where basements are more prevalent, and in rural or remote areas. A perimeter insulated raised wood floor crawlspace foundation system (PIRS), in which the interior of the crawlspace area serves as a mass area for energy accounting
purposes, is also competing successfully with concrete slab foundation systems in California and will be promoted in other southern areas. Also, the use of wood floors on-grade in place of concrete may alleviate the radon gas problem in some areas without the installation of costly ventilation systems. The PIRS system and wood floors on-grade have greater potential in the South and Southwest.

Floor systems are generally either concrete or wood based systems. The majority of floors in the South (56 pct) and the West (54 pct) are concrete, while most floors in the Northeast (85 pct) and the Midwest (83 pct) are wood based (LSI Systems 1986). The West is approximately evenly split between concrete and wood floors. Most wood floor systems are still dominated by 2-inch dimension lumber placed 16 inches on center. However, manufactured lumber floor trusses and wood I-beam trusses are used in about 10 percent of wood floor area. There was no major regional difference in the use of floor trusses. Their use is expected to grow in the future. Plywood is the most commonly used subflooring and underlayment material used with wood floor systems. Overall, plywood is used about 75 percent of the time for floor sheathing, waferboard about 12 percent, and particleboard 10 percent. Regionally, OSB/waferboard was used at a somewhat higher rate of 18 percent in the Midwest.

Wall systems are predominantly wood framed using either 2x4's or 2x6's. In 1985, over 93 percent of exterior walls were wood, about 6 percent cement products, and less than 1 percent metal or other materials (LSI Systems 1986). Most of the houses built with cement products are in the South. Noteworthy is the increased use of 2x6 exterior wall studs in recent years. About 28 percent of the houses in the Northeast and 35 percent of those in the Midwest use 2x6's for exterior walls, as compared to only 3 percent in the South and the West. Nearly 90 percent of these studs were placed 16 inches on center and only 10 percent were spaced 24 inches. Almost all interior walls were framed using 2x4's.

Exterior wall sheathing materials vary by region. Nationally, foam board and foil-faced panels have largely been replacing fiberboard for nonstructural uses. Since 1974, fiberboard has declined from 58 percent of wall sheathing to 17 percent, while foam boards and foil-faced boards have risen to nearly half the market in 1985. Regionally, the Northeast used about 29 percent foam or foil-faced panels, 37 percent plywood, 25 percent OSB/waferboard, and 5 percent fiberboard; the Midwest 47 percent foam and foil-faced boards, 10 percent plywood, 31 percent fiberboard, and 9 percent waferboard; the South 61 percent foam or foil-faced boards, 10 percent plywood, and 3 percent OSB/waferboard; the West 35 percent foam and foil-faced boards, 37 percent plywood, 11 percent fiberboard and 3 percent OSB/waferboard (LSI Systems 1986).

Wood use as the exterior wall material has increased from 28 percent in 1969 to 43 percent in 1985 (U.S. Department of Commerce 1986b). Correspondingly, the use of brick declined from 47 percent to 22 percent. Houses in the Northeast were 50 percent wood exterior, the Midwest 55 percent, the South 38 percent, and the West 43 percent.
Roof trusses are used in about two-thirds of roof systems throughout the country. There were no great differences between the major regions of the country, although within regions New England and Texas use more raftered roofs. Flat roofs were used in about 3 percent of houses. Plywood is still the dominant material for roof decking. However, OSB/waferboard has made major inroads for this use. Overall, plywood is used in 55 percent of roof sheathing for the major regions according to our preliminary survey. OSB/waferboard is used for 36 percent of the roofs and lumber for the remaining 5 percent. Regionally OSB/waferboard is used more commonly in the Midwest for about 46 percent of the roofs, followed by the South with 43 percent, the Northeast with 28 percent and the West with 15 percent. Wood shingles and shakes were used on 12 percent of the houses in the West, 7 percent in the South and Midwest, and 3 percent in the Northeast (LSI Systems 1986).

LUMBER USE

Lumber use for framing continues to be the dominant framing material for new housing construction. Framing accounts for about 70 percent of lumber use in single-family houses, the remainder is accounted for by miscellaneous nonstructural uses and millwork. Overall lumber use levels per house in 1985 have been estimated from data available from consultant reports and the author's calculations (LSI Systems 1986). Houses in the North are generally larger than the national average, with New England having the largest and most expensive in the country. Most houses in the North have basements. Lumber use is highest in the Northeast, averaging 14,800 bd ft for single-family houses, and 5,700 bd ft for multi-family structures in 1985. Lumber use in the Midwest or North Central Region averaged 12,800 bd ft for single-family houses, and 6,100 bd ft for multi-unit structures. Lumber use in the South averaged 11,500 bd ft for single-family houses and 4,600 bd ft for multi-family housing units in 1985.

Overall wood products consumption can be calculated from the level of housing production by type of unit and the level of use for various products. Estimates of use are included in the following sentences for consumption of lumber and plywood in 1985. The South used about 8.5 billion bd ft of lumber for new housing in 1985, the North about 6 billion, and the West about 4.5 billion bd ft.

PANEL PRODUCTS USE

Structural panels and exterior siding are major uses for panel products. In this section these major uses are discussed and estimates of their usage presented. The structural panel products particularly important are softwood plywood and OSB/waferboard which compete in many applications. Estimates of use are based upon trade associations and consultants reports, and the author's calculations (Anderson and Hutton 1986, and LSI Systems 1986).

Overall structural panel products consumption was estimated at 9.15 billion sq ft (3/8-in. equivalence) for the Nation in 1985 (Anderson and Hutton 1986). This total included 1.4 billion sq ft of plywood siding and
450 million sq ft for mobile home manufacture. Of the remaining 7.3 billion sq ft of structural panels used for conventional housing, it is estimated that about 2 billion was OSB/waferboard and 5.3 billion softwood plywood. Regionally, structural panel products use, excluding siding for conventional housing, was: the Northeast, 1.1 billion sq ft of softwood plywood and 330 million sq ft of OSB/waferboard; the Midwest, 850 million sq ft of softwood plywood and 430 million sq ft of OSB/waferboard; the South, 2 billion sq ft of softwood plywood and 850,000 sq ft of OSB/waferboard; and the West, 1.4 billion sq ft of softwood plywood and 170 million sq ft OSB/waferboard. In 1985, wood siding panel consumption was estimated by region as: the Northeast, 167 million sq ft (3/8-in. equivalence) of plywood and 34 million sq ft of hardboard siding; the Midwest, 267 million sq ft of plywood and 180 million sq ft of hardboard siding; the South, 510 million sq ft of plywood and 410 million sq ft of hardboard siding; and the West, 360 million sq ft of plywood and 240 million sq ft of hardboard siding.

SUMMARY

The South is the greatest consumer of forest products for housing where housing demand continues to be strong. Houses continue to be predominantly made out of wood products. Greater use of OSB/waferboard panel products is expected as production of these materials increases in the region. The housing market in the North remains an important market for wood products and has great potential for innovative composite wood products like waferboard, made from species native to the area such as aspen (Marcin 1984). A revival of residential construction has occurred in the Northeast and to a lesser extent the Midwest in recent years. The use of 2x6 exterior walls has increased substantially because of energy efficiency considerations. The West continues to be a major consumer of wood products for housing. Plywood continues to be the predominate structural panel product in the West because OSB/waferboard has not yet penetrated deeply into the Western housing market. Overall wood use for housing continues to be dominant in all regions of the Nation.

LITERATURE CITED


