AN ANALYSIS OF FACTORS INFLUENCING SELECTION OF SOFTWOOD FRAMING LUMBER UTILIZED IN RESIDENTIAL CONSTRUCTION

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ABSTRACT

AN ANALYSIS OF FACTORS
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by Donald D. Drone

The purpose of this study was to establish the importance of the various factors that influence the selection of softwood framing lumber utilized in residential construction. Since framing lumber is manufactured in diverse production regions located at various distances from consumption points, this study is concerned with what factors influence the consumption of various species of softwood framing lumber from various production regions.

Factors possibly influencing the selection of softwood framing lumber were categorized as economic and non-economic factors. Economic factors were limited to those factors with which an actual monetary cost could be associated. Initial cost of the raw material to the user, installation cost, storage cost, and the cost of call-backs are among those factors. Non-economic factors are those factors with which there is no cost associated. Factors included in this category are familiarity, home buyer preference, raw material characteristics, and architectural influences.

Each of the economic and non-economic factors were examined as to what possible influence they could have upon the buying decision made by residential builders on the softwood framing lumber used in residential

construction. The numerous economic and non-economic factors were evaluated by using information obtained from previous studies of builder buying and consumption habits and through the results of a survey conducted by the author on framing lumber users, sellers, and specifiers in the Chicago, Illinois, metropolitan area. The "ideal modern builder" was introduced in order that a criterion could be established for evaluating factors influencing builders' purchasing habits.

An extensive review of literature revealed that information concerning the buying habits of residential builders for softwood framing lumber was not available. The theory that today's builders would make purchasing decisions in a manner similar to those of the "ideal modern builder" was developed. Based upon this theory and findings of the author's survey, the economic and non-economic factors were formulated. Based on this analysis, these three factors, initial cost; product performance; and institutional factors, are, without question, the most influential factors. What species of framing lumber that is selected for use in residential construction is dependent upon these three factors. Other factors outlined in the summary of the study are of some importance but in no way equal the importance of the foregoing. It is important that price alone is not the only factor entering into the decision as to what species of framing lumber is going to be utilized for use in residential construction. Instead, it is a combination of several factors of which price is very important, but by no means the only one.

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By

Donald D. Drone

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PREFACE

This particular subject was chosen for a Master's thesis for two reasons. First, it was intended that it might satisfy an innate desire of the author to understand how the various commercially available species of softwood framing lumber are established in the market. Second, it was intended that a review of the factors influencing species selection might be of some academic value to those involved in the various aspects of manufacturing, distributing, and using softwood framing lumber.

The coverage of this work is primarily selective rather than exhaustive. It was the author's intentions to concentrate on the basic factors that are congruent to the beliefs and feelings that are frequently voiced by those involved in the residential building industry. Groundwork for this study was secured through the author's contact of over seventy-five builders, lumber wholesalers, and lumber retailers in the Chicago metropolitan area. Extensive use was also made of the available information pertaining to the subject matter included in this study. To the author's knowledge, this is the first study of this nature that has been done on this topic.

I am deeply indebted to Professor William B. Lloyd for his guidance and suggestions. I also wish to acknowledge the help that fellow students and the staff of the Department of Forest Products

have given me. I am also deeply indebted to my wife, Cynthia, who patiently bore the burden of typing and proofreading the text of this study. The author claims full responsibility for any errors or shortcomings of this thesis.

D. D. D.

East Lansing, Michigan
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INTRODUCTION

Purpose

The major purpose of this study is to establish the importance of the various factors that influence selection of softwood framing lumber utilized in the framing of one and two-family residences.

Importance of Study

This study would be of little value to the residential builders, but to lumber intermediaries it can serve the purpose of explaining some of the factors entering into the buying decision for framing lumber faced by residential builders. It is not an attempt to isolate a specific factor and establish it as the controlling one; instead, it is an attempt to evaluate the more influential factors entering into the complete process from the manufacturer to the home buyer.

The product this study is concerned with--framing lumber--is a vitally important end product of the American softwood lumber industry. Bureau of Census figures indicate a total of 1,052,200 one and two-family housing starts in 1962(41). These starts accounted for an estimated consumption of 7.5 billion board feet of dimension lumber and 2.5 billion board feet of boards(46). If allowances are made for the consumption utilized in multiple family units, this is in excess of one-half of the total softwood lumber production of 26.8 billion board feet in 1962(43). Consumption of this material is not limited to housing units. Lumber is a versatile product that can be used for commercial, farm, and residential construction as well as for industrial purposes. Building and construction account for the consumption of approximately 87 percent of the total domestic softwood lumber production(26).

The subject of this study is brought about by the fact that framing lumber is manufactured from a variety of species that grow in diverse places some of which are quite remote from the major consumption areas. Transportation of lumber is expensive due to its bulk and relatively low value. Prior to the extensive development of railroads, inter-regional competition was limited by the remoteness of the production regions from major consumption areas (20,16). The cost associated with transporting lumber any sizeable distance was a potent stimulus in establishing lumber mills in regions close to major consumption areas in earlier times. The high cost of transporting eastern white pine (Pinus strobus) from Michigan to the regional market around St. Louis, Missouri was instrumental in establishing the lumber industry in Minnesota (20).

Early inter-regional competition was limited to eastern white pine. It was not until the Mississippi Trunk Lines standardized their guages that inter-regional competition between various species developed. Once rail lines to the North were standardized, southern yellow pine was available in the major Midwestern consumption areas heretofore limited to eastern white pine. Similarly, upon the completion of transcontinental rail lines, Eastern markets were opened up to species from the West.

Inter-regional competition is a real thing today, and has been ever since the beginning of the American softwood lumber industry in New England early in the nineteenth century. One only has to examine the available statistics and testimonies to see what effect inter-regional competition has on lumber consumption (46,47,42,48). In 1903, southern yellow pine was selling in the cities of Michigan at prices below those

of eastern white pine that was still being produced in Michigan pine mills less than 200 miles away (30). In 1963, Douglas-fir and the western spruces were selling in the southern half of Florida and in Texas Gulf Port cities at prices below that of southern yellow pine produced in neighboring states (31,47). These are the extremes of inter-regional competition, but nevertheless conditions occasionally prevail which permit these extremes to occur.

Economic conditions within the various production regions are extremely susceptible to fluctuations in demand for the region's output. In the twelve state production region for southern yellow pine, the number of mills decreased by as much as 76 percent in some states between 1953 and 1963 (47). Softwood lumber production in this region was down 33 percent from what it was in 1947 (47). The result of this was a decrease in employment and a depressing effect on economic conditions in the lumber producing areas in these states. More recently, some areas of the Western production region have experienced similar difficulties as Canadian imports and rising production in the inland empire have supplemented the production of the Western production region (48,17).

The major concern of this study is to evaluate the factors influencing utilization of the species of framing lumber employed in residential construction.

CHAPTER I

THE PRODUCT

Sawlogs cut from standing timber eventually reach a lumber mill where they are processed into lumber or other wood products. Exact processing methods vary between the different production regions and manufacturers as species, size of saw timber, and other factors change. Framing lumber coming from one region and manufacturer is similar in size to framing lumber coming from other manufacturers or production regions. Regardless of the production region or species, framing lumber destined for residential construction follows approximately the same channels of distribution from producer to builder.

Framing Lumber

Framing lumber is a descriptive term applied to boards and dimension lumber utilized in residential construction. Dimension lumber is defined in the Commercial Standard for Softwood Lumber R-16 as "lumber less than 2 inches to but not including 5 inches thick and 2 or more inches wide"(23). In the same standards, boards are defined as, "lumber less than 2 inches thick and 1 or more inches wide"(23). Dimension lumber may also be classified as framing, joists, planks, rafters, studs, and small timbers. Throughout the remainder of this study, the term "framing lumber" is used to refer collectively to dimension lumber and boards.

Physical Characteristics of Framing Lumber

Seasoning

Wood is a non-homogeneous substance with substantial variance within and between different species. Lumber shrinks in volume as its

moisture content drops below the fiber saturation point. Moisture content is the weight of the water contained in the wood expressed as a percentage of the weight of the oven-dry wood, and the fiber saturation point is that stage in the wetting or drying of wood at which cell walls are saturated but cell cavities are free of water(52). Since water leaves wood at a rather slow rate, it must either be stored for a considerable period of time in drying yards, where free circulation of air decreases the moisture content of the lumber, or placed in kilns, where artificial heat and circulating air remove the excess moisture at an accelerated rate. In either method, a cost is incurred in supplying heat and power for kilns or in the form of having large amounts of capital invested in inventories stored in drying yards over considerable periods of time. Since a cost is associated with either of the drying methods, considerable volumes of framing lumber are shipped with a rather high moisture content, i.e., green.

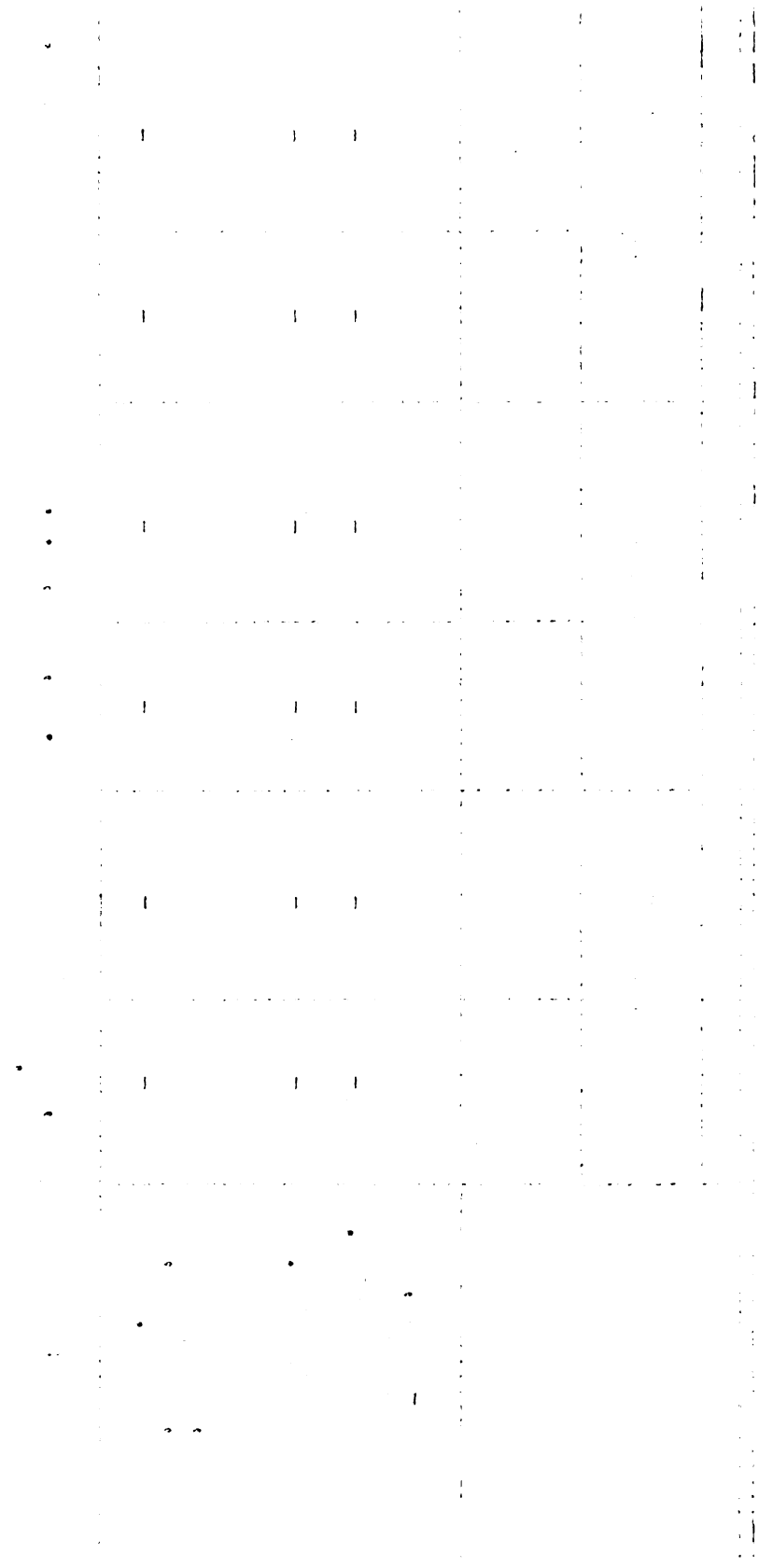
Since lumber shrinks in volume as it loses moisture below the fiber saturation point, significant amounts of shrinkage can occur if the lumber is installed in a structure before it is properly seasoned(33). On the average, softwood species decrease one percent in volume for every three percent change in moisture content below the fiber saturation point(46). Since wood that is not sufficiently seasoned will lose moisture to its surrounding atmosphere, it is important that framing lumber be installed at a moisture content approximating the final equilibrium moisture content to be obtained in service, if shrinkage is to be minimized. Table 1 gives the recommended moisture content values for framing lumber and other wood items found in residential structures at the time of installation in various geographic regions. Advantages

TABLE 1

RECOMMENDED MOISTURE CONTENT VALUES FOR VARIOUS WOOD ITEMS AT TIME OF INSTALLATION[a]

USE OF LUMBER	MOISTURE CONTENT[b]					
	Dry Southwestern States		Damp Southern Coastal States		Remainder of the United States	
	Average	Individual Pieces	Average	Individual Pieces	Average	Individual Pieces
Interior-finish, woodwork and softwood flooring.	5-7%	4-9%	10-12%	8-13%	7-9%	5-10%
Hardwood flooring.	6-7%	5-8%	10-11%	9-12%	7-8%	6-9%
Siding, exterior trim, sheathing, and framing.	8-10%	7-12%	11-13%	9-14%	11-13%	9-14%

[a]Source: Wood Handbook, Agriculture Handbook No. 72, 1955, U.S. Department of Agriculture(52).
[b]Expressed as a percentage.



associated with the use of dry lumber are generally recognized by wood scientists; however, a few of the more common advantages of using dry lumber associated with residential construction are listed below:

1. Shrinkage associated with the loss of water from wood occurs prior to installation.

2. Increased stress ratings are permitted in wood members less than four inches in thickness when they are properly seasoned to lower moisture contents (see Table 2).

3. Proper seasoning significantly reduces the chance of stain, mildew, or decay developing in transit, in storage, or in subsequent use.

4. The strength of joints made with common fasteners, such as nails and screws, is greater in seasoned wood than in green wood seasoned after assembly.

5. Dry wood is a better thermal insulator than wet wood.

6. Appreciable reduction in weight accompanying seasoning is a factor in reducing shipping costs by rail.

For most uses, properly seasoned material is superior in performance; and the advantages are generally recognized creating a demand for properly seasoned framing lumber. This is not the case in all instances, however, where seasoned and unseasoned material is used indiscriminately.

Strength Characteristics

Among the different species of softwood framing lumber, strength characteristics vary. Some species are ideally suited for structural purposes while others are not so well adapted. In past years, numerous species have been used successfully in the erection of homes and other structures. Today, a wide variety of softwood framing lumber is available in most metropolitan markets located outside of lumber producing regions.

TABLE 2

CHANGES IN STRENGTH PROPERTIES OF WOOD AS MOISTURE CONTENT DECREASES OR INCREASES[a]

STRENGTH PROPERTY	Change per one-percent change in moisture content(percent)
Static Bending:	
Fiber stress at proportional limit	5%
Modulus of elasticity	4%
Modulus of rupture	2%
Compression parallel to grain:	
Fiber stress at proportional limit	5%
Shear parallel to grain:	
Maximum shearing strength	3%
Tension perpendicular to grain:	
Maximum tensile strength	1.5%

[a] Source: Wood Handbook, Agriculture Handbook No. 72, 1955, U.S. Department of Agriculture(52).

Lumber Standardization

The American softwood lumber industry, like many other industries, cooperates with the United States Department of Commerce in establishing Simplified Practice Recommendations to govern the industry's production. It is SPR 16 which provides the American softwood lumber industry with standards for sizes, rating certification, and labeling of wood items and provides a uniform basis for fair competition(46).

In accordance with the provisions and requirements of the American Standards for Softwood Lumber, namely SPR 16, grading rules and regulations have been formulated by associations and individuals involved with the consumption and marketing of framing lumber to provide standards by which the production of the various regions might be graded. At the present time, there are six inspection bureaus and/or associations that formulate and publish grading rules for the various species of softwood lumber that are suitable for manufacturing into framing lumber(18).

Even though the lumber industry has established a commercial standard to govern the production of framing lumber, approved or so-called standard sizes vary from one production region to another and from one grade rule promulgating agency to another. Size deviations are usually not great enough to create major problems. The American Lumber Standards for Softwood Lumber do not specify at what moisture content lumber is dry or at what moisture content lumber is green(46). Responsibility of defining and regulating seasoning falls upon each of the grade rule promulgating agencies or associations. At the present time only one agency, the Southern Pine Inspection Bureau, specifically defines and enforces the moisture content of framing lumber prior to being grade marked(32). Other inspection agencies have written regulations into their rules,

but they do not state a maximum moisture content for the material before grade marking as standard lumber. Instead, grading provisions for dry lumber are alternates to the more common grading provisions where no mention is made of moisture content.

The present standard for softwood lumber has been the subject of much controversy since 1957. When the present standard SPR-16-53 was adopted in 1953, reference to moisture level was left ambiguous since intraindustry conflicts evidently desired to delete limitations on moisture content or size. The proposed revision of SPR-16-53, submitted to the Department of Commerce in February, 1964, contains four areas in which significant changes were proposed (46). The areas of significant change are:

1. Reference Moisture Level.--This would permit, for the first time, size standards related to moisture content. The reference level for standard dry lumber has been set at a maximum of 19 percent based on oven-dry weight. This figure is compatible with the Federal Housing Administration's Minimum Property Standards. It is a moisture content level that can readily be obtained in most sections of the country through air drying.

2. Altered Standard Sizes.--Nominal 1 and 2 inch thicknesses would be reduced below those in SPR-16-53. Nominal 2 inch thickness would become 1-1/2 inches at 19 percent moisture content, and 1 inch nominal would be 3/4 inch. A new standard 5/8 inch board would allow for resawing nominal 2 inch material.

3. Distinctions Between Green and Dry Lumber.--Provisions are made for grade marking all lumber as dry lumber when dressed at a maximum moisture content of 19 percent or less. Lumber machined or surfaced at higher moisture content levels cannot be grade marked as dry standard lumber. Minimum sizes have been specified for green lumber which are larger than dry sizes to allow for shrinkage.

4. Machine Grading.--Provisions have been made to enable the incorporation of machine stress rating into the new standards.

The balloting of almost twenty thousand producers, distributors, and users failed to show any consensus favoring the proposed standard(46). In June of 1964, the Department of Commerce returned the proposed standard to the American Lumber Standards Committee for further study. In August, 1966, the American Lumber Standards Committee with a three-fourths majority again submitted recommended sizes to the Department of Commerce. This will permit the Department of Commerce to move ahead with the revision of SPR-16-53. The original withdrawal date of SPR-16-53, September 16, 1966, has been extended by the Department in anticipation of the industry's approval of the revised standard. If the revised standard is not approved by January 15, 1967, it is subject to withdrawal by the Department of Commerce. Further information pertaining to the proposed revision of Simplified Practice Recommendation 16-53 can be found in The Impact Upon Small Business of U. S. Softwood Lumber Standards(46).

Channel of Distribution

Framing lumber destined for use in residential construction is, for the most part, distributed through the traditional channel of manufacturer, wholesaler, and retailer. Each of the intermediaries in the chain of distribution performs necessary functions that cannot be eliminated, but may be assumed by others. Alternate channels are created when the builder or lumber retailer by-passes or eliminates other members within the traditional channel. It is felt that direct buying from wholesalers or manufacturers is necessarily limited to large builders, and that it is restricted both in number and volume(24,13).

The gross sales of 18,705 retail lumber yards in 1963 amounted to 5.28 billion dollars(39). The volume of framing lumber sold through

retail lumber dealers is not known, but it probably accounts for the bulk of the estimated 7,472,000,000 board feet of framing lumber going into one and two-family units built in 1963(46). Retail lumber dealers offer residential builders a wide variety of services in addition to performing the basic functions of assembly and storage of a high bulk and relatively low value product. Due to a variety of causes, the number of retail lumber establishments has been declining in the past decade(39,26). However, unless significant advances are made in construction technology or consumer preferences are altered, the retail lumber dealer is likely to remain a significant factor in the distribution of framing lumber for residential construction.

Lumber wholesalers have played an important part in the distribution of lumber in the past and will most likely continue to do so in the future. Wholesalers have been responsible for the distribution of more than fifty percent of all softwood lumber in past years(1). In 1962, lumber wholesalers and commission men accounted for the distribution of at least 62.3 percent of the total domestic softwood lumber production(34). Commission men have decreased both in number and importance in recent years. This is due to the changing needs of manufacturers with respect to disposing of their production.

In addition to wholesalers and commission men, large manufacturers maintain sales branches and offices in many of the larger metropolitan areas. Recent census data confirm the increasing popularity of manufacturers' establishing branch offices and warehouses(26,40). The efforts of the manufacturers' sales branches may or may not complement those of other middlemen, depending upon the policy of the manufacturer. Some manufacturers prefer to sell their entire production through their

own sales force while other manufacturers solicit the aid of other sales outlets outside their organization. Wholesalers' and manufacturers' sales branches may or may not include storage and distribution facilities. In recent years, the number of independent wholesalers with distribution yards has decreased while manufacturers or non-independent wholesalers have been increasing their number of branches with storage and distribution facilities. Recent census data to affirm these trends are not available, although the consistent appearance of business terminations as noted in trade publications might indicate such a trend.

Use of Framing Lumber

In general, framing lumber, as previously defined, is lumber used in the erection of the structural frame of the home. Within this major classification are two product groups--boards and dimension lumber. Dimension lumber, as previously described, is used for joists, rafters, headers, sills, plates, and studs, while boards find use as decking, subflooring, and sheathing. Inroads by alternate products such as low density fiber board, plywood, and gypsum sheathing and new techniques of construction have reduced the volume of framing lumber required in the erection of the average one and two-family residences.

Framing lumber is not necessarily limited to residential construction. A 2 x 10 may be used as a floor joist by residential builders, scaffolding by masonry contractors, or shoring by excavating contractors. Also, considerable volumes of framing lumber find their way into farm structures, commercial structures, repair, maintenance, and industrial uses. However, for the purpose of this study, framing lumber shall consist of all dimension lumber and boards normally used in the erection of the structural frame of one and two-family residences.

CHAPTER II

THE MAJOR CONSUMER

Residential builders are a very important group of lumber consumers. Annually, they use approximately thirty-eight percent of the domestic softwood lumber production in the erection of single-family dwellings(46,26). Another thirty-four percent of the total lumber production is used in other private and public construction(26). The remaining twenty-eight percent of domestic softwood production is used by industries or exported. Without question, the residential construction industry is the single most important user of softwood lumber, and the residential builder the largest single consumer.

Residential Builders

The American homebuilding industry is an exception among major industries in that a proportion of all houses built in the United States are constructed by individual households or non-professionals(24). In some areas, mostly rural, it is not uncommon to find individuals engaged with the help of friends in erecting their own homes. The total percentage of homes built by the owner-builder has been decreasing while the volume of homes built by other classes of builders has been increasing. The four classes of builders found in the building market are:

1. owner-builder
2. custom builder
3. merchant builder
4. prefabricator

Since owner-builders are not usually considered a part of the homebuilding industry, they are excluded from this study. These builders

seldom appear in the market more than once. The owner-builders actually account for only a very small percentage of the total homes built in a given year. Their knowledge and experience with softwood framing lumber is limited.

Custom Builders

There is no consensus in the building industry on the definition of a custom builder. Some authors consider any builder completing less than twenty-four homes per year a custom builder, while others associate custom builders with a method of operation rather than with a unit output criteria(24,19). For the purpose of this study, the definition of a custom homebuilder is consistent with an operational classification.

Typically, the custom builder enters the picture after the home buyer has acquired a lot and has plans or definite ideas of what he wants in his home. Financing of construction is generally secured from a bank or a savings and loan institution through the efforts of the owner himself. The custom builder and home buyer usually reach a decision on final cost after a quantitative estimate has been prepared by the builder and a bid price submitted. Contracts between custom builders and owners vary considerably depending upon the specific needs of the owner and on what the builder can offer. This process gives the home buyer the maximum degree of individuality.

The typical custom builder usually expects to do some of the work with his own labor force and to subcontract the balance. Carpentry work is often done with his own labor force since it extends through most of the entire construction period. Excavation, concrete, masonry, plumbing, heating, and electrical work are usually subcontracted. Subcontractors are an essential part of the custom building process. It is rare to find

a builder who will build the complete structure with his own organization. Conversely, very few custom builders subcontract the complete job. If the custom builder subcontracts the carpentry work, he usually exercises some degree of control over material used, either by direct purchasing of the material himself or the right to approve all materials selected by his subcontractors.

Homes built by custom builders are generally characterized by the following features: more spacious, more expensive fixtures, unique designs, and higher quality materials. The custom builder's reputation plays an important role in obtaining jobs. For the most part, they rely on market contacts secured from acquaintances among real estate dealers and through previous customers.

The custom builder's operation necessarily dictates that the purchases of framing lumber be made through the traditional channel of distribution. This is brought about by the variety of framing lumber sizes necessary in the erection of custom homes. The logistics involved in purchasing, storing, and delivering framing lumber to the job site exceed the resources that the average custom builder possesses. Purchasing procedures of custom builders vary, but two definite patterns have been established(24). First, there are the builders who purchase their material from a particular retail lumber firm with the belief that they obtain better service and higher quality material. Second, there are the builders who believe that there are no perceptible variations in quality and service obtained from retail lumber dealers but feel that competitive bidding between lumber suppliers gives them a more realistic price of framing lumber.

Merchant Builders

Merchant builders are also referred to as operative or development builders. In the past, they were recognized as the "speculative builders". As was the case with custom builders, there is no consensus in the industry on what constitutes a merchant builder. Some authors prefer to associate the merchant builder with a size criteria, while others consider operating procedures as the distinguishing factor. Size is not necessarily the distinguishing feature between custom and operative builders. Merchant builders, erecting large groups of houses in populus urban and suburban areas, have become the industry's largest suppliers of single family residences.

Merchant builders' current popularity and success can be attributed to three different factors--buyer preference, construction, and land. The difficulties and problems associated with finding a lot, obtaining a builder, arranging financing, and planning a house have become too cumbersome and time consuming for the average individual. Custom building is even more involved where financial and legal problems are more detailed, placing greater responsibility on the home buyer. The consumer's desire to purchase a completed house has been a major factor in establishing the position of merchant builders. Buyers are taking an easy and safe path of buying something they can actually see, even if they are not completely satisfied.

Economies of scale of operation become possible when large numbers of similar houses are erected in close proximity. The size of the merchant builder's operation has a direct influence on the economies available. Direct purchasing from manufacturers or wholesalers is done for some products, while others are still bought through traditional

channels regardless of the required volume. Not all the savings accrued through eliminating a market intermediary can be passed on to increase company profits. This is due to the fact that some of the functions formerly performed by the intermediary must be assumed by the builder. Higher degrees of specialization accrue to the labor force when sufficient work is available to assign specific tasks to individuals. As the production of homes increases, savings accrued through labor specialization become significant. Economies are also available through greater efficiency in purchasing, mechanization, land development, planning, cost control, promotion, and sales.

A survey of merchant builders completing 100 or more homes per year revealed that only 17 percent bought framing lumber directly from office wholesalers or saw mills(49). Fifty-eight percent of the builders bought their framing lumber through retail lumber dealers while only twenty-five percent bought from a wholesale distribution yard(49). From the available data, it is difficult to draw any concrete conclusions as to a definite trend for or against the continued use of the retail lumber dealer as a source of supply for framing lumber. The study did find, however, that direct mill purchases or direct shipments through office wholesalers were limited to the largest of the merchant builders(49).

Prefabricators

Prefabrication is not a recent innovation of the building industry. Prefabricated store buildings were available for shipment to merchants as the transcontinental railroads pushed westward. It was not until the end of World War II that prefabricated homes became an important factor in supplying American housing. In the late 1940's, prefabrication accounted for only three to four percent of all single-family residences(19).

It is expected that 24.11 percent of the single-family starts in 1966 will be prefabricated homes(10).

For the purpose of this study, prefabrication refers to the construction of the major assemblies, such as walls, in a factory or other location away from the house site. A prefabricated house is constructed of components built in a factory and trucked to the site. The house package usually consists of exterior walls with windows and doors installed, interior partitions, exterior siding, and roof and floor systems. Kitchen cabinets, appliances, heating, wiring, and plumbing may or may not be included. Although the degree of factory fabrication varies between different manufacturers, all have a common purpose, namely, reduction of on-site labor requirements. Typically, the prefabricator sells his production through dealers who may or may not be a custom or merchant builder.

The major objective of prefabrication or prefabricated homes is to reduce the final cost of the home. This can be achieved in prefabrication through(19):

1. Transfer of labor from the construction site into a plant where more efficient working conditions prevail, where lower wage rates may be paid, and where production is not dependent upon climatic conditions.

2. Quantity buying of raw material and equipment at prices lower than those available to other types of builders.

3. Higher management efficiency.

Regardless of the manner in which a house is constructed much the same types of materials are utilized. With few exceptions, the material going into a prefabricated house would be similar to those going into a house being constructed in the conventional on-site manner. When a

prefabricated home is erected, the builder or erector is not responsible for selecting or purchasing the materials going into the assembly. Instead, the responsibility is assumed by the prefabricated home manufacturer.

Normally, manufacturers of prefabricated homes do not purchase their materials through the traditional channels of distribution. The volume of production associated with the successful operation of a prefabricated homes' manufacturer requires large quantities of softwood framing lumber and other materials. Consequently, it would not normally be economically feasible for a prefabricator to secure softwood framing lumber through a retail lumber yard. Instead, the prefabricator would purchase framing lumber through a wholesaler, commission man, or directly from the mill. In this manner, savings could be accrued through eliminating the middleman's overhead and profit.

Buying Situation

Residential builders, custom and merchant, and prefabricators are faced with two questions in every buying situation--price and quality. The quality of each of the different materials going into a residence is partly responsible for the overall quality of the completed structure. It is generally assumed that a higher quality material contributes greater performance or satisfaction, real or imaginary, to the consumer. Higher quality is not without its counterpart, increased price. A general consensus of criteria for quality is often missing. In situations such as this, higher quality materials may or may not be more costly, depending upon the criteria by which one judges quality.

Price and quality are understandably of major importance to builders. If final quality of the finished residence is too low, a

major problem arises in disposing of it. On the other hand, if the final quality is too high, the final cost might be excessive. In periods of intense demand for all available housing, the question of too low or too high quality is not a problem. In periods when demand for housing is not unusually intense, price and quality become an important factor for the builder to consider in making material purchasing decisions. The weight that quality or price carries in making the buying decision will depend upon, among other factors, the conditions of the housing market, the type of home being built, and the integrity of the builder.

Level of Quality

The general level of quality that the finished home takes on may have a definite effect on its sales possibilities. While the highest level of quality is generally thought to be most desirable, this may not be the case if it excessively increases the final cost. Thus the builder is constantly confronted with a conflict between quality and cost. The various factors involved in establishing suitable levels of quality can best be determined by examining the hypothetical analysis of two diametrically opposed builders--the price builder and the quality builder.

The price builder would be the builder who gives all possible consideration to the price of the product in making the buying decision. Increasing his profit or lowering the selling price of the finished home through minimizing raw material expenditures would motivate him to purchase the cheapest product available. The price builder would not hesitate to use substandard grades if he felt that they would not be detected. In short, the price builder's goal would be to erect a home that just meets the minimum acceptable level of performance.

The quality builder, on the other hand, would be the builder who gives paramount consideration to the quality of products in making the buying decision. A quality builder would be motivated to place the highest quality materials available into the construction, giving cost only a casual consideration. His true interest would be to give the home buyer a quality home that would, among other things, minimize all maintenance costs.

In reality, it is almost impossible for a pure price or a pure quality builder, as they have been defined, to exist. The highly monopolistic-competitive market in which the builder operates directly influences the quality of homes(21). Similar styles and sizes of homes must be in proximity price-wise if builders are to enjoy any degree of sales success. Given a particular size and style of home, the pure quality builder would not be able to give the consumer a competitively priced home if he stressed quality--his overt consciousness of quality would price him out of the market. Since profit is the driving force in the free enterprise system, no builder would knowingly operate as a pure quality builder, due to the effect on his profit. The small custom builder in today's housing market comes the closest to being a pure quality builder.

The pure price builder, on the other hand, would optimize his profits by purchasing the lowest priced material available and selling the finished home at a price level comparable to other offerings on the market as far as style and size are concerned. This would, at first, seem like a very profitable method of operating; however, a builder cannot ignore quality if he expects to maintain a profitable return on his business investment. It is recognized that unless the

builder maintains a sales volume, he will not earn a profit from his business investment. The builder's reputation plays an important role in maintaining his sales volume. A recent survey conducted in three cities revealed that a builder's reputation was ranked as one of the top four reasons given by home buyers for initially contacting a particular builder(5). Unless the builder erects a home with an acceptable minimum level of quality, his reputation is likely to be anything but favorable. A builder who wants to remain in business would strive to maintain his reputation as a reputable builder; and, therefore, he would not necessarily purchase the least expensive or lowest quality material but would try to maintain some acceptable level of quality.

The Ideal Modern Builder

The ideal modern builder is introduced at this time to establish a criteria by which the operation of builders in today's market can be evaluated. However, no builder in reality would actually be described. Instead, this discussion is offered as an aid in evaluating aspects of the buying and selling situation faced in the residential building industry.

The business behavior of the perfect modern builder would assume some of the characteristics of both the quality and of the price builder. Profit motivation and maximization would restrict pure quality building, and product performance would restrict pure price building. Desire for maintaining profits over an extended period would prompt the ideal modern builder to erect a home with a satisfactory level of quality such that his product would give the consumer a level of service commensurable to his investment, while at the same time convincing himself that the finished home is of a quality which is consistent

with his reputation as a reputable builder within the community.

As might be suspected, the ideal modern builder displays various traits of the quality and price builder, depending upon the products he is purchasing for use in the homes he builds. The ideal modern builder would increase the quality of products going into the finished home above the minimum acceptable level only if it would cause a greater or equal change in his total revenue derived from the final sale. This can be expressed mathematically where dC represents the relative change in cost divided by dR, the relative change in revenue.

$$\frac{dC}{dR} < 1$$

With this in mind, the ideal modern builder would be justified in increasing the quality of products until the added revenue received from an improvement in quality just equalled the added cost accrued through improving the final level of quality in the finished home. That is,

$$\frac{dC}{dR} = 1$$

An example of this principle would be the substitution of vinyl tile for linoleum as a floor covering in some rooms of the home. A home buyer might have a greater desire for tile than linoleum and be quite willing to pay more than the cost of a linoleum installation. It would not be a profitable decision to substitute vinyl tile for a linoleum installation if the home owner is only willing to pay the price of a linoleum installation. In the former case, the added cost would be more than offset by the added revenue, that is:

$$\frac{dC}{dR} < 1$$

But, in the latter case, the added cost would be more than offset by the added revenue, that is:

$$\frac{dC}{dR} > 1$$

Another example that could be cited would be the weight of roofing shingles. The lightest weight shingles commercially available are not approved by the Federal Housing Administration for use on government insured housing. This forces the builder to use a higher quality of roofing than he might normally use. This does not necessarily mean that he would voluntarily use the highest quality of roofing available. A builder could increase the quality of roofing considerably above the acceptable minimum if he desired; but if the home buyer did not recognize or want the higher quality roof and was not willing to pay for it, it would not be profitable for the builder to raise the quality above the accepted minimum.

If today's builder is to maintain or maximize profits, he must have some concept of the above principle. To increase the quality of products going into the home, without consideration of the consumer's needs or what he is willing to pay for, would not be the most profitable action. Excessive quality built into a home could exceed both the level needed or wanted by the consumer and the price he would be willing to pay.

Home Buyer's Preference

Consumer preferences can have a direct bearing upon the quality of materials going into the home. A recent study indicated that home buyers are particularly interested in interior and considerably less interested in exterior aspects of today's housing(13). Table 3 indicates the home buyer's ranking of eleven factors pertaining to characteristics of the home. As shown in Table 3, exterior style is ranked extremely low when compared to interior design and other factors. The ideal modern builder would thus be more receptive to increasing the level of quality

TABLE 3

HOME BUYER'S INITIAL REASONS FOR LOOKING
AT A PARTICULAR BUILDER'S HOUSES[a]

REASON	PERCENT INDICATING[b]
Interior Design	60%
Community Attractiveness	57%
Space for Family Needs	50%
Quality Construction	49%
Builder's Reputation	47%
General Location	46%
Location Convenient to Schools, Shopping, and Employment	36%
Overall Value	29%
Built-in Features, Equipment	23%
Exterior Style	14%
As an Investment	11%

[a]Source: Products Used In Today's New Homes . . . And Who Selects Them. Bureau of Building Marketing Research(5).

[b]Multiple response of four.

in the materials for home interiors where the improvements in quality would more likely be recognized.

For products that the home buyer is aware of, has a greater desire for, and is willing to pay for, the ideal modern builder would not be as conscious of price and would exhibit buying traits characteristic of the pure quality builder. On the other hand, the ideal modern builder might exhibit traits more characteristic of the pure price buyer for products that the home buyer is not aware of or for which he does not have a strong desire. The ideal modern builder would not lower the quality of any materials going into the home below the acceptable minimum even though it might be an item for which the consumer shows little interest or is unaware of.

Today's Builders

Where today's builders belong in the described model with respect to softwood framing lumber is of concern in this study. As in the previous discussion on elements going into the modern home, the ideal modern builder would want to maximize his returns on framing lumber if at all possible. That is to say, for every dollar spent on framing lumber in the erection of a home, the builder would expect this cost to be passed on to the ultimate consumer in its entirety.

There is a possibility of conflict over the consumer's valuation of the structural framing of the modern home and what the builder feels is the proper valuation for the structural framing of a home. The most probable cause of conflict would arise out of the builder's interpretation of what is necessary for proper construction and what the home buyer is willing to accept or pay for.

Since framing lumber is likely to go unrecognized in the finished home by the home buyer, there is little advantage in increasing its grade or quality. The fact that builders will use practically any softwood framing lumber is illustrated by the variety of grades and species of commercially available softwood framing lumber from the inventories of retail lumber yards. Normally,

home buyers are not well enough informed to determine the grade and commercially available species of framing lumber best suited for a particular end-use. With the possible exception of wall studs, framing lumber is sold on a price basis alone.

It is the consensus of the various lumber wholesalers, retailers, and residential builders contacted by the author that the home buyers do not exhibit any great concern over the species, grade, or quality of dimension lumber used in framing their homes(Appendix). In fact, a few wholesale and retail lumbermen even questioned the degree of concern that home builders exhibited for the grade and quality of framing lumber used. A recent survey by the Bureau of Building Research indicates that home buyers are concerned with the quality of construction, but only in a realistic way--"they rely on the builder's reputation and knowledge for assurance of value in terms of construction qualities and techniques"(13).

With this apparent indifference existing for softwood framing lumber, it would seem unlikely that the ideal modern builder's position would differ significantly from that of the pure price buyer. The quality of framing lumber going into the structural framing of a home would tend to be of a minimum level that would be sufficient to permit the home to conform to the building code. Building codes and the Federal Housing Administration's Minimum Property Standards have established a minimum acceptable level of construction for most of the new housing being erected today(11,2,38). In the few municipalities where building codes are non-existent, the selection of framing lumber is left to the discretion of the builder, if the home is not to be financed by a government insured mortgage. In either case, framing lumber is not likely to be of an exceptionally high grade or quality if a lower grade or quality material meets the requirements established by the building code or Minimum Property Standards.

CHAPTER III

ECONOMIC FACTORS INFLUENCING SOFTWOOD FRAMING LUMBER UTILIZED IN RESIDENTIAL CONSTRUCTION

For the purpose of this study, economic factors will be those factors with which an actual cost is associated. Economic factors included in this study are initial cost of building materials, installation cost, insurance costs, storage costs, and costs associated with adjustments made to the finished structure upon completion, hereafter referred to as "call-backs".

Initial Cost

To the residential builder, the initial cost of framing material is composed of several separate sub-costs. The sub-costs that make up the total costs to the builder are as follows:

1. F.O.B. cost of dimension lumber at the manufacturer's mill.
2. Transportation costs from the mill to the construction site.
3. Operating cost of retail lumber yards.
4. Operating cost of lumber wholesalers or other intermediaries.

It is possible for a builder with sufficient volume to buy directly from the manufacturer. This practice is common among industrial users of wood, but studies of the residential building industry reveal that this is not a common practice(24,25).

For the purpose of this study, the wholesaler's and retailer's portion of the builder's initial cost will be disregarded. It will be assumed that the initial cost of framing lumber to the residential builder consists of the f.o.b. mill price and transportation costs.

Here we are assuming that the combined operating costs and profits of any combination of wholesalers and retail lumber yards are equal. This is not unrealistic since the operating cost and profits of any one retail lumber yard or wholesaler would approximate the operating costs and profits of any other wholesalers or retailers. This is due to the fact that both the wholesaler and retailer are in very competitive positions. Wholesalers are constantly under the pressure that new firms might enter into the market if they earn excessive profits, "pure profits"; or retailers might circumvent them and buy directly from producing mills if costs are too high. Retail lumber yards operate in a similar situation where excessive profits might attract new firms, or excessive costs might make direct purchasing from manufacturers' mills or wholesalers attractive to large residential builders. In both cases, the market for softwood framing lumber assumes the characteristics of a pure competitive market(21).

For present purposes, the price of framing lumber that the residential builder faces in the market place (P) is made up of two elements: f.o.b. mill price (p) and cost of transportation (t). Then for any destination and/or use point,

$$P = p + t$$

where the unit of valuation for (P) is equal to dollars per thousand board feet (MBM). The f.o.b. mill price of the dimension lumber at the manufacturer's mill (p) is made up of direct raw material cost, sawlogs (s) plus all other operating costs (c), such that

$$p = s + c \qquad 3.2$$

Transportation cost (t) can also be further broken down to distinguish between lumber movements via water and rail. Transportation costs for

shipments by water are generally given in dollars per thousand Nominal Board Measure for a specific origin/destination, and can be considered a constant (t_w). Transportation costs for shipments by railroads are a function of weight (w) and of the freight rate (f_r), so that the transportation costs of framing lumber shipped to the destination become

$$t_r = wf_r \qquad 3.3$$

The delivered price of framing lumber can mathematically be expressed as

$$p = s + c + t_w \qquad 3.4$$

for deliveries made to destinations via water carriers and

$$p = s + c + wf_r \qquad 3.5$$

for deliveries made to destinations via railroads.

Two other common modes of transportation, motor trucks and barges, are used in varying degrees by lumber shippers. The transportation cost (t) for framing lumber delivered to the destination/use point via motor freight is a function of two elements, the weight (w) and the freight rate (f_t) so that

$$t = wf_t \qquad 3.6$$

Transportation costs for air and motor freight both are based on the weight and the corresponding freight rate based on the commodity classification and the distance involved. The price that the builder must pay for dimension lumber shipped via motor freight is represented as

$$P = s + c + wf_t \qquad 3.7$$

Transportation charges for framing lumber delivered to points of destination/use via barge on the inland waterways are determined by the origin/destination. This situation is identical to the previously discussed case of transportation via water. Thus, the delivered price

of dimension lumber in the market place is identical to 3.4

$$P = s + c + t_w \qquad 3.8$$

All of the factors brought out in the preceding discussion play a role in establishing the final price (P) that the residential builder pays in the market for softwood framing lumber. The relative importance of the various factors in determining price varies within and between various production regions(46, 16,53).

Raw Material Cost

From 1900 until 1940, the average stumpage price in the United States remained about constant being approximately equal to seven percent of the total lumber costs(39,14,1). The price of stumpage has risen rapidly in the years since World War II, until it now represents at least 20 percent of the delivered cost of softwood framing lumber(53,47).

Sawlog cost (s) at the manufacturer's mill is made up of the cost of stumpage (s_t) in the forest and all other costs associated with the conversion of stumpage into sawlogs and delivery to the lumber mill (c_1). The mill price of sawlogs can thus be expressed as,

$$s = s_t + c_1 \qquad 3.9$$

The valuation placed on stumpage or sawlog timber is a residual value(7,9). The value of stumpage is the difference between the selling price of log products, e.g. lumber; plywood; pulp products; etc., and total operating costs and profits incurred in its removal and manufacture(53,7,9). Or,

$$s = S - (c_1 + P) \qquad 4.0$$

where,

s = stumpage valuation or costs
P = margin for profit and risk
S = sales returns from sale of log products
c_1= operating costs exclusive of stumpage

Since stumpage prices are a residual value, they do not exert an upward pressure on lumber prices (53). High stumpage prices are a counterpart of high lumber prices and not the causing factor for high lumber prices. High stumpage prices put considerable pressure on the level of profits that a manufacturer can expect to earn from the conversion of sawlogs into a usable end product. An example of this would be the Douglas-fir production region where demand has escalated stumpage prices to such a level that only the more efficient manufacturers have been able to sustain profitable operations.

The relationship between lumber prices and stumpage costs can be illustrated by examining an end product, dimension lumber of southern pine (Pinus, sp.) and Douglas-fir (Pseudotsuga menziesii). The stumpage price of southern pine timber has exceeded, in practically every year since 1910, the stumpage price of Douglas-fir (14). Due to the influence of various economic factors, the higher stumpage price for southern pine sawtimber has not excluded it from competing in the major consumption areas in the East and Midwest during the past one-half century. The delivered price at the market place is the important factor, and a production region with higher than normal raw material costs or a low level of productivity might still be competitive due to other factors. A recent illustration of this is the extremely competitive price that southern pine framing lumber has maintained with respect to Douglas-fir framing lumber in recent years. Southern pine framing lumber was at a price disadvantage for numerous years; but through an adjustment in an economic factor, freight rates, southern pine manufacturers have secured the competitive advantage in many of the major consumption areas east of the Mississippi. In this specific situation, stumpage, as an economic

factor, was not involved; and the adjustment made to alter the competitive position of southern pine manufacturers was to obtain a more favorable freight rate, a non-manufacturing and processing cost.

Manufacturing-Processing Cost and Mill Price

Operating cost is the other cost associated with the f.o.b. mill price of framing lumber as indicated in formula 3.2. Included under the heading of operating costs would be all costs associated with the logging, processing, and manufacturing of lumber from sawlogs. To the lumber producer the only cost not included in the category of operating cost is the cost associated with stumpage. Otherwise, all of the firm's explicit costs associated with its operation are included.

For the purpose of this study the cost of logging is included in the firm's explicit costs. Some of the costs associated with this phase are the felling of trees, bucking to length, and transporting logs from the forest to the lumber mill. Logging cost varies within as well as between the various producing regions. In determining the valuation of stumpage or standing timber, operating costs, along with the margin for profits and risks, are prime factors. The relationship between logging cost and stumpage price is an inverse one. Other things being equal, a higher logging cost in a geographic area for a given species of timber will result in a lower stumpage cost. Table 4 shows the differences in stumpage valuation for several species in various geographic locations.

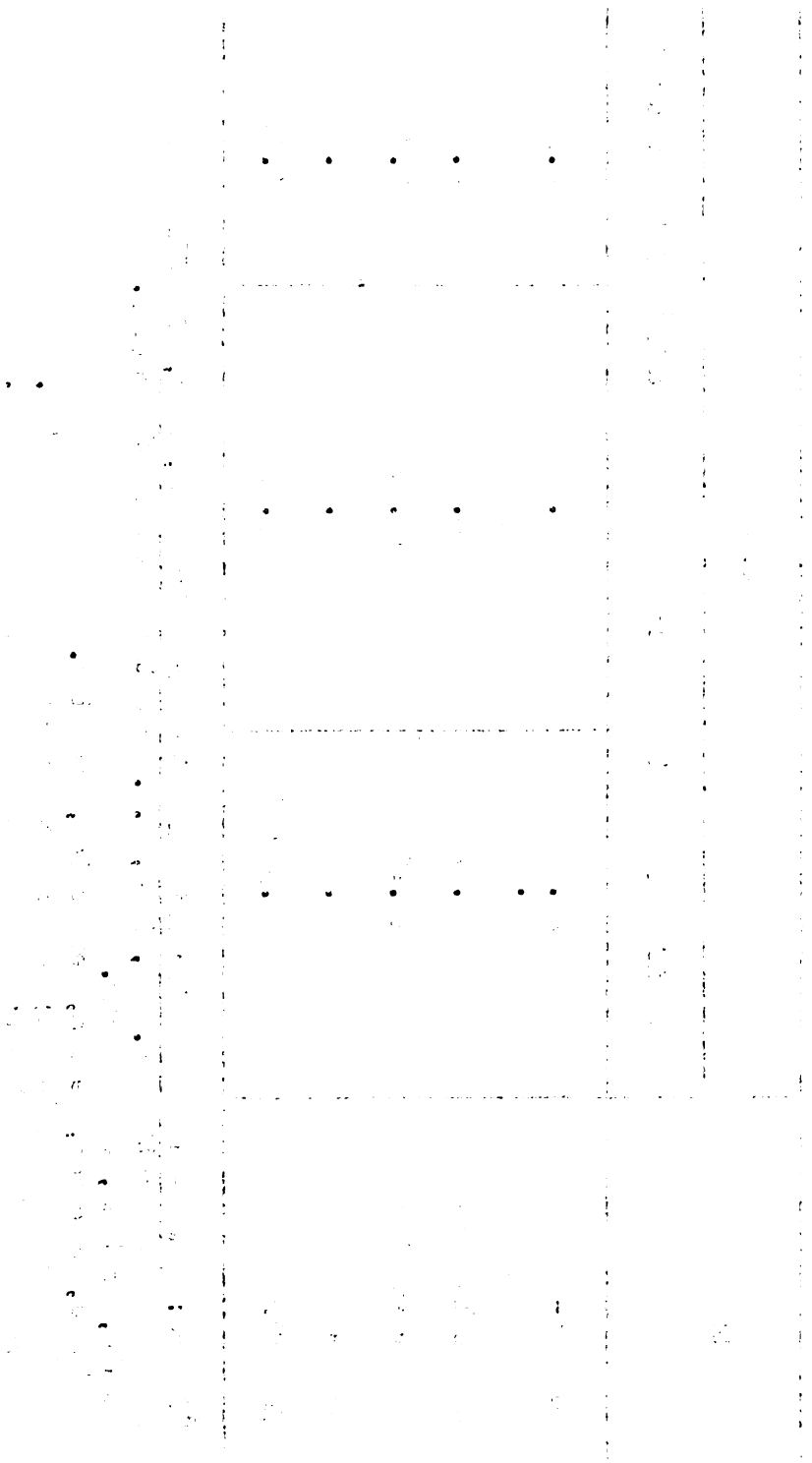
For Douglas-fir sawtimber, the difference in stumpage prices between the various geographic regions is quite marked. In western Oregon and Washington, the average price per thousand board feet in

TABLE 4

STUMPAGE PRICES FOR SAWTIMBER SOLD FROM NATIONAL FOREST FOR SELECTED SPECIES AND REGIONS, 1963[a]

SPECIES	REGION		
	Pacific Northwest	Northern Rocky Mountain[b]	Intermountain[c]
Douglas-fir	$27.95[d] 5.83[e]	$7.56	$2.78
Lodgepole pine	3.67	2.90	2.38
Ponderosa pine	14.23	11.30	7.74
Spruce	9.47	7.84	3.43
True fir	7.58	3.25	1.39

[a]Source: The Demand and Price Situation for Forest Products, 1964, Miscellaneous Publication No. 983, 1964, U.S. Department of Agriculture(14).
[b]Idaho, Montana, and Wyoming.
[c]Arizona, Colorado, Nevada, New Mexico, and Utah.
[d]Western Pacific Northwest; Western Oregon and Western Washington.
[e]Eastern Pacific Northwest; Eastern Oregon and Eastern Washington.



1963 was $27.95 while in eastern Washington and Oregon it was only $5.83; and in the Intermountain region the average price was $2.78(14). For ponderosa pine, the highest stumpage price was in the Pacific Northwest region at $14.23; and the lowest was $7.74 in the Intermountain region(14).

Variations in logging costs can be due to several factors. Among these factors are variances in labor rates, equipment cost, labor productivity, site conditions, and stand characteristics. No doubt much of the difference in stumpage valuation between western Oregon and Washington and the Intermountain region is due to accessibility, volume of timber in stands, and site conditions.

The variations in production costs between different regions can be quite pronounced. This difference in productivity in man-hours needed to produce one thousand board feet of framing lumber between different production regions can best be summarized by the statement of C. H. Lewis, of the Louisiana Forestry Commission, in his testimony before the Committee on Commerce in hearings on The Impact of Lumber Imports on the U. S. Softwood Lumber Industry:

> "... out West, huge logs this big, some of them as big as that table, they can manufacture 1,000 board feet of lumber with the use of about 11.7 man-hours whereas down South the average is about 25 man-hours in the manufacture of lumber out of logs about the size of your leg or a little bigger(47)."

Similar man-hour production figures are given in forestry periodicals and texts dealing with forest economy(12,50). Productivity per thousand board feet being what it is in these two regions, if all other factors were equal, the average wage rate in the South would have to be at least 50 percent less than the average rate in the West. Non-unionized operators in the South are, in fact, paying labor scales that

are approximately one-half those faced by Western producers(15,12).

The fact that one region might have a lower wage rate becomes insignificant when differences in productivity are so pronounced. That is, the relatively cheaper labor rates in the South do not give those manufacturers a decisive price advantage of any degree due to the greater number of man-hours needed to produce an equal volume of lumber. A gain in productivity would naturally be appreciated in any production region; however, in the past, what gains have been made in productivity have been absorbed by increasing stumpage or labor costs(12).

Transportation and Delivered Price

The transportation cost under consideration is the cost of transporting one thousand board feet of lumber from the mill (origin) to the end/use point (destination). The role of transportation cost in influencing the market price for lumber products is truly a historical one. Southern producers did not enter the lucrative Northern markets until Mississippi Valley Lines standardized their guages in the early 1870's and Western producers could not compete in the Midwestern and Eastern markets until they received favorable rates from the trans-continental railroads(16).

Transportation charges are calculated from freight rates based on destination and origin in cents per hundred pounds or thousand board feet depending upon whether the shipments are via motor truck, rail, barges on inland waterways, or ships. How the specific rates on lumber are determined for given destinations and origins will not be discussed due to the numerous factors and inherent complexities. The important factors relevant to freight rates are that they are influenced by the distances involved, the value of the product, the

volume of movement, competition from other modes, and competition from other carriers(8,42).

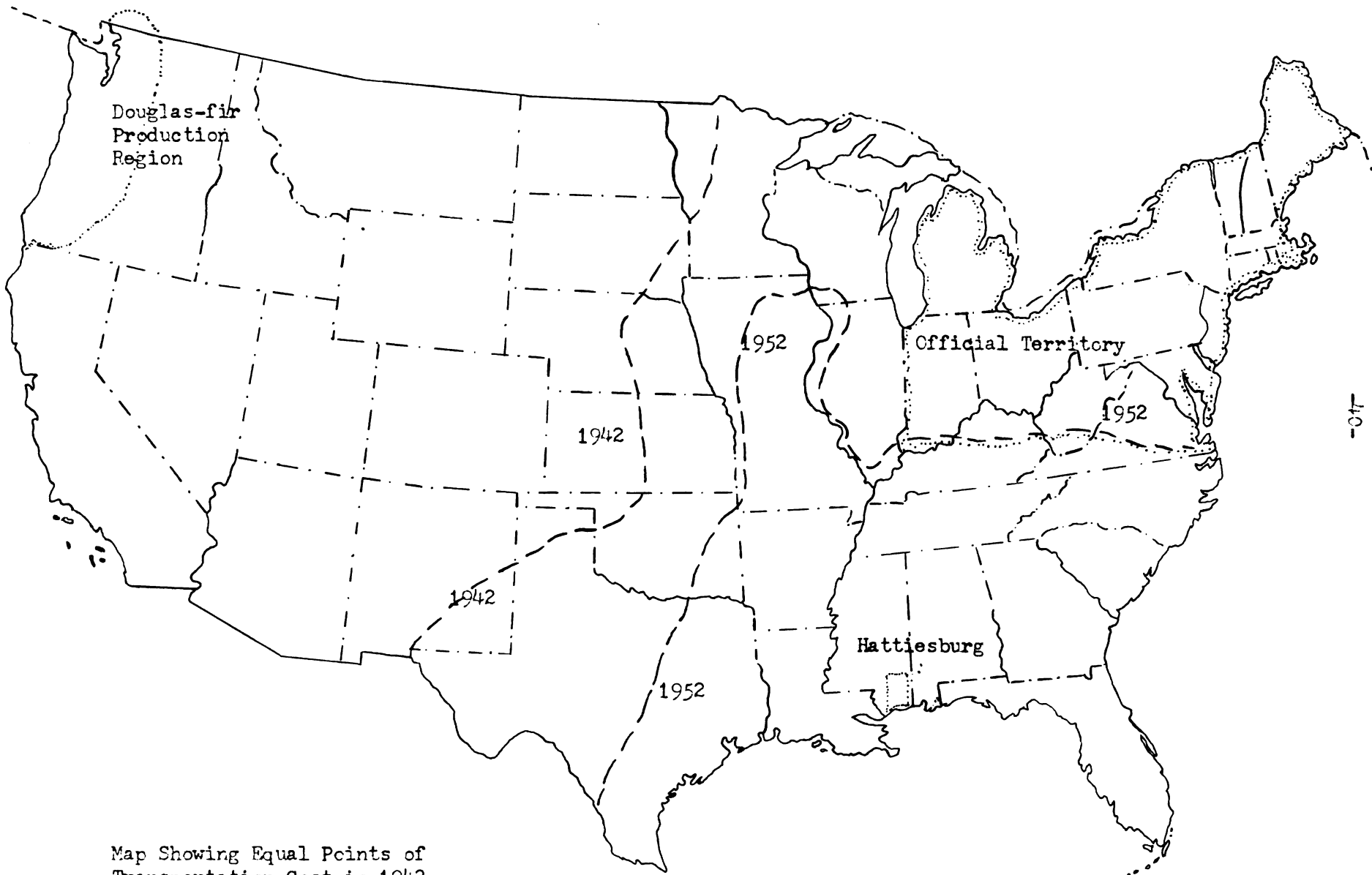
Framing lumber as defined in this study fits into the commodity description on which blanket lumber rates apply. The blanket lumber rate applies to the various wood products manufactured from logs by sawing, resawing, and passing lengthwise through a standard planing machine, crosscutting to length, and/or end-matching(44). All of the manufactured products of wood that fit within the above commodity description would take the same freight rate in cents per hundred pounds for identical origins and destinations.

For the most part, the major softwood lumber producing regions are quite remote from major consumption areas. Over 56 percent of the nation's total sawtimber is contained in and west of the states of Montana, Wyoming, Colorado, and New Mexico--an area which contains only 15.5 percent of the nation's total population(42,36). This same area annually accounts for approximately 70 percent of the total domestic lumber production. The other major softwood producing region, the South, contains approximately 22 percent of the nation's sawtimber and annually produces approximately 25 percent of the domestic lumber production(36,14). The markets for framing lumber produced in the West are those areas of the United States which are heavily populated; that is, those markets on and east of the Mississippi River and large cities located on the Pacific Coast(42). Without exception, the major markets for framing lumber manufactured in the South lie in those areas around and east of the Mississippi River.

Transportation cost has become an increasingly important factor as the center of the softwood lumber industry migrated from the Northeast

and Lake States into the South and finally the Pacific Northwest. Softwood framing lumber consumed in major market areas is shipped distances that were not economically or even physically feasible when the lumber industry was still centered in the Lake States and the Northeast. Prior to 1860, a lumber haul of 500 miles was exceptional. Shortly after the Civil War, water shipments from Gulf ports to the Atlantic Coast, distances up to 2,000 miles; and water shipments from Puget Sound to New York, 7,000 miles, became commonplace. It was not until the 1890's that rail shipments aside those to purely local markets became practical. Today, southern pine can be shipped from Hattiesburg, Mississippi to Boston, Massachusetts, more than 2,000 miles by water and 1,400 miles by rail, while West Coast species are shipped more than 7,000 miles by water or 3,000 miles by rail to eastern consumption areas.

If all of the implicit and explicit costs of production were constant or equal throughout the various production regions, it is quite clear how freight rates could be manipulated to give one region a competitive advantage over another production region with respect to delivered cost. In reality, neither stumpage, production costs, nor other explicit costs are equal in the various production regions; and freight rates can be a hindrance or an aid to the various regions in disposing of their regional outputs. Due to the greater distances involved and higher freight rates, the West Coast manufacturers would need to have substantially lower f.o.b. mill prices if they are to effectively compete in the major markets that are in closer proximity to the other major softwood lumber production region, the South. Southern producers, on the other hand, would appear to have a competitive advantage in freight costs with their close proximity



Map Showing Equal Points of Transportation Cost in 1942 and 1952(15).

FIGURE 1

to major consuming areas. In actuality, raw material and production costs differ significantly between these two major producing regions. Cost differentials coupled with differences in freight rates have permitted each of these regions to have the competitive edge over the other in the past(35,42).

Lines connecting points of approximate equality in delivered cost per thousand board feet of lumber from the Douglas-fir production region and the southern pine production region are shown in Figure 1. The dashed lines represent approximately equal points of delivered costs of lumber shipped from the Douglas-fir production region and from Hattiesburg, Mississippi, in 1942 and 1952. As can be seen from the illustration, the area in which southern pine manufacturers can effectively compete on a delivered price basis has been reduced since 1942. Table 5 gives freight rates for various years for destinations in major consumption areas. The Douglas-fir production region is used to represent the Western origin; and Hattiesburg, Mississippi, is used as a representative origin for the South. Through the use of hold-downs on successive freight rate increases, the differences between the two rate structures have successively declined in recent years (15,22). This is indicated in Figure 1 and Table 5.

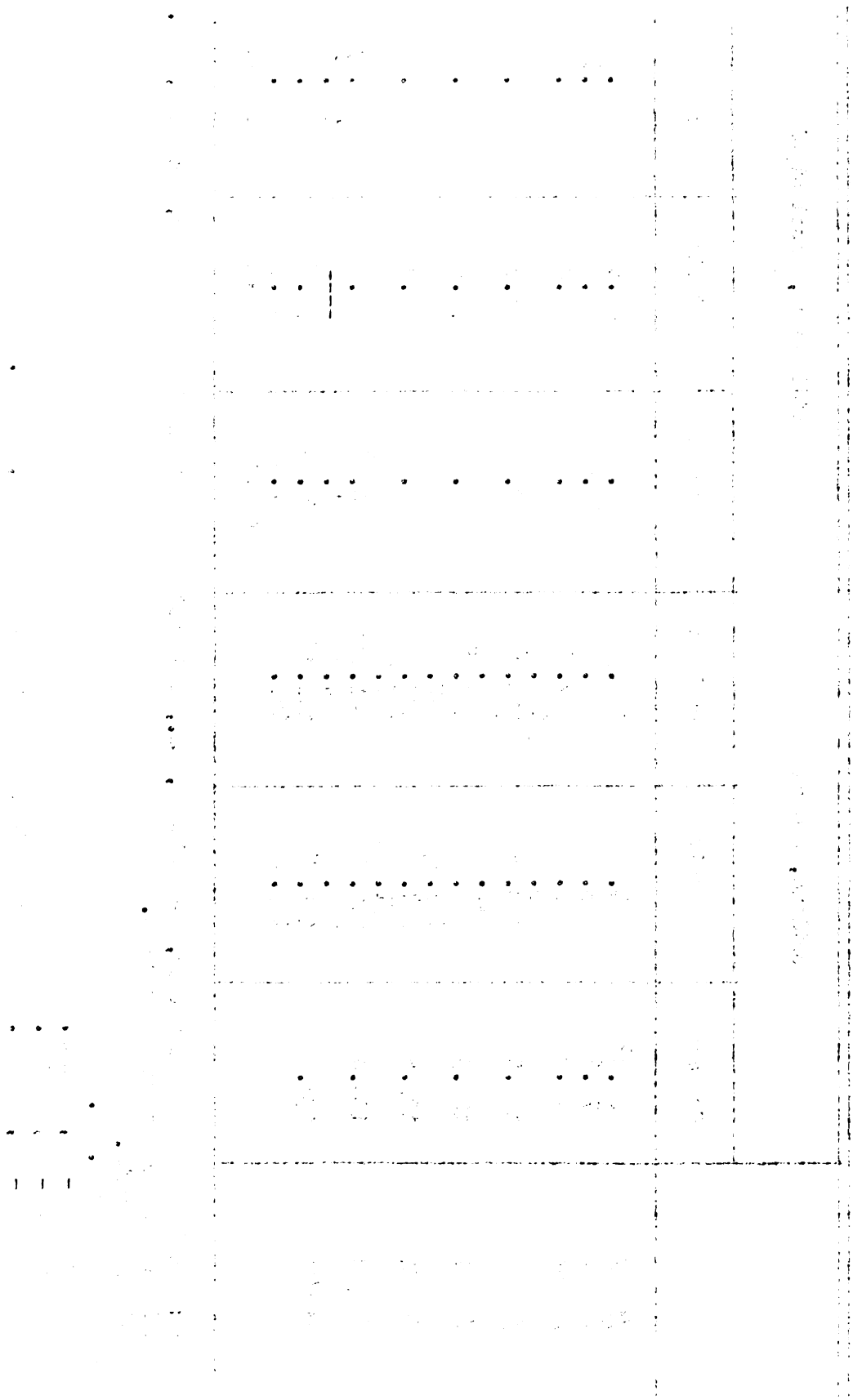
As indicated in Figure 1, an origin group for West Coast shippers has been established(15). The blanketing principle of establishing a single schedule of rates which applies for every shipping point within a specific area has been used in other regions but not to the extent that it is used in the West(51,8,47). In addition to origin blankets, the same principle of blanketing has been applied to eastern destinations for shipments originating within the West Coast origin group. The

TABLE 5

FREIGHT RATES FOR SOFTWOOD FRAMING LUMBER ORIGINATING IN MAJOR PRODUCTION REGIONS AND SHIPPED TO MAJOR MARKETS[a]

	Portland, Oregon To			Hattiesburg, Mississippi To		
	Chicago	Detroit	New York	Chicago	Detroit	New York
1/10/20	60.0[b]	94.5	106.5	31.5	47.5	52.0
1/ 4/32	72.6	85.6	90.6	38.6	43.6	47.6
3/18/42	80.0	87.0[c]	87.0[c]	42.0	43.0	48.0
		95.0	100.0			
5/ 6/48	105.5	112.0[c]	112.0[c]	60.0	61.0	70.0
		119.0	124.5			
5/ 2/52	123.5	130.0[c]	130.0[c]	75.9	77.9	87.4
		137.5	142.5			
8/26/57	137.5	144.0[c]	144.0[c]	88.0	89.0	98.0
		151.5	156.5			
12/ 1/61	134.0	141.0[cd]	141.0[cd]	80.0[e]	92.0	96.0[e]
		149.0	154.0	91.0[f]	----	101.0[f]
7/10/64	134.0	141.0[cd]	141.0[cd]	59.0[g]	70.0[g]	85.0[g]
		149.0	149.0	37.0	43.5	51.0
				excess	excess	excess

[a] Source: Southern Pine Association, New Orleans, La., and Western Wood Products Association, Portland, Ore.
[b] Rates in cents per one hundred pounds.
[c] Blanket lumber rate.
[d] Incentive rate of .07¢.
[e] Minimum carload - 60,000 lbs.
[f] Minimum carload - 36,000 lbs.
[g] Minimum carload - 60,000 lbs. with lower rate on weight in excess of 60,000 lbs.



blanket destination territory for lumber shipments originating within the West Coast origin group is also shown in Figure 1.

For shipments originating within the West Coast origin group and destined for the Official Territory, special reduced rates have been established. These special rates, referred to as incentive rates hereafter, are not without restriction(42). Cars moving into the Official Territory from the western origin group must meet increased loading requirements on weight or volume considerably above the minimums set for the normal car load rate if the incentive rates are to apply(42). The present incentive rate of $1.41 per hundred pounds from the western origin group went into effect in 1961 and was found just, reasonable, and otherwise lawful in 1963(42). As might be expected, the proposed rate was strongly opposed by southern and southwestern lumber producers, inter-coastal water carriers, and various other interests(42). The $ .07 incentive can mean a savings of $1.68 per thousand board feet on cars meeting the tariff requirements and destined for the Official Territory.

In areas where the delivered price for western softwood framing lumber and southern softwood framing lumber had been equal before the establishment of the $1.41 incentive rate, the western species could have a $1.68 competitive freight edge over southern pine. It is doubtful if the competitive advantage ever reached this magnitude in many places. Even if it had approached this magnitude, its effect on the southern pine lumber industry was not strongly felt since the market for southern softwood framing lumber had long been excluded in midwestern and eastern consumption areas(31,47,15). Southern pine manufacturers obtained incentive rates for rail shipments into the North and East in 1964. The incentive rates permitted southern pine framing lumber to

be sold for as much as $10 per thousand board feet less than the major species of softwood framing lumber produced in the West, Douglas-fir. The aggregate demand proved too great for the available supply, and prices have successively increased until there is little or no price advantage remaining for southern pine in most market areas.

Other Cost

The residential building industry, like the lumber industry, has traditionally been a labor intensive industry. Lumber is an ideal material for construction due to its high strength to weight ratio, low initial cost, and ease of working. However, the factors of installation and maintenance costs must also be considered before any final decision can be made as to the most feasible materials to be used in residential construction.

The residential building industry is one of the few large industries which uses on-site assembly techniques. Standardization and uniformity, which characterize most manufactured products, are almost completely lacking in American housing. Even though some degree of standardization has been achieved, its acceptance has not been extensive enough to permit prefabrication to obtain more than 24 percent of the total new housing market(10).

Inplace Cost

Inplace cost of wood framing has favored the use of lumber in residential construction. While the cost of lumber has risen more than many of its alternates, higher inplace costs associated with alternate materials have more than offset the rising material cost of wood framed construction (53,26). The total cost of any building material is composed of the initial material cost and cost of installation. Inplace cost is a

function of the time required in man-hours to install or complete the installation of a particular item and the per hour cost of labor. Therefore, the inplace cost of framing lumber is dependent upon the delivered cost of framing material, the local wage scale, and the time necessary to complete the installation.

New building materials have been and are continuing to be developed for the residential building industry. The sum effect has not been a total loss to the forest products industry but a shift in emphasis from one product to another. Most noticeable have been the decline in use of boards for sheathing and subflooring and the increased popularity of softwood plywood, low density fiber board, and gypsum board. The economies of sheet materials over small pieces result in considerable labor savings when used for decking, sheathing, and sub-flooring.

The comparative inplace cost for solid wood sheathing and its various substitutes is shown in Table 6. As can be seen, gypsum sheathing and plywood are the most economical. As might be expected in the competitive home building market, the consumption of plywood and boards for wall sheathing has been reduced by the increased use of gypsum and low density fiber board products. Strength characteristics of gypsum and low density fiber board products do not permit their use for subflooring and roof decking. For subflooring and roof decking where strength is required, plywood is the most frequently used product. By 1962, an average of only 2,500 board feet of solid wood sheathing were being used in new single family residences(46). This accounted for approximately 2.5 billion board feet of the domestic softwood lumber production in that year(46). While the exact data are not available, it is obvious that the total volume of solid wood sheathing has declined significantly,

since in 1956 20 percent fewer homes were sheathed with solid wood than in 1940(53,26).

The inplace price advantage that sheet products have over solid wood is not necessarily due to price alone, but to labor savings as well. As shown in Table 6, the use of plywood for subflooring can mean a savings of $5.00 per hundred square feet over 1 x 8 T&G boards. Further savings are possible if power actuated nailing apparatus is used in applying sheet products(28). Some of the board products cost more than their structural equivalent, solid wood, but in all cases the purchase of 100 square feet of board products actually yields a coverage of 100 square feet which helps to offset the price differential. It is necessary to purchase approximately 112 board feet of 1 x 8 SE boards and approximately 114 board feet of 1 x 8 T&G boards to obtain 100 square feet of surface coverage. Labor savings coupled with competitive product costs have substantially curtailed the market for solid wood sheathing and subflooring.

Dimension lumber has also been affected by innovations in residential building methodology. The increased popularity of slab construction in some geographic localities has eliminated the need for floor joist and sub-flooring. Trussed rafters which utilize smaller quantities of dimension lumber have replaced the traditional ceiling joist and roof rafters in much of today's new housing. In other areas of the country, solid masonry wall construction has eliminated the exterior wall studs and sheathing.

Species formerly left in the forest and referred to as "weed species" are now logged, and the lumber is commercially available in most consumption areas(17). This is quite a contrast to the time when

TABLE 6

INPLACE COST COMPARISON OF VARIOUS SHEATHING, DECKING AND SUBFLOORING MATERIALS[a]

PRODUCT USE	SIZE	MATERIAL[b] COST	INSTALLATION COST	INPLACE[d] COST
Wall Sheathing				
plywood	4x8-$\frac{1}{2}$	$12.00	$6.00	$18.00
gypsum	2x8-$\frac{1}{2}$ T&G	8.00	7.00	14.00
wood fiber	4x8-$\frac{1}{2}$ SE	8.00	7.00	15.00
	2x8-25/32	14.00	7.00	21.00
	1x6-T&G	14.00	9.00	23.00
	SE	13.00	8.00	21.00
Subflooring				
plywood	4x8-$\frac{1}{2}$	12.00	5.50	17.50
boards	1x6-T&G	14.00	8.00	22.00
	SE	13.00	7.00	20.00
Roof Sheathing				
plywood	4x8-$\frac{1}{2}$	12.00	6.50	18.50
boards	1x6-T&G	14.00	9.00	23.00
	SE	13.00	8.00	21.00

[a] Source: Building Construction Cost Data, 1966, Duxbury, Mass., Robert Snow Means Co., Inc.(3).

[b] Material cost expressed as cost for material to cover 100 square feet of surface.

[c] Installation cost expressed as the cost to install material to cover 100 square feet of surface.

[d] The total cost of covering 100 square feet of surface does not include allowance for profit or overhead.

only one species was used for the structural frame of the house. Today it would be uncommon to find a structure framed entirely of only one of the commercially available species. When the southern pines fell into disfavor after World War II, Douglas-fir became the major framing lumber species. More recently, West Coast hemlock, larch, true firs, lodgepole pine, western spruces, and ponderosa pine have all been added as commercially available species likely to be found in major consumption areas. The various species and groups of species all command different prices in the market. Generally, the denser and higher strength species of softwood framing lumber are more costly, while the lower density and strength species are less expensive. The installed cost of framing lumber is dependent upon the cost of the material, plus the associated cost of installation. It is the opinion of some builders that the inplace cost is greater for the higher density species (Appendix).

Call-backs

The term used to identify costs resulting from making adjustments to otherwise completed residences is call-backs. The source of complaints that result in call-back costs originates from a dissatisfied homeowner. A complaint may or may not develop into a direct cost depending upon its nature and authenticity.

Builders seldom attribute the source of call-backs to defects in framing lumber (Appendix). Instead, painting failures, chipped tile, marked casing, and leaky plumbing are some of the most common sources of complaints leading to call-backs. Evidently, the occurrence of cracked plaster, dry wall nail pops, and uneven floors are not a

problem. If the homeowner can be convinced that certain defects are common everyday occurrences and a hazard of homeownership, builders are able to avoid some types of call-backs.

While some lumber possesses inherent characteristics that have the potential to cause problems in its performance as framing lumber, none of the commercially available species is totally unsuited for use in single family residences. Through proper seasoning and manufacture, framing lumber with erratic seasoning characteristics can be rendered usable for structural framing purposes. The economic importance or cost of call-backs is also of importance in determining which of the commercially available species of framing lumber will be used in residential construction. The cost of call-backs is of importance in determining whether framing lumber will be kiln dried. Given softwood framing lumber of proper manufacture, call-backs are not the deciding factor as to which of the commercially available species of framing lumber will be demanded and available in the market. The criterion by which proper manufacture is measured varies; but, in general, it would mean that an end product of any one of the commercially available species would possess characteristics which would permit it to perform satisfactorily for those purposes for which it would normally be intended.

CHAPTER IV

NON-ECONOMIC FACTORS INFLUENCING SOFTWOOD FRAMING LUMBER UTILIZED IN RESIDENTIAL CONSTRUCTION

Non-economic factors are those factors with which there is no cost associated. Factors which could be included under such a grouping are properties of species, building codes and/or minimum property standards, availability, builder familiarity, home buyer preference, and architectural influences. It should be understood that this list is not a complete listing but represents the more common factors.

Regulating Factors

The purpose of a building code is to establish and enforce minimum standards of safe design and construction for all structures erected, repaired, or moved within the limit of the code's jurisdiction and to promote the public health, welfare, and safety. For most codes, a reasonable amount of safety to life and health is all that is required and expected. Not all codes have been equitable in establishing minimum requirements and standards of acceptance. Restrictions within codes that prohibit the use of certain materials and methods of construction that are economically and structurally feasible are not uncommon(24,13).

The exact number of building codes within the United States is unknown; but in any case, they are numerous and varied in their requirements for construction. A survey conducted in 1965 of communities with populations of 10,000 and over revealed that only 52 communities were without a building code(27). In excess of 58 percent of the communities

were served by one of the nation's major building codes. The Uniform Building Code was used by 21 percent of the communities, the National Building Code by 18 percent, the Building Official's Conference of America Code by 9 percent, and the Southern Building Code by 10 percent(27). In addition to these four major codes, eight state and four regional codes were used by 14 percent of the communities(27). This means that 23 percent of the communities with populations over 10,000 have formulated their own building codes.

There are three methods by which a building code can be established in a community. The first method is to duplicate one with minor variations from another community. A second method is to formulate one while the third method is to adopt one by reference. The adoption of a standardized code by reference has proven to be a very satisfactory method for establishing a municipal building code. The two most common standardized building codes are the Uniform Building Code of the Pacific Coast Building Official's Conference and the National Building Code of the National Board of Fire Underwriters.

The specification for framing lumber in building codes is usually limited to assigning maximum stress values to the various species and grades of framing lumber(38,2). From these stress values, the sizes and spacing of members can be obtained from standard formulas for shear, bending moment, and deflection. Assigned stresses found in building codes may or may not be equal to stresses assigned by lumber grading agencies to the various grades of commercially available softwood framing lumber. Depending upon the building code, ungraded framing material may be required to take a stress rating of the lowest recognized stress grade for that particular species or group of species.

Most building codes permit any of the commercially available species of framing lumber to be used in residential construction. It may or may not be economically feasible to utilize specific species depending upon the allowable spans and spacings.

In addition to the building codes of local municipalities, single-family residences that have mortgages insured under one of the federal programs must meet the requirements of the Minimum Property Standards of the Federal Housing Administration for one and two-family residences. Minimum property standards are not intended to serve as a building code for the residential building industry, but are designed to "obtain those characteristics in a property which will assure present and continuing utility, durability and desirability as well as compliance with basic safety and health requirements"(33). The Federal Housing Administration's Minimum Property Standards, like most building codes, is a set of minimum standards or requirements of construction that must be met. In areas in which building codes have been formulated and are enforced, the FHA Minimum Property Standards serve as a supplement to existing code requirements, but the minimum requirement of both must be met.

In the Minimum Property Standards for one and two-family living units, the Federal Housing Administration has developed span tables for the various commercially available species of softwood framing lumber. The tables give allowable spans for various spacings, sizes, loadings, and end uses. This does not differ radically in principle from other codes although all calculations have been performed using allowable stresses and loadings to simplify the interpretation of the standards. Allowable stresses used in the tables are those published by lumber grading agencies. As in the case with most

building codes, the Minimum Property Standards do not specifically restrict any particular species of commercially available softwood framing lumber from being used. Instead, the use of any particular species is left to builder preference or to what is economically and structurally feasible.

Home Buyers - Architects

The role that the home buyer plays in determining which of the commercially available species of lumber will be utilized in the construction of his future home is, at best, a minor one. Many homes bought today are sold from a sales model. In such a situation neither seller nor buyer indicates any apparent concern over the softwood framing lumber used in the structural frame of the home. As brought out in Chapter II, the home buyers as a group tend to put their complete trust into the reputation of the builder and/or architect and the protection of codes and Minimum Property Standards to maintain a satisfactory level of quality for the home.

Today's merchant builders are responsible for the majority of new housing. Merchant builders offer a choice of color, brand, and style for many of the materials for today's homes. The choices are usually in the area of furnishings and finishings and not in the structural elements. In a survey of builders conducted in the Chicago metropolitan area, merchant builders did not offer home buyers an option for framing lumber(Appendix). Custom builders as a group, however, indicated that they were willing to use any of the commercially available species specified by the home buyer or architect.

Architects are not often in a position to control the materials which are used in the structural frames of new housing because, with the

possible exception of custom homes, residences are not architecturally designed. It is not uncommon for merchant builders to consult architects in designing homes to be used as models; however, the function of the architect often lies more in the realm of exterior and interior design than in the preparation of specifications and structural details. When the architect does prepare specifications for framing lumber to be used in residential construction, he usually specifies a particular grade species and fiber stress rating which he knows is readily available.

Since the architect's role in residential construction is, for all practical purposes, limited to designing custom homes and models for operative builders, he does not usually determine or decide which of the commercially available species of framing lumber will be used in the majority of residential structures. The architect is usually limited in residential design by what is available in local retail lumber yards. However, the architect is in a position to influence the commercially available species of framing lumber to be used in any project that he designs. This fact is recognized; and the Southern Pine Association, especially, is making an intense effort to acquaint the architect with the properties and merits of southern yellow pine. In the program to reach architects, the association tries to persuade the architect to include a minimum requirement for modulus of elasticity and a maximum moisture content requirement for softwood framing lumber. The minimum requirement for modulus of elasticity automatically narrows the number of potential species, while the maximum moisture content requirement usually narrows it to the southern pines. If the architect played a greater role in residential construction, this method of specifying framing lumber could have a much greater influence on

softwood framing lumber.

Inherent Characteristics of Commercially Available Framing Lumber

The various commercially available species of softwood framing lumber each possess inherent individual characteristics. These characteristics place some species at a disadvantage where a high degree of strength is necessary. Strength values for comparable grades of commercially available softwood framing lumber are given in Table 7. The variance in modulus of elasticity and extreme fiber bending stress is quite marked. These two values are extremely important since the extreme fiber bending stress "f" reflects the relative strength of the framing member and the modulus of elasticity affects deflection. Those species of framing lumber that are most frequently used in residences for joists and rafters are indicated by an asterisk. Stress values associated with these particular species make apparent their use for joists and rafters. Any of the species included in Table 7 are accepted by builders for use as studs, plates, sheathing, joists and rafters.

What effect allowable stresses have upon the use of different species becomes apparent when the allowable spans for floor joists with given size, spacings, and loads are examined. Table 8 gives the various maximum spans of floor joists for grades of species listed in Table 7. As shown in Table 8, those species with the higher assigned stress values and modulus of elasticity are allowed greater spans. Span tables for joists and rafters such as those found in the Federal Housing Administration's Minimum Property Standards restrict the number of species that can be economically utilized in residential construction.

Where building codes are non-existent, inadequately formulated, or

TABLE 7

ALLOWABLE STRESSES FOR COMMON SPECIES OF SOFTWOOD
FRAMING LUMBER--EDGEWISE LOADING[a]

SPECIES	GRADE	SPECIFIC GRAVITY 15%MC	DENSITY #/cu.ft.[b]	"E"[c] psi	"F"[d] psi	"H"[e] psi
Douglas-fir*						
(coastal)	Const. J & P	0.48	34.3	1,760,000	1,450	95
(inland)	"	.43	30.5	1,320,000	1,050	90
Fir, white	"	.37	26.7	1,210,000	1,050	-
balsam	"	.36	26.9	1,100,000	850	-
West Coast Hemlock*	"	.42	29.6	1,540,000	1,450	80
Southern pine*	No. 1, K.D.	.51	38.6	1,760,000	1,700	135
Spruce, red &						
white	No. 1 Dimension	.40	28.9	1,320,000	1,050	-
englemen	"	.34	24.3	1,100,000	650	-
Redwood	Sap Common	.40	28.6	1,320,000	850	-
Western Red Cedar	Const. J & P	.33	23.4	1,100,000	850	-

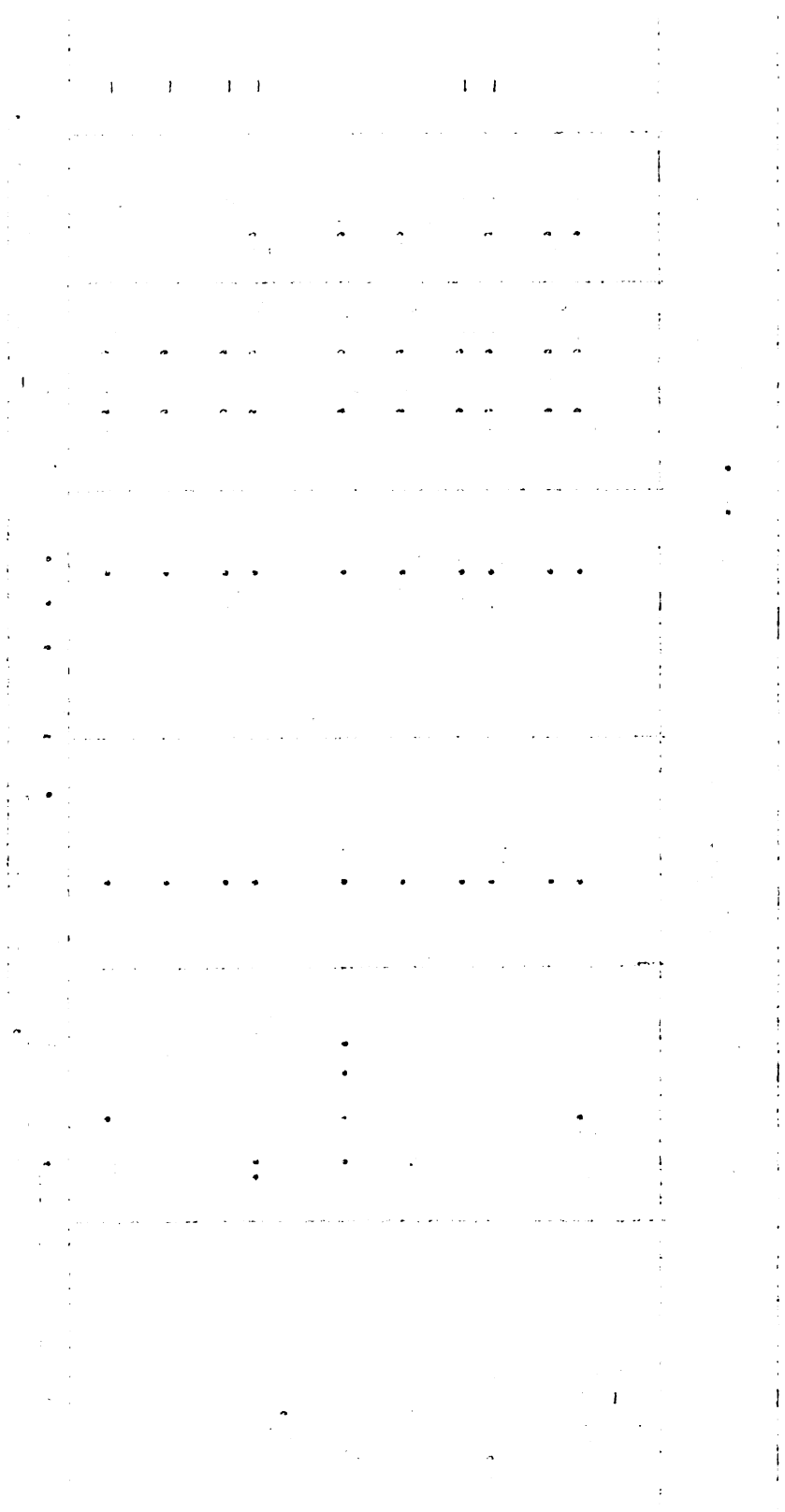
[a]Source: Wood Handbook, Agriculture Handbook No. 72, 1955, U. S. Department of Agriculture and Federal Housing Administration, Minimum Property Standards for One and Two-Family Residences, 1965(11,52).

[b]The weight of one cubic foot at a moisture content of 15 percent.

[c]The modulus of elasticity.

[d]The fiber stress at proportional limit.

[e]Shearing strength parallel to direction of grain.



ineffectively enforced, the Minimum Property Standards will tend to control construction standards if housing mortgages are to be insured with federal funds. If the housing is not to be insured by federal funds, the spans and spacings of the various grades and sizes of commercially available framing lumber are left to the discretion of the builder or architect.

There are many situations in which lower strength species cannot be economically used as substitutes for the higher strength species. In cases such as this, major structural alterations would have to be made to accommodate the use of lower strength members. It is highly improbable that a savings could occur if lower strength framing lumber available at reduced costs is directly substituted for the relatively higher cost and higher strength species. In Table 9, an index system based on the added volume of wood needed to permit direct substitution of lower strength material for coastal region Douglas-fir is given. The data are derived from a 28 ft. x 40 ft. floor deck over a crawl space foundation that would permit changes in joist size or span without altering the quantity of sub-flooring and other required materials.

The data in Table 9 give the relative difference in price necessary to justify the use of relatively lower cost and strength framing lumber. Assuming there is no difference in the man-hours required to fabricate the joist system out of a relatively higher or lower strength material, the relative inplace cost of the floor system using the various species is given in Table 9. Table 9 is applicable where joists are placed on identical spacings. If the relative differences in price between high and low strength material

TABLE 8

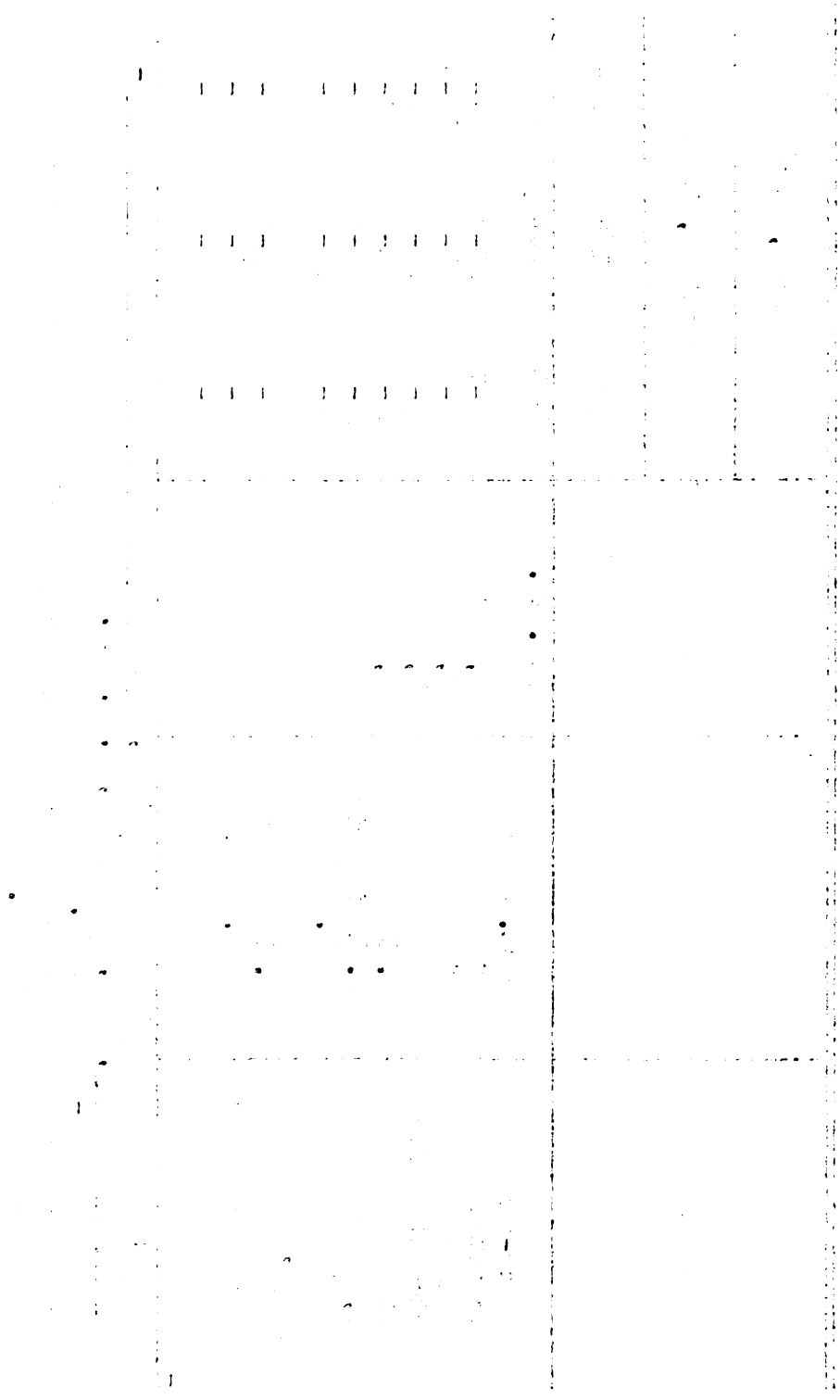
ALLOWABLE SPANS FOR VARIOUS SPECIES OF FLOOR JOIST[a]

SPECIES	GRADE	FIBER STRESS	Span, feet[c]		
			Spacings, inches		
			12"	16"	24"
		#/sq. in.	feet	feet	feet
Douglas-fir	Const. J & P				
(coastal)	"	1,450f	14-4	13-0	11-6
(inland)	"	1,050f	13-0	11-10	10-4
Westcoast hemlock	"	1,450f	13-10	12-6	11-0
Southern pine	No. 1 KD	1,700f	14-4	13-0	11-6
Fir, balsam	No. 1 Dimension	b	12-4	11-2	9-4
white	Const. J & P	"	12-8	11-6	10-0
Spruce, red &					
white	No. 1 Dimension	"	13-0	11-10	10-4
Western red cedar	Const. J & P	"	12-4	11-2	9-4
Redwood	2" Sap Common	"	13-0	11-4	9-4

[a]Source: Federal Housing Administration, Minimum Property Standards for One and Two-Family Residences, 1965, Washington, D. C.(11).

[b]Indicates a non-stress grade.

[c]For a 2 x 8 joist of various commercially available species and groups of species of softwood dimension lumber.



are great enough, it is economical to use a greater volume of the lower cost and strength material. As can be seen in Table 9, there is not a species with lower allowable stress values that can be economically substituted for coastal Douglas-fir. An example of this is green redwood. From the table, it is shown that to enable a larger quantity of redwood joist material on 16 inch spacing to be substituted for coastal Douglas-fir, the redwood material would have to be selling at a 20 percent lower price than coastal Douglas-fir. That is, 2 x 10 redwood would have to be selling for 10 percent less than 2 x 8 Douglas-fir. As can be seen from the table, green redwood is currently selling for approximately 1 percent more than green Douglas-fir, assuming only material cost and no allowance for increased installation cost of 2 x 10 joist in place of 2 x 8 joist. The inplace cost of redwood would actually be greater than 1 percent since more time would be required to install the 2 x 10 joist material. Similar conditions exist for the other species listed in Table 9.

While there is no question about the ability of a low strength species to perform as sheathing, wall studs, and plates, there is some concern over their ability to give adequate performance as floor and ceiling joist and roof rafters. As long as an adequate building code is enforced or a mortgage is insured by a federal agency, it is probable that the use of softwood framing lumber in structural framing will be reasonably correct. In the absence of codes or other regulating factors, the proper utilization of the various commercially available species of framing lumber is left to the discretion of the builder.

Market Factors

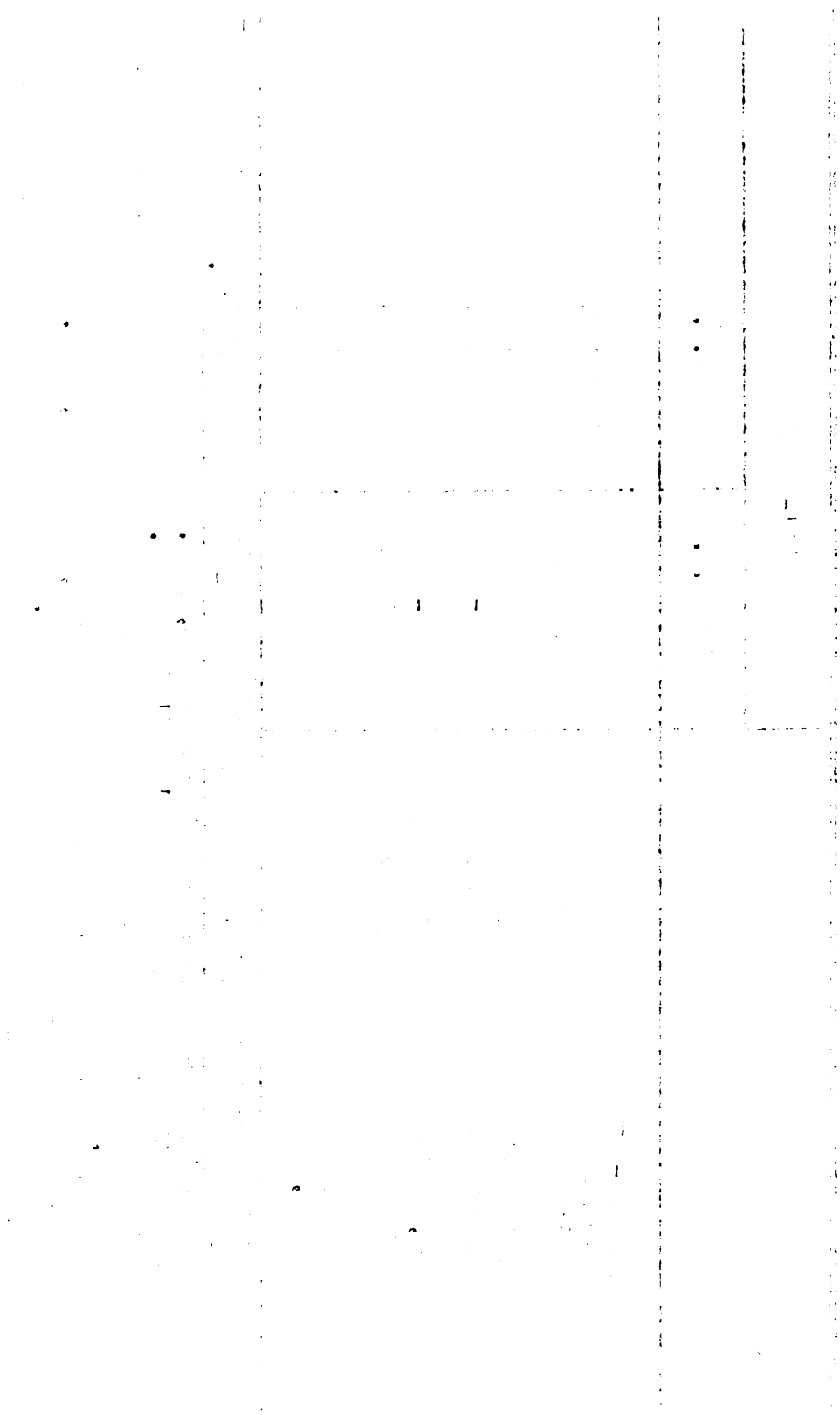
In addition to influences exerted by architects and home buyers, inherent characteristics of species, building codes, and Minimum

TABLE 9

RELATIVE PRICE DIFFERENTIALS NECESSARY TO MAKE IT ECONOMICALLY FEASIBLE TO SUBSTITUTE VARIOUS SPECIES OF FLOOR JOIST FOR UNSEASONED DOUGLAS-FIR JOIST[a]

SPECIES		13'-0" SPAN[c]	
		12" O.C.	16" O.C.
Douglas-fir (coastal)[f]	(green)		100[f] (100)[f]
(inland)	(green)	76[d] (97)[e]	80[d] (97)[e]
West Coast Hemlock	(kiln dry)	76 (99)	80 (101)
Western Red Cedar	(green)	-	80 (90)
Fir, White & Balsam	(kiln dry)	-	80 (90)
Redwood	(green)	76 (106)	80 (101)
Southern Yellow Pine	(kiln dry)		100 (101)
Spruce, White	(kiln dry)	76 (85)	80 (87)

[a]Based on allowable spans for various species as indicated in Federal Housing Administration Minimum Property Standards for One and Two-Family Residences(11).
[b]Commercially available species in the Midwest, 1966.
[c]Joist acting as simple beam in 28' x 40' floor deck.
[d]Price index giving relative price necessary to make it economically feasible to use this species.
[e]Price index giving relative price of the species, November 3, 1966.
[f]Species taken as the base for all calculations.
Note: ( ) Indicates the required price necessary to make a direct product substitution.



Property Standards, framing lumber utilized in residential construction is also affected by other factors. Among these are availability, local traditions, and product performance.

Availability

The old adage, "you can't sell it if you don't have it" is very applicable to the market situation for softwood framing lumber. In the case of the residential builder, he cannot use it unless it is available. The potential market for the manufacturer of framing lumber is directly affected by the availability of his product. The willingness of the retail lumber dealers to inventory particular species is even a larger factor. Much work has been done to cultivate positive dealer response towards the southern yellow pine in recent years. Dealer's apathy towards this species was but one of the barriers that had to be removed before it could be re-established in the Midwestern and Eastern markets. Unless retail lumber dealers cooperate with other intermediaries in the distribution channel, a serious bottleneck can occur at this level of distribution.

The large merchant builders with over one hundred starts per year deal mostly with one or maybe two suppliers of framing lumber(49). Normally, the selection of the commercially available species of framing lumber to be utilized in residential construction occurs prior to negotiations over price. While price is a very important factor, the decision as to what particular species will be utilized is made prior to price commitments(25). It is not uncommon for a supplier to occasionally ship a species other than the one specifically called for by the builder. These substitutions are limited both by the number of species available to the supplier and by the number of species that

are accepted by the builders. In any event, contracts negotiated for framing lumber will include implied or expressed restrictions on what species of material is acceptable.

Promotion programs can affect framing lumber usage. This has been dramatically illustrated by the success of the Southern Pine Association in promoting the southern pines in St. Louis and Kansas City, Missouri. In addition, southern yellow pine has also been successfully reintroduced into the Chicago metropolitan market in recent years. In the Chicago market, the initiative was spearheaded by a large wholesale-retail organization. The success of the promotion program for this species has dramatically shown that a carefully planned promotion program can affect the consumption of a particular species. Prior to the recent promotion program, dimension lumber manufactured from southern yellow pine had been absent from the Northern and Eastern markets for a period of twelve to fourteen years.

The only other merchandising effort to promote the use of a particular product manufactured from a given species has been the highly successful merchandising effort of stud manufacturers. The 2 x 4 stud has been the most heavily merchandised item of framing lumber. Advantages of kiln dried studs will not be reiterated here, but it will suffice to say that kiln dried studs are highly demanded and appreciated by most builders. Brand names have been established in the minds of some retailers and satisfied builders. A few of the merchandising techniques developed for studs have been end-branding, edge-marking, wrapping, and steel strapping(29).

Local Tradition

Wood is often referred to as the traditional building material;

however, with the exception of markets located within the immediate production region, there is no particular species of softwood framing lumber that could be so considered. The shifting of the center of lumber production has placed many regions in excellent market positions until the supply in that particular region diminished and production shifted to another region. As a result of the shifting, there have been several species that have supplied the major portions of lumber consumed.

Most recently Douglas-fir was in this unique position from after World War II until the early 1960's. During much of this time, Douglas-fir was often the only species of dimension lumber available in many market areas. Prior to Douglas-fir, the southern pines and eastern white pine were the most prevalently used species in the Midwestern and Eastern markets(16).

The widespread acceptance of Douglas-fir over a period of years has, in effect, tended to establish it as the only possible species of framing lumber suitable for use in residential construction. Builders' reluctance to switch from it to available alternates is widespread. While there is no empirical evidence available, the same situation undoubtedly existed in the past when one species was used over a protracted period of time. Today, as a result, builders have been extremely reluctant to accept substitutes or alternates for Douglas-fir. Once builders have become familiar with utilizing a particular species, they unconscientiously continue to use it. This is verified by the fact that builders do not freely switch from one species of framing lumber to another even when there are numerous species available capable of performing satisfactorily.

While the initial response to a superior product manufactured from a substitute species might be everything but favorable, an economic advantage, if not better product performance, can win its eventual acceptance in the end. In Chicago, southern pine dimension lumber was not able to gain widespread acceptance until it was available at a lower cost than Douglas-fir. Slightly higher prices but kiln dried studs manufactured from relatively low strength species have replaced air dried and green studs manufactured from relatively higher strength species in most of the metropolitan areas. If a substitute species of framing lumber does not offer an advantage in price or product performance, it is not likely to meet with immediate acceptance upon being offered in a market. On the other hand, if it has a price advantage or superior product performance, it is likely that it will have some degree of acceptance upon entering into a market once users and suppliers have been convinced of its merits.

The proper performance of framing lumber in various applications is of utmost importance to the builder. Improperly manufactured framing lumber can cause a host of difficulties depending upon the end-use. Machining and seasoning defects, improper grading, and inadequate seasoning are just a few of the items that can contribute to its poor performance. The need for proper performance is not just limited to end-use. If the retailers incur excessive degrading during storage, this can be just as critical as having the material warp or shrink excessively after installation.

Tendencies of some species to have high longitudinal shrinkage rates render them less suitable unless they are subject to extreme care in manufacture. The subsequent deviations from a plane surface

associated with high rates of longitudinal shrinkage reduce utility where straightness is of importance. Species falling within this category are the western spruces, lodgepole pine, and the southern pines. Warping is common in all of these species if they are not carefully manufactured. Improper manufacturing is likely to result in the builder's refusal of them.

Product performance has, in the past, affected the pattern in which new species of framing lumber have been accepted as well as their consumption. Inferior product quality resulting in poor in-place performance drastically curtailed the consumption of southern yellow pine framing lumber which was already established as a framing lumber species in the Midwestern and Eastern markets prior to World War II. Even though studs manufactured from low strength species were not overwhelmingly accepted in many markets when first introduced, they were able to gain acceptance after technological processing improvements were able to insure consistent quality. These kiln dried studs are more expensive than their structural equivalent, green studs; however, kiln dried studs are still accepted at greater cost due to their ability to remain straight and not shrink after installation.

CHAPTER V

SUMMARY AND CONCLUSIONS

At this point, it seems appropirate to review the factors introduced in the prior chapters and relate them to the total problem under study. Unless the economic setting is drastically altered in future years or unexpected technical advances are made, framing lumber is likely to continue to be a major component in American housing. This will undoubtedly be due to the relative cheapness of wood framing when compared to the available substitute products.

Competition between the various species of framing lumber and to a greater extent between the different production regions will continue as long as wood is used in construction. As mentioned previously, inter-regional and/or species competition has existed since the establishment of the American softwood lumber industry. Again, the question of how softwood framing lumber is selected and what factors are involved is the matter under study.

Initial cost is a very important factor that influences framing lumber utilization in residential construction. The southern pines became the major construction species used in the Midwest and East late in the nineteenth and early twentieth centuries. Price, no doubt, played a major role as the scarcity of eastern white pine drove its price to high levels. This made it economical to use southern pine framing lumber shipped from distant mills. Douglas-fir became the dominant species of framing lumber in many East Coast consumption areas when the completion of the Panama Canal made it possible for this

material to be economically shipped from West Coast tidewater mills to Eastern markets. More recently, the southern pines have replaced western species in Midwestern markets when favorable freight rates made it possible for this material to be delivered into the market at a very competitive price.

In each of the situations described above, an economic factor was involved. At some time the laws of supply and demand have affected the raw material cost for practically all of the commercially available species. Most notable have been eastern and western white pines, both highly valued in the past due to desirable characteristics inherent in these species. A recent example of the forces of supply and demand would be that of lodgepole pine stumpage. As favorable economic conditions developed that made it feasible to exploit lodgepole pine, the cost of lodgepole pine stumpage increased(51). Where limited amounts of stumpage are available, the cost of stumpage will not necessarily reflect its true value. The cost of raw material utilized in the production of framing lumber is residual in nature(7,45). That is, the cost of stumpage is directly influenced or determined by the market price of the finished products and the cost of processing them. High cost of stumpage is a counterpart of increased demand for lumber. Higher lumber prices are the cause of and not the result of increased stumpage cost(53).

Transportation is a very important cost entering into the delivered price of framing lumber since transportation accounts for approximately 30 percent of the delivered price to retail lumber dealers. Freight rates have dramatically affected the distribution of softwood framing lumber since the establishment of the softwood lumber industry.

Transportation charges are a cost that lumber manufacturers can alter. An example of this are the incentive rates that have been secured by both Southern and Western manufacturers. Prior to this, Western producers obtained a group destination, Official Territory, in the early 1930's(44). The Official Territory improved the competitive position of Western manufacturers in Eastern markets at the expense of intercoastal water carriers and Southern lumber manufacturers. Transportation costs, in turn, represent one of the most important factors in determining the initial cost of framing lumber to the consumers.

Economic factors other than those contributing to initial cost are inplace cost and the cost of call-backs. Inplace cost is determined by two factors, initial cost and the cost of installation. Since there is no evidence available that indicates a higher installation cost is associated with a particular species, it will be assumed that the cost of installing framing lumber is independent of species. Inplace cost can have a dramatic effect upon lumber consumption. As previously mentioned, substitute products have been developed to replace solid wood sheathing, decking, and subflooring. These substitute materials, some with a higher initial cost, would not be as well received if they did not offer some type of inplace cost advantage. Inplace cost advantages can also account for the widespread acceptance of trussed rafters and concrete slab construction. Installation cost can account for alternate products' use, but they do not account for the consumption of various species of softwood framing lumber.

Call-backs represent real cost to the builder. They are not normally associated with framing lumber. Builders contacted by the

author in the St. Louis and Chicago metropolitan areas attributed their main cost of call-backs to shoddy workmanship on the part of skilled labor(Appendix). Unless framing lumber is improperly manufactured, a builder is unlikely to incur any difficulties with its use or performance. If the product meets the performance requirements of building codes, Minimum Property Standards, or the general expectations of builders and home buyers, it is assumed that it is a suitable framing material. If framing lumber manufactured from a particular species is totally unfit for its intended end-use, builders will refuse to use it. A case in point here is that of southern pine framing lumber immediately after World War II.

Among the non-economic factors are several factors that influence softwood framing utilized in residential construction. Perhaps the most important ones are building codes and Minimum Property Standards. Building codes may or may not specifically state what species may be used. The standardized codes formulated for adoption by reference do not place specific restrictions on what species may be used(24,13,38,2). Instead, the codes generally specify maximum allowable fiber stresses for the various commercially available species. This insures proper utilization but does not prevent any of the commercially available species from being used. Minimum Property Standards have similar requirements.

The allowable stresses assigned to the different commercially available species restrict their use to where allowable stresses will not be exceeded. A result of this is that the most economical species will tend to be used for any end-use. An example of this would be the use of a smaller quantity of relatively higher cost Douglas-fir in

comparison with a relatively larger quantity of lower cost white spruce floor joist. Economics might be ignored when building inspectors or other officials have definite opinions as to what species of softwood framing lumber is suitable for use in residential construction.

Home buyers are not normally cognizant of the structural aspects of the homes they buy. A recent study indicates that both the buyer and builder express concern over location, style, price, and size among other non-structural factors(5). Normally, options offered to home buyers are in the area of color, pattern, and style and not in the area of structural systems or materials(6).

Architects do not influence species of framing lumber available in the market for use in residential construction. This is due to two factors: (1) the architect designs only a relatively small percentage of new housing starts; and (2) specifications are often written with limitations on fiber stress and dryness, without specifically mentioning a particular species(4).

The inherent characteristics of species are an important factor accounting for their suitability for different end-uses and their acceptance in the market. Strength is a factor that restricts the uses of several relatively low strength species. Among these species are ponderosa pine, western spruces, and lodgepole pine. Their use is limited to where stresses in individual members are relatively low. Here again, what is or is not acceptable is determined by building codes, Minimum Property Standards, or traditional methods. The inherent characteristics of the various species determine which are suitable for a given end-use but do not necessarily determine what species will be used for a particular end-use.

Tradition can exert considerable influence upon the softwood framing lumber used by residential builders. Builders develop definite ideas on what species of softwood framing lumber are suitable for specific end-uses either through their own experiences or through hearsay. Unless the builder is experiencing definite problems in end-use performance, he is not likely to switch from one species to another. Builders will switch from one species if an alternate species offers an economic and/or performance advantage. This has been demonstrated both by the acceptance of a variety of species of wall studs and the increased acceptance of southern pine dimension lumber. Product performance can play a very important role. Unless the product adequately performs in its end-uses, builders will recognize the deficiency and will not continue to utilize it. Given a species performing in a satisfactory manner, builders do not freely change.

The style of housing does not have a significant effect upon softwood framing lumber utilized in residential construction. While the specific design of a particular house might reduce the number of commercially available species suitable for use in its structural frame, its effect upon the total housing market and total lumber consumption would be limited. In homes departing from traditional designs, the major difference in framing lumber requirements are usually restricted to the number and size of members required. Unless an economically feasible substitute product is developed for wood framing, housing style is unlikely to affect present consumption patterns.

Conclusions

From the factors analyzed in the preceding parts of this study, some definite conclusions can be drawn about the market for softwood

framing lumber. Among those factors influencing softwood framing lumber utilized in residential construction are the following factors listed in order of descending importance:

1. INSTITUTIONAL FACTORS. Institutional factors restrict the number of species that can be utilized in many end-uses by assigning maximum stress and minimum strength requirements.

2. PRODUCT PERFORMANCE. Product performance is of importance in gaining and holding builders' acceptance.

3. INITIAL COST. Price is important. Price competition enters into the process after the selection of species has been made.

4. INHERENT CHARACTERISTICS. Inherent properties of species limit their utilization.

5. TRADITION. Tradition plays an important role in builders' acceptance for the various commercially available species of softwood framing lumber.

6. TRANSPORTATION. Transportation charges represent a major cost that may be altered to obtain a more competitive position for lumber manufacturers.

7. RAW MATERIAL COST. Stumpage costs do not have a significant effect upon the softwood framing lumber utilized in residential construction.

8. HOME BUYERS AND HOME ARCHITECTS. Volume wise, home buyers and home architects do not have any significant effect upon the framing lumber utilized in framing one and two-family residences.

This list is by no means collectively exhaustive. While there might be some question over the specific rank of a particular factor, the author believes that the list as a whole is fairly representative of the importance that these factors actually assume in the market place.

Initial cost, product performance, and institutional factors are, without question, the three most influential factors. The species of framing lumber could possibly gain builder acceptance if they meet the requirements of these three factors. Meeting the requirements of

these three factors does not mean that a product manufactured from a particular species will gain builder approval and subsequent use. It is likely that some effort will have to be exerted by parties within the distribution channel before widespread acceptance is gained. If there are any traditional factors that contribute to resisting the acceptance of a particular species, these can be nullified in time if there are real advantages associated with the new species.

Unless a commercially available species meets the institutional requirements, its use will be limited. An example of this is the relatively low strength woods widely used in wall framing but not for joist and rafters where higher stresses are incurred. Generally speaking, the price differential between the lower and relatively higher strength framing lumber is not great enough to permit the use of larger quantities of lower strength material. If traditional prejudices are lacking and institutional and product requirements are met, initial cost becomes the determining factor. A competitive price may not be a sufficient incentive to gain builder acceptance if considerable prejudice exists against it.

The other economic and non-economic factors all play a role in influencing the framing lumber utilized in residential construction. These factors play a supporting role with respect to initial cost, institutional factors, and product performance. In the future, it is possible that some of these present supporting factors might gain in importance. This could be due to greater demand being placed on forest products, adjustments in institutional factors, advances in building technology, more prefabrication, more large builders, or home buyers showing greater interest in the structural frame of

their homes. Until that time, product performance, initial cost, and institutional factors will continue to be the three dominant forces influencing the selection of softwood framing lumber used in residential construction.

APPENDIX

QUALITY DIMENSION LUMBER SURVEY

In the summer of 1965, the author conducted a survey of users, specifiers, and sellers of dimension lumber for the Southern Pine Association. The purpose of the survey was to obtain an unbiased judgment of market opportunities and the state of the market for quality southern pine dimension lumber. Quality was used in this survey to distinguish the product which results from good manufacturing, proper seasoning, and careful grading in strict conformance with industrial standards from a poorly manufactured, seasoned, and loosely graded product sold only on a basis of price.

The Midwest was selected for this study because the increased shipments of southern pine framing lumber into this region offered an excellent opportunity to get opinions based on current experience with southern pine. Within the Midwestern region, the Chicago metropolitan area was selected for the site of the study, with a possible alternative city of Detroit, St. Louis, or Milwaukee if time permitted. Chicago was chosen as the primary city because southern pine dimension lumber had been absent in this market for a period of approximately 10-12 years, having been reintroduced into the market 2-3 years prior to the time that the survey was conducted. Also, the Chicago metropolitan area is one of the largest consumption areas for dimension lumber in the Midwestern region.

Some of the questions for which answers were sought by this survey were:

1. How deep seated is the dissatisfaction of residential builders and retail lumber dealers with unseasoned dimension lumber, which has been the principal kind of dimension lumber used in recent years in some areas until the increased shipments of seasoned southern pine?

2. Are building construction techniques, labor costs, or problems experienced by home builders because of call-backs to make corrections a factor in builder interest in using quality southern pine?

3. Is the price of quality southern pine dimension lumber a factor in its use? Would a cheaper price on competitive species bring the competitive species back into use?

4. How significant are the differences in quality of lumber in regard to its salability by retail lumber dealers or its acceptance by residential builders?

5. What are the principal sizes and lengths of dimension lumber used?

6. Are there differences in requirements with regard to quality between builders of single family residences and multiple apartments, or between large tract builders and the small custom home builder?

The following groups of people comprised the universe from which a sample population was taken and contacted in making this survey:

1. Retail Lumber Dealers
2. Residential Builders
3. Architects
4. Lumber Wholesalers
5. Lumber Commission Men

It was decided beforehand that at least 50 percent of the respondents in the sample population would be residential builders, and at least 25 percent would be retail lumber dealers. The remaining portion of the sample was to be composed of architects, lumber wholesalers, and commission men. The sample size was estimated to be approximately 90 persons. This was based on completing four contacts per day in a four day week based on a project completion time of five weeks.

Retail lumber dealers in the sample were selected on the basis of

estimated capital worth(37). It was decided that emphasis would be placed on the dealers with higher capital worth. The retail lumber dealers with the higher capital worth were, without exception, the lumber dealers selling large volumes of framing lumber to merchant builders. Dealers with lower capital ratings were almost exclusively selling to the custom builders, to the smaller merchant builders, and to the walk-in trade. Retailers were also included in the sample upon recommendations made by wholesalers and commission men. Wholesalers and commission men were primarily selected at random.

Architects were selected from the "Architects Bulletin Mailing List" provided by the Southern Pine Association and from recommendations made by retail lumber dealers and residential builders. Builders were primarily selected from the phone directory and newspaper advertisements. Also, builders were selected from a list that was compiled from recommendations made by retail lumber dealers and personnel at the Home Builders Association of Chicago. An attempt was made to contact various sizes of builders in each of the operating classifications.

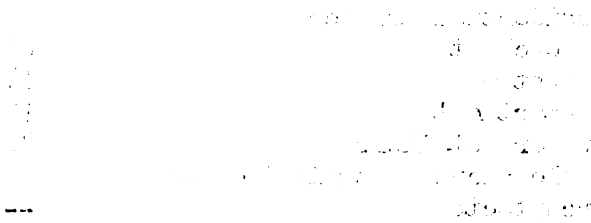
A questionnaire was designed to satisfy the objectives of the survey. Specific questions were formulated to elicit information pertaining to the questions for which answers were desired. An attempt was made to formulate the questions in such a manner to make the questionnaire usable for the various groups of people in the total population. The original questionnaire was first tested on individuals within the various classifications in the population. Revisions were made to the original questionnaire after initially testing it. The final form of the questionnaire used in the survey can be found on pages 88-89.

At the termination of the five weeks, it was found that 77 usable questionnaires had been completed. Analysis of the classification data on the completed questionnaires gave the following breakdown on respondents:

Residential Builders	52%
Merchant	29
Custom	14
Apartment	12
Lumber Retailers	40
Wholesalers & Commission Men	9
Architects	--

The total number of builders in the sample met the projected number of respondents originally established for this particular classification. Lumber retailers also met the original projected number. No completed and usable questionnaires were obtained from the contacts made with architects. Wholesale lumbermen and commission men were combined due to the fact that none of the lumbermen contacted acted purely as commission men. The group classification of residential builders is further broken down into three subclassifications of custom, merchant, and apartment. The 77 completed and usable questionnaires fell 14 percent short of the 90 originally established as the sample size for the survey.

The respondents included in the sample taken from the population were not significantly divided over question two. The combined returns indicated that 49.3 percent of the sample population felt that unseasoned framing lumber is satisfactory for use in residential construction. A breakdown of question two follows where the percentages represent the relative number of respondents in each of the classifications feeling that unseasoned dimension lumber is or is not satisfactory for use in residential construction.



	YES	NO
Residential Builders	48%	52%
Merchant	62	38
Custom	27	73
Apartment	36	64
Lumber Retailers	43	57
Wholesalers & Commission Men	86	14
Architects	--	--

As shown in the breakdown, there is considerable disparity between the various groups in the sample. While there do not seem to be any significant differences between retail lumbermen, 85.7 percent of the lumber wholesalers and commission men feel that unseasoned dimension lumber is satisfactory for use in residential construction. Builders, as a group, do not appear to be divided significantly over question two; however, the separate classes within the residential builders are distinctly divided over the question.

The respondents' attitudes toward the various factors listed in question three are broken down by the various factors presented in this particular question.

CALL-BACKS

	Very Important	Important	Not Important
Residential Builders	20%	38%	43%
Merchant	20	35	45
Custom	27	45	27
Apartment	00	50	50
Retail Lumbermen	3	24	72
Wholesalers & Commission Men	17	00	83

The only groups of respondents that felt that call-backs had any influence upon the quality of dimension lumber used in residential construction were custom, merchant builders, and wholesalers and commission men.

LABOR COSTS

	Very Important	Important	Not Important
Residential Builders	6%	70%	24%
Merchant	00	75	25
Custom	18	63	18
Apartment	00	50	50
Retail Lumbermen	7	59	34
Wholesalers & Commission Men	00	67	33
Architects	--	--	--

As a whole, each group of respondents indicated that labor costs had some influence in determining the level of quality of softwood dimension lumber used in residential construction.

CONSTRUCTION TECHNIQUES

	Very Important	Important	Not Important
Residential Builders	5%	70%	24%
Merchant	5	70	25
Custom	9	81	9
Apartment	00	50	50
Retail Lumbermen	00	48	52
Wholesalers & Commission Men	00	66	34
Architects	--	--	--

Response to construction techniques did not differ substantially from the response to labor costs. Examination of the responses to the factor "home buyers" reveals that home buyers are not considered an influencing factor in determining the quality of dimension lumber utilized in residential construction. The custom builders were the only respondents that showed any definite reaction to considering home buyers a factor in influencing the quality of dimension lumber used in residential construction.

HOME BUYERS

	Very Important	Important	Not Important
Residential Builders	00%	14%	86%
Merchant	00	5	95
Custom	00	36	64
Apartment	00	00	100
Retail Lumbermen	00	14	86
Wholesalers & Commission Men	00	00	00
Architects	--	--	--

In excess of thirty-three percent of the respondents indicated that they felt that price is the only factor determining what quality of dimension lumber is used in residential construction. Sixty-six percent of the respondents indicated that price is not the only factor entering into the decision on what level of quality of dimension lumber will be used in residential construction.

	YES	NO
Residential Builders	19%	81%
Merchant	20	80
Custom	00	100
Apartment	50	50
Retail Lumbermen	46	54
Wholesalers & Commission Men	80	20
Architects	--	--

Other factors entering into the decision as indicated by the respondents who did not feel that price is the only factor are as follows, where the percentage refers to the number of respondents mentioning a particular factor:

Dimensional Stability	70%
Strength	48
Other	16
Appearance	9
Maintenance	6
Availability	2

Some of the other factors mentioned and included under the category of "other" are architects, workability, weight, and sizes.

In response to question six, several builders indicated that they would possibly pay a premium for quality dimension lumber. The information presented below gives the number of builders willing to pay a particular premium for quality dimension lumber. This applies only to those builders who were at that time using southern pine dimension lumber construction.

Premium	Number
$000	19
0-2	18
0-4	12
0-7	5
0-10	2

In a similar manner, a few retail lumber dealers also thought that they could sell quality dimension lumber at a premium price. The information presented below gives the number of retail lumber dealers who thought that they could sell quality dimension lumber at a particular premium.

Premium	Number
$000	23
0-2	7
0-4	4
0-7	3
0-10	0

In response to question eight, the respondents, as a group, indicated that four of them had been using or selling quality southern pine dimension lumber for 0-6 months, seventeen from 6-12 months, twelve from 12-18 months, and twenty-two from 18-24 months. Of those respondents using or selling southern pine dimension lumber, twenty-six indicated that they have not incurred any problems with the material. Fifteen retail lumber dealers specifically mentioned that they had met sales resistance or that they had to use greater sales efforts in moving this material. Three respondents complained of the weight,

ten of the hardness, eleven of dimensional stability, and four of added cost associated with the installation of heavier material manufactured of southern pine. In excess of 59 percent of the retailers selling southern pine indicated that they were experiencing difficulties in securing the material in needed sizes and quantities. The most crucial items mentioned were 2 x 8 - 14' and 2 x 10 - 16' joist material.

The response to question eleven and twelve was limited. Most wholesalers and retailers had sold southern pine dimension lumber in the Chicago market before World War II. None of them had sold this material in recent years to residential builders until efforts were made to reintroduce this material into the market 2-3 years prior to the time when this survey was conducted. With the exception of two retail lumbermen and one wholesaler, none of the respondents had tried to sell any other products manufactured of southern pine in recent years. The only exception was southern pine boards used for sheathing and decking which have all but been eliminated from the market by the widespread use and acceptance of plywood and other sheet materials for use as decking and sheathing.

The analysis of completed and usable questionnaires provided facts that permitted several conclusions to be made about the users, specifiers, and sellers of dimension lumber in the Chicago metropolitan area. Briefly, these are:

1. As a group, sellers of dimension lumber believed that unseasoned dimension lumber is satisfactory for use in residential construction. Merchant builders feel that unseasoned dimension lumber is satisfactory for use in residential construction, while custom and apartment builders feel that unseasoned dimension lumber is not satisfactory for use in residential construction.

2. The consumption of quality dimension lumber can not be attributed to call-backs.

3. Home buyers do not directly influence the decision on what dimension lumber will be used in framing their residences.

4. Construction technique is a factor that exerts some influence upon what quality of dimension lumber is to be used in construction.

5. Labor cost is a factor that exerts some degree of influence upon the quality of dimension lumber used in framing residences.

6. The price on initial cost of dimension material is not the only factor determining what quality of dimension lumber will be used in residential construction.

7. Few residential builders are willing to pay a premium price for higher quality dimension lumber.

8. Architects do not normally play a role in determining what quality of dimension lumber will be used in residential construction.

These conclusions were drawn from the information elicited from the sample that was selected from the total population of builders, architects, commission men, wholesalers, and retail lumbermen in the Chicago metropolitan area. Without doubt, if another sample were taken from the universe there would be specific changes in the information elicited from the original sample; however, considering the time allocated for the survey, the original sample will be considered to be fairly representative of the universe. It is the opinion of the author that the market situation for quality dimension lumber would not vary significantly between large metropolitan areas in the Midwest. In large metropolitan areas, builders and lumber retailers face similar competitive situations for services and price. In the smaller metropolitan and rural areas residential builders and lumber retailers would also face similar competitive conditions. While these separate

markets are influenced by similar factors, the conclusions and findings should not be considered valid in all markets. This is due to the fact that competitive influences vary in degrees between the various markets and sizes of markets.

QUALITY LUMBER SURVEY
Summer 1965

Interviewee _____ Date __ / __1965

Position _____ Firm _____

Address _____ City _____

_____ Architect _____ Commission Agent _____ Builder
_____ Custom
_____ Lumber Retailer _____ Merchant
_____ Apartment
_____ Lumber Wholesaler

1. What dimension lumber are you now using/selling/specifying?

_____ Kiln Dried _____ Southern Pine
_____ Douglas-fir
_____ Unseasoned _____ West Coast Hemlock
_____ Other

2. Does your organization feel that unseasoned dimension lumber is satisfactory for use in residential construction?

_____ Yes _____ No

3. To what extent do the following factors influence the quality of dimension lumber used in residential construction?

	Very Important	Important	Not Important
Call-backs	_____	_____	_____
Construction Techniques	_____	_____	_____
Labor Costs	_____	_____	_____
Home Buyer	_____	_____	_____

4. Is price the only factor in deciding what quality of framing material will be used?

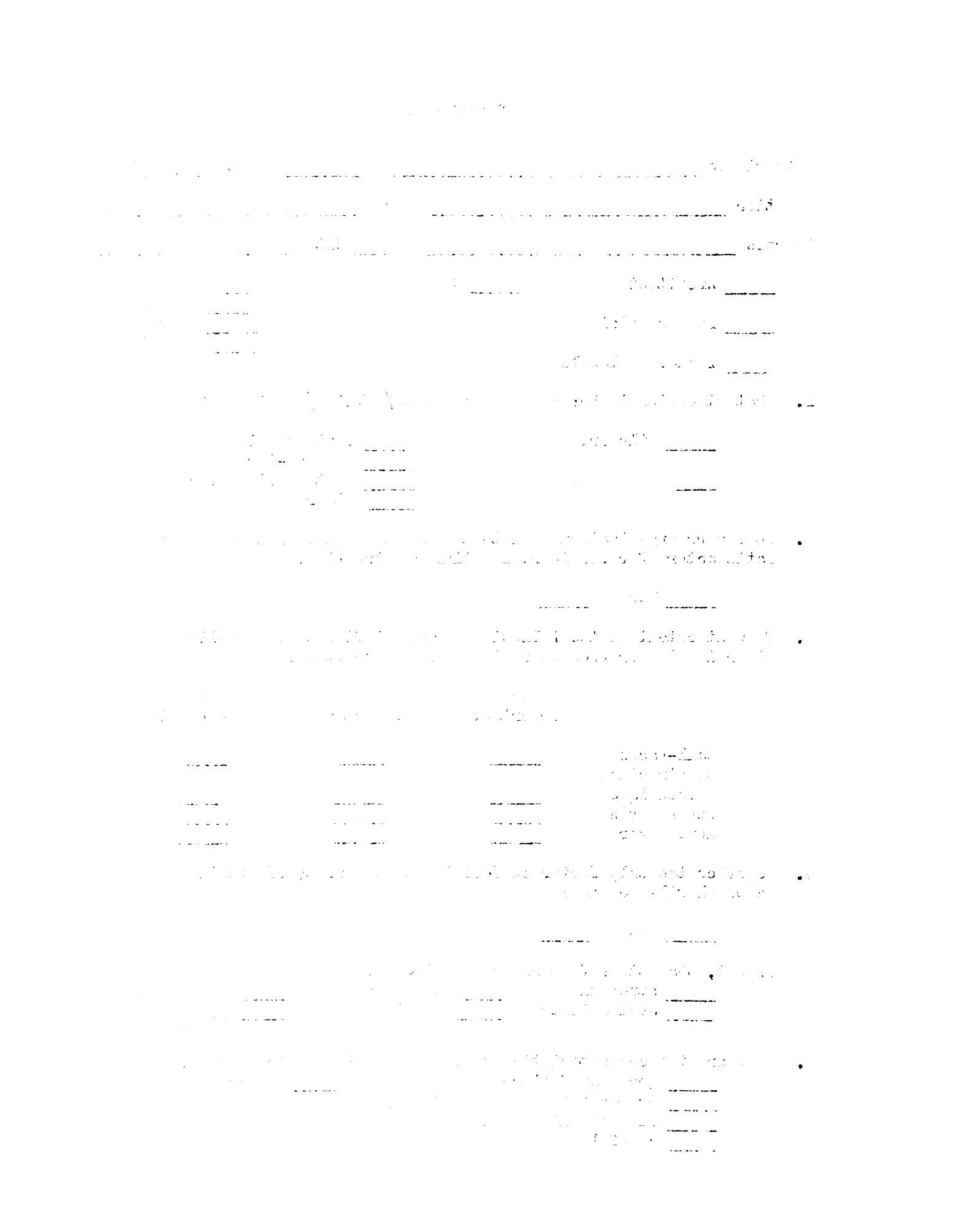
_____ Yes _____ No

If not, what other factors are considered?

_____ strength _____ appearance _____ dimensional
_____ availability _____ maintenance _____ other

5. What are the characteristics that you seek in framing lumber?

_____ good manufacture _____ other
_____ proper seasoning(kiln dried)
_____ dimensional stability
_____ careful grading



6. What is the maximum price if any that you would pay/sell quality framing lumber?
   _____ $MBM

7. What are the principal sizes and lengths of floor joists, ceiling joists, roof rafters, and trussed rafters used/sold?
   Floor joist _____
   Ceiling joist _____
   Roof rafters _____
   Trussed rafters _____

8. If southern pine is being used/sold/specified, how long have you been using/selling/specifying it?
   _____ months.

9. Have you incurred any disadvantages in using/selling southern pine?
   _____ None
   _____ Increased Labor Costs
   _____ Increased Selling Effort
   _____ Reduction of Profit Margin
   _____ Dimensional Stability
   _____ Other:

10. Do you have any difficulty in securing southern pine in the sizes and lengths necessary for your use/customers? _____ Yes _____ No.

    If so, what are the problem sizes and lengths _____
    _____

11. Have you ever used/sold/specified any other items manufactured of southern pine? _____ Yes _____ No.

    If so, what are the items?

_____ flooring	_____ shelving
_____ door jambs	_____ rough sawn siding
_____ mouldings	_____ other:
_____ boards	

    Did they give satisfactory performance? _____ Yes _____No. If not, what was the difficulty? _____
    _____

12. If other items manufactured from southern pine have not been used/specified/sold, what are the principal reasons?

_____ Not Available	_____ Lack of Information
_____ Hardness	_____ Low Dimensional Stability
_____ No Demand	_____ Other:

COMMENTS:

GLOSSARY OF TERMS

Air-dried.--Dried by exposure to air, usually in a yard, without artificial heat.

Boards.--Lumber less than 2 inches thick and 1 or more inches wide.

Custom builder.--A builder who typically erects individual houses to plans and specifications for specific home buyers.

Dimension lumber.--Lumber from 2 inches to but not including 5 inches thick, and 2 or more inches wide. It may be classified as framing, joists, planks, rafters, studs, small timbers, etc.

Framing lumber.--Lumber used for the structural members of a building, such as studs, joist, rafters, sheathing, etc.

Green.--Freshly sawed lumber or lumber that has received no intentional drying; unseasoned.

Joist.--One of a series of parallel beams used to support floor and ceiling loads, and supported in turn by larger beams, girders, or bearing walls.

Kiln-dried. Dried in a kiln with the use of artificial heat.

Lumber.--The product of a sawmill and planing mill not further manufactured other than by sawing, resawing, and passing lengthwise through a standard planing machine, crosscut to length, and matched.

Merchant builder.--Operative builder or development builder. Builders who erect groups of houses for sale on a specific site or group of sites.

Official territory.--A rate territory made up of North Central and Northeastern states. It closely corresponds to the blanket territory established for transcontinental lumber shipments.

Owner-builder.--A home buyer who takes on the role of a general contractor in erecting or sub-contracting for the erection of his own personal home.

Prefabricator.--A producer of homes who builds house packages in a shop and sends them out to be erected on sites located anywhere within an economical shipping distance.

Rafter.--One of a series of structural members of a roof designed to support roof loads.

Retail lumber yard.--Establishments primarily selling lumber, millwork, and other building materials such as brick, tile, cement, blocks, storm doors and windows, wall boards, and roofing material. Establishments are included in this category only if their receipts from sales of lumber and millwork are one-third or more of the firm's total receipts.

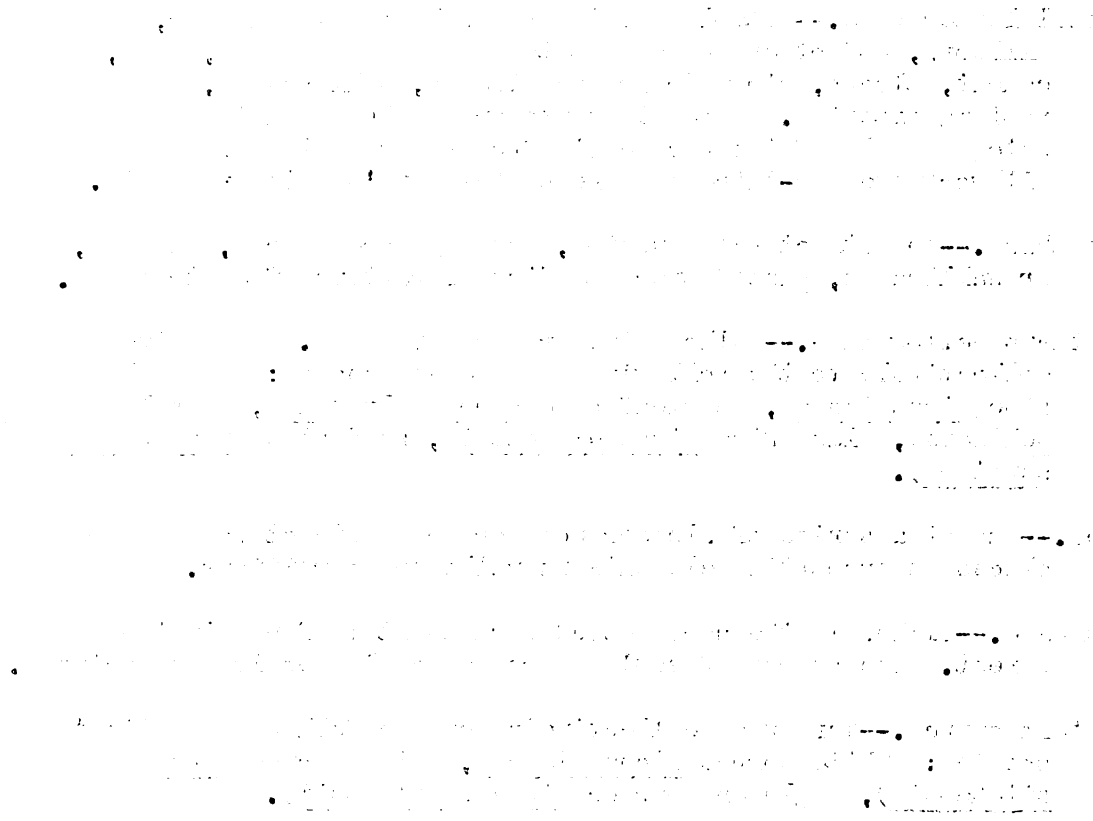
Sheathing.--The structural covering, usually wood boards, plywood, or wallboards, placed over studding or rafters of a structure.

Southern yellow pine.--Yellow pine or southern pine. Name given collectively to the following individual species: Loblolly Pine(Pinus taeda), Longleaf Pine(Pinus palustris), Shortleaf(Pinus echinata), Slash Pine(Pinus elliottii), Pond Pine(Pinus rigida serotina).

Stud.--One of a series of slender wood or metal structural members placed as supporting elements in walls and partitions.

Stumpage.--Timber in the unprocessed form as it is found in the forest. The source of sawlogs from which lumber is manufactured.

Western spruce.--Term used collectively for the following distinct species: White Spruce(Picea glauca), Sitka Spruce(Picea sitchensis), Englemann Spruce(Picea engelmannii).



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