

Material Substitution in the US Residential Construction Industry

To assess the extent of material substitution in structural applications in residential construction and to provide insight into the factors driving these changes, in 1995 researchers from CINTRAFOR surveyed residential homebuilding firms to determine the materials they use, factors affecting material selection, and attitudes about wooden-based building materials. In late 1999, CINTRAFOR conducted a follow up study of 2,500 residential construction firms (100 were ranked the largest in the US by Builder magazine) to characterize how builder behavior and attitudes have changed. The results showed that softwood lumber continues to lose market share and builders remain concerned about softwood lumber quality and price. Findings also revealed that builders are beginning to believe non-wood building materials, including steel and concrete, have less impact on the environment than softwood lumber.

Survey Results

The US residential construction industry, traditionally the largest market for softwood lumber, has undergone a period of uncharacteristically rapid change over the past decade. The effects of timber harvest restrictions in federal and state forests on softwood lumber price, price stability, and product quality, combined with technological advances by producers of substitute materials, have contributed increased use of material substitutes in residential construction.

Of 2,500 builders surveyed, 12.8% responded (12.1% of the random sample and 37.1% of the 100 largest firms). Survey results show that residential builders have steadily increased their use of substitute structural materials since 1995, Figure 1. Respondents reported increased use of substitute structural materials since 1995. Of all substitute materials included in the survey, almost 99% of respondents used at least one substitute product (compared to 91% in 1995). While use of steel, reinforced concrete and plastic-fiber lumber increased, engineered wood products emerged as the clear winners: over 80% of the respondents reported using glulam beams, wood I-joists, and laminated veneer lumber (LVL). Builders in the western US reported the highest use of substitute products. In addition, the survey data suggest that large firms were more likely than small firms to try new substitute products, particularly finger jointed lumber, structural insulated panels, and LVL, as well as newer engineered wood products such as parallel strand lumber and laminated strand lumber.

The data were analyzed to assess the extent to which various structural products were used in walls, floors, and roofs, the three end-use applications that consume the greatest volume of structural lumber. The most commonly used products were softwood lumber, steel framing, finger-jointed lumber, wood trusses, LVL, and wood I-joists.

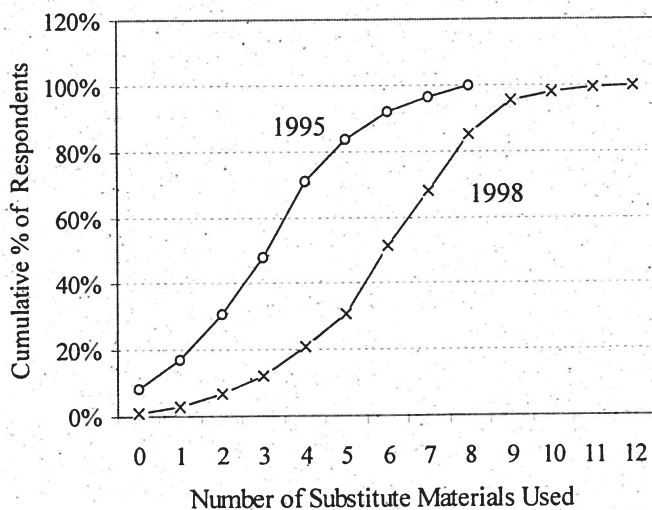


Figure 1. Use of substitute materials has increased since 1995.

Wall framing- Softwood lumber dominated wall framing in 1998, with an 83% market share, but it has lost market share since 1995 (down from 93%), particularly among large firms.

Floor framing- Softwood lumber's share of the floor framing market declined from 59% in 1995 to 42% in 1998. While it is still the most widely used product, the market share of wood I-joists increased from 23% to 39% in the same period.

Roof framing- Softwood lumber framing is no longer the dominant material in residential roof systems. Survey data show that wood trusses increased slightly from 46% to 48%, while softwood lumber declined from 51% to 40%.

To assess builder satisfaction with softwood lumber, respondents were asked to rate the level of the importance, and their corresponding level of satisfaction, with 13 softwood lumber attributes. The importance ratings obtained in 1998 were identical to

those reported in 1995. Softwood lumber straightness, strength, availability, and lack of defects were rated as the most important attributes. Price appears to be much more important to large firms than small firms. Builders reported that while they were somewhat more satisfied with the price and price stability of softwood lumber in 1998, they were still unhappy with softwood lumber quality, particularly straightness and the overall occurrence of defects.

Figure 2 illustrates the difference between the mean importance ratings (where 7 indicates "extremely important" and 1 indicates "not important at all") and the mean satisfaction ratings for each product attribute (where 7 indicates "extremely satisfied" and 1 indicates "extremely dissatisfied"). While builders appear to be less concerned with price and price stability than in 1995, they remain very concerned about the perceived decline in softwood lumber quality, expressing the least satisfaction with product attributes they rate as being most important. This suggests that they are dissatisfied with the value (defined as the ratio of quality/price) of softwood lumber.

To provide a more concise interpretation of the importance and satisfaction of the different softwood lumber attributes, a factor analysis was performed to group together attributes that are highly correlated. The results, which were almost identical to results obtained from the 1995 survey, suggest that the 13 product attributes used to describe softwood lumber can be summarized into three factors: performance, economic, and technical attributes.

Finally, the survey assessed builders' perceptions of the environmental impact associated with using substitute products. Although environmental marketing is not prevalent in the US forest products industry, most industry observers believe that it will become more important. While reduced environmental impact had the lowest importance rating of the 13 softwood lumber attributes, the 1998 survey data indicates a definite shift on the part of builders toward a more favorable perception of the environmental impacts associated with using substitutes, including steel and concrete, than in 1995.

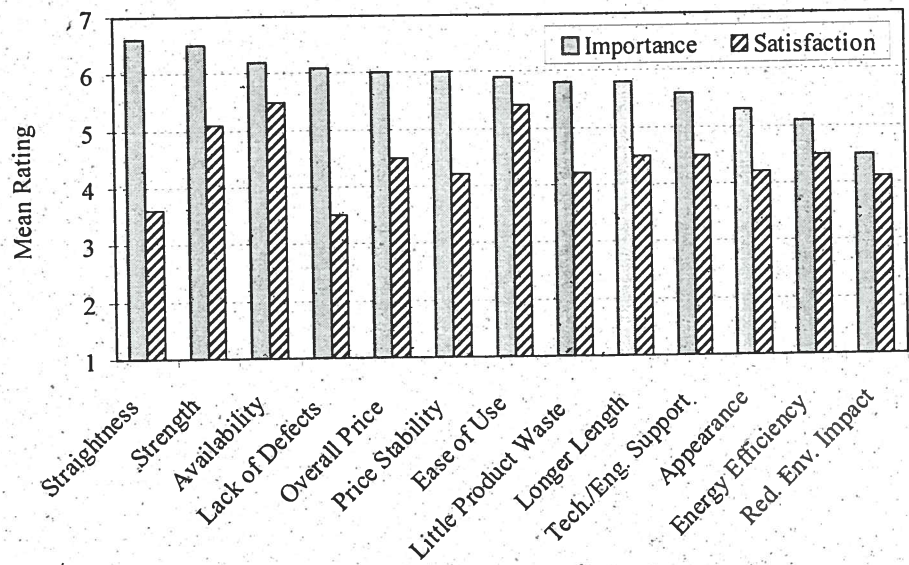


Figure 2. The gap between the importance and satisfaction rankings of thirteen product attributes is greatest for quality and price-related attributes.

Softwood lumber continues to be displaced by substitute materials in segments of the residential construction industry that it traditionally dominated: wall, floor, and roof framing. To a large degree, this loss of market share can be attributed to a perception among residential builders that the value of softwood lumber has declined: a direct result of rising prices and a perceived drop in lumber quality. Much of the loss in market share can be attributed to the increased use of engineered wood products. Many would argue that this is a normal process of product evolution within the forest products industry that can be attributed to technological advances in manufacturing processes driven by the changing forest resource. However, two trends should concern managers in the forest products industry. First, the use of non-wood substitute building materials has increased significantly since 1995. Second, there is a growing perception among home builders that using non-wood building materials (including steel and reinforced concrete) is better for the environment than using softwood lumber. Clearly the forest products industry must be more effective in developing a strategic response to the challenge posed by substitute materials.

Softwood Substitution in the US Residential Construction Industry is available as Working Paper 73 through CINTRA FOR.