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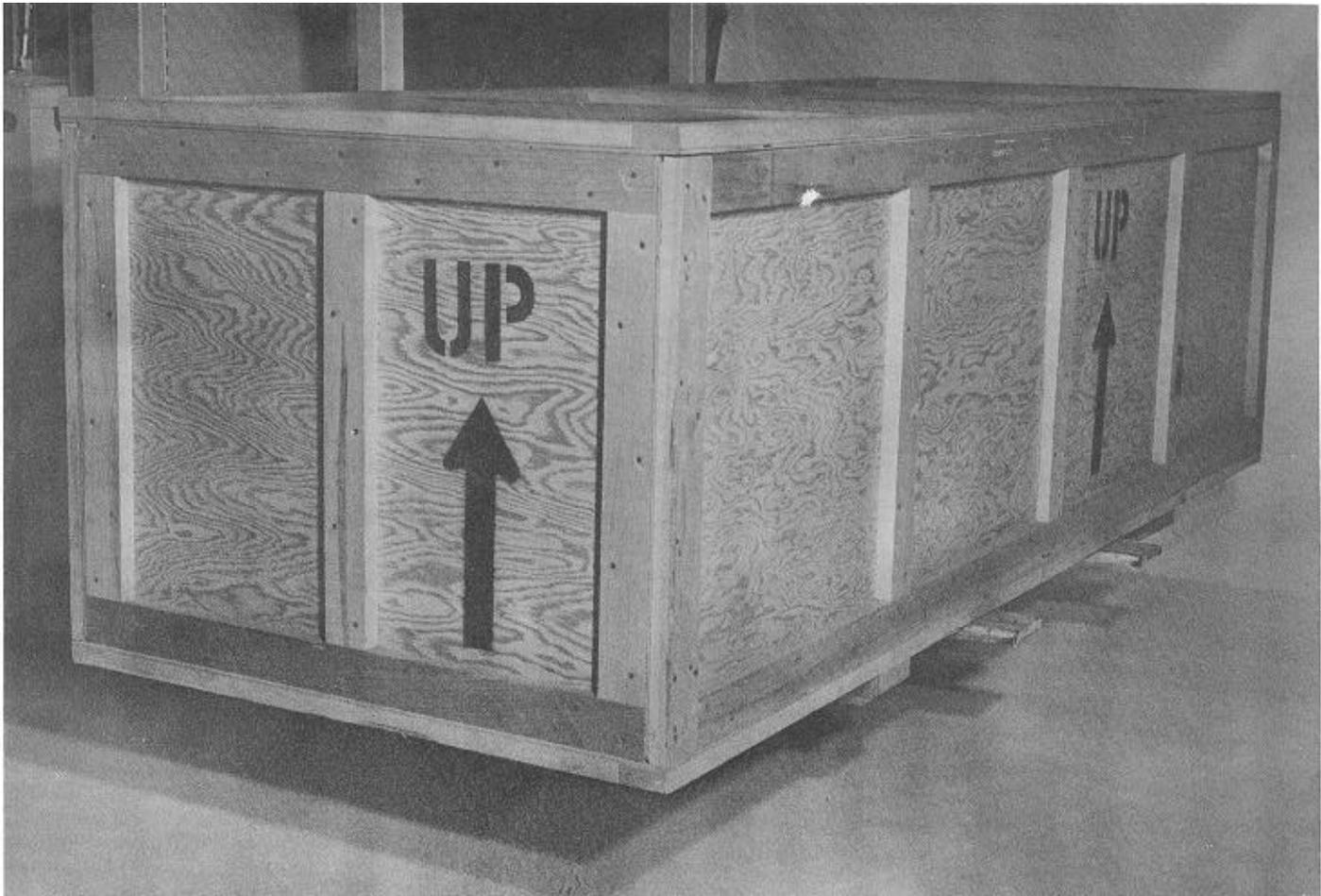
Forest Service

**Forest
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Resource
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Lumber and Panel Products Consumption for Packaging and Shipping in the United States— Perspective for the 1980's



Abstract

Trends in demand for lumber and panel products in packaging and materials handling are examined both for the past and the future. Effects of recent technological developments and innovations such as molded particleboard pallets, medium-density fiberboard pallets, and plywood pallets, are analyzed. Increased use of pallets is seen as the main reason for the expected increase in wood products consumption. Use of the slip-sheet is considered competition for the wood pallet. Projections are made for lumber and board use in the 1980's.

Highlights

... In 1978, almost 9 billion board feet of lumber, 1 billion square feet (3/8-in. basis) of plywood and veneer, and 90 million square feet (1/8-in. basis) of hardboard were consumed for packaging and shipping in the United States.

Since 1970, lumber use increased by 5.4 percent per year whereas combined board use (plywood, veneer, and hardboard) increased 7.2 percent per year.

... The pallet industry has provided the major impetus for growth in wood products use in packaging and shipping. Changes in types and quantities of wood products use in the 1980's will result from innovations and changing technologies in palletization.

... New technologies include molded particleboard pallets, medium-density fiberboard pallets, and plywood pallets.

No major technological changes or innovations are expected in wood containers or in dunnage, blocking, and bracing. Changes in wood products use are expected to follow recent trends.

Slip-sheets will be a challenge to the pallet industry during the 1980's because of their minimal weight, volume, and cost.

This report is based on a paper given at the Symposium on Wood-Based Panels in the 1980's: Economic and Technical Perspectives. It was held under the auspices of the United Nations Economic Commission for Europe, at Helsinki, Finland, May 12-16, 1980.

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Lumber and Panel Products Consumption for Packaging and Shipping in the United States— Perspective for the 1980's

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Introduction

In the United States, packaging, warehousing, and shipping of agricultural and manufactured products require large quantities of wood and wood products. These distribution-related markets provide good opportunities for growth in the use of wood-based panel products. Lumber, however, is the dominant wood material employed—especially in the large and expanding pallet market. For containers and packaging by far the leading fiber-based products today are paper and paperboard; they account for an estimated 40 percent of all materials used in 1979 (8).² The scope of this bulletin, however, is restricted to lumber and wood-based panel products: plywood, veneer, hardboard, particleboard, and medium-density fiberboard now in commercial production.

In 1978, the latest year for which detailed estimates of wood products use are available, almost 9 billion

board feet of lumber, 1 billion square feet (3/8- in. basis) of plywood and veneer, and 90 million square feet (1/8- in. basis) of hardboard were consumed in the manufacture of pallets, boxes, crates, and other wood containers, and for dunnage, blocking, and bracing (6) (table 1). This represents an increase in use since 1970 of 5.4 percent per year in lumber and of 7.2 percent per year in plywood, veneer, and hardboard.

The pallet industry has been the major impetus for growth in wood product use in the packaging and shipping segments of the economy. In the 1980's it is in pallets that innovations and changing technologies in materials handling will cause major changes in types and quantities of wood products used.

Since 1948 wood use in containers has steadily declined. This trend is expected to continue as shippers try to reduce costs by increasing the use of corrugated fiberboard and developing lighter weight containers.

The amount of wood needed for

dunnage, blocking, and bracing is small compared to that used for other shipping and packaging markets. However, board consumption has tended to increase during the 1970's, whereas lumber use has remained fairly constant.

Pallets- Past and Future

In the United States the use of pallets for shipping and warehousing of manufactured products has increased dramatically in the past two decades according to data of the National Wooden Pallet and Container Association. In 1970, some 126 million pallets were produced, consuming an estimated 3.2 billion board feet of lumber, 140 million square feet (3/8- in. basis) of plywood and veneer, and 28 million square feet (1/8- in.

¹ Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

² Italicized numbers in parentheses refer to literature cited at end of report.

Table 1 .—Consumption of wood products for packaging and shipping in the United States by end use, 1970, 1976, and 1978, with projections to 1990

| | Lumber | | | | Plywood and veneer | | | | Hardboard | | | |
|--------------------------------|-------------|-------------|-------------|-------------|--------------------------------|------------|-------------|-------------|--------------------------------|-----------|-----------|------------|
| | 1970 | 1976 | 1978 | 1990 | 1970 | 1976 | 1978 | 1990 | 1970 | 1976 | 1978 | 1990 |
| | Million bfm | | | | Million sq. ft (3/8-in. basis) | | | | Million sq. ft (1/8-in. basis) | | | |
| Pallets | 3150 | 4900 | 6700 | 7415 | 140 | 400 | 710 | 840 | 28 | 39 | 54 | 65 |
| Wooden containers | 1755 | 1153 | 1125 | 1110 | 437 | 319 | 300 | 265 | 26 | 22 | 30 | 35 |
| Dunnage, blocking, and bracing | 820 | 857 | 860 | 905 | 14 | 19 | 22 | 35 | 4 | 5 | 6 | 8 |
| Total | 5725 | 6910 | 8685 | 9430 | 591 | 738 | 1032 | 1140 | 58 | 66 | 90 | 108 |

Source: U.S. Department of Agriculture, Forest Service (6).

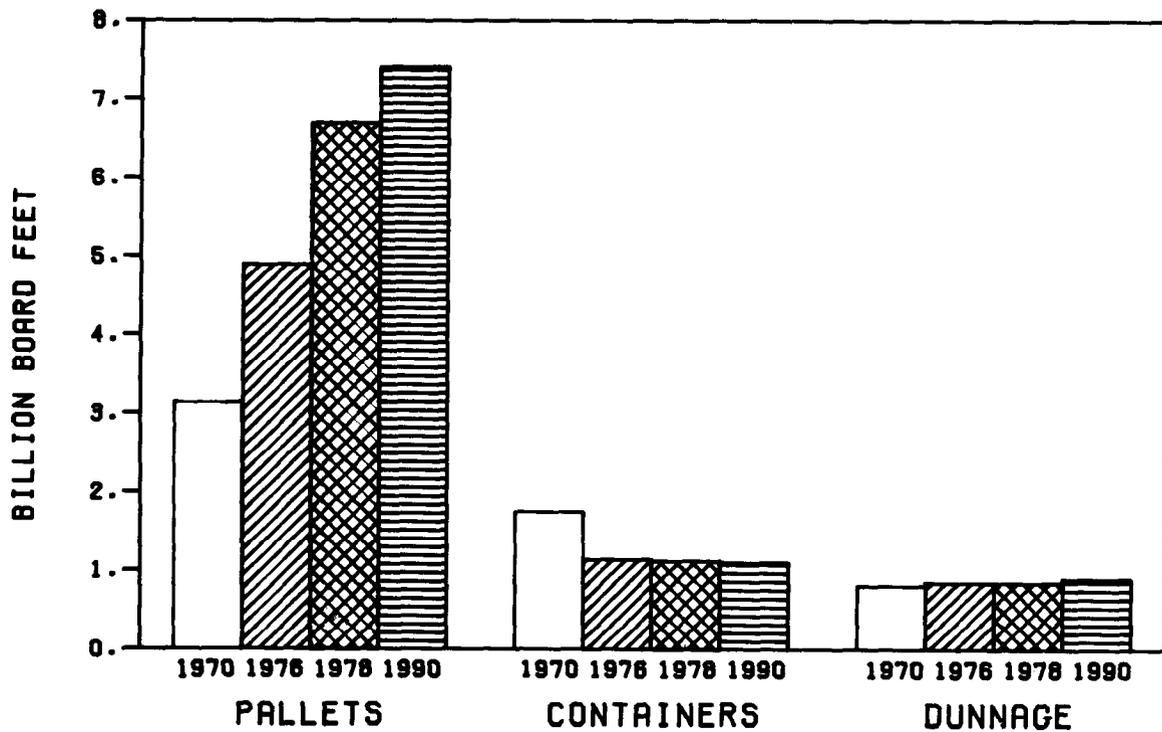


Figure 1. —Lumber consumption for packaging and shipping in the United States, 1970, 1976, and 1978 with projections to 1990. M 148 915

basis) of hardboard (table 1, figs. 1-3). By 1978, pallet production reached a record high of 270 million units, consuming 6.7 billion board feet of lumber, 710 million square feet of plywood and veneer, and 54 million square feet of hardboard. Since 1970 the total number of pallets manufactured annually has more than doubled (6).

Palletization is expected to continue to increase; this is based on projected increases in manufacturing shipments and continued pressures by all segments of industry and agriculture for improved materials handling. The rate of increase,

however, is expected to decline, particularly in the late 1980's, when more industries become palletized and the impact of the slip-sheet is felt. The slip-sheet is an alternative method of moving unitized loads, and will be discussed further.

Rising labor costs, coupled with improved materials-handling systems in warehouses and transportation systems, will directly influence a trend toward increased palletization. Studies in progress by the U.S. Department of Agriculture indicate considerable opportunity exists for increasing the efficiency of shipping many types of agricultural products

with pallets. The increased use of pallets and pallet bins to transport products from farm or orchard is but one area that will increase the demand for lumber, plywood, and other wood-based products in this packing and materials-handling area.

Projected levels of demand for pallets and the timber products consumed in their manufacture were made as a part of an assessment of the timber situation in the United States (6). From a 1976 base of 196 million pallets, demand for new pallets was projected to almost double in the 1980's and reach 338 million units by 1990 (medium level of

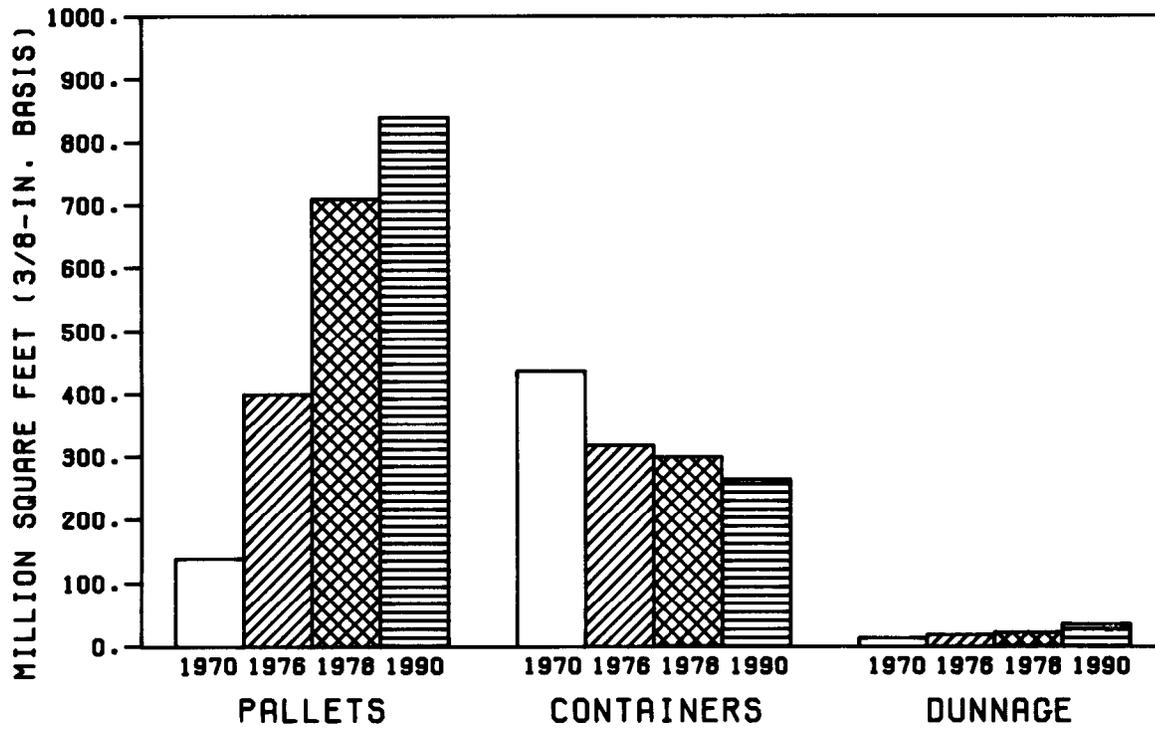


Figure 2.—Plywood consumption for packaging and shipping in the United States, 1970, 1976, and 1978 with projections to 1990. M 148 916

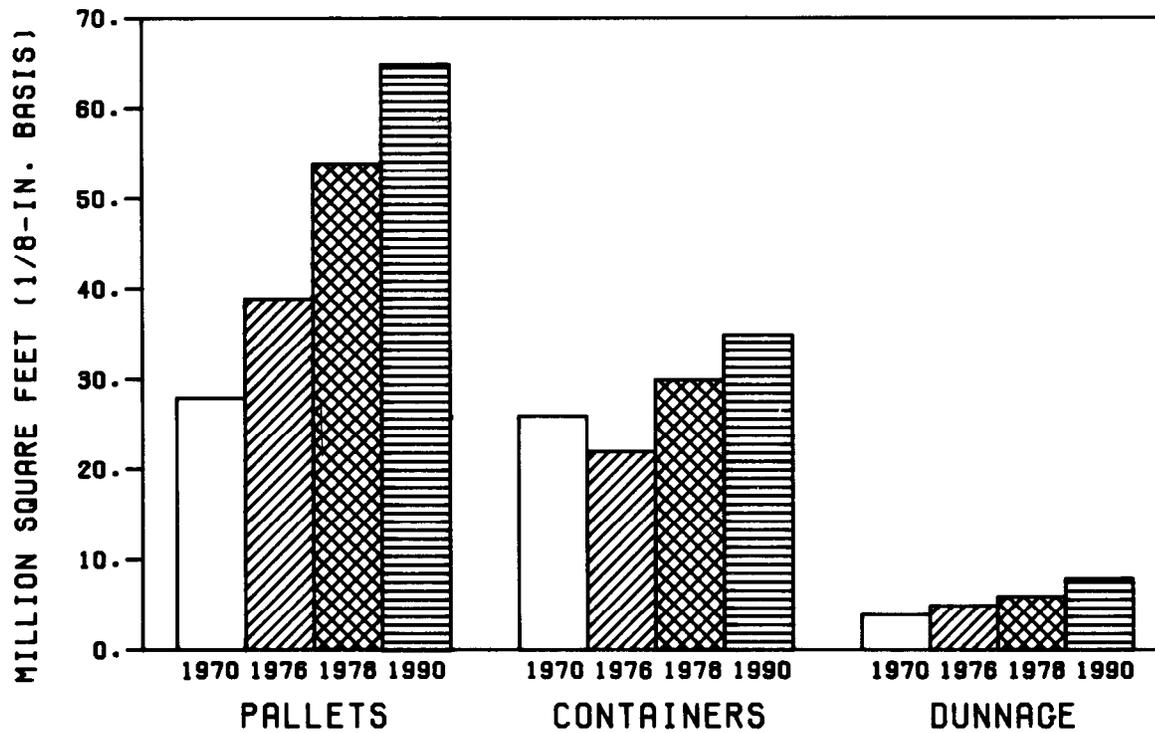


Figure 3.—Hardboard consumption for packaging and shipping in the United States, 1970, 1976, and 1978 with projections to 1990. M 148 917

projections based on real growth in total value of manufacturing shipments of 1.8 pct per year). Lumber use is projected to increase to almost 7.5 billion board feet by 1990, an average annual increase of 3.0 percent per year (table 1, fig. 1). Total board use (plywood, veneer, and hardboard) is projected to increase by almost 5.5 percent per year through the 1980's to 840 million square feet (318- in. basis) of plywood and veneer and 108 million square feet (1/8- in. basis) of hardboard (table 1, figs. 2-3). The increased demand for pallets into the 1980's will be met primarily by the conventional hardwood pallet. More than 50 percent of pallets are made from lower grade hardwood lumber. Pallets use approximately half of the Nation's annual hardwood lumber production. Localized problems in raw material availability have been reported, although USDA Forest Service data show that total U.S. hardwood timber supply has been expanding for the last three decades (7).

New Pallet Products and Markets

Modifications of the conventional hardwood pallet, and research into various alternatives are in progress by several governmental and private research organizations and by industry. A few of the more promising efforts include:

Molded Particleboard Pallet

Although molded particleboard pallets have been produced in Europe for several years, they have just recently been introduced to the United States. Molded particleboard pallets are light weight, require no nails, and can be shipped or stored in about one-fourth of the space required for standard lumber pallets. Current and projected estimates indicate these pallets can be manufactured and sold at prices competitive with those of lumber pallets (3).

By 1980 at least two molded particleboard pallet plants will be in operation in the United States. One plant, using the German Wezalit process, recently began production in Dover, Ohio. Whole-tree chips are being used as raw material. The owner reports brisk sales to a wide variety of industries, and has plans for expanding his production facilities in 1980. He also reports that the light

weight of the pallet enables him to sell his pallets to customers as far distant as California.

A second plant for molded particleboard pallets is nearing completion in the Detroit, Mich., area to serve the automotive supply industry. This plant will be the first to use a new process developed by the Institute of Wood Research at Michigan Technological University, Houghton, Mich. A U.S. patent is pending. The pallet reportedly can be manufactured in either a single- or a double-deck configuration, both of which allow four-way entry by standard forklift equipment. Double-deck pallets are commonly used by the grocery industry, the largest single market for pallets.

Several companies are known to be keenly interested in the "Michigan Tech pallet process" and are conducting independent feasibility studies. Based on preliminary industry reports, molded particleboard pallets could become competitive with the standard lumber pallet in the 1980's.

Medium-Density Fiberboard-Decked Pallets

Research is underway by the USDA Forest Service to determine the feasibility of using medium-density hardboard for top decks of pallets (4, 5). Similar boards are also commonly referred to in industry as medium-density fiberboard (MDF). A board with a density of at least 39 pounds per cubic foot, approximately 1 inch thick, would be required to equal or to exceed the performance of a conventional red oak pallet with decks of nominal 1-inch red oak lumber.

At current raw material prices, an MDF-decked pallet is estimated to cost approximately 30 percent more to produce than an all-lumber pallet. If this cost differential can be reduced, these pallets will become attractive to owners of mechanical or automated pallet systems where the increased dimensional stability of MDF pallets would be desirable.

Plywood Pallets

Plywood has been used to a limited extent as a decking material in pallet construction for more than 20 years. Tests by the American Plywood Association indicate that, although plywood pallets have an initial cost higher than conventional lumber pallets, the cost per use of plywood

pallets can be as much as a third less than that of conventional lumber pallets (1). Plywood pallets last longer (averaging 7 years compared to 4 years for a lumber pallet) and have a lower incidence of damage, which results in lower repair costs. Overall, plywood pallets have been estimated to cost 20 percent less per pallet per year than do lumber pallets. The lower lifetime cost of plywood pallets has not, however, dramatically increased their use. Many pallet users are unwilling to pay the higher initial cost for plywood pallets because, too often, the pallets are not returned after shipment or a lower quality pallet is returned.

The advantages suggest that plywood as a pallet decking material will increase throughout the 1980's, at the expense of the all-lumber pallet. Plywood for pallet bins is also a large potential growth market, because of reduced distribution costs in handling farm produce. As better systems for the return of pallets are developed, pallet users will become willing to invest in the higher quality plywood pallet. In addition, mechanized and automated materials-handling systems are being developed that require higher quality pallets.

Many companies in the United States are operating on a two-tier pallet system. High-quality plywood or hardwood lumber pallets are used to move goods within the companies' own warehouses and distribution systems. Lower quality pallets or slip-sheets are used to ship finished goods to the consumer. Companies also use lower quality pallets and slip-sheets if they lack reasonable control over pallet damage or loss. This two-tier strategy is probably increasing the total demand for most pallets and especially for the high-quality plywood-decked pallets.

Slip-Sheets

A major competitor of the conventional wood pallet is the slip-sheet. The slip-sheet, a thin sheet of solid fiber (usually laminated paper), corrugated board, or plastic, was developed in the 1950's by the food industry, but not until the 1970's did its use increase significantly. Over 50 million slip-sheets are estimated in use in the United States today.

Slip-sheets offer many advantages compared with wood pallets. They are low cost (as much as 90 pct less than a wood pallet), lightweight, and re-

quire only one-hundredth the storage space of a wood pallet. They are usually disposable, thus require no maintenance or return. Plastic slip-sheets, relatively new to the market, are more often used in a closed transportation system in which return of the slip-sheet is ensured. Plastic sheets have a greater life span than do fiber sheets and can be returned to a manufacturer for reprocessing.

The increased use of slip-sheets in the 1980's will be a major concern to the pallet industry (2). The initial effect of increased use of slip-sheets will be a reduction in demand for the lower quality wooden pallets. The demand for high-quality, permanent pallets, such as lumber- or plywood-decked metal pallets, should increase. The permanent pallets would be used for in-house movement of goods and materials through the manufacturing facility. For transporting finished products to customers, disposable slip-sheets will likely be used most often. Widespread acceptance of plastic slip-sheets may sharply curtail the demand for permanent pallets because the sheets are sufficiently durable to effectively replace pallets.

Within the last year, the American National Standards Institute (ANSI) has recognized slip-sheets as an important means of unitization, and is drafting a standard for industry (2).

Containers

During the 1970's the total estimated consumption of lumber, plywood, and veneer in containers declined (table 1, figs. 1,2). Hardboard use increased slightly (fig. 3). In general, shippers are striving to increase their use of lightweight corrugated boxes, paperboard containers, and steel or aluminum drums and containers, in place of wood boxes, crates, and cooperage. In 1978, shipments of corrugated and solid fiber boxes were almost 8 percent greater than those of the previous record year of 1973. However, wood containers of all types still account for approximately 16 percent of all material consumed for packaging (table 2).

End panels of particleboard are being used in crates for food produce with corrugated board "wrapped" around the sides instead of veneer.

Lumber and plywood have continued to be popular for packaging

Table 2.—Estimated material consumption for containers and packaging products by packaging weight in the United States, 1979

| Material type or functional use | Tons | Percent |
|---|---------|---------|
| | Million | |
| Paperboard | 22.5 | 33.1 |
| Glass | 14.0 | 20.6 |
| Wood | 11.0 | 16.2 |
| Steel | 6.8 | 10.0 |
| Paper | 6.2 | 9.1 |
| Plastics | 4.5 | 6.6 |
| Components, textiles, and cushioning materials | 1.6 | 2.3 |
| Aluminum | 1.4 | 2.1 |
| Total | 68.0 | 100.0 |

Source: U.S. Department of Commerce, Industry and Trade Administration (8).

large bulky items or heavy products. These materials are also necessary for the protection of delicate instruments, glass, ceramics, and other fragile items. Recent field reports indicate that some shippers are using waferboard for these boxes in an attempt to reduce their costs.

Dunnage, Blocking, and Bracing

In the last two decades the use of wood products for dunnage, blocking, and bracing in railroad cars, trucks, and ships has increased very little, an average of less than one-half of 1 percent per year. This relative stability in a period of rapidly increasing volumes of goods being transported reflects the growth in palletization, containerization, and bulk shipments of goods. Plywood use has been one notable exception to this trend; it has increased almost 5 percent per year since 1965 (table 1, fig. 1-3).

The dunnage, blocking, and bracing market is not large, and accounts for only 5 percent of the total lumber used in packaging and shipping and for only 2 percent of the panel products (plywood, veneer, and hardboard) used. The outlook for the 1980's is for no major changes in past trends. There are apparently no new innovations or changes in technology on the horizon that will dramatically change the types and the quantities of wood products consumed.

Conclusions

The outlook for increased lumber and wood-based panel use in packaging, handling, and shipping manufactured and agricultural goods in the 1980's is relatively bright. Lumber is expected to increase almost 9 percent by 1990 to more than 9 billion board feet per year. Total plywood and veneer use is expected to increase by approximately 10 percent to 1.1 billion square feet (3/8- in. basis). By 1990, hardboard use is also expected to increase to more than 100 million square feet (1/8- in. basis). Significant quantities of particleboard, medium-density fiberboard, and other manufactured board products will also be used.

The increased use of pallets is the main reason for the expected increase in wood products consumption. In 1978, some 77 percent of all lumber and almost 70 percent of all board products consumed in packaging, materials handling, and shipping were used for pallets. By 1990, these percentages are expected to increase to almost 80 and 75 percent, respectively.

As the 1980's progress, the slip-sheet, an inexpensive, disposable, lightweight alternative to the wood pallet, poses a challenge to the pallet industry. The minimal weight and volume of the slip-sheet result in cost savings when materials are shipped by air or truck.

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