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Wood remains the most popular material for deck construction. For centuries, consumers have chosen wood because of its desirable qualities and aesthetics. In recent years, wood plastic composites (WPC's) have seen rising demand as alternatives to wood decks, despite a large price premium. In addition, the removal of CCA treated wood from the residential market has resulted in substitution of more expensive wood preservatives that will lessen the price gap between the two products. Little research has been performed on homeowner perceptions of WPC's as decking material. Data was accumulated from consumers through computer aided questionnaires using choice-based conjoint analysis at home shows. The four locations are Atlanta, San Diego, Toronto and West Springfield. Consumer attitudes and desires were measured concerning decking material to provide decking manufacturers information for constructing marketing decisions. A sample of 1,285 respondents demonstrated consumer preferences for decking material attributes such as material, price, maintenance and lifetime. Results include the universal negative perception of treated wood and the growing acceptance of WPC's. Although results varied from region, overall naturally durable wood represented the most preferred decking material by consumers.

Consumer Perceptions of Decking Material

by

Jon M. Thomas

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Jon M. Thomas, Author

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1. INTRODUCTION

1.1 Problem Statement

Wood remains the most popular material for deck construction. For centuries, consumers have chosen wood because of its desirable qualities and aesthetics. In recent years, wood plastic composites (WPC's) have seen rising demand as alternatives to wood decks, despite a large price premium. The recent removal of CCA treated wood from the market has resulted in substitution of more expensive wood preservatives that will lessen the price gap between the two products. Wood-plastic composite companies are engaging in intensive advertising to exploit this new competitive situation. Can WPC products gain widespread acceptance by consumers? Little research has been performed on homeowner perceptions of WPC's as decking materials. Despite the lack of research about these alternative products, demand for residential WPC decking material is increasing dramatically. The residential deck material market experienced annualized growth of 8.1 percent between 1991 and 1999 (Shook and Eastin 2001). If WPC's can present a higher quality product containing more desirable attributes than wood, rates of substitution may increase. This study examined consumer attitudes and desires concerning decking material to provide useful consumer perception information to the decking industry that can be used for making marketing decisions.

1.2 Objectives

The annual use of wood-plastic composite (WPC) decking material is expected to reach 488 million board feet by 2005 (Koenig and Sypkens 2002). In order to compete with plastic decking products, wood-decking manufacturers need to establish the tradeoffs that consumers make regarding decking materials. What type of function does a deck serve to each type of consumer? Obviously, price is a determining factor in many purchases but evidently it is not the only factor. This study tried to connect the function and use of a deck to the consumer purchase decisions. Purchase decisions were measured using choice-based conjoint results as well as how consumers perceive a deck. Consumers' deck material perceptions were measured using a rating scale of utilitarian (purpose) or hedonic (image) dimension . A profile of consumer perceptions with regard to the importance they place on product attributes when comparing traditional wood decking and plastic-wood decking will be established. Consumer perceptions of decking attributes/options, both wood and plastic, including material, maintenance, durability and price will be compared to the function of the deck purchase in the consumer decision-making process. A better understanding of customer needs and desires is necessary for wood decking manufacturers to minimize market share loss and create sustainable strategic marketing plans.

The lack of information concerning consumer perceptions regarding wood-plastic composites as viable alternatives to wood for decking material makes it difficult for wood decking producers to address issues affecting their market. This project addressed the following objectives:

- Identify the most desired characteristics for decking material by consumers.
- Evaluate consumer perceptions of wood-plastic composites in comparison to wood with regard to material, maintenance, durability and a standard price basis.
- Profile consumer characteristics such as attitude, knowledge, beliefs and demographics related to deck materials.

2. LITERATURE REVIEW

2.1. Consumer Behavior

2.1.1. Consumer Behavior defined

The business world traditionally focused on products, not customers, until the 1950's. As post-war conditions created more affluent customers and increased competition, the marketing concept developed. Sales volume no longer indicated a company's profit or success because creating a satisfied customer through the establishment of long-term customer relationships could provide long-term stability. Businesses began to concentrate on selected groups of customers through market segmentation and product differentiation. Firms began taking a serious interest in their customers' point of view (Webster Jr. 1988). Understanding how and why consumers purchase products provides the means for companies to satisfy consumer wants and needs. The scientific study of consumers is called consumer behavior research and is defined as the study of consumers as they exchange something of value for a product or service that satisfies their needs (Prensky and Wells 1996). This decision process of consumers choosing products to satisfy their needs has initiated the in-depth study of consumer behavior. Consumer behavior studies can be approached using

methodologies from several different disciplines. Each discipline involves its own area of interest that may only address a specific aspect of consumer behavior. For example, a pitfall of past empirical consumer research deals with acquisition and purchase decisions while ignoring use and disposal issues (Holbrook 1995). The major disciplines and areas of interest include:

Psychology	- Consumer thought processes
Sociology	- Society's influence on consumer behavior
Economics	- The roles of economic factors in consumer behavior
Anthropology	- The effect of cultural rituals on consumer behavior
Organizational Behavior	- Influence of organizational activities on consumer behavior

Prensky and Wells (1996) suggested that more comprehensive conclusions can be attained through the inclusion of all perspectives within the analysis of consumer behavior than that offered by any individual discipline. Two ideologies further divide the study of consumer behavior – one group follows a holistic approach using verification through empirical sciences and the other group (relativists) believes there may be (or may not be) a reality independent of the observer and deems it impossible to measure such a reality through empirical tests (Robertson and Kassarjian 1991). Another major barrier among consumer behavior scholars is the lack of agreement on what aspects of the human condition, if any, qualify for exclusion from consideration, leaving the field with an infinite number of phenomena to account for (Peter 1991 p.533).

Other researchers insist that consumer behavior includes the study of all activities involved in acquiring, using and disposing of products (Holbrook 1987).

Three influential consumer behavior factors are offered by Tull and Kahle (1990): social – the influence of the people associated with a consumer, situational – influences dependent on the context in which a product is used and informational – influences that depend on the facts and beliefs a person has toward an object. Although many consumer behavior scholars disagree on how to study consumer decision processes, they all attempt to explain why consumers choose in the manner they do. In other words, how does one product offer superior satisfaction to a consumer over another?

2.1.2. Consumer Decision-Making

The inclusions of all major disciplines in consumer behavior create difficulties in measuring consumer choices. Payne et al. (1993) used the components that form a choice: alternatives, attributes of value and uncertainties to explain consumer decision-making. They also studied how the information is available in the environment in terms of content and structure. The content of information is further described by what information is available to the consumer in their existing environment. The authors also examined the structure or how the consumer organizes the information. This information offers valuable insights into consumer thought processes during buying situations. Decision-making choices are complicated to predict and the difficulty increases for the consumer (1) as the number of alternatives and attributes increases, (2) when some specific attribute values are difficult to process, (3) if there is a great deal of uncertainty about the values of many attributes, and (4) as the number of shared attributes becomes smaller. Bettman (1979) identified choice as a unifying theme in developing a theory of consumer information processing. Consumers are characterized

as attempting to achieve a goal by interacting with the choices available to them within their environment. The process of interaction includes:

1) Need recognition

2) Obtaining information from various sources

3) Processing the information

4) Making a selection from among the alternatives

The application of this model involves careful consideration of the specific choices. The interaction process may be simple or complex depending on the person, situation and product.

Berkman and Gilson (1986) illustrate need recognition as a consumer's motive to satisfy a specific objective. The consumer recognizes through mental or physical needs a desired state that can be solved by a purchase. A need for action is established and the consumer begins to gather information from an internal and external framework. The internal information is stored in the consumer's memory, usually from past experiences when previously faced with a similar problem. External information is gathered through outside sources such as marketing channels that include advertisements, television, salespeople, books and magazines. Other sources are interpersonal information that is accumulated through relations with friends, family and acquaintances. The priority of the desired goal has a direct influence on the information search and the effort the consumer is willing to apply. The information gathered by the consumer it is processed in a variety of ways. Consumers usually develop heuristics, simple "rules of thumb", which assist in dealing with complex situations during the information investigation. Bettman et al. (1991) state that 1) consumers may use only

one or a combination of heuristics, 2) heuristics can be constructed spontaneously or can be pre-planned, 3) the variance between required effort for heuristics development and use and how accurate they are within general consumer decision processes. The motivation, attention and perception of the consumer concerning purchase decisions play intricate roles in sifting through the relevant data. The pertinent information is then stored in the consumer's memory as a method for decision-making. The alternatives and benefits of acceptable products are weighed to select the best possible solution.

Payne et al (1993, p.9) defines this decision strategy as a "sequence of mental and effector (actions on the environment) operations used to transform an initial state of knowledge into a final goal state of knowledge where the decision maker views the particular decision problem as solved." Payne et al. (1993) also describe three major classes of factors that influence which strategy can be used to solve particular decision problems: characteristics of the decision problem, characteristics of the person and characteristics of the social context. These three types of factors influencing strategy choice affect the availability, accessibility, processability and perceived benefits of various decision strategies. Payne et al (1993) state that each strategy can be viewed as a sequence of operations (method) for searching through the decision problem task. The search may reflect information about certain aspects such as the relative importance of an attribute. Consumers create an acceptable weight or salience for each attribute. These cutoff values and differential preferences across specific attributes specify a minimal acceptance level for the consumer while forming decisions. A consumer's search is often selective and the use of different strategies limits the amount or type of information processed in various ways.

An example of this comes from Dhar and Wertenbroch (2000) who state that consumer choices are driven by utilitarian and hedonic considerations. The comparison of two goods is measured as each is viewed to be superior in the separate categories of hedonic and utilitarian dimensions. The consumer preferences are calculated in the acquisition and forfeiture conditions. The consumer chooses one of the two items to acquire and which of the same two items to give up. Dhar and Wertenbroch (2000) define hedonic goods as being consumed for an affective and sensory experience of aesthetic or sensual pleasure, fantasy and fun. Utilitarian goods are consumed in a more cognitive manner since they accomplish a specific function or practical task. Consumer choices are measured between both categories (hedonic and utilitarian) in preference to acquisition and forfeiture conditions. The Dhar and Wertenbroch (2000) study demonstrated a correlation between consumer decisions concerning the dimensions of acquisition and forfeiture. Consumer decisions consistently increased the weight of hedonic aspects compared to utilitarian in forfeiture situations. Conversely, consumers had a greater preference for utilitarian goods when faced with an acquisition choice. Kahn and Meyer (1991) state the level of attribute uncertainty can change the importance of attributes that improve or preserve an existing condition. These behaviors raise questions about how much of a specific attribute can be given up to increase the level of another. This reinforces the aforementioned interaction process, but also demonstrates the complexity of predicting an outcome due to the difference in people, products and situations. This tradeoff among important attributes is critical for the approach used in this study and will be explained in section 2.1.4.

2.1.3. Attitudes in Consumer Behavior

Recently, consumer researchers have concentrated on attitude as a basis for market segmentation (Kamakura and Novak 1992). Beliefs and values are the two key elements defining an attitude. Values are simply defined by what a society as well as individuals consider to be good or bad. Values exist at a societal and personal level. Realizing individuals may not agree, Rohan (2000) states that a group value, such as a society, is understood as being an ideological value system. People possess both their own value system as well as perceptions of others' value systems. While personal value systems are individualistic, social value systems contain perceptions and judgments of others' value priorities. Therefore, social value systems construct peoples' perceptions of others. Laws and mainstream behaviors, actions and perspectives are examples. It is generally assumed that both personal and social value priorities influence perception and behavior. Rokeach (1973) views a value as a lasting belief that a particular behavior or result is personally or socially preferable to the converse behavior.

A belief is an interpretation of the environment that consumers learn, store and process in order to guide their behavior. In context, a belief is measured as the probability that something exists (Hughes 1971). Fishbein (1967) states that an attitude is the product of a belief and a value. Within a person's cognitive system, values are more stable and possess a more central position to form attitudes. Rokeach (1973) believes that once a value is learned, it becomes prioritized in a person's value system. This enduring evaluation resides in the consumer's memory and is linked with specific situations or objects. This attitude then becomes a learned predisposition to respond in a consistently favorable or unfavorable manner towards a certain object. A consumer

places brands or products in multidimensional constructs according to his/her evaluation of its attributes in relation to other brands. Values have been used as a means for understanding the underlying motivation of consumers, however; consumers possess more than one value.

Most buying situations evoke several values, beliefs and attitudes that must be resolved through the use of a consumer's value system. Understanding belief, value and attitude formation can help researchers recognize consumer purchase behavior. While attitudes and values are among the most central determinants of consumer behavior, there is little consistency concerning each particular purchase decision. The consumer can be affected by many other immediate and more tangible environmental influences, such as price, sales promotion, and exposure. Product attributes and benefits are the easiest way to impact the attitudes held for a specific product (Kamakura and Novak 1992).

Another approach, created by Fishbein and Ajzen (1976), is the hierarchical conceptual framework that relates beliefs, attitudes, intentions and behaviors. This concept incorporates beliefs as basic building blocks. A consumer constructs beliefs about an object from direct observation, information from outside sources, or other assumption processes. Consumers often use assumptions as substitutes for prolonged information search. For example, a consumer enters a store to purchase a product and assumes the available selection is more than adequate, so there is no need to shop any of the store's competitors (Folkes 1989). This creates a mental shortcut so the consumer can concentrate on the decision process for specific product attributes. A consumer links the desired product with several attributes that result in the formation of beliefs

about himself, other people, institutions and behaviors. This belief system serves as an informational compass guiding attitude, intentions and behaviors and enables consumers to formulate rational decisions by processing the information available in the environment. The attitudes, beliefs and values held or formed by consumers directly reflect the brands and products they purchase.

2.1.4 Hedonic/utilitarian attitude dimensions in consumer behavior

The two previous sections connect attitude and consumer self-concept to purchase decisions. Belk (1988) describes the most primary and basic fact of consumer behavior by stating consumers are what they consume and consume what they are. Within consumer research, the self-concept is a knowledge structure that determines how consumers receive, decipher and process information (Chang 2001). Markus et al. (1982) suggest that a prediction of future consumer behavior is based on his/her self-concepts. This prediction of consumer choices has prompted a more in-depth look into the self-concepts of consumers by measuring their attitudes towards products. A connection between consumer self-concept and attitudes of products influences product evaluations.

Consumer research suggests that consumer attitudes are bidimensional. Hamilton (1987) suggests that consumers simultaneously use goods in two ways. Consumers use products as symbols of status and as a means to achieve some end result. Consumers consume products for two basic reasons: (1) affective gratification (hedonic) and (2) cognitive or instrumental reason (utilitarian) (Batra and Ahtola 1990). The hedonic dimension is derived from consumer sensations or experiences from using the

product while the utilitarian dimension is derived from the functions performed by the product (Voss et al. 2003). Measuring attitude in a separate hedonic and utilitarian dimension produces a stronger model when compared to overall attitude research. Spangenberg et al. (1997) offer a supporting theory to Hamilton (1987) for measuring the cognitive and affective dimensions of attitude. The hedonic and utilitarian attitudinal dimensions are experienced by the consumer on both the affective and cognitive levels, while the affective drives the hedonic and cognitive dominates the utilitarian as shown in Figure 1. Ultimately, all consumers partake in an internal negotiation to satisfy both hedonic and utilitarian consumption desires.

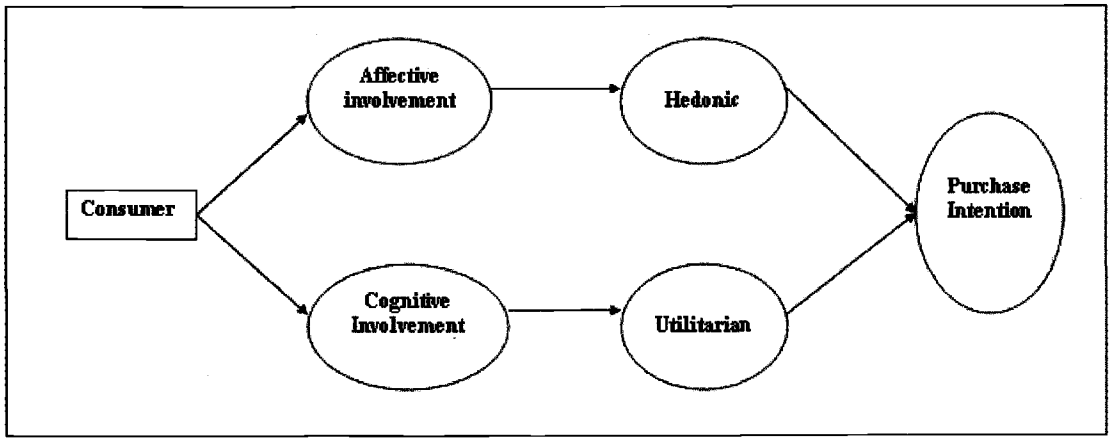

Figure 1. Consumer attitudes influencing purchasing decisions Adapted from Voss, Spangenberg and Grohmann, 2003

2.1.5. Lifestyle/Self-Concept in consumer behavior

The self-concept theory is a significant factor in consumer behavior. Big-ticket items or expensive purchases such as a car, clothing, electronics or gifts may be greatly influenced by our ideal self-concept. This includes how we view ourselves (private) or how we would like others to view us (social) (Hawkins et al. 1986). The visible product

becomes a form of expression. A person's lifestyle cannot be sufficiently explained without the use of self-concept dimension. Lifestyle refers to spending time and money in a pattern of consumption for specific products (Solomon 2002) while the 'self-concept' is a person's entire perception of themselves in relation to their thoughts and feelings including attitude towards self. Personal lifestyle is an outward expression of self-concept, therefore the self-concept provides the foundation for one's lifestyle (Hawkins et al. 1986). The self-concept can be divided into four basic groups:

1) Actual self-concept – who I am now
2) Ideal self-concept – who I would like to be
3) Private self-concept – how I would like to see myself
4) Social self-concept – how I would like to be seen by others

These categories influence consumer behavior, acting as a guide for product and brand choices and companies attempt to be aware of these gaps when developing marketing strategy. Hawkins et al. (1986) state that certain products provide social symbols and meanings that impact the individual users self-concept. Consequently, consumers may be inclined to consume goods that preserve or improve a desired self-concept.

Like self-concept, lifestyles can be flexible. Personal tastes and preferences evolve over time, thus changing both their self-concept and lifestyle. Products fit together usually reflecting a person's lifestyle because the same types of people choose them. Lifestyle choices become a means for consumers to identify with people and

products that possess similar characteristics.

While consumer self-concept also plays an intricate role in product decision processes through the action of acquiring specific possessions, many purchase decisions directly convey a self-concept that inevitably becomes a consumer's lifestyle. Certain products portray the attributes that consumers are attempting to display, specifically the ideal and social self-concepts. Consumer behavior is not motivated by the wish to imitate their current lifestyle group but instead the desire to copy one that he or she aspires to join. Consumer decisions revolve around the move away from an actual state and towards an ideal state (Englis and Solomon 1997). This explanation uses the extended self-concept, self plus possessions, to explain the correlation between self-concept and lifestyle. As consumers choose particular products, they are directly affecting their image to others and themselves as well as altering their lifestyles. Products become the building blocks of consumer lifestyle and self-concept. Lifestyle has been defined as "we are what we do." thus self-concept can be stated as "we are what we have." The interrelationships between these two concepts demonstrates the importance for marketers to fully understand the image portrayed by their products.

2.2 State of the Wood Decking Industry

Significant activity in the home improvement market has increased the demand for residential decking materials. The residential decking market has grown 8.1 percent annually between 1991 and 1999 (Shook and Eastin 2001). WMM (2002) forecasts decking consumption to exceed 5 billion bf in 2006 due to strong housing starts and steady growth in repair and remodeling expenditures. Previous studies indicate that approximately 4.2 percent of all households (over 3 million) add a deck to their existing homes in the U.S annually (Shook and Eastin 2001). Wood accounted for 61 percent of the US deck and patio-remodeling sector in 1997 (Fell and Gaston 2001). As the rate of homeowner deck construction increases, manufacturers of decking material are attempting to position their products and existing attributes in the market to further consumer use.

The U.S. Census Bureau states that expenditures for residential improvements and repairs totaled approximately $110 billion in 2001 (US Census 2002). The residential decking market continues to grow as homeowners are moving money from the stock market to home improvement as another form of investment. According to Trex, (2002), the growth in demand for residential decking reflects the increasing popularity of decks as a means of extending living areas and providing outdoor recreation spaces. Adding a deck has become one of the most popular home improvement projects because construction of a deck is a relatively low cost means of increasing homeowner recreational space. Trex estimates the majority of deck installation projects to range from $15 to $20 per square foot, which is less than the cost of a typical interior construction project. Many homeowners forego the purchase of a

new home and choose to improve their existing residence during times of economic uncertainty (Trex 2002).

According to WMM (2002), the estimated total size of the U.S. residential decking market in 2001 was 4.2 billion bf, (Figure 2) an increase of 6% from 1999 (Figure 3 - 3.95 billion bf) and 25% from 1995 (3 billion bf). The three main sectors comprising the residential decking market in 2001 were: 83% treated wood (83% in 1999), 11% naturally durable wood (15% in 1999) and 5% non-wood decking (3% in 1999). Treated lumber and naturally durable western red cedar and redwood lumber continue to dominate the U.S. residential decking market. However, according to WMM (2002), plastic and wood-plastic composite decking continue to put enormous market pressure on wood as consumer concerns about health, product durability and maintenance are combining with increased public interest in sustainable forest practices. Traditional wood decking producers have been forced to develop differentiating strategies targeting niche markets where the warmth and aesthetic appeal of wood are appreciated.

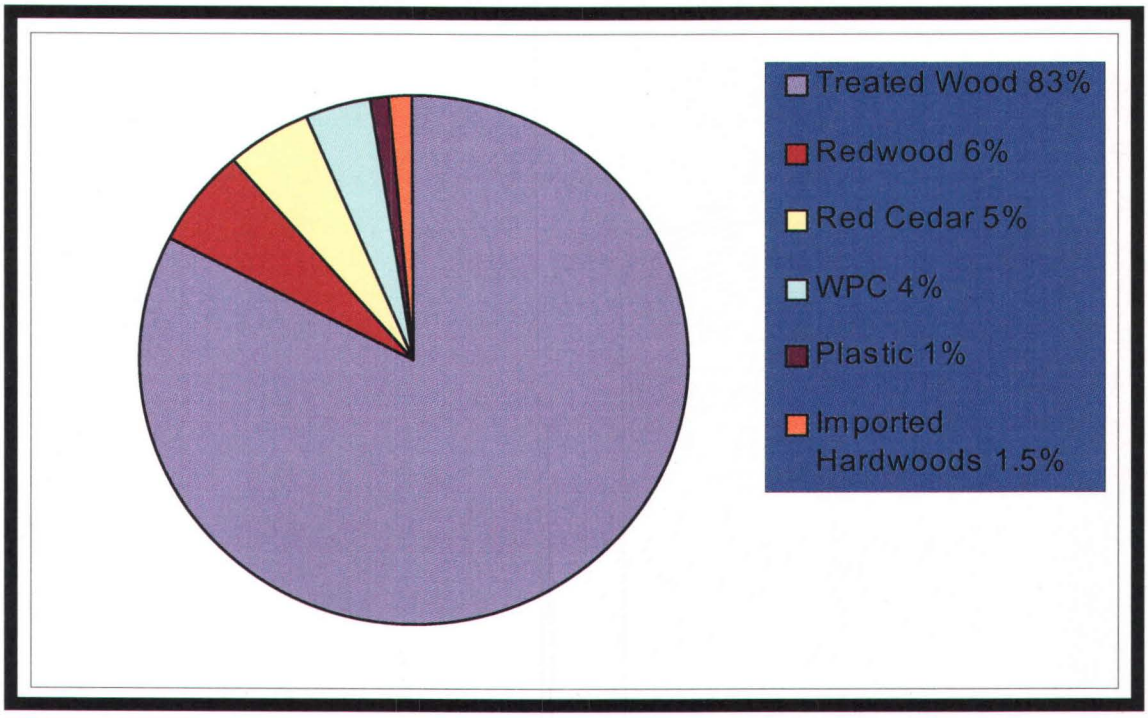

Figure 2: Relative amount of various material used in the U.S. residential decking market in 2001 (WMM, 2002) WPC: Wood Plastic Composite

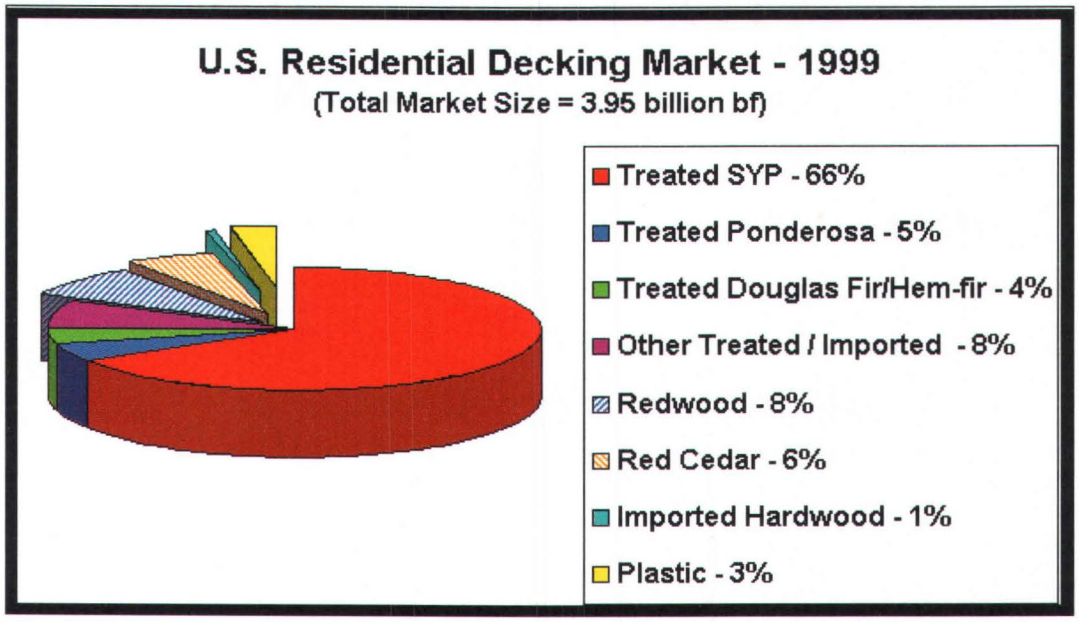

Figure 3: Relative market share of various materials in U.S. residential decking market in 1999 (Wood Markets, 2000)

The treated wood industry has removed CCA (Chromated Copper Arsenate) from consumer markets and the current favorites for replacement appear to be ACQ (Alkaline Copper Quaternary) or Copper Azole (WMM 2002). The alternatives are more expensive to consumers and more corrosive to treating equipment. The voluntary removal of CCA-treated wood from residential application (January 1, 2004) and reduced consumer health concerns with the alternative systems may help the treated decking sector preserve its leading share of the residential decking market (WMM 2002). Meanwhile, increasingly strict harvesting regulations limited redwood shipments to a 15-year low in 2001 despite increased availability of commercial redwood forest. Western redcedar production has fallen to a modern-day low as a result of an average 27.2% value-based import tax on Canadian softwood lumber shipments. Obviously, the treated and naturally durable wood producers must address the rising competition from plastic/WPC lumber (WMM 2002).

The residential decking market can be separated into three price tiers (Figure 4). Naturally durable wood (clear redwood and clear western redcedar) is the most expensive category at approximately $3300 per mbf; while plastic and WPC's are in the middle at $2200 per mbf and treated wood (ACQ) is the least expensive option at $1300 per mbf (WMM 2002). The emergence of three distinct price ranges among decking materials will allow builders and consumers to make their product selection based on a variety of qualitative issues. Although it is easier to measure material selection for professional contractors than consumers because of the former's exposure to a wider variety of products, consumers may exercise more control concerning material selection

due to the high visibility of decks and fences around the home (Fell and Gaston 2001). Developers generally use 'spec' plans to build the majority of homes without any input from the final homeowner. As consumers purchase these homes, the decisions concerning material usage for decks, fences and other outdoor projects rest with the homeowner (Fell and Gaston 2001). Deciding issues include material, durability, maintenance and price (Fell and Gaston, 2001, Shook and Eastin, 2001).

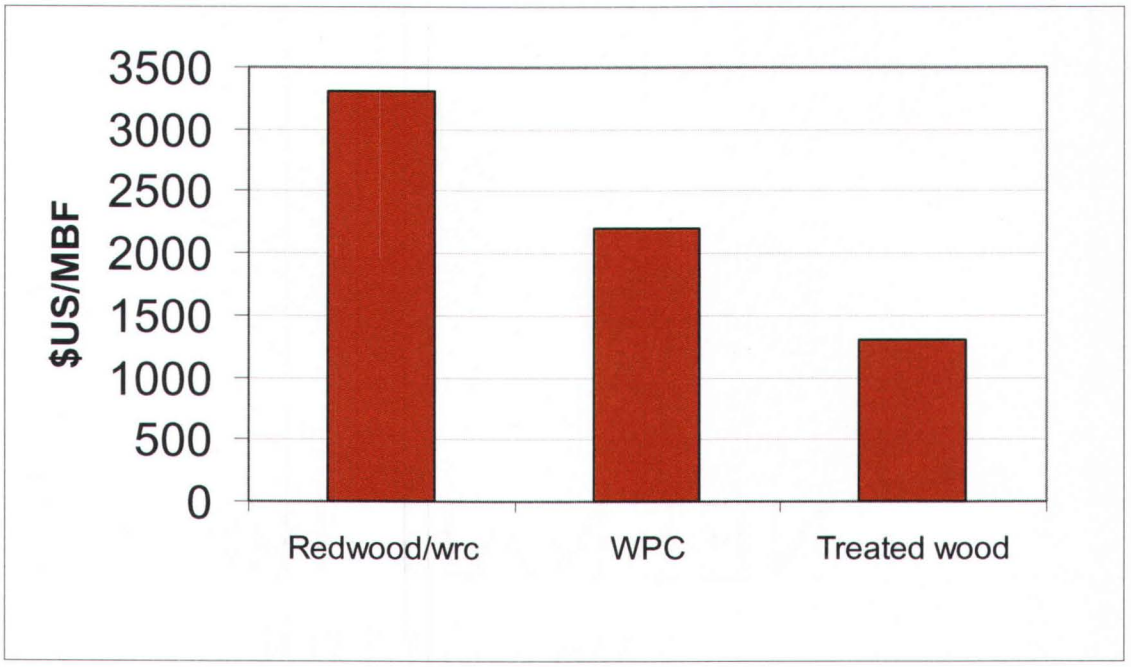

Figure 4: Retail deck prices for 5/4 by 6" sixteen ft. long clear redwood, western redcedar(WRC), wood plastic composites (WPC) and preservative treated wood (Source: Wood Markets Monthly Sept, 2002)

2.2.1 What is Decking Material?

The four most widely used decking materials are naturally durable wood (redwood and western redcedar), pressure-treated lumber, wood-plastic composites and plastic lumber (Shook and Eastin 2001). This study will concentrate on the first three materials. Decking components include deck boards, stair treads, balusters, spindles and

railings. Essentially all of this material gives the deck its outward appearance. Materials used for structural purposes such as foundations, beams, joints and stair stringers are excluded.

2.2.2 Why are Wood-Plastic Composites Gaining Popularity

Alternative products like plastic-based decking are intensely competing with traditional wood decking products such as treated southern yellow pine, redwood and western red cedar using warranties and targeted promotion (Butzelaar 2002). Despite higher prices for WPC's due to added production costs compared to wood, Koenig and Sypkens (2002) suggest that wood-plastic composites are easier to work with making total installation cost less than wood. Increased production of the more expensive WPC products may suggest that market opportunity is not necessarily tied to price. In fact, Shook and Eastin's, (2001) found that low material cost was the lowest-rated deck material attribute. Homebuilders rated low material cost as important but relatively less important than other product attributes. According to Butzelaar (2002), many consumers make decking decisions based on product benefits and maintenance concerns rather than price alone. Butzelaar suggests that as decking choices increase for the homeowner; changes in decking product usage can be expected as new products and technologies attempt to meet customer needs.

Two reasons that plastic and wood plastic composites (WPC) have made substantial inroads into residential decking market share in a short time are the withdrawal of CCA by the pressure treating industry and the softwood export tariff on naturally durable wood activity (cedar imported from Canada). Both events have forced price increases. ACQ and Copper Azole (CCA replacements) treated wood are more

expensive than the CCA counterpart, approximately $250 more per mbf (WMM 2002), while the tariff for western red cedar is passed on to consumers. Trex, the largest manufacturer of wood plastic composite decking material, believes the publicity surrounding CCA removal will contribute to increases in sales of wood plastic composites and 100% plastic lumber for decking by raising awareness of chemicals in pressure-treated lumber (Trex 2002).

Over the next three years, WPC's and plastics are expected to experience an average compounded growth of 15% per year (Figure 5). The relatively less expensive WPC decking products are leading the rapid advance of non-wood alternatives. WPC's registered a robust market in 2002, following a slow 2000-2001 as companies balanced channel inventories with production and consolidation within the industry (WMM 2002). According to Trex, the decline in lumber quality and quantity along with the growing consumer awareness of the

product attributes of non-wood decking alternatives have contributed to increased sales of wood/plastic composites and 100% plastic lumber for decking (Trex 2002). Recently, the non-wood decking sector has experienced intense growth due to new entrants in the market. What was once a two-contender industry (Trex and US Plastic), now includes several new companies competing for second and third place (Figure 6). An increase in demand for decking products is expected; however, competition should continue to be intense (WMM 2002).

	Demand (MMBF)			% Annual Growth	
Material	**1995**	**2000**	**2005**	**95/00**	**00/05**
Wood	3,976	4,366	4,470	1.9	0.5
Wood-Plastic	95	236	488	20.0	15.6
Plastic & Other	44	75	117	11.3	9.3
Total	4,115	4,677	5,075	2.6	1.6
Total Value	2,885	3,369	4,540	3.2	6.1
Source: The Freedonia Group					

Figure 5: Actual and estimated demand for various decking material (million board feet)(Estimated and actual demand for various decking materials by Koenig & Sypkens, 2002) www.iswonline.com

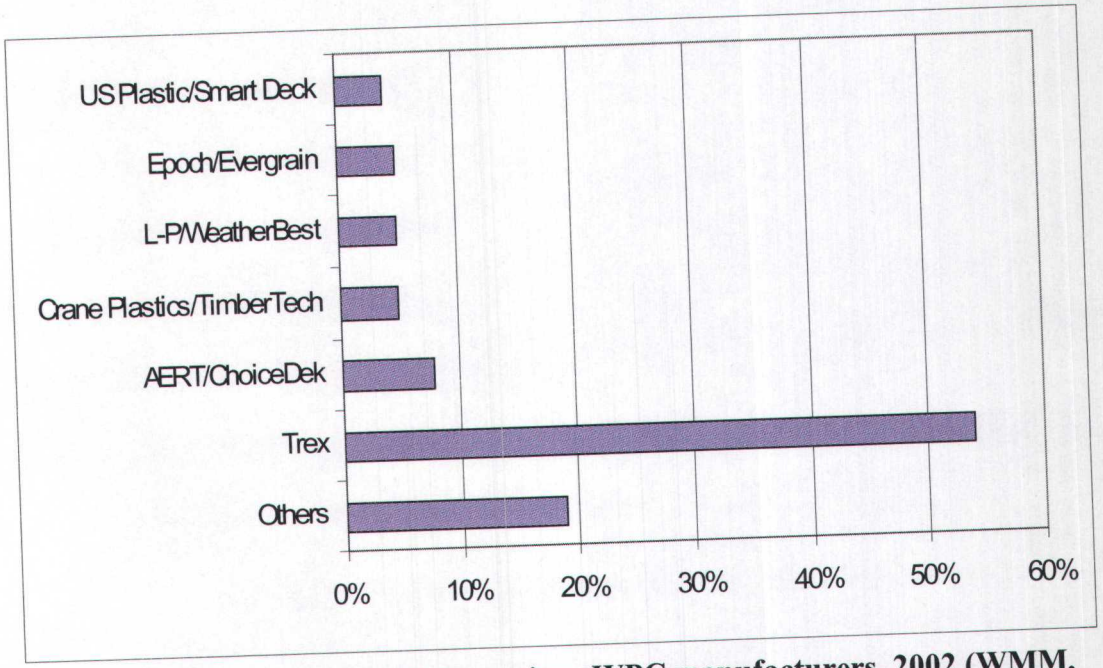

Figure 6: Market share held by various WPC manufacturers, 2002 (WMM, 2002)

2.2.3 Industry Profile

The following is a brief explanation of each type of decking material including redwood, western red cedar, treated wood and wood-plastic composites. Each decking material is followed by a company profile highlighting the major manufacturer in each respective sector.

2.2.3.1 Redwood

Redwood (Sequoia sempervirens) decking is the highest quality decking material on the market. One of the properties that gives redwood this title is its dimensional stability. Redwood is less likely to warp, split, cup or check than other woods because it has thinner cell walls. As a result water absorption does not induce such substantial dimensional stresses (Simpson literature (A) 2002). Simpson literature states that redwood is naturally durable, resists insect attack and absorbs and retains finishes well due to testing by the USDA (U.S. Department of Agriculture). Redwood also possesses good nail-holding strength and is highly workable. These physical properties coupled with its aesthetic warmth and beauty make this species highly attractive for decking material (Simpson literature (A) 2002).

The Simpson Company is a family owned company headquartered in Seattle, Washington. Simpson describes itself as one of the premier manufacturers of redwood. The Simpson Investment Company in 2002 split into Simpson Investment Company and Simpson Resource Company (Simpson website 3/12/03). The Resource Company deals exclusively with the management of its timberlands, while the Investment Company

operates the Simpson Door Company, Simpson Paper Company and Simpson Timber Company. The Simpson Resource Company provides the timber used in all operations (Scott 2003) and owns more than 866,000 acres of productive timberlands in Washington, Oregon and California. In April 2001, Simpson received certification for its timberland by meeting the requirements of the American Forest & Paper Association's Sustainable Forestry Initiative (SFI) (Simpson literature (A) 2002).

The company produces 80-90 million board feet of Douglas fir and 160 million board feet of redwood annually. The California operation manages 456,000 acres of timberland making it the second largest private timberland owner in the state. This timberland supplies Douglas fir and redwood to three mills located in Korbel, Orick and Brainard, California. The state-of-the-art Korbel mill produces 200 million board feet of green and kiln-dried lumber annually as well as ninety-nine percent of the Simpson redwood decking (Simpson literature (B) 2002). Sixty percent of the redwood lumber produced at the Korbel facility stays in California with the remaining serving a variety of markets reaching Colorado, Salt Lake area and parts of Montana (Scott 2003).

Simpson recently introduced a new type of beveled decking designed with a gentle curved face that keeps water from collecting on the surface. The edges are slightly angled to prevent debris from accumulating between deck boards and the backside contains kerfs to release tension. This product is wane-free and skip-free on the surface (Simpson literature (A) 2002). The company advertises in Merchant magazine through a co-op with distributors. Simpson educates each distributor on its product and then oversees the release of the advertisements. The ads are directed towards deck builders because of the influence on the customer (Scott 2003). The

advertisements are geared towards the middle to upper income tier and highlight luxury and beauty (Figure 7).

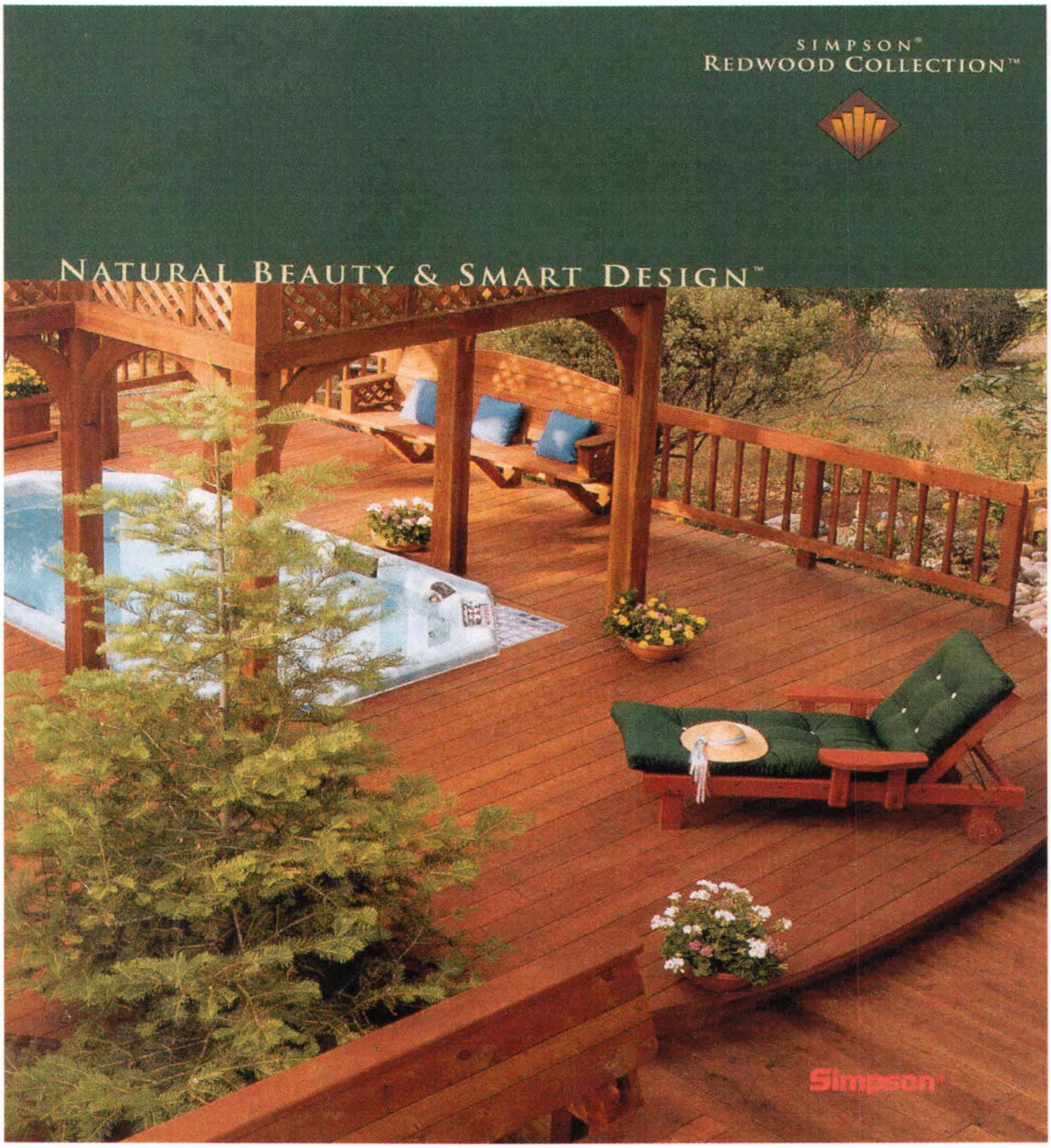

Figure 7: Example of a Simpson redwood advertisement

2.2.3.2 Western Red Cedar

Western red cedar (Thuja plicata) (WRC) properties are similar to redwood. Both sit atop of the decking market in terms of price and quality. WRC also has exceptional dimensional stability and after proper installation remains straight and retains fasteners well. WRC is well-suited for outdoor projects due to its ability to absorb stain or paint without compromising the quality of the wood. Practical attributes include naturally decay-resistance, light weight and workability. Unless the wood is in direct contact with the ground, WRC's natural preservative oil eliminates the need for further chemical treatments. WRC also cuts cleanly and easily while resisting cracking, warping, cupping and withdrawal from fasteners (Western Red Cedar Lumber Association website 3/5/03).

International Forest Products (Interfor) is a leading Canadian manufacturer of western redcedar decking materials. Interfor is one of Canada's largest logging and sawmilling companies producing lumber products for sale to world markets. The Company is headquartered in Vancouver, British Columbia and most of its facilities are based on the southern coastal region of the Province. There are 37 logging operations and six sawmills in this coastal region with one logging operation and one sawmill located in the central interior area. Interfor also operates six remanufacturing facilities (Interfor 2003). There are approximately 3,200 Interfor employees performing a variety of work including logging, sawmilling, marketing and administration. Interfor's primary cedar lumber market continues to be North America, although gains have been made in the offshore markets in Europe, Japan and Australia. Interfor had annual sales of $784 million in 2002 (Interfor 2003).

The Provincial government of British Columbia owns 95% of all timberlands in the Province and regulates all forestry operations under the Forest Act and the Forest Practices Act. Interfor has been granted licenses to harvest specific coastal and interior regions on a renewable five-year basis. The coastal region timber consists of 58% hemlock-balsam fir, 26% western red cedar, 9% Douglas-fir, 3% Spruce and 4% Alaska cedar to supply the mills. Beginning in 2001, Interfor independently certified all of their forestland through the Sustainable Forestry Initiative (SFI) program of the American Forest and Paper Association. The company is also a leader in using environmentally friendly helicopter logging techniques. Interfor owns and operates one of the largest helicopter logging operations in Canada and helicopter logs up to one-third of its total harvest annually (Interfor 2003).

Interfor's cedar logs are manufactured at the Hammond mill and remanufactured in the Albion Process Center. The Albion facility operates 7 kilometers from Hammond. This facility processes 12 million board feet of finished siding and decking products per year (Interfor 2003). Interfor's advertising is done through local distributors, while the Western Red Cedar Lumber Association (WRCLA) handles global promotion of cedar. For the first time in years, the WRCLA has allocated funds to direct its advertisements at the wood-plastic decking industry (Figure 8) in an attempt to combat consumer substitution of WPC's for cedar products (Mackie 2003). Although cedar advertisements are geared to the same market segment that purchases redwood the lower cost of cedar gives it some advantages.

Figure 8: Example of a Western Red Cedar Lumber Association advertisement

2.2.3.3 Treated Wood

Untreated wood is subject to attack by insects, microorganisms and decay by fungi. Treating wood protects it from these agents providing longer service life and maintaining structural soundness. The treatment process uses pressure to force chemical preservatives deep into the wood's cellular structure in a closed cylinder. This enables the preserved wood to maintain a chemical barrier against termites and decay for long periods of time. Pine species are most commonly used for treated decking material because of their high strength properties and its receptivity to treatment. A 40-year or

longer guarantee is given by most manufacturers of treated wood against decay and termite attack (American Wood Preservers Institute website 3/1/03).

Treated wood represents the lower product rung of decking materials in terms of price and quality. Pine is highly susceptible to cracking, warping and fastener withdrawal. Treated wood has a different color and feel than redwood and cedar, requiring more frequent maintenance. Despite these less-than-perfect, long-term characteristics, treated wood is a quality product and represents the vast majority of decking material with an 83% market share.

Universal Forest Products (UFP) is the largest manufacturer and distributor of treated wood and lumber products in the United States. Headquartered in Grand Rapids, Michigan, UFP has over 8,000 employees and 90 facilities in 79 locations throughout the United States, Canada and Mexico (UFP website 2003). The company owns and operates 21 wood treating plants, 7 of which are committed to treat wood exclusively for UFP. All residential products are treated with ACQ, one of the industry replacements for CCA. The process of treating wood begins with creating the desired working solution (chemical). This solution is held in a work tank consisting of the chosen ingredients. Different colors and special additives are available including moldicides, water repellants and colors or pre-stains. For example, UFP is currently selling a product called Sunwood – stained to mimic redwood in hopes of capturing some market share from redwood (Conklin 2003). Another strategic move in 2002 included the acquisition of EverX a composite decking company in Prairie du Chien, WI. UFP views EverX, as a higher end product, offering UFP access to customers considering the redwood and cedar market. The addition of composite decking to UFP's product line

was simple because the distributing infrastructure already exists. This is yet another example of UFP's goal to be an industry leader in all aspects of its business (Conklin 2003).

UFP is the leading North American provider of treated wood mills serving small independents to "bigbox" warehouses. Home Depot comprised 30% of Universal Forest Products total sales and 65% of DIY/retail sales in 2002 (Universal Annual Report 2002). Treated wood production in 2001 for UFP was over 1 billion board feet and the annual sales were approximately $1.5 billion dollars (Conklin 2003). The company operates in four major markets consisting of: Do-It-Yourself (DIY)/Retail, Industrial Products, Site-Built Construction and Manufactured Housing. DIY/retail comprised the majority of net 2002 sales at 46% while the remainder were almost evenly split Industrial – 16%, Site-Built – 20% and Manufactured Housing – 18% (Universal 2003). UFP offers support (How to Information) for retailers, but does not advertise directly to consumers. The advertisements (Figure 9) stem from the distributors and concentrate on the size and grandeur possible with the lower priced product.

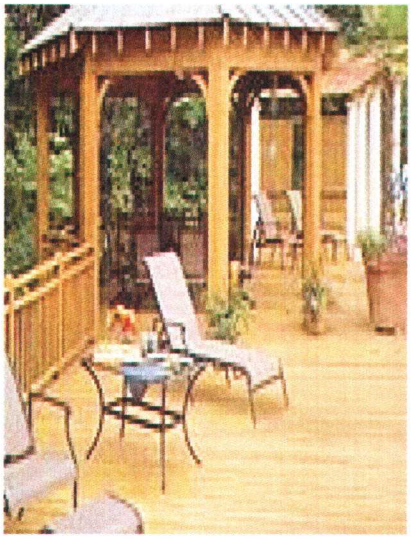

Figure 9: Example of a Universal Forest Products advertisement for ACQ treated wood

2.2.3.4 Wood-Plastic Composites - Trex

Wood-plastic composite (WPC) decking refers to any decking containing wood in any form (usually wood flour) and plastics. Thermoplastics are the most common form of plastics used in these materials since they can be repeatedly melted (Clemons 2002). Polyethylene or polyvinyl chloride are commonly used in commercial products like milk jugs and plastic grocery bags. WPC's performance depends on component material, interaction between materials, processing, product design and service environment. General points can be made but there are exceptions.

Adding wood to plastic makes the material stiffer but more brittle and still considerably less stiff than wood. WPC's absorb less water than wood and at a slower rate so resistance to fungal attack can be improved as well as dimensional stability (Clemons, 2002). Some major problems with WPC's are higher thermal expansion and color fading when exposed to UV rays (sunlight). The structural capacities of WPC are extremely limited compared to solid wood because creep resistance and stiffness are lower. Manufacturers of WPC decking promote its lower maintenance, lack of cracking, splintering and higher durability, despite being more expensive per lineal foot than pressure treated wood (Clemons 2002). Products with limited structural requirements such as decking, fencing, landscape timbers and moldings comprise the largest growth potential for WPC's (Clemons 2002).

Trex Wood-Polymer is the largest manufacturer of wood-plastic composite decking with headquarters located in Winchester, Virginia and a second facility in Fernley, Nevada. Trex combines waste wood fibers and reclaimed polyethylene to

produce residential and commercial decking. According to Trex (2002), this decking composite offers the attractive appearance and the workability of wood without the on-going maintenance requirements and functional disadvantages of wood. The company's decking and railing products are available in popular lumber sizes and are currently sold in five colors: Natural, Winchester Grey, Madeira, Woodland Brown and Saddle (Trex 2002). The company recycled nearly 200 million pounds of plastic and an equivalent amount of waste wood in 2002. Trex will shortly announce the third production facility site in the United States as well as the design and construction of two large recycling plants, one in Spain and the other in Virginia. Trex has over 300 employees and registered annual factory sales of residential decking approximately at $1.7 billion on about 2.9 billion board feet of lumber in 2002 (Trex 2002).

Trex has built a national network of more than 90 Trex distributors and over 3,000 retail dealers for its products. The company vision is to establish a quality brand name in the decking market that is dedicated to replace wood with Trex products. Trex states a fundamental philosophy: Create a better product, tell people about it, and make it easy to buy (Trex 2002). Residential decking is the primary market for Trex and, to a lesser extent, commercial decking. The focus of the company is to direct sales at the professional contractor, remodelers and homebuilders by expanding the distribution and information network. Contractors represent 60-70% of the decks built in the United States (Trex 2002). Future plans consist of reaching the contractor and consumer through the World Wide Web. Trex believes with the guidance of the contractor that the consumer makes the final decision to purchase Trex products (Trex 2002). Trex advertisements (Figure 10) focus on the attributes that elevate its product above treated

wood decking material. The ads concentrate on the lower maintenance, better appearance over time (no splitting, warping, cracking), environmentally friendliness, less shrinkage/swelling from moisture, resistance to decay and termites.

Figure 10: Example of Trex decking advertisement – www.trex.com (5/03/04)

2.3 Decking and Consumer Behavior

Utilitarian issues such as price and function are key concepts in the decision-making process for consumers. For example, 45 percent of contractors rate quality materials as the most important attribute, followed by service and price, when choosing a supplier (Merchant magazine 02/2002). Decking manufacturers target these builders to promote their products. Contractors are viewed as reliable specifiers and directly influence the products homeowners choose. Do consumers of new decking products use this same frame of reference? If the deck represents the user as a person, then a host of personal and product attributes are included. WPC marketing campaigns highlighting

the product attributes and benefits have gained momentum in the market over traditional wood decking products. Recently, the notion of maintenance-free products for outdoor furniture and decks has captured customers' attention (Koenig and Sypkens 2002).

2.3.1 Past Studies

Cohen et al, (1992) conducted a study in Vancouver, Canada to determine the importance of treated wood product attributes. A survey of retail store managers, a bridge between producers and end users, was used to provide real-time market information on consumer desired attributes of treated wood products. Retailers perceived the most dominant end-user segment as the do-it-yourself customer group. Store managers rated the importance of thirteen treated wood attributes on a five-point scale (Table 1). Respondents rated straightness, general appearance and grade equally or more important than price. These attributes were not performance related but instead aesthetic and architectural factors. Another interesting finding was that retailers perceived that customers were willing to pay a premium for a higher quality product with a mean score of 4.1 out of 5. Poor wood quality was the primary customer complaint at 70% of respondents. Although the wood species and treatment processes are not identical in Canada and the US, the attributes of treated wood are similar.

Eastin et al. (1994) performed research on softwood lumber substitution in the residential construction industry. Technical characteristics of the material, quality of product and ease of use were more important to respondents than price. Strength, straightness and quality were cited as the most important attributes on the purchase decision of substitutes for softwood lumber (Table 1). In the study, builders and

retailers indicated three limiting factors to widespread use of lumber substitutes in the US: 1) high price; 2) limited product availability; and 3) lack of consumer knowledge regarding products. If these obstacles could be addressed, then wider acceptance of substitute products may result.

More specific research regarding the US deck material market originates from Shook and Eastin (2001). A nationwide survey of construction firms characterized the use of seven different residential deck materials. The study addressed which attributes were most important to residential construction firms concerning deck material purchases. Respondents were asked to rate the importance of 11 attributes for deck surfaces. Long life, aesthetically pleasing, durability and material quality were ranked the most important (Table 1). It is important to note the respondents rated low material cost as the least important deck material attribute in comparison to other product attributes. This study suggests there are considerable differences in homebuilder perceptions about available decking materials.

Fell and Gaston, (2001) performed a similar study with decking attributes comparing material selection of outdoor projects in Western Canada (Table 1). One of the major differences was the inclusion of the decking material with specific attributes. Information was gathered on the do-it-yourself (DIY) sector-using computer driven exit surveys to focus on outdoor projects such as decks and fences. These surveys offered important insights for producers and retailers into consumer willingness to sacrifice other product attributes for long lasting outdoor projects. The respondents rated long-term durability, quality, maintenance ease, good value and attractive look as the most important attribute. As with the previous studies, low price was not a deciding factor

registering third from the bottom behind delivery and prestige.

Table 1. Past Research assessing important decking material attributes

Cohen et al. (1992)		Eastin et al. (1994)		2001 Shook & Eastin		2001 Fell & Gaston	
13 attributes for treated lumber		12 product attributes for substitution		11 attributes for deck material		13 attributes for decking	
1-5 rating	Mean	Firms rating 1-7	Mean	Firms rating 1-7	Mean	1-7 rating	Mean
Straightness	4.6	Straightness	6.4	Long Life	6.32	Long-term Durability	6.2
General appearance	4.4	Strength	6.4	Beauty & aesthetically pleasing	6.27	Quality	6.1
Price	4.1	Price	6.2	Durability	6.09	Easy to Maintain	5.9
Grade	4.1	Availability	6.2	Consistent Material Quality	6.02	Good Value	5.9
Variety of Sizes	3.9	Lack of Defects	6.1	Availability	6	Attractive Look	5.9
Surface Cleanliness	3.9	Price Stability	6.1	Easy to Maintain	5.72	Warranty	5.4
Color	3.2	Ease of Use	5.7	High Workability	5.7	Natural Look/Feel	5.2
Quality Mark	3.2	Long Lengths	5.7	Price Stability	5.67	Easy to Install	5.1
Retention Level	3	Technical Support	5.6	High Strength Properties	5.51	Low enviro impact	4.9
Species	2.8	Appearance	5	Little Material Waste	5.35	Technical Literature	4.8
Moisture Content	2.8	Energy Efficiency	4.9	Low Material Cost	5.3	Low Price	4.6
Brand Name	2.5	Environmental Impact	4.5			Delivery	4.4
Kiln-dried after treatment	2.4					Prestige	3.8

2.4 Conjoint Analysis

Conjoint analysis is a common tool marketers use to determine possible new combinations of product features and price. Conjoint has gained widespread acceptance because it is less expensive and more flexible than concept testing (Curry 1996). Concept testing primarily concentrates on potential new product development ideas versus conjoint methods for comparing existing products in a competitive setting (Decision Analyst 2003). Conjoint analysis revolves around three basic steps: 1) collecting consumers' trade-offs; 2) estimating buyer value systems and 3) making choice predictions. Huber (1987) suggests conjoint provides a measurement theory, which creates a scale for calculating judgments on compound or conjoint objects.

Suppose we want to create a new product. The three most important product features are known through research and experience, but there are a range of possible

alternatives for individual rankings of these attributes. Each consumer of this product may not rate the attributes in the exact same way. Conjoint data is collected using PC-based interviewing software or paper-and-pencil interviews by having respondents' rank or rate products with specific features depending on the chosen method. Most of the conjoint methods have been adapted for administration via computer. Even the staple conjoint method, Full-Profile Conjoint Analysis (CVA), which was originally designed for paper-and-pencil studies, has been adapted for computer interviews (Orme 2003). Sawtooth Software allows the respondent to make choices among product options and automatically adapts questions asked based on the respondent answers. The ranking/rating, through the collected data, gives the marketer a glimpse into the consumer trade-offs regarding the product and desired attributes.

Many consumers have difficulty precisely determining the importance of specific product attributes. Survey respondents find it problematic to mentally construct preferred combinations from a list of attributes (QuickMBA 2003). Consumers may view all of the attributes as important. In addition, consumers perceive individual attributes differently than combinations established in a product (QuickMBA 2003). Fortunately, conjoint analysis is an excellent marketing research tool that provides a process avoiding this problem. Conjoint analysis is based on measuring attribute values jointly rather than in isolation (QuickMBA 2003). Conjoint analysis is a multivariate technique used to measure respondents' preferences for products or services by listing different product offerings with specific attributes thus allowing the consumer to visualize the options (Hair et al. 1995). This process originates from consumer evaluations of the value or utility a product offers by combining each attribute with the

amount of utility provided for each option. Hair et al. (1995) suggested that conjoint operates on the basis of two objectives: 1) Determining the influence of predictor variables and their value to consumer preferences and 2) Constructing a valid model of consumer preferences for combinations of attributes. Essentially, the respondents are choosing among a set of products, thus providing their overall evaluations (Hair et al 1995).

2.4.1 How Conjoint Works

The consumer is inundated with many choices and options in the marketplace. Therefore, Huber (1997) suggested that consumers make choices based on relatively few attributes, essentially selecting the attributes with the most importance and value in a given choice. Conjoint reflects the simplification process consumers use to deal with complex market decisions. Huber (1997) explains that conjoint simulate the attribute selection process of consumers that occurs in their actual product choices.

A product consists of an assortment of attributes called factors in conjoint analysis. Automobile manufacturer, brand, model, number of doors, engine type and price are examples of possible attributes. Each possible attribute contains several levels. The level of each attribute, for example "number of doors," may be two or four. "Engine type" may consist of four, six or eight cylinders. Respondents surveyed through conjoint give their preferences for product features in terms of specific attributes. These preferred values are called a part worth or utilities. In this manner, conjoint analysis is useful for determining how buyers of a product value its numerous aspects or features (Sawtooth 2002).

The experimental design structure affords conjoint analysis the least restrictive set of assumptions compared to other multivariate techniques such as factor analysis, cluster analysis or multidimensional scaling (Hair et al 1995). However, the conceptual assumptions are in fact greater than with other analysis models because the model is pre-designed. The formulation of the model (main effects versus interactive model) before the study makes it impossible to test alternative models once the research is performed and the data collected (Hair et al 1995).

Three distinct areas separate conjoint analysis from other multivariate techniques: 1) decompositional method; 2) evaluations are made at the individual level and 3) flexibility of dependent and independent variable relationships (Hair et al 1995). Conjoint analysis is a decompositional model because the respondent's overall rating can be used to decompose the value of each attribute. Conversely, a compositional model collects ratings on many product characteristics to create a predictive model of a respondent's overall preference rating on each attribute.

Some methods of conjoint analysis can offer a separate model for preferences of each respondent. These other methods measure a single preference for each respondent followed by analysis of all respondents simultaneously (Hair et al 1995). Conjoint analysis allows research to be performed on individuals or groups of individuals. This allows the predictive accuracy to be measured for each person instead of the entire sample, then these individual results can be combined to create an overall model.

The necessary relationships between the dependent and independent variables are not limited within conjoint analysis. Conjoint allows separate predictions to be made with regard to the effects of each independent variable and does not assume they

are related. Conjoint analysis handles nonlinear relationships quite well even when one value is positive followed by a negative and the third positive again (Hair et al 1995). This means that the attributes in a design are tested independent of one another so when the respondent is presented with multiple attributes the response requires a trade off of high levels on one attribute with low levels of another (Huber 1987).

2.4.2 Different Types of Conjoint

Marketing researchers have adopted conjoint analysis as one of the most widely used quantitative tools (Orme 2003). There are many different varieties of conjoint analysis and the researcher must scrutinize each research situation to select the correct conjoint method. Software packages provided by Sawtooth Software are Adaptive Conjoint Analysis (ACA), Traditional Full-Profile Conjoint Analysis (CVA) and Choice-based Conjoint (CBC). Each package is designed to offer unique advantages under different research situations (Orme 2003).

2.4.2.1 Adaptive Conjoint Analysis (ACA)

Sawtooth Software's first conjoint method (ACA) was released in 1985 (Orme 2003). ACA became the most popular technique throughout the 1990's because it is user-friendly for both the analyst and respondent. This approach offers the advantage of measuring more attributes than recommended with traditional full-profile conjoint. ACA projects have a maximum capacity of 30 attributes, although 8 to15 attributes is the norm (Orme 2003). Information overload is a limitation for most full-profile studies, but respondents do not evaluate all attributes simultaneously with ACA. Orme

(2003) believes more than 6 attributes at a time cannot be successfully interpreted by respondents.

ACA uses a hybrid approach connecting attribute evaluations with conjoint pair wise comparisons. This technique consists of respondents ranking attribute levels followed by assigning importance (weights) to these attributes. In this context, products are evaluated in a systematic, feature-by-feature manner instead of products being judged as a whole or in a competitive environment (Orme 2003). This self-explicated section is followed by trade-off questions. For example, two products are presented and respondents use a rating scale to specify which one is preferred. The product combinations are customized for each respondent as each displayed product is shown in partial-profile. The attributes presented for any question are only a small subset, usually two or three (Orme 2003).

ACA possesses the ability to stabilize respondents' preferences for more attributes by using smaller sample sizes than other conjoint methods. This is made possible by the introductory self-explicated section, adaptive questionnaire ability and the rating-based conjoint trade-offs (Orme 2003). ACA performs well for research models concerning high-involvement purchases because respondents make a well-thought-out decision after considering a number of product attributes. Huber (1997) suggest that the method of pair wise comparisons mirrors buyers' purchase behavior when comparing products side-by-side.

2.4.2.2 Conjoint Value Analysis (CVA)

Traditional full-profile conjoint analysis or Conjoint Value Analysis (CVA) is similar to ACA's introductory phase of creating pair-wise designs and CVA is recommended for use with about six attributes. This pair-wise method may be complicated for the respondent because 'full-profile' refers to preferences with respect to all attributes being studied (Sawtooth 2002). The full-profile may cause respondents to use simplification strategies or heuristics when presented with too much information to process (Orme 2003). A formulation of subset attributes does not occur as in ACA. Therefore, as the number of attributes increases, so do the number and complexity of questions and the format may become excessive for the respondent. The pair-wise method is best used for side-by-side comparisons to help distinguish finer differences between product features (Sawtooth 2002).

CVA is also used to create a single-concept or card-sort design. This process shows one product and its attributes to the respondent at a time. The focus is on the acceptability of the product to the respondent rather than differences between competitive products (Orme 2003). A set of profiles is given to respondents and they are asked to sort the cards in order of preference from most to least. Data suggests that either technique produces similar results (Sawtooth 2002).

2.4.2.3 Choice-based Conjoint (CBC)

Choice-based conjoint (CBC) is the most commonly used conjoint technique (Orme 2003). CBC closely reflects consumers' purchase decision-making process for

products in a competitive setting. Respondents are shown a group of products in full-profile and asked to identify which set they would purchase. Since CBC is based on the respondent choice, a 'none' option is specified replicating the real world. Conjoint research is based on the prediction of product choices therefore it only seems obvious to use data resulting from choices (Orme 2003). The choice procedure is more definite and concrete than abstract rating systems (Huber 1997). This method encourages even more respondent simplification than traditional full-profile questions because the choices are in full-profile. More emphasis is placed on attributes with greater importance in CBC while less important factors receive less emphasis in relation to CVA or ACA. Another difference between CBC and the other two options comes in the analysis section. CBC concentrates the analysis on the aggregate or group level rather than the individual respondent preference scores (Orme 2003). However, recent additions to CBC have created latent class and hierarchical Bayes (HB) estimation methods, which offer practical analysis of group-based and individual level data (Orme 2003).

Choice results can be analyzed in a variety of ways. The three most recognized approaches are Aggregate, Latent Class and Hierarchical Bayes (HB) analysis. Aggregate Choice Analysis offers a large amount of data about respondent choices, thus providing estimations of subtle interaction effects within the group (Orme 2003). Generally, interactions cannot be measured at the individual level through ranking or sort-based approaches because respondents cannot offer enough information. However, it is argued that the aggregate system assumes homogeneity and therefore cannot be as accurate as individual models because not all consumers are the same. Latent Class analysis detects homogeneous response sets and segments respondents into groups.

Essentially, group estimation can be accomplished while acknowledging market heterogeneity, thus improving predictability versus aggregate choice models. HB organizes information from the respondents into individual part worth through the specific choices. The overall distribution of individuals is combined with individuals with the same answers. The lines for segmentation are done on a much more distinct scale than the group analysis of latent class (Huber 1998).

2.4.3 Appropriate Conjoint Methods and Limitations

The primary limitation of Adaptive Conjoint Analysis (ACA) is the administration of the research. The respondents' previous answers are adapted throughout the interview, which is impossible via paper-and-pencil interviews so computers must be used. ACA is also a main-effects model meaning that attributes are measured in an "all else equal" model, omitting attribute interactions (Orme 2003). This is especially restrictive on studies estimating price sensitivity for each brand. Another pricing issue in the ACA method surfaces when price is included among several attributes. In this case, the importance is likely to be understated and this increases as the number of attributes increases. Self-explicated models such as ACA are commonly used for services to measure respondent attitudes for an alternative. Positive attitudes toward a brand do not present much insight into actual purchase decisions in a competitive setting (Huber 1997). Huber (1997) also suggests self-explicated models are best suited for studies which require the evaluation of many attributes, expectations about levels and correlations among attributes are stable and actions depend on attitude towards individual action or alternative and not a competitive setting. ACA also has

paired comparisons with two products being compared side-by-side. This draws attention to the difference in attributes not the importance of each attribute.

Conjoint Value Analysis (CVA) is difficult to perform because the interview for the respondents cannot be simplified in any manner. All of the attributes are used in each question, which makes it very easy for the questionnaire to become overloaded with information. Another shortcoming is CVA's focus on acceptability of alternative attributes instead of differences between alternatives such as with pairs. Huber (1997) suggested that CVA produced values that were context free because the design will create profiles that defy respondents' prior expectations. The full-profile model forces respondents to ignore their own reference levels and focus on the attributes given. Huber (1997) gives three reasons for using full-profile conjoint: 1) It is desirable to base analysis on abstract associational beliefs, 2) Choices include a limited number of attributes that place greater weight on the most negative levels and 3) The focus of the decision is within the alternative so that pairs of options are well defined with little possible confusion.

Although CBC does simulate the decision-making process well, this is also considered a disadvantage. Respondents choose between profile sets with all specific attributes so the amount of time it takes for a single answer is longer than with a traditional ranking method. Thus, the amount of available information is considerably lower compared to a rating technique (Sawtooth 2001). CBC is not conducive for studies involving large number of attributes because each set contains all of the attributes being studied creating difficulty for the respondent. CBC is not recommended for small sample sizes unless the respondents are able to answer a large number of

choice tasks (Orme 2003). Huber (1997) summarizes three appropriate reasons for choice testing as; 1) The goal is responses to competitive products especially brand and price studies, 2) Few, well-known attributes are used for decisions and the worst levels of each attribute are avoided and 3) Respondents base their decisions on competitive differences among the given attributes.

2.4.4 Sample Size Issues for each Conjoint Method

There are other factors relevant to particular conjoint methods besides the standard statistical rules for sample size. A prominent concern in market research is to minimize error in a cost-efficient manner. There are two primary sources of error causing data to deviate from truth assuming the correct method has already been chosen. Sampling error occurs when respondents within the sample differ from the overall population (Orme 1998). Assuming a random sample is obtained, sampling error is minimized through increasing the sample size. However, Orme (1998) notes that samples used in market research are never truly random because respondents have the right to resist participation in the interview thus becoming a source of non-response bias.

Measurement error is the second source of error in conjoint analysis. Measurement error is reduced by collecting a larger quantity and better quality data from the respondent (Orme 1998). Conjoint solves this dilemma by including more conjoint questions. However, respondents will only provide reliable data up to a point, which also represents the limit for reducing measurement error.

ACA sets parameters for each individual, establishing the minimum sample size at one person. ACA's ability to conform to the respondents' answers allows this method

to be the most efficient at minimizing measurement error over CVA and CBC (Orme 1998). The number of paired questions for ACA is determined according to Orme (1998) by a total of three times the number of observations as parameters are available at the individual level for computing part worth. If sample size is quite small and the number of attributes to measure is large, then ACA is probably the correct method to use.

Similar to ACA, CVA measures the individual level part worth and the minimum sample size is one. CVA has a larger standard error at the individual level if there is not a preliminary section of ACA used. Orme (1998) suggested that the CVA manual asks for enough questions (cards) to acquire three times the number of observations as parameters to be estimated. The researcher must create a balance between striving for necessary data but not overloading the respondent with too many options as well as not stabilizing the estimates because there are too few questions (Orme 1998).

CBC questions are inefficient in extracting consumer preferences and larger sample sizes than ACA or CVA are generally required. If the population is adequately represented then doubling the tasks per respondent is as good as doubling the sample size in regard to reducing error (Johnson & Orme 1996). From a cost-benefit standpoint it makes sense to have respondents perform as many choice tasks as possible. However, the same rules do apply as stated in the above paragraph. Orme (1998) suggested conjoint analysis sample sizes ranging from about 150 to 1200 respondents, but if the research purpose is to compare groups of respondents then a minimum of approximately 200 per group were recommended.

3. Theoretical Framework

Figure 11 represents the theoretical model used for this research. The computer-administered questions consist of attitude – hedonic and utilitarian, choice-based conjoint followed by demographics. The bold components below are measured.

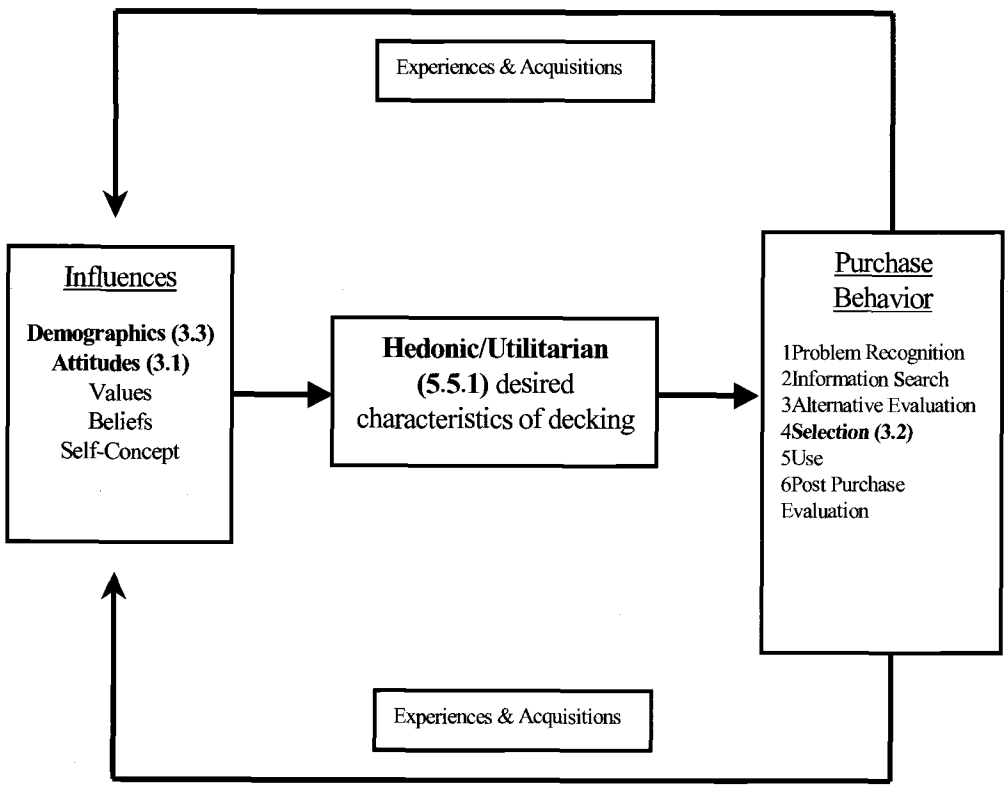

Figure 11: Decking study theoretical framework (Adapted from Hawkins, Best & Coney, 2002)

3.1 Attitudes (Hedonic/Utilitarian)

Hirschman and Holbrook (1982) pioneered development of the hedonic and utilitarian constructs. In their work, hedonic consumption concentrates on aesthetic products such as novels, movies and art; however, the authors extended their results to many other product classes. Hedonic consumption occurs on the basis of externally sensed, product-related stimuli. This theory was considered problematic because it focuses on the attitude of respondents (like or dislike) relative to preference of other brands, which is considered one characteristic of hedonic response. This led to a study by Batra and Ahtola (1990) that demonstrated the distinct separation of hedonic and utilitarian attitudes towards specific brands and behavior. Batra and Ahtola demonstrated a valid measurement for hedonic and utilitarian consumption. Voss et al. (2003) further developed the hedonic and utilitarian scales. In this study, the scale was adapted using decking material as the product. Responses demonstrate the dimension (H/U) used when making purchase decisions for decking material. Participants were asked to indicate their opinion of a deck on the following scales:

Hedonic

Not fun/fun
Dull/exciting
Not delightful/delightful
Enjoyable/not enjoyable

Utilitarian

Useful/useless
Functional/not functional
Necessary/unnecessary
Practical/impractical

3.2 Purchase Behavior

Consumer purchase behavior is based on the features and levels of each decking product. The CBC model simulates actual consumer purchase decisions for choosing similar products within the same category. The features or attributes consist of decking material, maintenance, durability and price. The levels consist of different types of material, hours of annual maintenance, lifetime and cost per lineal foot. The choice-based conjoint required respondents to choose the deck they would be most likely to build. The respondent made 15 separate deck choices based on randomly bundled attributes (See Figure 14). Sawtooth Software recommends 12-20 choices for best results. Each choice set also included a "none" option.

1. Material
   - Naturally durable wood (cedar & others)
   - Treated wood (ACQ & others)
   - Wood-plastic Composite
2. Maintenance
   - 5/10/15 hours annually
3. Durability (Service Life)
   - Lasts 10/15/20 years
4. Price (average of four locations)
   - $0.75/$1.50/$2.00 per lineal foot

3.3 Demographics

Demographic questions provide valuable information concerning the respondents by allowing the sample population to be segmented into groups relating to the given information. The following demographic questions were included in the questionnaire:

1. Please indicate your gender.

2. Please indicate your annual household income?

   - Under $25,000
   - $25,000 – $49,999
   - $50,000 – $74,999
   - $75,000 – $99,999
   - $100,000 - $124,999
   - $125,000 - $149,999
   - $150,000 and above

3. Please indicate your age

   - Under 20
   - 20 – 34
   - 35 – 49
   - 50 – 64
   - 65 and over

4. What is the highest education level you have completed?

   - High school graduate or GED
   - Some college coursework
   - College graduate
   - Graduate degree
   - Other

5. Do you own or rent your current residence?

- Own
- Rent

6. Do you have or plan to build a deck in the next 5 years?

- Yes
- No

7. What material is or will your deck be constructed from?

- Naturally durable wood (cedar & others)
- Pre-treated wood (treated when purchased)
- Non-durable wood (regular lumber)
- Wood-plastic composite
- Plastic
- Other

8. Please rank these decking products in order from most environmentally friendly to the least.

- Naturally durable lumber
- Treated lumber
- Non-durable wood
- Wood-plastic composite
- Plastic

4. Methods

Fell and Gaston's, (2001) research methods were adapted for this study. The focus was on homeowner perceptions of wood decking versus wood-plastic composite decking. Computer driven questionnaires and conjoint analysis was used to gather information at home and garden shows. Previous home and garden show information

indicated that many attendees own their homes thus providing a viable source for collecting data. The specific shows used for data collection were in Atlanta, Georgia; San Diego, California; Toronto, Ontario; and West Springfield, Massachusetts.

A 10'x10' booth was rented at each respective show and four laptops were used to administer the questionnaire. Attendees at the home shows were asked to sit and complete the 8-12 minute questionnaire voluntarily and received a tree seedling upon completion as an incentive. One-foot samples of decking material were present at each computer so respondents could view the options. Questions about decking material were addressed after the interview was complete so not to influence responses. Questions/explanations concerning the interview were addressed immediately by one of the two researchers. Attendee enthusiasm for completing the questionnaire varied widely depending upon show location.

4.1 Sample

The purpose of this study is to identify consumer purchase decisions concerning decking material. These decisions focus on consumer perceptions regarding a comparison of a few set profiles including material, maintenance, durability and price within a competitive context. The number of potential consumers for decking material is very large. Generally, attendees of home shows own at least one detached home (e.g. Figure 12). Since many of these homes have or could add a deck home shows were chosen as the point of data collection. The goal for this study was to obtain 500 responses from each show out of the average attendance of over 30,000 per show.

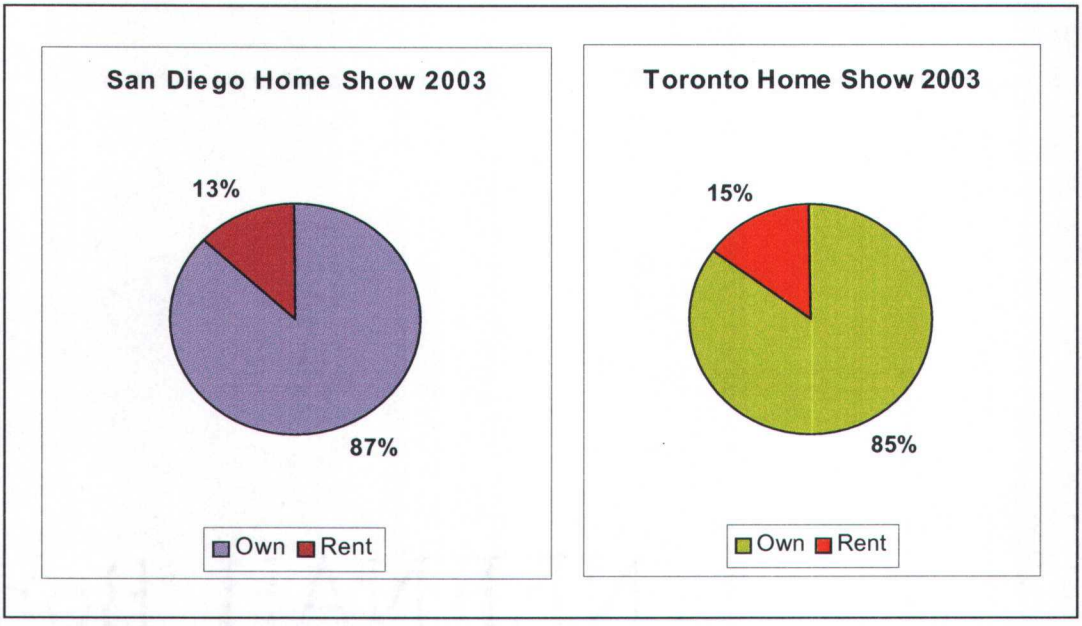

Figure 12: Percentage of attendees at home shows in San Diego and Toronto who own their homes (Source: San Diego – Nationwide Surveys & Toronto – EventCorp. Services Inc.)

4.2 Questionnaire

The questionnaire was constructed using Sawtooth Software field disks, which contained 20 interviews each. The interview process involved a point and click method using a mouse to provide responses. The questionnaire consisted of two components. In the first section, respondents provided their opinions of a deck on a seven point Likert scale using a hedonic/utilitarian (H/U) scale. The hedonic and utilitarian questions alternate the polarized positive and negative responses to ensure valid data. This data provides correlation with the CBC responses to determine the type of consumer (H/U) for each preferred choice.

The second section consisted of fifteen choice-based conjoint (CBC) questions

using four different attributes (material, maintenance, durability and price), each at three levels. For example, the price attribute was represented at $0.75, $1.50, or $2.00 per lineal foot. The software was set up so that the respondent was presented with 3 hypothetical decks, each a unique combination of the four product attributes (Figure 13). The software arbitrarily attached a level from each attribute to a decking material creating three different "concepts". The respondent chose which deck they would most likely buy given three concepts of decking material with one level of the three remaining attributes attached –maintenance, durability and price. A "none" option was included for respondents that did not prefer any of the given concepts. A balanced overlap system was used so that a level for each attribute may be identical in two different concepts. The objective was to create a part worth for each attribute. As each part worth was being processed the software began to offer concepts without a previously deciding level for that specific respondent thus forcing other attributes to be determined. From these choices, the researcher can determine which attributes the respondent most preferred.

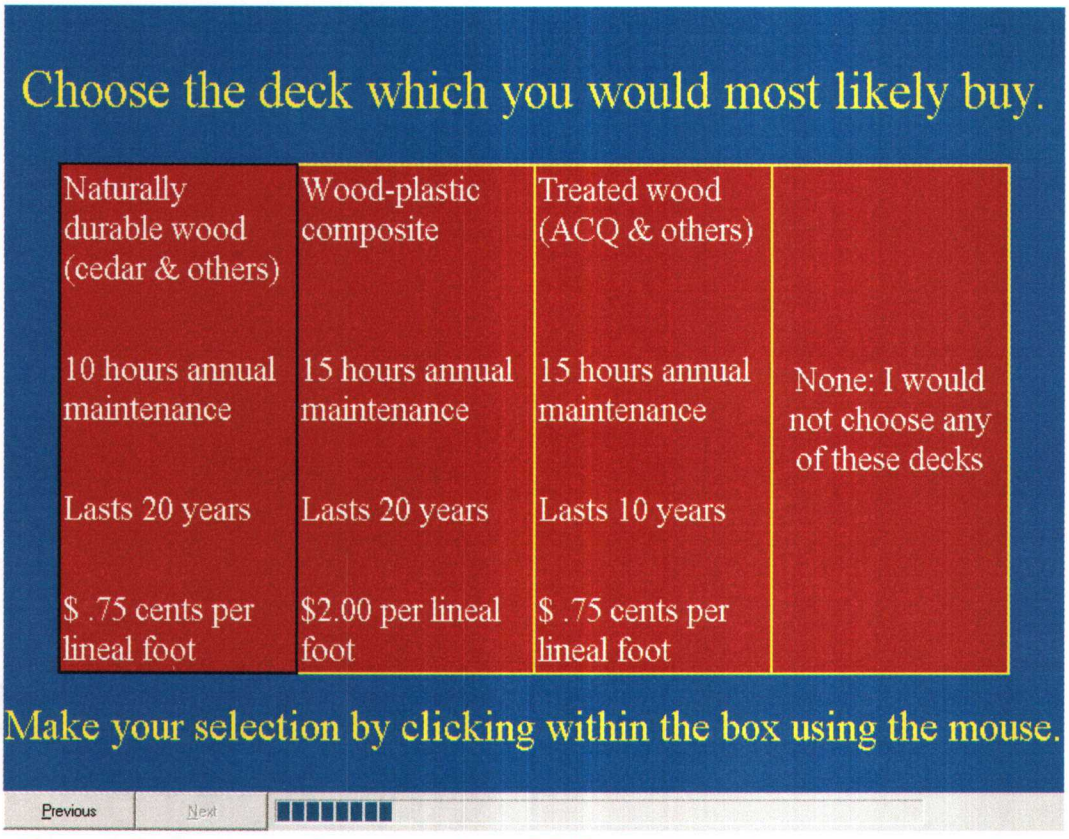

Figure 13: Example of question from CBC questionnaire used to assess deck preferences

The last section consisted of general demographic questions including gender, age, income, education and home ownership. Other segmentation questions included whether the respondent had a deck and choice of material if constructing a "new" deck as well as a rank of decking material from most to least environmentally friendly. In this manner the most important deck attributes were found for specific consumers.

4.2.1 Pretest

A pretest was administered to the attendees of a Natural Resources Day in Corvallis, Oregon. While the children visited our booth, adults were asked to complete

the questionnaire. Each participant was instructed to ask any questions or clarify any confusion before continuing. Upon completion, all 28 participants were interviewed to discuss any confusion areas or problems. The H/U section was refined by asking the same question ("In your opinion a deck is.....") to ascertain the attitudes related to a deck. The color in each CBC question was also changed to create contrast from one question to another. The price attribute was changed slightly from $0.85, $1.33, and $2.00 to $0.75, $1.50, and $2.00 to make it easier for respondents to use price as a deciding attribute. The new prices were chosen because they more closely approximated the cost of deck boards for treated wood, cedar and wood-plastic composites. Several less important demographic questions were eliminated to shorten the interview time (Figure 14). The questionnaire was ready for the home shows after these minor changes.

Which best describes where you live? •Urban •Suburban •Rural
Do you have children? •Yes, some or all live at home •Yes, all have left home •No •Refused
Is your household single or dual income? •Single •Dual •Refused
Which best describes your primary residence? •Detached house •Duplex •Mobile Home •Townhouse •Apartment

Figure 14: Demographic questions that were deleted as a result of the pre-test

4.3 Data Collection

A total of 1311 questionnaires were completed at the four shows. Respondents that consistently answered "none" for all CBC or "refused" for all demographic questions were deleted. After deleting the unusable responses, 1285 responses remained. The deleted data by region included six from Atlanta, nine from San Diego, seven from Toronto and four from West Springfield (Table 2).

Table 2: Total useable responses from CBC given at home shows in four cities.

Shows	Dates (2003)	Deleted data	Useable responses
ATLANTA	September 18-21st	6	402
SAN DIEGO	September 26th-28th	9	279
TORONTO	October 2nd-5th	7	286
WEST SPRINGFIELD	October 17th-19th	4	318
Total		26	**1285**

The booth layout at each show was nearly identical (Figure 15 and 16); however, the responses of attendees differed greatly. Some respondents in each city were not computer savvy, thus slowing their response time and limiting the ability of others to take the survey. Others were more interested in discussing the "correct" answers versus anonymously completing the questionnaire. The CBC section presented questions with slight changes, which resulted in some participants believing the same question was repeating. Respondents reacted to the CBC section in two distinct manners. Some analyzed each question, thoroughly debating the desired characteristics, while others quickly choose a concept-based on one of the four attributes given.

Figure 15: Example of respondents at the West Springfield show

Figure 16: Example of booth used at the Toronto show

Atlanta was the best show in terms of the willingness of attendees to participate. On average, Toronto respondents completed the questionnaire in less time than those at the other three shows and had fewer questions. The San Diego show was by far the most difficult. The vast majority of attendees were not interested in participating. Many San Diego attendees did not believe we were not selling a product or that we were representing a research study. The lowest attendance was at the West Springfield show; however, almost everyone that approached the booth was willing to participate. The close proximity of University of Massachusetts at Amherst might have influenced the willingness of attendees to contribute.

4.4 Nonresponse Bias

A one-page questionnaire was administered to respondents that refused to complete the computer questionnaire. The questionnaire included questions about gender, age, income and rank of decking material by environmental friendliness. This data was used to determine the difference, if any, between respondents and non-respondents at each show.

Approximately forty non-response questionnaires were accumulated from each show. The non-response data from each show was compared to forty randomly selected respondents from that show's data with the Statistical Package for the Social Sciences (SPSS) using a Pearson Chi-Square in 2-sided asymptotic significance. Gender, age, income and environmental rank did not differ significantly between respondents and non-respondents ($\alpha.= 0.05$, Table 3). A comparison of homeownership data (Figure 17) provided by each show sponsor and from our respondents provided (Figure 12)

additional insight into whether our sample was similar to overall show attendees.

Table 3: Non-response bias data analysis for respondents and non-respondents at each show as shown using Pearson Chi-square analysis.

Pearson Chi-Square	Atlanta	San Diego	Toronto	West Springfield
Gender	0.614	0.754	0.583	0.715
Age	0.257	0.292	0.242	0.369
Income	0.256	0.151	0.172	0.407
Rank	0.570	0.417	0.211	0.139

(2-sided asymptotic significance as p-value)

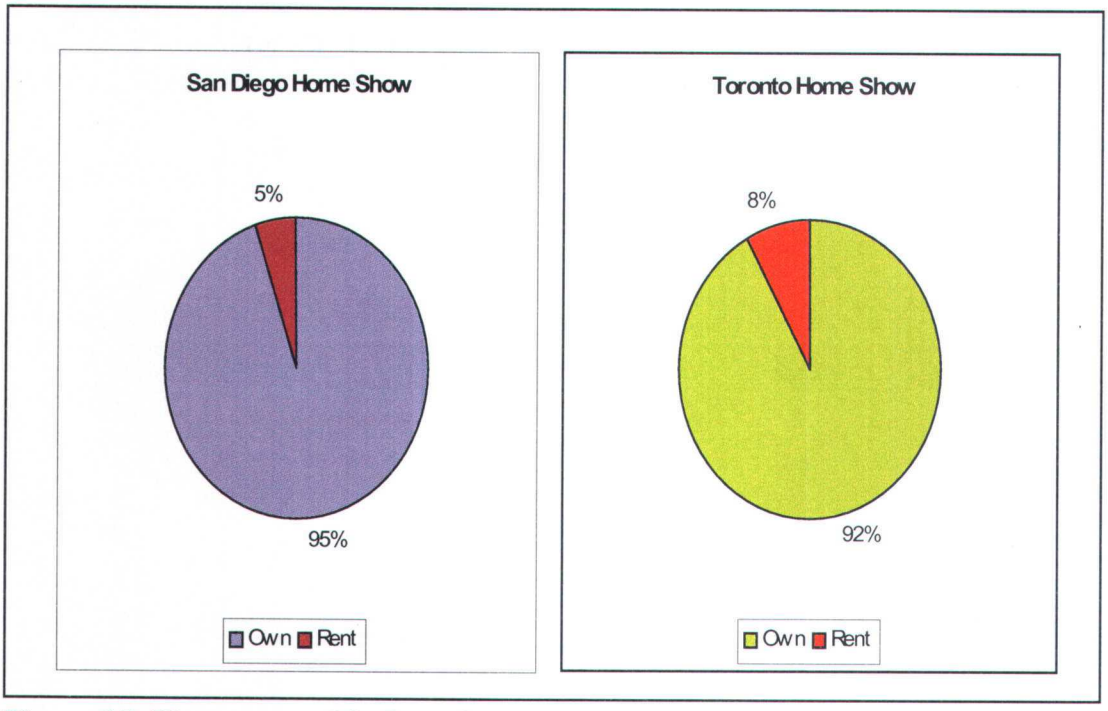

Figure 17: Homeownership Data for attendees at two of the four home shows as provided by the organizers

4.5 Conjoint method chosen for this study

CBC was the method of choice because it was most appropriate for measuring responses to price studies of competitive products. A few well-known attributes can be offered to respondents with a considerable dislike for the worst levels of each attribute and respondents' decisions are based on the competitive differences among these attributes (Huber 1997). Having fulfilled Huber's (1997) requirements, the logical technique to use was choice-based conjoint analysis. Computer-aided interviews allowed us to perform analysis of a consumer population at the group level. The choice procedure best simulated the real decisions consumer form when purchasing deck material and was more accurate than a ranking system. Since CBC analysis package was limited, SPSS was used to perform further analyses such as comparing regional means.

5. Results and Discussion

5.1 Consumer Segments

Segmenting consumers based on demographic or other information allows for a much richer look at the dynamics and preferences that exist in a market. The following segments were considered in this study:

1. City – Atlanta, San Diego, Toronto, West Springfield
2. Gender
3. Age - under 35, 35 – 49, 50 & above
4. Family income - Under $50K, $50K - $99K, $100K - $149K, $150K & above
5. House ownership - Own, Rent
6. Education - high school graduate (GED) and some college, College graduate, Graduate degree & Other)

5.2 Respondent Profile

Using demographic data to segment consumers provides an enhanced view of existing preferences within a specific market. Respondents represented a wide range of age, education and income. During analysis these three categories were arranged in the following groups:

Age
34 and younger
35-49
50 and older

Education
High school grad/GED and some college
College graduate
Graduate degree and other

Income
$49,999 and below
$50,000 - $99,999
$100,000 - $149,999
$150,000 and above

Ninety-four percent of respondents were homeowners and gender was split almost exactly at fifty percent, therefore these categories were not combined (Table 4). A breakdown of regional demographic data can be found in the Appendix.

Table 4: Demographic breakdown for all respondents at all four home shows.

	Total	%
AGE		
Under 20	18	1.4%
20 – 34	215	16.7%
35 – 49	489	38.1%
50 – 64	486	37.8%
65 & over	61	4.7%
Refused	16	1.2%
GENDER		
Male	645	50.2%
Female	620	48.2%
Refused	20	1.6%
EDUCATION		
HS grad/GED	117	9.1%
Some college	258	20.1%
College graduate	495	38.5%
Graduate degree	374	29.1%
Other	27	2.1%
Refused	14	1.1%
OWN/RENT		
Own	1208	94.0%
Rent	58	4.5%
Refused	19	1.5%
INCOME		
Under $25,000	26	2.0%
$25,000 - $49,999	147	11.4%
$50,000 - $74,999	243	18.9%
$75,000 - $99,999	220	17.1%
$100,000 - $124,999	219	17.0%
$125,000 - $149,999	103	8.0%
$150,000 & above	150	11.7%
Refused	177	13.8%
Total	1285	

5.3 Conjoint Results

5.3.1 Interpreting Conjoint results

Sawtooth Software allows the use of logit analysis for the CBC data. Logit analysis fits a multinomial logit model to the data through an iterative procedure to determine the maximum likelihood solution. The log-likelihood is given for each iteration along with a root likelihood (rlh) value which is an intuitive measure of how well the solution fits the data. The best possible value for the rlh is 1.0 while the worst possible value is the reciprocal of the number of choices available in the average task. In this study, each task presented the respondents with three concepts (columns in Figure 13) and a "None option, the minimum possible value for rlh is 0.25. Below is an example of the diagnostic outputs provided via logit analysis in Sawtooth Software (Figure 18).

```
Files built for 645 respondents.
There are data for 9675 choice tasks.

Iter   1  Chi Square =   3278.26352  rlh =     0.29615
Iter   2  Chi Square =   3347.28057  rlh =     0.29721
Iter   3  Chi Square =   3347.67690  rlh =     0.29722
Iter   4  Chi Square =   3347.67692  rlh =     0.29722
Iter   5  Chi Square =   3347.67692  rlh =     0.29722
Converged.

Log-likelihood for this model =  -11738.55948
Log-likelihood for null model =  -13412.39794
                          ----------
Difference = 1673.83846    Chi Square =  3347.67692
```

Figure 18: Example of Logit analysis output for all male respondents

Logit analyses are often measured by Chi Square statistics which is a procedure that determines the difference between the obtained and expected data. The difference of the log-likelihood for this model and the null model is shown above (1673.84). The Chi Square statistic was then calculated by doubling the difference of the two log likelihood models degree of freedom equal to the number of parameters estimated. The number of parameters for this study was eight which was obtained by adding the total number of levels (12) and subtracting the number of attributes (4). With eight degrees of freedom a Chi Square statistic of 20.09 would be significant at the 0.01 level (Ramsey & Schafer 1997). Respondent choices were significantly affected by the various attribute levels appearing in the concepts because the obtained level of 3,347.68 was sufficiently larger than 20.

Conjoint analysis produces a series of 'utility' effects that indicate the magnitude of consumer preference for a particular attribute level, relative to other levels of the same attribute. Conjoint utility effects range from –1 to 1 and are centered on zero (Figure 19). An attribute level with an effect of zero would indicate indifference to the level. A negative effect indicates that level of the attribute takes away from overall utility of the product.

	Effect/Utility	Std Err	t Ratio	Attribute Level
1	0.22071	0.01649	13.38840	1 Nat.durable wood (cedar & others)
2	-0.42651	0.01847	-23.08886	2 Treated wood (ACQ & others)
3	0.20579	0.01648	12.48713	3 Wood-plastic composite
4	0.17894	0.01642	10.89941	5 hours annual maintenance
5	-0.02753	0.01691	-1.62802	10 hours annual maintenance
6	-0.15141	0.01729	-8.75845	15 hours annual maintenance
7	-0.35658	0.01811	-19.69372	Lasts 10 years
8	0.00652	0.01685	0.38659	Lasts 15 years
9	0.35007	0.01618	21.62965	Lasts 20 years
10	0.34279	0.01615	21.23087	$0 .75 cents per lineal foot
11	-0.02687	0.01696	-1.58485	$1.50 per lineal foot
12	-0.31592	0.01795	-17.59927	$2.00 per lineal foot

Figure 19: Example of utility effects for all male respondents

Utility effects are useful for gauging the degree of preference for individual attribute levels. For example, naturally durable wood and wood-plastic composite bring approximately the same positive utility, while treated wood was strongly avoided by consumers in the sample (Table 5).

In addition, the range of effects within an attribute give an indication of the importance consumers place on that attribute relative to the other attributes of the product. An "attribute importance" was calculated that reflect the range of an attribute relative to the summed ranges of all attributes. The attribute importance of material was 29.4% while maintenance was only 16.1% (Table 5). This may mean that material played a larger factor in deck selection than maintenance requirements. This measure should be used cautiously; however, as it represents an "average" of decision-makers.

There are usually several segments that make decisions in different ways within any set of consumers.

Table 5: Overall conjoint results from questionnaires from home show attendees at all four shows.

Attribute	Attribute Level	Utility Effect	Attribute Importance
Material	Naturally durable wood	0.24	29.4%
	Treated Wood	-0.42	
	Wood-plastic composite	0.174	
Maintenance	5 hours annual maintenance	0.20	16.1%
	10 hours annual maintenance	-0.022	
	15 hours annual maintenance	-0.17	
Durability	Lasts 10 years	-0.332	29.4%
	Lasts 15 years	0.003	
	Lasts 20 years	0.33	
Price	$.75 per lineal foot	0.29	25.1%
	$1.50 per lineal foot	-0.015	
	$2 per lineal foot	-0.274	

5.3.2 Overall Utilities

Consumers held specific decking material in very high regard, but the most significant aspect of this study was the high importance of the service life attribute linked to this material. Consumers were willing to sacrifice other product attributes for decking material that lasts longer. Table 5 provides the overall utilities for the entire data set of 1,285 consumers. Material and durability of decking products represented the most important consumer attributes. Treated wood consistently received a negative utility for material. This means treated wood may have been acceptable to respondents,

but the other two options were considered better. Both naturally durable lumber and wood-plastic composites received high positive utilities.

The projected lifetime of twenty years was the most desired level of any attribute. A twenty-year lifetime for decking provided the largest positive utility among consumers followed by an identical dislike for a ten year lifespan. The durability utility was polarized and respondents were indifferent to a deck that lasted fifteen years (0.003).

The next criterion consumers used as a basis for choice was material price. Although price was the third criteria in overall importance, the lowest cost demonstrated the highest positive utility among the three levels. As expected, consumers desired the least expensive decking, but used price as the third criterion when choosing decking material.

The least important attribute to consumers was projected hours of annual maintenance. Consumers were relatively insensitive to this attribute other than logically desiring the least amount of annual maintenance.

Table 6 provides the conjoint results from Fell and Gastin's study in 2001. Although there was one extra attribute, the results were similar. The attribute importance for Material, Maintenance, Lifetime and Price were ranked in the same order for both studies; however, a notable difference between the two studies was that US consumers gave WPC a positive utility while Canadian's provided a negative. Toronto exhibited a negative utility for WPC's, but the magnitude was lower than the 2001 study. Although Toronto was not included in the 2001 study, this may suggest a growing acceptance of plastic-based decking material in Canada.

Table 6: Overall conjoint results from a previous study of deck preferences.

Attribute	Attribute Level	Utility Effect	Attribute Importance
Material	Naturally Durable Wood	0.242	32.0%
	Pre-treated Wood	0.266	
	Plastic Lumber	-0.507	
Maintenance	5 hours annually	0.173	13.4%
	10 hours annually	-0.023	
	15 hours annually	-0.15	
Lifetime	Lasts 10 years	-0.385	31.3%
	Lasts 15 years	0.014	
	Lasts 20 years	0.371	
Profile of Decking	Radius edged	0.107	6.9%
	Square edged	-0.047	
	Tongue and groove	-0.061	
Price	$5 per square ft.	0.161	16.5%
	$7 per square ft.	0.077	
	$9 per square ft.	-0.238	

(Fell and Gastin, 2001)

5.3.3 Regional Utilities

Responses were analyzed by home show location to determine consumer preferences by region (Table 7). Atlanta was the only city that ranked important attribute levels differently when compared to the remaining three cities. It was interesting to note that durability was the most important attribute followed by price for Atlanta. A deck lasting twenty years had the largest positive utility. Consumers

logically desire decking products that last the longest and are least expensive. This may explain why the largest positive utility in material is for the wood-plastic composite in all cities except Toronto. Other points of interest include the very high negative utility for treated wood in San Diego and West Springfield (Table 7). Respondents in Toronto preferred naturally durable wood with the highest positive utility (0.564), while the remaining three regions preferred wood-plastic composites (Table 7). The utilities for San Diego, Toronto and West Springfield were similar to the overall results in terms of attribute ranking (Table 7). Material was the most important attribute with naturally durable wood and wood-plastic composites both receiving high positive utilities. Treated wood received the most negative utility for all attribute levels. The remaining attributes (maintenance, durability and price) were all ranked in the same order as the overall utilities (Table 7).

Table 7: Regional utilities for responses to the deck material preference questionnaire administered at four home shows.

Attribute Level	ATLANTA		SAN DIEGO*		TORONTO*		WEST SPRINGFIELD	
Material								
Nat. dur.	0.08	20.3%	0.24	31.9%	0.564	38.4%	0.164	39.5%
Treated	-0.26		-0.51		-0.37		-0.58	
WPC	0.18		0.27		-0.20		0.42	
Maintenance								
5 hrs. main.	0.23	18.4%	0.18	14.1%	0.201	15.7%	0.16	13.4%
10 hrs. main.	-0.06		-0.013		-0.02		0.02	
15 hrs. main.	-0.17		-0.162		-0.18		-0.18	
Durability								
10 years	-0.343	32.4%	-0.352	29.3%	-0.29	23.5%	-0.36	27.3%
15 years	-0.016		-0.007		0.011		0.255	
20 years	0.36		0.36		0.28		0.332	
Price								
$.75 plf.	0.325	29.0%	0.30	24.7%	0.275	22.4%	0.26	19.8%
$1.50 plf.	-0.022		-0.005		-0.006		-0.017	
$2 plf.	-0.303		-0.30		-0.27		-0.241	

*** Prices were different for SD & Toronto ($.85, $1.33 & $2 respectively)**

5.4 Conjoint Segmentation Results

The full conjoint segmentation results appear in a series of tables arranged by attribute in the Appendix. Comparing the utilities on the aggregate level was not a definitive process and thus required some judgment. In the case of comparing utility rows, the range (0-1) was used as a measure. When a substantial range exists, it can be said that respondents are sensitive to the attribute level (e.g., price). But in the case of comparing columns within an attribute, the largest positive utility can be stated as most preferred. An overview of some of the more interesting results taken from Table 7 and 10 - 13 can be summarized as follows:

Cities

1. Atlanta had a different ranking of attributes than the other three cities. The lifetime of a deck was the most important attribute.
2. Toronto provided the highest utility for naturally durable wood and the only negative utility for wood-plastic composites.
3. Each city except Toronto preferred wood-plastic composite.
4. Treated wood received a consistent negative utility for all locations.
5. Respondents from Atlanta were more sensitive to price than respondents from the other three cities

Gender

1. Males were more sensitive to price than females.
2. Females were more sensitive to maintenance than males.
3. Males slightly preferred naturally durable wood to wood-plastic.
4. Females noticeably preferred naturally durable wood.
5. Males were more sensitive to lifetime of decking products than females.

Age

1. As age increased, respondents were more positive towards WPC.
2. The under 35 group was the least sensitive to maintenance requirements despite the highest positive utility for the fewest hours of maintenance.

3. The 50 & above age group was least sensitive to price while the under 35 age group was the most sensitive.

Family income

1. Respondents with family incomes $150,000 & above were the most sensitive to material and clearly preferred naturally durable wood.
2. Respondents with family incomes $150,000 & above were more sensitive to maintenance requirements.
3. Respondents with family incomes $150,000 & above had the least importance rating for lifetime and price.
4. Respondents with family income $100,000 - $149,000 were the most sensitive to price.

Education

1. The HS graduate and graduate degree/other education groups were the most sensitive to material. Although the HS graduate group clearly preferred wood-plastic composite while the graduate degree/other preferred naturally durable wood.
2. The college graduate education group was the most sensitive to maintenance requirements, lifetime and price.

5.4.1 Hedonic and Utilitarian

Hedonic and utilitarian ranges provide further insights into consumer attitudes towards a deck. There were eight total questions with four representing each category (Section 3.1). The responses were averaged for each category, which provided two numbers for each respondent's attitude (hedonic and utilitarian) towards a deck. Next, the hedonic average was subtracted from the utilitarian average giving a range with (-6) being highly utilitarian and (3.5) being highly hedonic (Table 8). A histogram was produced using SPSS to demonstrate the dispersion of the data for all respondents with a mean of 0.2 and standard deviation of 0.93 (See Figure 20). One standard deviation (1.13 and -.73) from the mean was used to categorize the data into three groups. In

Table 8 (1) represents the utilitarian consumers, (2) the middle, undefined group and (3) represents the hedonic consumers. The CBC data is shown in Table 9 for each group.

Table 8: Hedonic and utilitarian range for all four home show attendants.

Category		Frequency	Percent	Valid Percent	Cumulative Percent
1	-6.00	1	.1	.1	.1
1	-3.50	1	.1	.1	.2
1	-2.75	2	.2	.2	.3
1	-2.50	1	.1	.1	.4
1	-2.25	4	.3	.3	.7
1	-2.00	4	.3	.3	1.0
1	-1.75	8	.6	.6	1.6
1	-1.50	19	1.5	1.5	3.1
1	-1.25	19	1.5	1.5	4.6
1	-1.00	49	3.8	3.8	8.4
1	-.75	64	5.0	5.0	13.4
2	-.50	103	8.0	8.0	21.4
2	-.25	145	11.3	11.3	32.7
2	.00	254	19.8	19.8	52.5
2	.25	146	11.4	11.4	63.8
2	.50	112	8.7	8.7	72.5
2	.75	94	7.3	7.3	79.8
2	1.00	65	5.1	5.1	84.9
3	1.25	50	3.9	3.9	88.8
3	1.50	44	3.4	3.4	92.2
3	1.75	33	2.6	2.6	94.8
3	2.00	18	1.4	1.4	96.2
3	2.25	15	1.2	1.2	97.4
3	2.50	10	.8	.8	98.1
3	2.75	8	.6	.6	98.8
3	3.00	8	.6	.6	99.4
3	3.25	5	.4	.4	99.8
3	3.50	3	.2	.2	100.0
	Total	1285	100.0	100.0	

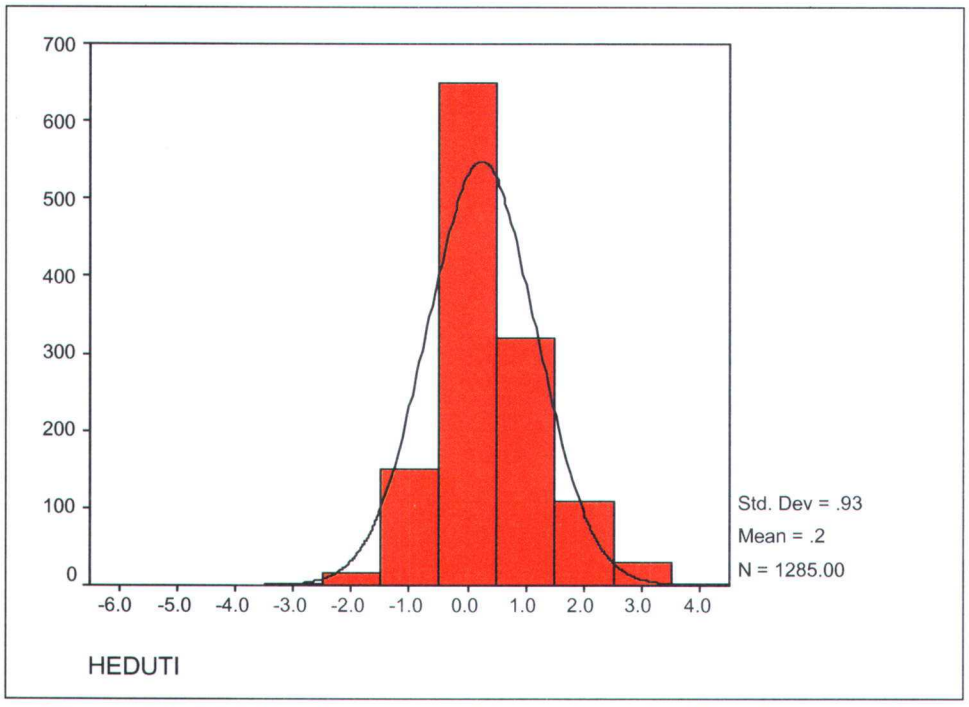

Figure 20: Distribution range of hedonic and utilitarian scale for respondents from all four home shows

Table 9: Utilities of hedonic and utilitarian groups from all four home shows.

	HEDONIC		MIDDLE		UTILITARIAN	
Material		%		%		%
Nat. Dur.	0.181		0.26		0.223	
Treated	-0.442	32.3	-0.404	30.0	-0.435	25.1
WPC	0.262		0.15		0.212	
Maintenance		%		%		%
5 hrs.	0.17		0.185		0.26	
10 hrs.	0.002	15.6	-0.023	15.7	-0.045	18.1
15 hrs.	-0.17		-0.162		-0.215	
Lifetime		%		%		%
10 years	-0.303		-0.33		-0.40	
15 years	0.004	27.7	0.007	29.4	-0.02	31.0
20 years	0.30		0.321		0.412	
Price		%		%		%
$.75 plf.	0.261		0.29		0.331	
$1.50 plf.	0.004	24.4	-0.023	25.0	0.012	25.7
$2. plf.	-0.27		-0.264		-0.343	
	N = 194		N = 919		N = 172	

The Hedonic group places more emphasis on the material attribute when purchasing decking products, while the Utilitarian group places more emphasis on the lifetime and maintenance attributes. As previously stated, consumers consume products for two basis reasons: (1) affective gratification (hedonic) and (2) cognitive or instrumental reason (utilitarian) manner. Although both aspects exist within consumers, it is possible for one dimension to dominate the purchase decision (See Figure 1).

Demographic data was used to compare hedonic and utilitarian consumers. The distribution was normally distributed and no patterns were present. Analysis consisted of performing a Chi-Square test on the hedonic and utilitarian categories to demographic data. Age was the only category that provided a suggestive difference with a Chi-Square value of 0.087. As consumers become older, they are more likely to be hedonic, thus decking products they choose are influenced to a greater degree by hedonic attitudes.

5.4.2 Environmental Ranking

Respondents were asked to rank decking products from most to least "environmentally friendly". Tables 15 and 16 in the Appendix show the demographic distribution of ranking response and conjoint utilities for most environmentally friendly decking material. Naturally durable wood (491) was most often ranked as the most environmentally friendly wood decking at 38%. Interestingly, 47% of respondents (604) ranked WPC and plastic lumber as the most environmentally friendly over any

type of wood decking. In addition, only 85 respondents ranked pressure-treated wood as the most environmentally friendly material. This may be a result of the negative publicity treated wood has received and the recent withdrawal of CCA from the market. This provides consumer perceptions on types of wood decking, excluding naturally durable wood. By combining the two categories of treated and non-treated wood, less than 15% of consumers view these materials as environmentally friendly. Although treated wood dominates the decking market, the overall image or feeling towards this product is poor. Health concerns about CCA in treated wood and the lifetime issues of non-treated wood could be the rationale for such a low ranking. This may help to explain the growing consumer acceptance for WPC and plastic decking products. If consumers base decking choices on environmental impact then naturally durable wood and WPC/plastic would be the most preferred decking material.

5.5 Managerial Implications

The results suggest that consumers desire a longer lasting decking product. The lifetime of decking products is more important than price or hours of maintenance. For treated wood producers, these results should encourage the development of chemical treatments that provide more resistance to decay, insect attack, and photo-degradation even if such treatments result in a moderate price increase. As manufacturers of the overall preferred decking material, redwood and western red cedar producers are strongly encouraged to emphasize maintenance requirements and environmental impact information to consumers through an owner's manual. In fact, it would be prudent for all wood decking manufacturers to participate in some sort of high profile advertising to

restore consumer confidence. WPC manufacturers are currently engaging in this activity with enormous success.

A material preference trend appeared when segmenting by age. As consumer age increased, so did acceptance for WPC. A possible explanation may be the consumer preference for the longer expected lifetime and less maintenance of WPC's when compared to wood products. Lifetime and hours of maintenance necessary for a deck became more important than specific decking material and price among older consumers.

Females noticeably preferred naturally durable wood and were less sensitive to price than males. However, females indicated a greater sensitivity to maintenance than men. A perceived low environmental impact was also a more important consideration for females. Targeting this market with literature on installation and maintenance is advisable. This literature should also discuss the environmental aspects of the deck material and deck maintenance products.

Respondents representing various locations in the US and Canada all viewed treated wood negatively. This study may provide insight on the impact of recent negative publicity regarding health concerns surrounding wood treatments. Although treated wood clearly dominates the decking market (Figure 2), it is obvious that the product fails to meet consumer expectations. Wood decking manufacturers should address the high profile marketing of WPC's – No maintenance and long lifetime campaign. Consumers use lifetime and expected lifetime as the most important criteria when choosing a decking material. The lack of knowledge about maintenance requirements and treatment options for wood products may explain the quick acceptance

of WPCs and plastic lumber.

It would be incorrect to generalize from this data, but data from the geographic areas in our study suggest a different marketing approach for decking material. For example, Toronto is an attractive region for naturally durable decking manufacturers, while Atlanta is not (Table 7). WPC products are perceived to be desirable in West Springfield and San Diego, but not in Toronto. Atlanta ranked the attributes in different order when compared to the other cities. In Atlanta, lifetime was ranked as the most important attribute and respondents were more price sensitive. Other demographic patterns within each region supply pertinent information regarding preferences in relation to income, age, gender and education as well. Organizations developing a marketing campaign for decking materials in these regions should find this information useful.

Generally, consumers perceive specific decking material differently but the most significant aspect of this study was the high importance of the service life attribute (lifetime) linked to each material. Consumers are willing to sacrifice other product attributes for decking material that lasts longer. The consumer chooses decking material based upon a myriad of tradeoffs. The specific attributes of the decking material are the deciding factors – lifetime, maintenance, price, aesthetics etc. Although service life was favored in this study, there is seldom one definitive feature that dictates a consumer decision for purchasing decking products. Not only are the dynamics of the product important, but also the attitudes of the individual consumer. This explains why it is so important for decking manufacturers to understand their target market. The attitudes of consumers may change along with the introduction of alternative products as with the

explosion of WPC use. Wood decking manufacturers must evolve with this change and highlight product attributes such as service life, long-term maintenance, price, and environmental impact in order to succeed. The WPC industry's creation of innovative products and advertisements makes it imperative that wood decking manufacturers follow suit.

5.6 Conclusions

This study used Choice-based Conjoint analysis as a mechanism to develop a better understanding of consumer decking purchase decisions in four different locations in North America. Although treated wood currently dominates the decking market, the results of this study suggest that consumers often do not have positive perceptions of treated wood, relative to competing materials. In fact, all of the decking materials in this study were available in each region to different degrees. The difference can possibly be explained by varying distribution patterns and regional consumer preferences for each deck material. But when offered alternatives, treated wood was the least attractive material to consumers. The perspective of consumers with respect to environmental friendliness response suggests a disconnect between consumer knowledge of wood species, manufacturing processes and origin of deck materials since plastic-based material received such a high acceptance rate.

Service life and material were found to be the most important attributes for decking material. These results reinforce the idea that price is not a dominant factor in consumer selection of deck material purchase decisions. Anecdotal evidence suggests consumer frustration with the aesthetic look of treated wood after a few years of service.

Improved dimensional stability is likely the most important goal for treated wood manufacturers.

5.7 Limitations

The inclusion of treated wood in this study increased the overall range scores for material, thus decreasing the importance level. There was a difference in price for material presented to respondents from San Diego and Toronto compared to the other two cities. The price of treated wood and naturally durable wood in San Diego and Toronto were $0.85 and $1.33 per lineal foot compared to $0.75 and $1.50 respectively. The results suggest the price difference has little effect because the average of attribute importance ranking for these cities was similar to the price average of Atlanta and West Springfield. Statistical analyses were performed on attribute importance from the aggregate level. This may result in limitations by understating the importance of attributes regarding level of disagreement preference within groups. For example if two brands are compared (A & B) and half of the respondents preferred both brands then the utilities would be tied and brand importance would be zero. A different conjoint method like ICE (Individual Choice Estimation) which computes importance individually for respondents should be used to avoid this difficulty. Other potential limitations include the assumptions that:

- Respondents provided honest/correct demographic information
- Respondents provided true intentions in the CBC section regarding which deck they would purchase
- Respondents had adequate computer skills to easily complete the questionnaire and fully comprehended the questions
- Respondents answering the questionnaire with a friend or spouse were not influenced

- Professional contractors install the majority of decks on houses before the consumer takes ownership of the home, e.g. "spec" housing developments thus limiting the consumers choice for decking material
- This is not a representative sample but rather an indicator of patterns or trends

5.8 Future Research

The quantitative approach offers insight into 'what' consumers choose concerning decking products, but fails to illustrate 'why' they make these decisions. Future studies on this subject should involve qualitative methods for data collection, including speaking to individual consumers with a deck on their home. Forums or door-to-door interviewing of deck owners may provide evidence for consumer preferences of one material over another. This method incorporates past and present experience with specific decking material as well as the potential influence of media exposure to advertisements.

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APPENDIX

Table 10: Material utilities for all four home shows.

MATERIAL Utilities	Nat. Durable	Treated	WPC	Range	% Importance
All respondents	0.24	-0.42	0.174	0.66	29.4%
Atlanta	0.08	-0.26	0.18	0.44	20.3%
San Diego	0.24	-0.51	0.27	0.777	32.1%
Toronto	0.564	-0.37	-0.20	0.934	38.4%
West Springfield	0.164	-0.58	0.42	1.0	39.5%
Male	0.221	-0.43	0.21	0.651	27.7%
Female	0.26	-0.401	0.14	0.661	30.7%
Under $50,000	0.30	-0.34	0.045	0.64	31.7%
$50,000 - $99,999	0.201	-0.42	0.215	0.635	29.0%
$100,000 - $149,999	0.235	-0.38	0.141	0.615	26.8%
$150,000 & above	0.38	-0.575	0.20	0.955	36.5%
Under 35	0.30	-0.28	-0.023	0.58	27.6%
35-49	0.27	-0.46	0.19	0.73	30.7%
50 & over	0.193	-0.442	0.25	0.692	31.2%
Own	0.225	-0.423	0.20	0.648	28.5%
Rent	0.50	-0.26	-0.242	0.76	44.3%
HS/GED or some college	0.075	-0.42	0.346	0.766	34.0%
College graduate	0.28	-0.385	0.107	0.665	28.2%
Graduate degree/Other	0.34	-0.45	0.11	0.79	33.2%

Table 11: Maintenance utilities for all four home shows.

MAINTENANCE Utilities	5 Hours	10 Hours	15 Hours	Range	% Importance
All respondents	0.192	-0.022	-0.17	0.362	16.1%
Atlanta	0.23	-0.06	-0.17	0.4	18.4%
San Diego	0.18	-0.013	-0.162	0.342	13.9%
Toronto	0.201	-0.021	-0.18	0.381	15.7%
West Springfield	0.16	0.02	-0.18	0.34	13.4%
Male	0.18	-0.028	-0.151	0.33	14.0%
Female	0.21	-0.02	-0.19	0.4	18.6%
Under $50,000	0.16	-0.005	-0.16	0.32	15.9%
$50,000 - $99,999	0.17	-0.013	-0.16	0.33	15.0%
$100,000 - $149,999	0.195	-0.05	-0.15	0.345	15.1%
$150,000 & above	0.28	-0.035	-0.243	0.523	20.0%
Under 35	0.22	-0.02	-0.201	0.24	11.4%
35-49	0.19	-0.032	-0.154	0.34	14.3%
50 & over	0.19	-0.019	-0.17	0.36	16.2%
Own	0.193	-0.021	-0.172	0.363	16.0%
Rent	0.174	-0.065	-0.11	0.284	16.5%
HS/GED or some college	0.184	-0.025	-0.16	0.344	15.2%
College graduate	0.21	-0.02	-0.192	0.402	17.1%
Graduate degree/Other	0.19	-0.03	-0.16	0.35	14.7%

Table 12: Lifetime utilities for all four home shows.

LIFETIME Utilities	10 Years	15 Years	20 Years	Range	% Importance
All respondents	-0.332	0.003	0.33	0.662	29.4%
Atlanta	-0.343	-0.016	0.36	0.703	32.4%
San Diego	-0.352	-0.007	0.36	0.712	29.4%
Toronto	-0.29	0.011	0.28	0.57	23.5%
West Springfield	-0.36	0.255	0.332	0.692	27.3%
Male	-0.36	0.007	0.35	0.71	30.2%
Female	-0.313	-0.001	0.315	0.628	29.2%
Under $50,000	-0.285	-0.027	0.312	0.597	29.6%
$50,000 - $99,999	-0.345	0.014	0.331	0.676	30.9%
$100,000 - $149,999	-0.34	0.01	0.33	0.67	29.2%
$150,000 & above	-0.344	0.017	0.33	0.674	25.8%
Under 35	-0.32	-0.002	0.32	0.64	30.4%
35-49	-0.37	0.023	0.343	0.713	30.0%
50 & over	-0.32	-0.014	0.334	0.654	29.5%
Own	-0.343	0.006	0.34	0.683	30.0%
Rent	-0.161	-0.064	0.225	0.386	22.5%
HS/GED or some college	-0.302	-0.012	0.313	0.615	27.2%
College graduate	-0.354	0.006	0.35	0.704	29.9%
Graduate degree/Other	-0.343	0.015	0.33	0.673	28.2%

Table 13: Price utilities for all four home shows.

PRICE Utilities	$.75	$1.50	$2	Range	% Importance
All respondents	0.29	-0.014	-0.274	0.564	25.1%
Atlanta	0.325	-0.022	-0.303	0.628	29.0%
San Diego	0.30	-0.005	-0.30	0.60	24.6%
Toronto	0.275	-0.006	-0.27	0.545	22.4%
West Springfield	0.26	-0.017	-0.241	0.501	19.8%
Male	0.343	-0.027	-0.32	0.663	28.2%
Female	0.233	-0.002	-0.231	0.464	21.5%
Under $50,000	0.231	0.007	-0.231	0.462	22.9%
$50,000 - $99,999	0.28	-0.013	-0.27	0.55	25.1%
$100,000 - $149,999	0.35	-0.037	-0.311	0.661	28.9%
$150,000 & above	0.23	0.003	-0.232	0.462	17.7%
Under 35	0.352	-0.07	-0.29	0.642	30.5%
35-49	0.29	0.010	-0.302	0.593	25.0%
50 & over	0.26	-0.011	-0.25	0.51	23.0%
Own	0.295	-0.013	-0.282	0.577	25.4%
Rent	0.16	-0.034	-0.125	0.285	16.6%
HS/GED or some college	0.272	-0.012	-0.26	0.532	23.6%
College graduate	0.31	-0.036	-0.273	0.583	24.8%
Graduate degree/Other	0.28	0.01	-0.29	0.57	23.9%

Prices in lineal feet

Table 14: Regional breakdown of demographics for each city.

	ATL	%	SD.	%	TOR	%	W.S.	%
AGE								
Under 20	7	1.7%	4	1.4%	6	2.1%	1	0.3%
20 – 34	47	11.7%	31	11.1%	78	27.3%	59	18.6%
35 – 49	158	39.3%	92	33.0%	120	42.0%	119	37.4%
50 – 64	163	40.5%	136	48.7%	72	25.2%	115	36.2%
65 & over	15	3.7%	15	5.4%	9	3.1%	22	6.9%
Refused	12	3.0%	1	0.4%	1	0.3%	2	0.6%
GENDER								
Male	204	50.7%	122	43.7%	140	49.0%	179	56.3%
Female	190	47.3%	156	55.9%	141	49.3%	133	41.8%
Refused	8	2.0%	1	0.4%	5	1.7%	6	1.9%
EDUCATION								
HS grad/GED	32	8.0%	14	5.0%	29	10.1%	42	13.2%
Some college	74	18.4%	70	25.1%	32	11.2%	82	25.8%
College graduate	169	42.0%	104	37.3%	112	39.2%	110	34.6%
Graduate degree	117	29.1%	85	30.5%	97	33.9%	75	23.6%
Other	3	0.7%	5	1.8%	12	4.2%	7	2.2%
Refused	7	1.7%	1	0.4%	4	1.4%	2	0.6%
OWN/RENT								
Own	382	95.0%	266	95.3%	261	91.3%	299	94.0%
Rent	12	3.0%	11	3.9%	20	7.0%	15	4.7%
Refused	8	2.0%	2	0.7%	5	1.7%	4	1.3%
INCOME								
Under $25,000	7	1.7%	7	2.5%	4	1.4%	8	2.5%
$25,000 - $49,999	34	8.5%	18	6.5%	44	15.4%	51	16.0%
$50,000 - $74,999	54	13.4%	43	15.4%	65	22.7%	81	25.5%
$75,000 - $99,999	62	15.4%	45	16.1%	45	15.7%	68	21.4%
$100,000 - $124,999	88	21.9%	49	17.6%	44	15.4%	38	11.9%
$125,000 - $149,999	30	7.5%	36	12.9%	27	9.4%	10	3.1%
$150,000 & above	55	13.7%	46	16.5%	30	10.5%	19	6.0%
Refused	72	17.9%	35	12.5%	27	9.4%	43	13.5%
Total	N= 402		N= 279		N= 286		N= 318	

Table 15: Demographics from environmentally friendly ranking response.

Ranking deck products as most environmentally friendly	Naturally Durable Wood		Treated Wood		Non-Treated Wood		Wood Plastic Composite		Plastic Lumber		Total
Overall ranking percent	38.2%		6.6%		8.2%		23.4%		23.6%		100%
Atlanta	144	35.8%	32	8.0%	33	8.2%	97	24.1%	96	23.9%	402
San Diego	88	31.5%	13	4.7%	25	9.0%	76	27.2%	77	27.6%	279
Toronto	131	45.8%	29	10.1%	20	7.0%	50	17.5%	56	19.6%	286
West Springfield	128	40.2%	11	3.5%	27	8.5%	78	24.5%	74	23.3%	318
Male	240	37.2%	37	5.7%	48	7.4%	166	25.7%	154	23.9%	645
Female	241	38.9%	48	7.7%	55	8.9%	130	21.0%	146	23.5%	620
Refused	10	50.0%	--	--	2	10.0%	5	25.0%	3	15.0%	20
Under $50,000	54	31.2%	18	10.4%	18	10.4%	32	18.5%	51	29.5%	173
$50,000 - $99,999	163	35.2%	37	8.0%	34	7.3%	112	24.2%	117	25.3%	463
$100,000 - $149,999	135	41.9%	13	4.0%	23	7.1%	81	25.2%	70	21.7%	322
$150,000 & above	63	41.7%	9	6.0%	12	7.9%	39	25.8%	28	18.5%	151
Refused	77	43.5%	8	4.5%	18	10.2%	37	20.9%	37	20.9%	177
Under 35	78	35.0%	22	9.9%	27	12.1%	43	19.3%	53	23.8%	223
35 – 49	190	38.8%	23	4.7%	36	7.4%	115	23.5%	125	25.6%	489
50 & over	204	37.3%	40	7.3%	40	7.3%	141	25.8%	122	22.3%	547
Refused	9	56.3%	--	--	2	12.5%	2	12.5%	3	18.7%	16
Own	458	37.9%	76	6.3%	99	8.2%	286	23.7%	289	23.9%	1208
Rent	25	43.1%	8	13.8%	5	8.6%	9	15.5%	11	19.0%	58
Refused	8	42.1%	1	5.3%	1	5.3%	6	31.6%	3	15.8%	19
HS/GED or some college	122	32.5%	35	9.3%	23	6.1%	85	22.7%	110	29.3%	375
College graduate	203	41.0%	26	5.2%	42	8.5%	118	23.8%	106	21.4%	495
Graduate degree/Other	156	38.9%	24	6.0%	39	9.7%	96	23.9%	86	21.4%	401
Refused	10	71.4%	--	--	1	7.1%	2	14.3%	1	7.1%	14
Total	N= 491		N= 85		N= 105		N= 301		N= 303		1285

Table 16: Utilities from ranking of environmentally friendly decking material.

Rank as #1	Naturally Durable wood		Treated Wood		Non-treated Wood		Wood Plastic Composite		Plastic Lumber	
Material		%		%		%		%		%
Nat. dur.	0.70	40.0	0.20	45.4	0.22	20.7	-0.09	46.0	-0.08	34.7
Treated	-0.43		0.483		-0.17		-0.7		-0.44	
WPC	-0.25		-0.68		-0.05		0.77		0.52	
Maintenance		%		%		%		%		%
5 hrs.	0.203	13.0	0.16	12.5	0.20	19.1	0.22	12.8	0.214	15.8
10 hrs.	-0.04		0.002		-0.04		-0.03		0.011	
15 hrs.	-0.163		-0.16		-0.16		-0.19		-0.225	
Lifetime		%		%		%		%		%
10 years	-0.37	25.8	-0.26	21.0	-0.31	30.8	-0.36	22.3	-0.365	27.0
15 years	0.011		-0.02		0.04		0.007		-0.018	
20 years	0.36		0.28		0.27		0.354		0.383	
Price		%		%		%		%		%
$.75 plf	0.32	21.2	0.27	21.0	0.283	29.4	0.291	18.8	0.32	22.5
$1.50 plf	-0.04		0.004		-0.013		0.02		-0.013	
$2 plf	-0.28		-0.27		-0.27		-0.31		-0.302	
	N= 491		N= 85		N= 105		N= 301		N= 303	