

Chapter 8

Conclusions and Market Strategy

Conclusions

No differences were found among the infrastructure groups' overall performance ratings for wood in different US regions. Wood was perceived to be above average in its overall performance ratings by the infrastructure groups. This study determined that the decision-maker education level, age and years of work experience did not affect officials' perceptions of wood's overall performance as a construction material. Also, this study determined that course-work in structural wood design and wood design standards did not affect the officials perceptions of wood as an infrastructure construction material.

No differences in importance for overall factors were found among infrastructure officials in different United States regions. Combined infrastructure groups had different importance for the factors used when making a material choice decision. *Durability, maintenance* and *cost* were the most important factors in a material choice decision and should be considered in market strategy development. *Environmental impact, ease of design* and *innovativeness of material* were the least important factors. These factors were rated above average in importance, although they were less important than *durability, maintenance* and *cost*. Therefore, a wood products manufacturer may want to include these factors in development of market strategies, but not devote as many resources to them as given to the most important factors.

Wood Products: Pros and Cons in Infrastructure

Manufacturers require information about wood in the individual infrastructure markets to best formulate market strategies. The following sections describe how wood was perceived by officials in each infrastructure market and the infrastructure markets combined. Wood products manufacturers may want to carefully consider this information and adjust their market strategy if they may enter or are currently competing in the these markets.

Highway Market:

Manufacturers can use the benefits of wood in highway structures for improved highway market strategies. Highway officials perceived wood to have *low initial cost* in highway structures. Officials perceived wood to be highly *corrosion resistant*. Wood was considered *easy in construction* and *construction equipment was available* for wood. Officials perceived *design*

standards to be available for wood, but these standards may need improvements. They had high perceptions of wood being *aesthetically pleasing* and *disposable/biodegradable*. Officials perceived wood in highway structures as *easy to repair* and *easy in field modification*.

Wood products could be improved upon in several areas in order to improve market strategies. Highway officials perceived wood to be high in *maintenance* and *life-cycle costs*. They perceived wood to have low *fatigue*, *mechanical wear/abrasion*, *fire*, *weathering* and *biological decay resistance*. Wood was considered *available* in highway markets, but not as *available* as other materials. Wood products were perceived to be less *chemically safe* and *recyclable/reusable*. Officials perceived *standard structure designs in maintenance* not to be available for wood, wood to be *difficult to inspect* and maintenance personnel to have *less experience with wood*. Highway officials perceived wood to be the least *innovative* material.

Marine/Inland Waterway Market:

Benefits of wood in marine/inland waterway structures can be utilized by manufacturers to improve marketing strategies. Marine/inland waterway officials perceived wood to be among materials with *lowest initial costs*. They perceived wood to be highly *corrosion resistant*. Wood was thought to be *available* and *easy in construction*. Officials perceived *construction equipment to be available* for wood, and *structure design engineers to have experience* with wood. Wood is perceived to be above average in *chemical safety* and *disposability/biodegradability*.

Wood products could be improved in several areas to compete better in this market. Marine/inland waterway officials perceived wood to be among the highest *maintenance cost* and *life-cycle cost* materials. They felt that wood had low *fatigue*, *mechanical wear/abrasion*, *fire*, *weathering* and *biological decay resistance*. They perceived *design standards to be less available* for wood than for other materials. Marine/inland waterway officials indicated that wood may require improvements in *recyclability/reusability* and *percent recycled content of material* (perhaps from an engineered wood product).

Railroad Market:

Benefits of wood in railroad structures can be utilized by manufacturers to best compete in the railroad market. Railroad officials perceived wood to have the lowest *initial cost* of materials. They perceived wood to be among the most *corrosion resistant* and *fatigue resistant* of materials.

Wood products were perceived to be highly *available* and *easy in construction*. *Construction equipment* and *design standards* were perceived *available* for wood. Officials perceived *structural designers* to have *experience* with wood. Wood was thought to be *aesthetically pleasing*, to have *low environmental effects in production*, and to be *disposable/biodegradable*. *Field modification, repair* and *inspection* were perceived to be easy with wood. Officials perceived *standard structure designs in maintenance* to be *less available* for wood and maintenance personnel to have *experience with wood*. Officials perceived wood to be slightly above average in most *innovation* attributes.

Wood products could be improved in several areas to better compete in the railroad market. Railroad officials perceived wood to be high in *maintenance cost* and *life-cycle cost*. They perceived wood to be among the least *mechanical wear/abrasion resistant, fire resistant, weathering resistant*, and *biological decay resistant* materials. Wood was thought to be the below average in *recyclability/reusability* and *percent recycled content of material*. Wood was perceived to be the least *chemically safe* material. Railroad officials perceived wood to be the least *innovative in design* of all materials.

Utility Market:

Benefits of wood in utility structures can be employed by manufacturers to strengthen utility market strategies. Utility officials perceived wood to be low in *initial, maintenance* and *life-cycle cost*. They perceived wood to have high *corrosion resistance, fatigue resistance* and *weathering resistance*. Wood was observed to be the most *available material* and *easiest material in utility construction*. Officials perceived *construction equipment and design standards* to be *available* for wood. They perceived *structural designers* to have *experience* with wood. Wood was thought to be *aesthetically pleasing*, to have *low environmental effects in production*, and to be *disposable/biodegradable*. Officials perceived *standard structure designs* to be *available* for wood and maintenance personnel to have the most *experience with wood*. Wood was perceived to be *easy in field modification, repair, and inspection*.

Wood products could be improved in several areas to better compete in the utility market. Utility officials perceived wood to be among the least *mechanical wear/abrasion resistant, fire resistant* and *biological decay resistant* materials. Wood is thought to be among the least

chemically safe and recyclable/reusable. Officials perceived wood to be low in *innovative attributes.*

Wood in the United States Infrastructure Market:

Benefits of wood in infrastructure can be utilized by manufacturers to best compete in the infrastructure market. Infrastructure officials perceived wood to have the lowest *initial cost* of materials tested. Wood was thought to be highly *corrosion resistant* and somewhat *fatigue, mechanical wear/abrasion and weathering resistant.* Wood was rated high in *material availability and ease of construction.* *Construction equipment and design standards* were perceived to be available for wood. Officials perceived wood to be *aesthetically pleasing and disposable/biodegradable.* They perceived wood to be *easy to repair, easy to modify in the field* and they perceived *maintenance personnel to have experience* with wood. Finally, wood was perceived to be as *innovative in the environment* as other standard structural materials.

Wood products could be improved in several areas for better competitive strategies in the infrastructure market. Infrastructure officials perceived wood to be high in *maintenance cost* and *life-cycle cost.* Wood was observed to have poor *fire resistance* and *biological decay resistance.* Structural designers were perceived to have *low experience* with wood. Officials perceived wood not to be *recyclable/reusable* and to have high *environmental effects of material production.* They perceived wood to be less *chemically safe* and to have low *percent recycled content of material.* Officials thought wood was *difficult to inspect* and *standard structure designs in maintenance* for wood were perceived less available. Finally, wood was perceived to be the among the least *innovative materials in performance, design, maintenance and durability.*

Competitive Strategies in Infrastructure Markets:

Strategic planning is defined by Kotler and Armstrong (1997) as “the process of developing and maintaining a strategic fit between the organization’s goals and changing market opportunities.” For wood products manufacturers to best compete in the infrastructure market, they will need to have a strategic plan composed of an overall goal and carefully chosen objectives that will be used to meet this goal. The infrastructure market has changed its perceptions of wood products and manufacturers may want to change their marketing strategies to meet these new perceptions. Wood products manufacturers who plan to enter or are competing in the

infrastructure market may wish to consider the following information in their improving their strategic marketing plans.

1. There should be a greater market approach by the wood products industry. Manufacturers may need to direct market efforts to infrastructure decision-makers through financial, educational and promotional support of a cohesive, financed, wood industry technical group/association in transportation markets. This research supports the efforts of the National Wood in Transportation Information Center. Wood products associations may want to change their education plans and place less emphasis on structural design with wood and more on the proper use/maintenance of wood in infrastructure. Wood products associations may wish to increase promotional efforts by informing decision-makers where suppliers are located and informing wood products manufacturers about areas in which decision-makers are working.
2. The wood products industry may want improve timber structure design details for infrastructure applications so that the details better fit the decision-maker's needs. These design details should be simplified for easier use by infrastructure decision-makers not familiar with wood. There is a need for a textbook or centralized information source on wood design in infrastructure applications.
3. Long service life is important to infrastructure decision-makers. To lengthen wood service life, manufacturers may need to improve its durability. Increasing the durability of wood will increase the confidence infrastructure decision-makers have in the wood. This could be accomplished through advancements in wood chemical preservative treatments.
4. Wood has been perceived by infrastructure decision-makers as less environmentally friendly than other materials because of its chemical treatments, its perceived affect on environment during production, and its low reusability/recyclability. Manufacturers may want to use or develop more environmentally friendly, but still effective, chemical preservatives. Associations and manufacturers may want to increase promotion of best management practices in timber harvesting and wood products manufacturing. Also, recycling/reuse of solid wood products may require more promotion by the wood products associations.

Areas of Future Research:

This study has revealed that there are problems with connections/fasteners in wood products used in infrastructure. Nail withdrawal, loose bolts and failed connections were identified as problems with wood structures in each of the infrastructure areas. These difficulties may be caused by inferior connection/fastener designs, poor structure maintenance or improper

construction methods. In order for decision-makers to have increased confidence in using wood in infrastructure, they need to have confidence in the available connections/fasteners. Therefore, more research should be accomplished to improve wood fasteners, connection details and education about fasteners/connections in wood structures.

Chemical treatments are causing many infrastructure decision-makers to have a lower perception of wood than alternate materials. It has been determined that wood preservative chemicals are perceived to be harmful to people in contact with the treated wood (construction/maintenance workers, pedestrians) and to the environment. At the same time, officials state that these chemicals are not performing well enough to protect wood from decay organisms. Research should be conducted to develop more environmentally friendly chemical preservatives that better protect wood from decay organisms.

This study has determined that the recyclability of solid wood products may need to be researched. Due to the large amount of treated wood removed from service, recycling or reuse of treated wood products was an issue with decision-makers in each infrastructure market. Future environmental regulations may cause disposal of treated wood products to be difficult. To reduce disposal costs, infrastructure decision-makers need information on how to recycle or reuse treated wood products.

Wood quality issues are present among decision-makers in each infrastructure area. They stated that wood products manufactured today can not be found in needed lengths or in required straightness. The fast grown wood products manufactured today are perceived by decision-makers to have less strength than wood product in the past. In order for wood products to be used in infrastructure applications, decision-makers need to know that the wood they use has the needed strength to perform. Further research on the quality of wood produced today should be conducted to determine how to improve the perceptions of wood by decision-makers.

Frequent issues were raised concerning the wood details and standards in place for today's infrastructure market. The details are perceived to be difficult to understand and not to be compatible with the strength of wood products manufactured today. Also, many decision-makers perceive them to be obsolete for today's requirements in infrastructure. Decision-makers must have confidence that wood details and designs they use in infrastructure are up-to-date with today's infrastructure requirements. Research needs to be conducted on wood details and designs in infrastructure to determine if they should be changed to meet current infrastructure needs.

In today's infrastructure, many structures are constructed of material combinations engineered for high durability, low maintenance and low cost. Some decision-makers expressed interest in how wood can be best used with alternate materials (concrete, steel, plastics) in composites that increase service life and decrease costs of structures. Research should be conducted to find best methods for use of combination wood/alternate material products in infrastructure applications. Also, in this time of engineered wood products, it would be beneficial to research their best use in infrastructure.

Limitations To Study:

For lack of resources, only infrastructure leaders' importance for material choice factors and perceptions of materials were studied. This means that the non-leaders' perceptions/ideas were not included in the study, even though they may have an effect on material choice decision in infrastructure. Also, personal interviews were performed in only four states to gather information and clarify the survey. Therefore, the interview portion of the study is limited to four states, and the information gathered may not be representative of other decision-makers' perceptions in other states. It should be remembered that this study measured the perceptions of materials and not their actual performance. Perceptions may not be the same as performance in all applications.

Literature Cited:

Kotler, Philip and Gary Armstrong. 1997. *Marketing: An Introduction*. 4th Edition. Prentice-Hall, Inc. Upper Saddle River, New Jersey.