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Working Paper

56

THE NORTH AMERICAN RESIDENTIAL DECKING AND SIDING MARKETS

Steven R. Shook
Ivan L. Eastin

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CENTER FOR INTERNATIONAL TRADE IN FOREST PRODUCTS
UNIVERSITY OF WASHINGTON
COLLEGE OF FOREST RESOURCES
BOX 352100
SEATTLE, WASHINGTON 98195-2100

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CINTRAFOR
College of Forest Resources
University of Washington
Box 352100
Seattle WA 98195

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EXECUTIVE SUMMARY

The market for residential decking and siding products in North America has become increasingly competitive over the past two decades. Given an increasing assortment of substitute materials, coupled with aggressive promotional and product-service campaigns of competitors, the market share for western red cedar residential decking and siding products has become stagnant. To determine those factors that influence the selection and utilization of western red cedar as a residential decking and siding material relative to substitute products, the Western Red Cedar Lumber Association (WRCLA) commissioned the Center for International Trade in Forest Products (CINTRAFOR) to conduct an in-depth analysis of the market for western red cedar residential decking and siding products in North America. This study brings together all available secondary sources of information known to exist for these two classes of products. Furthermore, this study reports the results of a mail survey regarding the Puget Sound residential siding market. The mail survey provides the WRCLA with baseline data on a potential test market.

Residential Decking Market

Treated lumber, western red cedar, redwood, and a wood-polymer composite (Trex™) manufactured by Mobil Chemical Company clearly dominate the residential decking market. Extremely aggressive price competition, modest product differentiation, economies of scale, and well-developed marketing and distribution systems characterize the residential decking industry. All four major residential decking materials are essentially marketed and distributed in a similar fashion.

The residential decking market in the United States is extremely large. Government statistics reveal that over 85 percent of all single family homes include either a deck or deck-like structure (e.g., porch, balcony). Annually, over 4 percent of all households either add a deck or replace an existing deck, leading to more than 3.5 million new decks being constructed onto existing single family structures. Deck construction activity should increase substantially in the deck replacement market given that economic conditions are anticipated to improve or remain stable.

Unfortunately, no accurate market share estimates exist for the various decking materials available on the market. One source estimates that treated lumber commands 82.5 percent of the residential decking market on a board foot basis, with redwood at 11.5 percent, western red cedar at 3.2 percent, and other deck materials at 2.8 percent. This same source, however, also estimates in a different study that western red cedar controls 23.3 percent of the residential decking market. Regardless of the estimates, it can be concluded from this source that the market share of western red cedar decking materials has been eroded by treated lumber and redwood substitutes, especially in regions of the US where western red cedar materials once dominated the market (e.g., US West). Furthermore, the western red cedar market share is likely to continue to decline as Mobil Chemical Company increases promotional campaigns for its Trex™ wood fiber-plastic composite decking material.

The relative difference between the various products in material, installation, and maintenance costs has become the primary basis for product differentiation in the residential decking market. After cost considerations, the choice of decking material individuals utilize when constructing a deck is mostly dependent on product quality factors (e.g., structural properties, durability, susceptibility to wear) and manufacturer and retailer service factors (e.g., product availability, price incentives, moisture content). Unlike the residential siding market, image, beauty, and social status factors are not seen as fundamental determinants in consumer choice for decking materials. Western red cedar does not "sell itself" on its image and beauty characteristics alone since consumers generally perceive all residential decking materials to be about the same (*i.e.*, commodity products). If the past holds true, marketing efforts designed to promote only image and beauty characteristics of western red cedar residential decks will likely have a limited impact on changing consumer perceptions.

Firms producing residential decking materials can implement several strategies in order to create product differentiation for materials that consumers perceive as commodities. For instance, western red cedar producers could physically differentiate their decking products by making them easier to use, improving product quality,

grade consistency, and durability characteristics, providing additional accessories, or providing additional elements of service (e.g., improved packaging, installation instructions).

Western red cedar producers could also differentiate their product through properly designed marketing efforts. Changing price, providing discounts, offering guarantees or warranties, improving service levels, changing advertising strategy, devising promotions, and changing the image of the product are several market-oriented strategies that could be utilized to increase sales and market share of western red cedar decking materials. The treated lumber industry has successfully used a branding strategy to create consumer awareness and knowledge of their products. This branding strategy transformed the image of a product once viewed as substandard to that of a naturally decay-resistant product. The result of the treated lumber industry's branding strategy has been a decline in the use of western red cedar as a residential decking material. The lack of a well-formulated, market-oriented strategy in the western red cedar residential decking industry will likely lead to further decline.

Residential Siding Market

Fifteen different materials have a considerable impact in the residential siding market. Vinyl, structural panels (*i.e.*, OSB and plywood), brick, and hardboard, however, are the dominant residential siding materials installed. Aggressive price competition, low product differentiation despite significant contrasts between the physical attributes of the products available, economies of scale, well-developed marketing and distribution systems, and an intensification of competition among manufacturers and distributors characterize the residential siding industry.

Demand for residential siding materials is a function of two factors; namely, the level of new residential home construction starts and the level of replacement, repair, remodeling, and addition activity taking place on existing residential housing units. While residential siding demand increases and declines with changes in the cycle of residential home building, it is relatively stable compared to many other building products. This stability is an outcome of the size of the replacement and remodeling markets, which have accounted for anywhere from 25 to 33 percent of all residential siding use (square foot basis) during the past decade. Despite the replacement and remodeling markets' impressive and growing size, vinyl siding firms have been the only residential siding material manufacturers to target this market successfully.

According to market share estimates prepared exclusively for this study, vinyl siding products control 36.7 percent of the residential siding market. Trailing vinyl siding in market share are structural panels (27.9 percent), brick (17.2 percent), hardboard (13.2 percent), western red cedar (2.5 percent), and aluminum (2.4 percent). In the past eight years, the total residential siding market has grown at an average annual rate of 0.46 percent. Vinyl siding use has grown at an average annual rate of 10.25 percent. The only other residential siding material to experience growth in this same period has been western red cedar, which has grown at an average annual rate of 3.52 percent. The market share growth of vinyl siding has come at great expense to the producers of aluminum siding, as well as to hardboard and structural panel siding producers.

Relative differences in material and installation costs typically establish the competitive relationships between the materials used in the residential siding market. Unlike decking materials, however, products in the residential siding market, especially brick and western red cedar, are differentiated to a much greater degree by the image that they project. Past research has shown that consumers perceive vinyl, aluminum, hardboard, and plywood residential siding materials to be close substitutes for one another. Therefore, these four residential siding materials compete primarily on price and installation cost.

Relative to competing residential siding materials, consumers tend to see western red cedar as being expensive and time-consuming to install. Western red cedar residential siding material is also seen as possessing price instability and poor grade consistency. However, consumers believe that western red cedar has a tremendous curb appeal and a high status image, being nearly equal to that of brick. Unfortunately, the image and beauty characteristics of western red cedar residential siding are neutralized by consumer perception of western red cedar's high cost.

It appears that the competitive position of western red cedar is not optimal relative to other residential siding materials. Promotional literature for western red cedar siding stresses heavily its quality image, while other important characteristics such as price and durability tend to be mentioned infrequently. While the actual cost of installation for western red cedar siding is greater than that of competing residential siding materials, there is speculation that most consumers perceive the cost as being substantially more than it actually is.

Survey of Puget Sound Residential Siding Market

The demand for residential siding in the Puget Sound market should increase over 1994 and 1995 levels since, according to survey respondents, there is an expectation for new home construction to increase substantially. Survey results clearly reveal that the 8.9 percent market share for western red cedar in the Puget Sound residential siding market has declined over the past five years. Unfortunately, this study cannot determine at what rate the market share has declined or what factor(s) triggered the decline (e.g., higher prices, lower quality of material, lack of product availability).

The following four residential siding materials have a significant presence in the Puget Sound market: OSB, hardboard, plywood, and western red cedar. Builders indicate that their use of wood fiber-cement residential siding has increased substantially over the past five years. This may be the result of the increased promotional effort on the part of a major producer of wood fiber-cement siding (Hardi Plank) in the US West.

The Puget Sound market represents a disproportionately large share of the national market for OSB residential siding. Two factors may be working either independently or together in creating this disproportionate market. First, OSB residential siding manufacturers (namely, Louisiana-Pacific) may be specifically targeting the Puget Sound market through promotional efforts due to distribution advantages associated with the market and its port access. Second, builders may simply have a preference for OSB residential siding due to its ease of installation and their preference for a material that has the "curb appearance" of real wood.

While installation of western red cedar siding occurs more often as new home prices increased, the effect was found to be not significant. In fact, installation of western red cedar siding occurs in nearly equal proportions (square foot basis) on new homes across all price ranges. This suggests that western red cedar is being accepted more readily as a siding material for new lower-end-priced homes. If this is the case, then builder perceptions of western red cedar's high status/quality image and beautiful appearance may be eroding.

Analysis of the survey data reveals that western red cedar siding's very low rating in product consistency and uniformity, as well as its low rating along the easy/low cost maintenance attribute, is disturbing. However, it offers western red cedar siding manufacturers, wholesalers, and retailers considerable opportunity, since alterations in these perceptions can be made with relative ease with changes in manufacturing methods, quality control practices, and distribution.

Western red cedar manufacturers should make a concerted effort to change the quality of their shipped product. In particular, the survey results suggest that manufacturers address issues dealing with product consistency and uniformity. The WRCLA should actively manufacture and promote high-grade western red cedar residential siding products in such a manner that the product consistency and uniformity perceptions of their products are nearly equal among builders to that of brick, hardboard, stucco, and OSB residential siding materials. Improving western red cedar siding's product consistency and uniformity, or creating a high-grade branded western red cedar residential siding product, will at the same time improve the perception that builders have of western red cedar's image status and beautiful appearance. As such, an improved, high-end western red cedar residential siding product may warrant a premium price.

A promotional effort should be made to address western red cedar siding's poor perceptual rating on the low cost and easy maintenance attribute. How can the perception of this attribute be improved? First, the material can be prefinished using a high grade stain or primer and a reliable and consistent application process. In addition, the material should be grade-consistent and not placed on the market in green condition. Third, promotional literature addressing long-term maintenance issues should be considered. This literature should accompany every lift of

western red cedar sold, and it should also address the proper method of installing western red cedar residential siding.

Finally, western red cedar siding manufacturers, wholesalers, and retailers should make a strong attempt to avoid price competition. The results of this study indicate that price competition conflicts with builders' perception of a residential siding product's high status/quality image and beautiful appearance attributes. Creating a conflicting image of western red cedar siding has likely decreased its demand among high-end home builders while at the same time increased demand among lower-end home builders. This shift in the market, however, has not been substantial enough for western red cedar siding manufacturers, wholesalers, and retailers to recoup profits that have historically been made in the high-end market.

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Steven R. Shook
Ivan L. Eastin

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INTRODUCTION AND BACKGROUND

Substantial changes have occurred in the market environment for residential decking and siding materials over the past decade in North America. New products, increased competition, and greater consumer demand for higher-quality products are among the many factors that have considerably altered the competitive landscape for manufacturers and suppliers of residential decking and siding materials. A result of this dynamic environment has been an increased generation and use of marketing information in the siding and decking industries to develop and guide market strategy and tactics. This study was the direct outcome of an organization that perceived that failure to generate, collect, and act on market information in the residential decking and siding markets would lead to a gradual decline in their overall performance. This organization provides the context in which this study is written. The present section provides a brief summary of the organization's situation prior to this study. An outline of the research problem follows. The section concludes with an overview of the general structure of this report.

The Western Red Cedar Lumber Association (WRCLA) is an organization that provides market assistance to manufacturers of western red cedar products. Two major components of most western red cedar manufacturers' product lines are residential decking and siding. It was the WRCLA's perception that the markets for western red cedar residential decking and siding material were either stagnant or declining in North America. Specifically, the WRCLA speculated that a greater assortment of substitute materials in the market, combined with the aggressive promotional and product-service campaigns of competitors, had systematically reduced the market shares for western red cedar residential decking and siding products.

A fundamental goal of the WRCLA is to promote and increase the market potential for member manufacturers and suppliers of western red cedar products. Achieving this goal, however, requires that the WRCLA have a database of pertinent information from which market strategy and tactics can be developed and then implemented and monitored. Prior to this study, the WRCLA had relatively little information on the structure and status of the residential decking and siding markets in North America. As a result of this situation, the WRCLA dedicated substantial resources to determine both quantitatively and qualitatively those factors that influence the selection and utilization of western red cedar as a residential decking and siding material relative to substitute products.

The WRCLA contracted CINTRAFOR to conduct a detailed analysis of the markets for western red cedar residential decking and siding products in North America. This study represents a substantial portion of that analysis. In particular, this study examines all available secondary sources of information known to exist for these two classes of products. In addition to the review of the extant literature, a mail survey was conducted to examine residential siding usage within a specific market; namely, the Puget Sound market in Washington State. Together, the results of the literature review and survey provide the most current and comprehensive overview of the residential decking and siding markets currently available to the public.

Objectives

The primary objective of this research effort was to define the character of the residential decking and siding markets in North America and the residential siding market in the Puget Sound region of Washington State. Given that this study was originally conducted with a specific focus on the western red cedar residential decking and siding markets, several of the conclusions and recommendations are stated in such a context.

Explicitly, the six objectives of this report are as follows:

1. Provide an overview of the general market statistics which influence the demand for residential decking and siding materials.
   - What are the trends in housing starts at national and regional levels?
   - What are the selling prices for existing homes at national and regional levels?
   - What are the selling prices for newly-built homes at national and regional levels?

2. Examine the character of selected materials in the residential decking and siding markets.
   - What are the product attributes of selected materials in the residential decking and siding markets (e.g., vinyl and hardboard siding, treated lumber decking)?
   - What are the market shares of selected residential decking and siding materials in the North American market?
   - How are selected residential decking and siding materials promoted, distributed, and priced in the North American market?

3. Conduct an exhaustive literature review of the residential decking and siding markets in North America in order to provide strategic market information on product perceptions.
   - What are wholesaler and retailer perceptions of residential decking and siding materials?
   - What are builder perceptions of residential decking and siding materials?
   - What are homeowner perceptions of residential decking and siding materials?

4. Determine the characteristics of the repair, remodeling, and retrofit market with regard to their use of residential decking and siding materials.
   - What is the size of the repair, remodeling, and retrofit market?
   - Who services the repair, remodeling, and retrofit market (e.g., contractors, homeowners)?

5. Determine areas in which additional primary research should be targeted to evaluate the residential decking and siding markets better.

6. Conduct a mail survey of the Puget Sound residential siding market to answer several key marketing questions.
   - Identify the perceptions, attitudes, and usage patterns that Puget Sound area builders and contractors possess for selected residential siding materials.
   - Develop marketing strategy recommendations for western red cedar siding manufacturers based on the results of the literature review and mail survey.

LITERATURE REVIEW RESEARCH METHODOLOGY

The literature assembled for this study originates from a variety of sources. Specifically, consulting reports, trade journals, academic articles, and promotional literature provided information concerning consumer perceptions of residential decking and siding materials. Industry associations (e.g., Vinyl Siding Institute, American Hardboard Association) provided a substantial amount of the information concerning the market share of residential decking and siding materials. Governmental reports, consulting firms, and commercial firms that specialize in information resource gathering provided housing starts and housing price information.

A systematic methodology was employed to gather the extant literature related to residential decking and siding materials. Over fifty different public and commercial databases were searched by keyword, and combinations of such keywords as: *building materials*, *clapboard*, *cladding*, *decking*, *exterior*, *market*, *marketing*, *patio*, *porch*, *promotion*, *siding*, *treated lumber*, and *treated wood*, among others.

The following databases provided the bulk of the published materials collected for this study:

- ***Agricola***: database providing international coverage of agriculturally related journals and periodicals, government reports, and consulting reports
- ***Avery Index to Architectural Periodicals:*** database providing international coverage of architecture, building materials, and building management journals and periodicals
- ***Business Index:*** database providing North American and Western European coverage of business periodicals and journals, business newspapers, trade journals, and government reports
- ***CARL Uncover:*** database providing international coverage of 5,000+ academic journals and periodicals

- ***EconLit:*** database providing international coverage of economic journals, periodicals, and government reports
- ***Expanded Academic Index:*** database providing international coverage of 3,000 academic journals
- ***Forest Products Abstracts:*** database providing international coverage of all areas of forest products and wood science and technology
- ***Forestry Abstracts:*** database providing international coverage of all areas of forestry and forest science
- ***INSPEC:*** database providing international coverage of science-oriented databases
- ***OCLC:*** database providing access to 30 million books, reports, dissertations, and theses housed at over 2,000+ libraries internationally
- ***TREE-CD:*** database of forestry, forest products, wood science and technology articles from academic journals and nonacademic periodicals

Since several sources of information were not available from the University of Washington's library system, the University's Interlibrary Borrowing System provided some collection services. Nearly all sources of information located in the database searches were obtained using either the University's libraries or the Interlibrary Borrowing System. As a result, we believe that we have exhausted all possible published sources of information concerning the residential decking and siding markets currently available.

REVIEW OF THE GENERAL MARKET ENVIRONMENT

The material in this section presents the current market situation for new and renovated residential homes in the US. It is essential to have an understanding of the trends and existing conditions of the residential housing market in order to interpret the developments in the residential siding and decking markets properly.

For the most part, the data contained in this section is abstracted from US Department of Commerce, US Bureau of the Census, and National Realtors Association sources. As such, the data is considered to be reliable, but subject to considerable interpretation. Most data series displayed within this section extend back to 1980.

General Determinants of Market Demand

The demand for residential siding is essentially a function of two factors; namely, the level of new residential housing starts and the level of repair, maintenance, and replacement of residential siding on existing residential homes. The demand for residential decking is also a function of these two factors, but to a somewhat lesser degree. Residential decking demand is also contingent on the preferences of consumers in various geographic regions. Although requirements for residential decking and siding materials rise and decline with changes in the home building cycle, the demand for these materials is typically more stable than the demand for other building materials. The large repair, maintenance, and replacement markets provide much of the stability in demand for these two materials (Breckling 1984). This market, for instance, accounts for over one-third of the demand for residential siding.

The interest rate on fixed-rate mortgages also has an impact on the demand for residential decking and siding materials. Not only do lower interest rates make new home purchasing more attractive and achievable, but they also significantly increase the activity in the remodeling and renovation market by making major additions and repairs less expensive. Additionally, mortgage refinancing has freed up billions of dollars in equity that is now available for use as financing for remodeling and renovation projects. Currently, the interest rates on fixed-rate mortgages is low relative to what they were in the 1970's and 1980's. The National Association of Home Builders expects interest rates to remain relatively stable through 1996. Figure 1 provides a time series of effective interest rates on conventional loans closed by major lenders for newly-built homes between January 1992 and March 1996.

Housing Inventory

As of 1993, there were 93.72 million housing units in place in the US. Approximately one-third of these units were renter-occupied. The remaining units were occupied by the owner. Detached one-unit structures accounted for 58.92 million units, with slightly over 14% of these units being renter-occupied. Approximately 5% of all housing units and detached one-unit housing structures have been constructed within the past four years (1990-1993). Table 1 provides statistics on the number of existing one-unit residential homes sold by region. This table reveals that, on average, the South accounts for 37% of existing one-unit residential home sales in the US, while the Northeast accounts for approximately 17%, and the Midwest and West account for 26 and 20%, respectively.

Table 1. Existing one-unit residential homes sold in the US by region, 1980-1995 (in thousands).

		Region			
Year	Total Existing Homes Sold	Northeast	Midwest	South	West
1980	2,973	403	806	1,092	672
1981	2,419	353	632	917	516
1982	1,990	354	490	780	366
1983	2,719	493	709	1,035	481
1984	2,868	511	755	1,073	529
1985	3,214	622	866	1,172	554
1986	3,565	703	991	1,261	610
1987	3,526	685	959	1,282	600
1988	3,594	673	929	1,350	642
1989	3,346	531	855	1,185	775
1990	3,211	469	831	1,202	709
1991	3,220	479	840	1,199	702
1992	3,520	534	939	1,292	755
1993	4,290	620	1,170	1,560	940
1994	3,760	540	1,010	1,400	810
1995	4,040	640	1,060	1,460	880

Source: National Association of Realtors; Federal Reserve Bank of Chicago [accessed electronically]

Table 2 displays the number of existing one-unit residential homes sold in the US by price class from 1980-1995. Generally, the selling price of comparable existing homes has increased within the past twelve years due to inflationary pressures and increased housing competition. The number of existing homes sold at a price greater than $100,000 tripled since 1980, while the number sold at a price less than $50,000 is about one-third of 1980 existing home sales rates.

Table 3 displays the median price of existing one-unit residential homes sold in the US by region. As expected given the data in the previous table, the median selling price of homes has increased across each of the four regions. The average annual increase in the median selling price of existing one-unit homes across the US has been approximately 4.4% since 1980. The average annual increase according to geographic region has been the greatest in the Northeast, at 7.5%. The West follows at 4.2%, the South at 3.9%, and the Midwest at 3.9%. A significant amount of the increase in the median selling price across all geographic regions, however, occurred between 1985 and 1989.

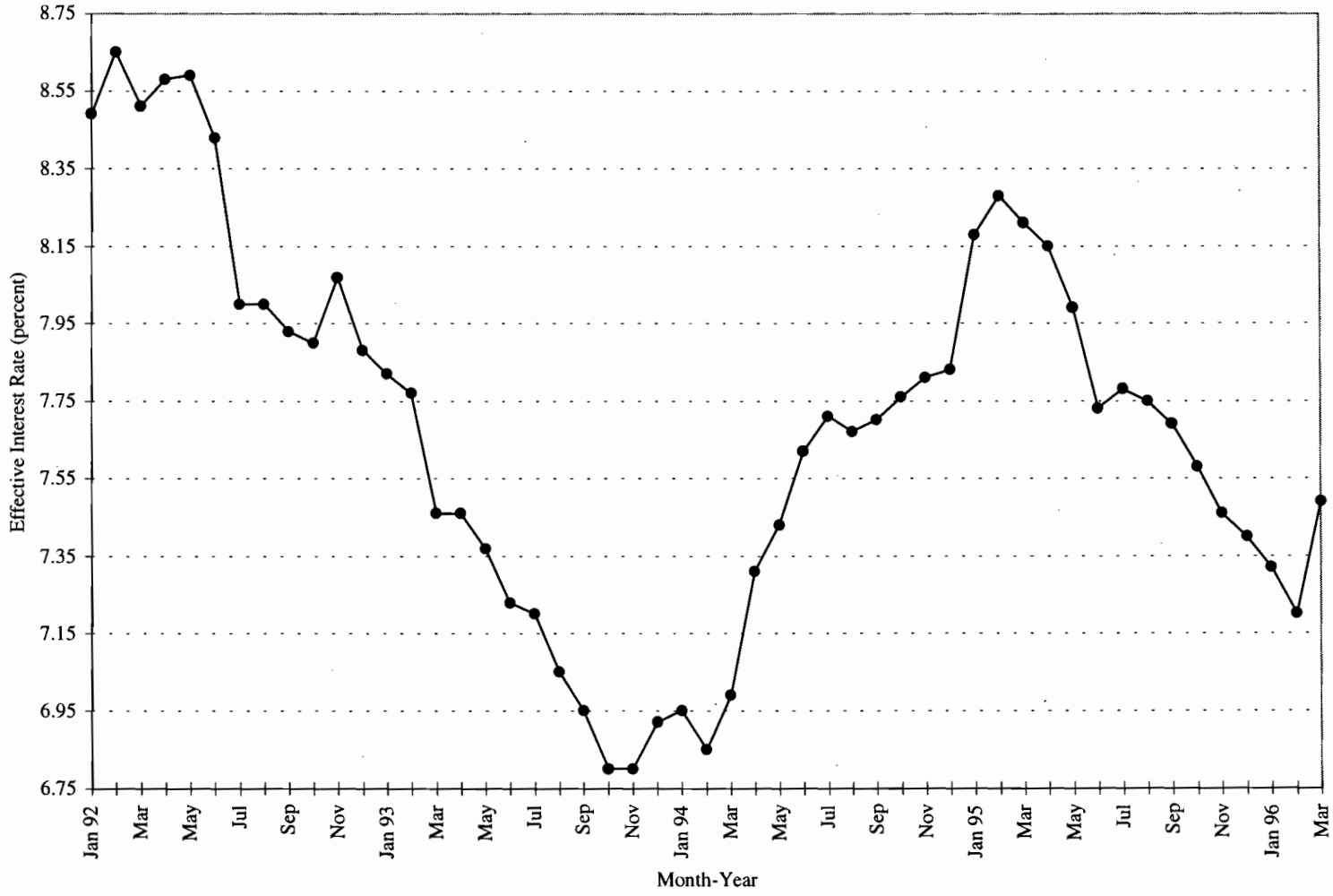

Figure 1. Effective interest rates on conventional loans closed by major lenders for newly-built homes, January 1992 to March 1996.

Note: Rates are not seasonally adjusted. Effective interest rate = contract interest rate + fees and charges amortized over a ten year period.

Source: US Federal Housing Finance Board

Table 2. Existing one-unit residential homes sold in the US by price class, 1980-1995 (in thousands).

Year	US Total	< $40,000	$40,000-$49,999	$50,000-$59,999	$60,000-$79,999	$80,000-$99,999	> $100,000
1980	2,973	618	395	389	652	378	541
1981	2,419	433	290	300	525	341	530
1982	1,990	326	237	249	429	277	472
1983	2,719	370	299	345	631	402	672
1984	2,868	367	295	347	657	433	769
1985	3,214	363	305	363	720	489	974
1986	3,565	346	310	374	731	542	1,262
1987	3,526	377	282	335	645	476	1,407
1988	3,594	352	262	298	632	499	1,549
1989	3,346	281	214	261	592	465	1,533
1990	3,211	283	199	251	565	462	1,451
1991	3,220	238	174	225	547	473	1,562
1992	3,520	218	172	229	563	521	1,816
1993	4,290	--[a]	--	--	--	--	--
1994	3,760	--	--	--	--	--	--
1995	4,040	--	--	--	--	--	--

[a] Information not available at time of study.

Source: National Association of Realtors; National Association of Homebuilders; Federal Reserve Bank of Chicago [accessed electronically]

Table 3. Median price ($) of existing one-unit residential homes sold in the US by region, 1980-1992.

		Region			
Year	Median	Northeast	Midwest	South	West
1980	62,200	60,800	51,900	58,300	89,300
1981	66,400	63,700	54,300	64,400	96,200
1982	67,800	63,500	55,100	67,100	98,900
1983	70,300	72,200	56,600	69,200	94,900
1984	72,400	78,700	57,100	71,300	95,800
1985	75,500	88,900	58,900	75,200	95,400
1986	80,300	104,800	63,500	78,200	100,900
1987	85,600	133,300	66,000	80,400	113,200
1988	89,300	143,000	68,400	82,200	124,900
1989	93,100	145,200	71,300	84,500	139,900
1990	95,500	141,200	74,000	85,900	139,600
1991	100,300	141,900	77,800	88,900	147,200
1992	103,700	140,000	81,700	92,100	143,800

Source: National Association of Realtors

New Housing

Between the years of 1980 and 1992, the average annual rate of growth in the number of new one-unit residential homes in the US has been 2.4%. As Table 4 reveals, the South accounts for a significant proportion of the number of new homes sold over this period. However, the average annual rate of growth in the number of new one-unit residential homes in the South, at approximately 1%, has been the lowest among the four geographic regions of the US. The Northeast and the Midwest have experienced the greatest annual rates of growth at 4.5% and 4.7%, respectively. The average annual growth in the number of new one-unit residential homes sold in the West has been modest, at 3.1%.

Table 4. New one-unit residential homes sold in the US by region, 1980-1995 (in thousands).

Year	Total New Homes Sold	Region of United States			
		Northeast	Midwest	South	West
1980	545	50	81	267	146
1981	436	46	60	219	112
1982	412	47	48	219	99
1983	623	76	71	324	152
1984	639	94	76	309	160
1985	688	112	82	323	170
1986	749	136	96	321	196
1987	671	117	97	271	186
1988	676	101	97	276	202
1989	650	86	102	260	202
1990	534	71	89	225	149
1991	509	57	93	215	144
1992	610	65	116	259	170
1993	813	51	206	329	227
1994	625	46	117	301	161
1995	666	79	127	287	173

Source: US Department of Commerce; National Association of Realtors; Federal Reserve Bank of Chicago [accessed electronically]; US Bureau of the Census [accessed electronically]

Table 5 displays the number of new one-unit residential homes sold in the US by price class between 1980 and 1995. The proportion of new homes sold in the upper price ranges has increased slightly over this time-frame. Most of the increase of new homes sold in the upper ranges is attributable to modest, inflation since there have been no significant housing shortages in any of the four major regions of the US during the period displayed in the table.

Table 5. New one-unit residential homes sold in the US by price class, 1980-1995 (in thousands).

Year	US Total	Under $80,000	$80,000 to $99,999	$100,000 to $119,999	$120,000 to $149,999	$150,000 to $199,999	$200,000 and Over
1980	545	384	68	--	--	--	--
1981	436	277	63	--	--	--	--
1982	412	266	60	--	--	--	--
1983	623	354	113	--	--	--	--
1984	639	323	125	--	--	--	--
1985	688	311	141	68	73	54	40
1986	749	269	164	92	83	77	64
1987	671	182	138	84	99	84	84
1988	676	160	121	87	108	93	107
1989	650	141	103	81	103	97	125
1990	534	110	84	63	88	86	102
1991	509	99	88	65	86	82	89
1992	610	100	117	79	111	97	107
1993	813	--[a]	--	--	--	--	--
1994	625	--	--	--	--	--	--
1995	666	--	--	--	--	--	--

[a] Information not available at time of study.

Source: US Department of Commerce; National Association of Realtors; Federal Reserve Bank of Chicago [accessed electronically]; US Bureau of the Census [accessed electronically]

Table 6 displays the median price of new one-unit residential homes sold in different regions of the US. Similar to that of existing one-unit homes, the median selling price of new one-unit homes has increased across each of the four regions. However, the rate of increase is somewhat greater for new one-unit homes. For example, the average annual increase in the median selling price of new one-unit homes across the US has been about 5.5% since 1980. The average annual increase according to geographic region has been the greatest in the Northeast, at approximately 7.9%. The West and Midwest follow at 5.3% and the South at 4.9%. As with the price of existing one-unit homes, a significant amount of the increase in the median selling price across all geographic regions occurred between 1985 and 1989.

Table 6. Median price ($) of new one-unit residential homes sold in the US by region, 1980-1992.

		Region			
Year	**Median**	**Northeast**	**Midwest**	**South**	**West**
1980	64,600	69,500	63,400	59,600	72,300
1981	68,900	76,000	65,900	64,400	77,800
1982	69,300	78,200	68,900	66,100	75,000
1983	75,300	82,200	79,500	70,900	80,100
1984	79,900	88,600	85,400	72,000	87,300
1985	84,300	103,300	80,300	75,000	92,600
1986	92,000	125,000	88,300	80,200	95,700
1987	104,500	140,000	95,000	88,000	111,000
1988	112,500	149,000	101,600	92,000	126,500
1989	120,000	159,600	108,800	96,400	139,000
1990	122,900	159,000	107,900	99,000	147,500
1991	120,000	155,900	110,000	100,000	141,100
1992	121,500	169,000	115,600	100,000	141,100
1993	126,500	--[a]	--	--	--
1994	130,000	--	--	--	--
1995	133,000	--	--	--	--

[a] Information not available at time of study.

Source: US Department of Commerce; US Bureau of the Census [accessed electronically]

REVIEW OF THE RESIDENTIAL DECKING MARKET

There have been remarkably few research studies investigating the residential decking market despite its considerable size. After a thorough search of a number of databases, only a dozen articles and reports were found to examine, either specifically or tangentially, the residential decking market. Therefore, due to the modest amount of information currently available, this section on residential decking products attempts to draw together all the information contained within these dozen sources. Future research must address gaps in the available data to support development of a marketing strategy for residential decking material.

General Residential Decking Market Information

The demand for residential decking materials is a function of several factors. First, the number of new residential home starts influences the demand for residential decking materials. US Department of Commerce data reveals that over 85% of new single-family homes include either a deck, patio, porch, or balcony. Second, the amount of activity occurring in the residential remodeling, renovation, and home improvement markets affects the demand for residential decking materials. Survey results from one study indicate that 4.2% of all households in the US added a deck to their existing home in 1991 (Home Improvement Research Institute 1993). Similarly, consulting research conducted by George Carter & Affiliates (1989b) found that 4.1% of all households in the US added a deck in 1987, which resulted in 3.6 million new decks. Furthermore, the importance of the do-it-yourself market is evident in the fact that nearly 46% of all households have built a deck onto their home as a do-it-yourself

project during their tenure as a homeowner (Home Improvement Research Institute 1993). Finally, the rate of replacement of decks already in place influences the demand for residential decking materials. Currently, the market size for replacement decks is unknown.

Results summarized in George Carter & Affiliate's (1989b) consulting report provide some detail on the general characteristics of the residential decking market in the US during 1987. These include:

- The average cost of a deck was $1,086, with the cost being highest in the Northeast ($1,254) and lowest in the South Central region ($847).
- The major cost element in deck construction was materials, which accounted for 68% of moneys spent.
- The average deck consisted of 86.3 board feet of posts, 251 board feet of joists, and 506 board feet of lumber.
- Decks in the South Atlantic US tended to be nearly twice as large as decks in the US West and South Central regions.

Extremely aggressive price competition, modest product differentiation, economies of scale, and well-developed marketing and distribution systems characterize the residential decking market (D.G. Bell & Associates 1986; Smith and Sinclair 1990). The characteristics of manufacturers of residential decking materials vary. Most firms are small- to medium-sized. However, several large firms supply a significant proportion of residential decking materials in markets located in certain regions of the US, especially rural regions.

Residential Decking Products Available in the Market

Several dozen materials are currently utilized in residential deck construction. Many of these materials, however, are only used in relatively small, regional markets. For example, cypress deck boards are utilized to some extent in the US South. Black locust deck posts have been used in markets in the Upper Midwest. Three types of materials, however, are used to a much greater extent in deck construction than any others. These materials include untreated solid wood (e.g., western red cedar and redwood), treated wood (e.g., southern yellow pine, Douglas-fir, spruce), and wood-polymer composite (Trex™).

Several factors establish the competitive relationships between the materials used in the residential decking market. The relative difference in material, installation, and maintenance costs between the differing products is the primary basis for differentiation. In addition, product quality factors, such as longevity, durability, and maintenance requirements, are also a basis for product differentiation. Product aesthetics and availability of the material have become increasingly important factors for producers of residential decking materials on which to base competition--especially in the remodeling and renovation market, where homeowners complete the deck project themselves.

In the following section, we examine the characteristics of each of the major materials that compete in the residential decking market based on information that is currently available. Specifically, production and distribution, pricing and demand, and promotional characteristics are examined. These characteristics are followed by product characteristics that are considered to differentiate each of the products from competing products. Finally, a general outlook for each product market is made, provided enough information exists to make such an assessment.

Western Red Cedar

Western red cedar is a tree species that grows in significant numbers in the Pacific Northwest, most notably in Washington State and British Columbia. Due to resource location, a majority of western red cedar decking is produced in these two regions. The producers of western red cedar decking materials range from small firms to large corporations. Western red cedar residential decking materials are distributed nationally. A concern in certain US markets, however, is the immediate availability of these materials. A D.G. Bell & Associates (1986) report, for instance, suggests that "*cedar producers helped create the treated wood market in this country*

[Canada] *because of their pricing policies and the quality and the availability of the product* [cedar] *in the eastern part of the country.*"

The demand for western red cedar decking material has remained relatively static in the 1990's. Poor product promotion by western red cedar manufacturers and increased competition from manufacturers of alternative decking materials, especially treated wood, are factors that have created a lagging demand. A survey conducted by George Carter & Affiliates (1989b) found that residential decks constructed of western red cedar utilized significantly less material than decks constructed of either redwood or treated wood. Specifically, results reveal that western red cedar decks are on average constructed with a total of 774 board feet of material, whereas treated wood and redwood decks use 1,029 and 991 board feet of material, respectively. The survey also found that only 4% of all decks in 1987 were constructed of western red cedar material.

Figure 2 displays the national average monthly price of western red cedar, 5/4x6, random length, radius edge decking from January 1992 to May 1996, as well as the national average monthly price of SYP, 5/4x6, 12-foot, treated radius edge decking. Comparing these two residential decking materials reveals that the price of western red cedar is considerably more stable than SYP. Specifically, the standard deviation in price for western red cedar during the 53 months in this time series is $52.30, while SYP treated lumber deviates by $99.12. The price of western red cedar has been relatively stable since the middle of 1994. The higher price of western red cedar decking, however, should make SYP treated wood decking materials somewhat more attractive to price sensitive builders.

The Western Red Cedar Lumber Association produces high-quality promotional and technical literature for western red cedar decking on an industry-wide basis. Promotional materials tend to emphasize the beauty and quality (*i.e.*, image characteristics) of western red cedar decking relative to other available decking materials, as well as the fact that it is a naturally durable wood.

Appearance and natural durability are the primary characteristics that differentiate western red cedar decking from other residential decking materials. Western red cedar decking is also competitively priced relative to alternative residential decking materials. Promotional materials for other residential decking materials tend to emphasize that despite western red cedar's natural durability, it does not necessarily have a longer lifespan when used as a decking material. Competitors also point out that the maintenance costs of western red cedar decks tend to be higher over the lifespan of the deck.

Redwood

Redwood is a tree species that grows in Central and Northern California and in some southern regions of Oregon. Producers of redwood decking materials are essentially small- to medium-sized firms, the majority located in California, who distribute redwood decking nationally. The availability of redwood decking material is much greater than redwood siding. According to a representative from the California Redwood Association, the greater availability of redwood decking materials relative to siding materials is likely due to the fact that the primary market for redwood lumber is the residential deck market.

According to a representative from *Crow's*, the demand and price for redwood lumber has remained fairly stable for the past decade. The price of redwood decking materials is not as sensitive to changes in housing starts and timber constraints relative to western red cedar and southern yellow pine. Unfortunately, neither *Random Lengths* nor *Crow's* tracks prices of redwood lumber.

Industry-wide, the California Redwood Association promotes redwood decking materials. Their promotional and technical information regarding installation and care for redwood decks ranks as the best in the industry. The California Redwood Association does not archive statistical records on redwood decking production or sales.

Figure 2. National average monthly ($) price per MBF of western red cedar and SYP treated lumber residential decking materials, January 1992 through May 1996.

Note: Western red cedar prices net f.o.b. coastal mill; random lengths. SYP prices net f.o.b. treating facility in GA, FL, SC, AL, and MS; waterborne preservatives; quality marked; wet from cylinder; LP-2 at 0.25 lbs./cu.ft.
Source: Random Lengths [SYP]; Crows [western red cedar]

Speculation is that redwood and western red cedar are direct substitutes for one another in the residential decking market. If this is true, it may explain the nearly identical promotional efforts used to market redwood and western red cedar residential decking materials. Redwood residential decking materials, however, are not as available in the national market as western red cedar. Despite this lack of availability, it is reported that 12% of all residential decks constructed in 1987 utilized redwood (George Carter & Affiliates 1989b). In other words, for every residential deck constructed of western red cedar material, three decks of redwood are built. It should be noted, however, that representatives from both *Random Lengths* and *Crow's* believe that western red cedar holds a competitive edge over redwood as a residential decking material, especially in southern and eastern US markets, due to its greater availability in these markets.

Treated Wood

Frequently, wood products are treated with chemical preservatives in order to increase their durability properties. Increasing durability results in an extended lifespan that reduces the need for replacement. Preservative treatment of lumber also reduces the need for oversize design of structural members to compensate for anticipated deterioration. A wide variety of wood species are treated with chemical preservatives in order to increase their durability and lifespan. The most commonly treated softwood species include: Douglas-fir, hemlock, jack pine, lodgepole pine, ponderosa pine, the southern yellow pines (SYP), spruce, true firs, western red cedar, and western white pine. Chromated copper arsenate (CCA) is the predominant chemical compound used to treat wood in the US. However, ammoniacal copper arsenate (ACA), acid copper chromate (ACC), chromated zinc chloride (CZC), and pentachlorophenol are also used as the treating compound.

A number of large and small treating facilities, most located in the US South, US West, and Canada, produce treated lumber in North America. Nearly every type of lumber distributor and retailer in virtually every market in the US distributes treated wood products. Relative to all other decking materials on the market, treated wood is the most readily available.

The decking and fencing markets are the primary drivers of demand for treated wood materials (D. G. Bell & Associates 1986). Treated wood materials are used in eight of every ten residential decks built in the US (George Carter & Affiliates 1989b). Although accurate statistics are not available to determine activity in these two markets, the general consensus from industry representatives is that they are both growing.

Figure 2 displays the national average monthly price of SYP, 5/4x6, 12-foot, treated radius edge decking. As evidenced from this figure, the price of SYP treated decking material is much more erratic than western red cedar decking material of equivalent cross section and surface finish. This is a result of SYP lumber prices being driven more by construction activity than is that of western red cedar lumber.

For the most part, treated wood is promoted by the Canadian Institute of Treated Lumber, the Western Wood Preservers Institute, and the Southern Pressure Treaters Association. These three organizations aggressively promote treated wood to architects and designers, builders, contractors, and do-it-yourself homeowners. They base a significant amount of their promotional efforts on differentiating their product. For example, treated wood is heavily promoted at the retail level on its life span.

Treated wood producers have succeeded in developing a market strategy that differentiates their product from other materials available in the residential decking market. Osmose® and Wolmanized® wood products are highly recognized brands that the treated wood industry promotes directly against western red cedar and redwood residential decking materials. Consumers of treated wood typically receive a 25 to 30 year warranty from the date of purchase and are given detailed product safety information. Additionally, a Southern Pressure Treaters Association representative suggests that the industry has succeeded to some extent in getting distributors and retailers to promote treated wood materials more heavily than substitute materials.

Treated wood decking materials also possess some negative characteristics. The perceived health risk associated with using treated wood is one area that industry promotional efforts have attempted to dispel. One method in

reducing risk has been the creation of major brand image and brand loyalty, which are two factors Sinclair and Smith (1990) cite as being vital in relieving consumers' perception of risk of product use. Disposal of treated wood is another major concern to the industry, especially since there has been an increase in the number of municipalities that have banned treated wood from their landfills. For example, data from the 1994 National Association of Home Builders Annual Industry Survey indicates that 8% of all builders cannot utilize traditional waste disposal methods for treated lumber. Burning treated wood waste is illegal in nearly all US municipalities since the resulting fumes are toxic.

Consistent product quality can also be a problem when utilizing treated wood. In fact, Dost (1982) states that there is "*...substantial evidence that salt treated wood at retail frequently does not meet the requirements of the AWPA* [American Wood-Preservers' Association] *Standards, especially with respect to penetration* [of the treatment]." Dost makes similar comments about West Coast species of wood in an article published in 1988. He suggests that several factors contribute to the poor consistency of treated wood. These include: differences in permeability between species and races of species, differences in preservative formulations, inadequate drying prior to treatment, excessive decay in the wood to be treated, shortened treatment cycles, and a lack of concern by treaters, distributors, specifiers, and code inspectors.

Although treated wood decking materials have several negative perceptions and characteristics, it does not appear to have had an impact on consumer use. As stated in a government report prepared by D.G. Bell & Associates (1986), "*The consumer attitude toward treated lumber has been positive due to merchandising and promotional efforts placed behind the major brands, and although there has been some negative publicity regarding the potential health hazards of the product, no negative sales impact has been apparent.*"

Treated wood decking materials are likely to be the primary competitive threat to western red cedar manufacturers. Despite western red cedar's natural durability, beauty, and cost-competitiveness, consumers have been purchasing treated wood in much greater volume. A study by Smith and Sinclair (1990), however, suggests that consumers' lack of knowledge of the aspects of treated wood could lead to an unstable market. Their study concludes that "*...with no strong opinion regarding the physical risk of treated wood, consumers may be highly susceptible to bad publicity and negative advertisements concerning the safety of treated wood. This is clearly an undesirable situation for the treating industry.*"

Trex™

A newer residential decking material to appear on the market is Trex™, a wood-polymer composite manufactured by Mobil Chemical Company's Composite Products Division. Originally, the composite was marketed as Timbrex® and Rivenite®. Raw materials used in the manufacture of this product include recycled plastic grocery bags, recycled industrial stretch film, sawdust from furniture factories, and used wooden pallets. Individually, these materials are broken down into their basic components, mixed together, and then formed into lumber dimensions utilizing an extrusion process. Extruded boards are available in 2x2, 2x4, 2x6, 2x8, 2x10, 5/4x6, 4x4, 4x6, 6x6, and 6x8 dimensions. While Trex™ is not commonly stocked in all sizes at traditional lumber distribution centers, its distribution network is extensive enough that it can be ordered and quickly delivered with relative ease to any US market.

Trex™ is more expensive than treated lumber. In the Seattle market area, for instance, the price per board foot of 2x4 material is more than double that of 2x4 treated lumber. Table 7 provides an example of the price of Trex™ per lineal foot in various dimensions in the Seattle-Tacoma market. Demand at the consumer level has been relatively weak, most likely due to the lack of local suppliers and consumer knowledge. Trex™ has found its biggest market among municipalities; the product being used in playground equipment, park structures, and as decking on docks, piers, and walkways.

Trex™ is promoted by Mobil Chemical Company at several levels. According to a company representative, Mobil primarily markets Trex™ to architects, builders, renovators, and municipalities. Promotion at the homeowner level has been light, but has increased during the past two years.

Table 7. Price ($) of Trex™ per lineal foot in various dimensions in the Seattle-Tacoma market.

Dimension (inches)	Available Lengths (feet)	Price per Lineal Foot[a] ($)
2x2	4	0.79
2x4	12 and 16	0.98
2x6	12 and 16	1.51
2x8	12	2.17
2x10	8 and 12	2.92
5/4x6	12 and 16	1.28
4x4	8 and 16	2.17
4x6	8 and 12	3.54
6x6	8	5.36
6x8	8	7.55

[a] Prices reflect Spring 1995 price quotations.

Trex™ is a highly differentiated product relative to other residential decking materials. According to Mobil's promotional materials, the product possesses the following characteristics:

- Will not check, split, or rot
- Resistant to insect damage
- Resistant to UV damage
- Can be sawed, routed, sanded, nailed, drilled, and turned on a lathe
- Holds fasteners tighter than wood
- Readily accepts ordinary paints and stains
- Splinter-free
- Superior traction relative to solid wood
- Contains no preservative
- Uses no virgin wood
- Made from reclaimed plastic and wood waste
- Product is 100% recyclable

However, the product also has other desirable features. Trex™, like most composite products, is extremely consistent relative to solid wood residential decking materials. The product is dimensionally stable, and allegedly does not warp, cup, twist, or loosen fasteners. Finally, the product requires minimal maintenance in order to keep it in good condition.

Trex™ does possess some negative characteristics that may hamper its marketability in the residential construction market. Most notable is the price of the product and its availability at local suppliers. In addition, the weight of Trex™ is nearly twice that of lumber of equivalent dimensions (e.g., one 8-foot 2x6 weighs approximately 30 pounds). Hence, it requires more time to handle and install the product, resulting in increased labor costs. Due to the plastic composition of the product, Trex™ is much more flexible than competing solid wood decking materials. In fact, Trex™ is not intended for use as a column, beam, joist, stringer, and other primary structural load-bearing member. Table 8 represents data published by Mobil on the maximum allowable span for decks given various live loads and product dimensions.

Table 8. Trex™ decking span recommendations.

	Live Load (pounds per square foot)[a]				
Dimensions	**100**	**125**	**150**	**175**	**200**
5/4x6	17"	16"	15"	14"	13"
2x4, 2x6, 2x8	21"	20"	19"	18"	17"

[a] Maximum recommended span on center, deflection = length/360

There has been some speculation concerning Mobil's claim that Trex™ is truly an environmentally friendly (Tomsho 1991). To illustrate, some environmentalists favor the reformulation of products so that they can be recycled into their original form (*e.g.*, glass to glass, plastic jugs to plastic jugs). Trex™ can be recycled, but Mobil can only recycle the product back into Trex™. Separation technology has not yet been developed to break Trex™ down into its primary components.

It is difficult to speculate on the future of Trex™ as a residential decking material. First, the distribution of the product is not fully developed at the retailer level. Second, Mobil has just begun to promote the product more heavily at the consumer level. It is too early to evaluate the success of these promotional efforts. Finally, the product could become increasingly expensive to produce if oil prices should substantially increase. Although Trex™ utilizes waste plastics, the price for these wastes will increase proportionately if oil prices rise significantly. Despite these factors, Trex™ should be considered a credible threat to the traditional solid wood materials currently utilized in the residential decking market. The product is highly differentiated, has extremely low maintenance costs, and is promoted and positioned well relative to solid wood residential decking materials.

Market Share of Residential Decking Products

To date, no studies specifically examining the market share of residential decking products have been published or publicly released. Research conducted by George Carter & Affiliates (1989a, p.9) led to the conclusion that "*56.6% of decking materials sold is treated lumber. This is followed by cedar products with a combined market share of 23.3*[%]." However, a caveat to this conclusion states: "*The reader is reminded that a portion of the retailers and builders were selected by Fletcher Challenge distributors* [namely, western red cedar distributors]. *For this reason, there may be a built-in bias favoring cedar products.*" Reviewing other statistics and conclusions, the authors of this study believe that an upward bias on western red cedar products does indeed exist in the George Carter & Affiliates consulting report.

Regardless of the limitation of George Carter & Affiliate's conclusions, their research has come closest in determining the market share for residential decking materials. George Carter & Affiliates (1989b) also conducted a survey in 1987 examining the residential decking market for existing homes. Their survey results indicate that on a board foot basis for three competing residential decking products that treated lumber's market share was over 82%, followed by redwood at 11.5%, western red cedar at 3.2%, and other products at 2.8%. Table 9 displays the board foot data and percentage breakdowns from this survey. Note that the consultant's report states that these numbers are likely to be more reflective of the true market share for different decking products than their previous results due to the sampling methodology involved.

Table 9. Market share, on a board foot basis, for three competing wood products in the US residential deck construction market, 1987.

Residential Siding Material	Total Amount of Lumber Used in US Residential Deck Construction (millions of board feet)	US Market Share (percent)
Treated Wood	3,032.88	82.5
Redwood	428.63	11.5
Western Red Cedar	115.77	3.2
Other	103.36	2.8
Total	3,680.64	100.0

Source: George Carter & Affiliates 1989b

Distribution Channels for Residential Decking Products

Except for treated wood, there has been no study conducted to determine the channels of distribution used for the different types of decking materials. Given that a significant number of residential decks are built by do-it-yourself homeowners, however, it is likely that the predominant distribution agents are retailers.

In a survey of professional contractors and remodelers, Smith and Sinclair (1990) found that retailers supplied 84% of the treated lumber market. Wholesalers supplied 13% of this market, while treating facilities supplied 3%. They also found that builders in the US West purchased a greater amount of their treated wood from wholesalers (73%) and less from retailers (26%).

Perceptions of Residential Decking Products

Since there are so few studies examining residential decking materials, it is nearly impossible to make general conclusions concerning consumer perceptions of the different residential decking materials available to them. Currently, there have been no studies conducted specifically examining consumer perceptions over the range of residential decking materials available. This review of consumer perceptions of residential decking materials, then, will cover those factors mentioned in the residential decking literature as affecting consumer choice and purchase decision. To reduce the bias in what several studies perceive as being important factors in evaluating perceptions of residential decking materials, we have categorized all the factors that have been mentioned to influence the planning, selection, and purchase process for residential decking. We then proceed to review the results of one study investigating consumer perceptions toward treated wood.

Factors Influencing Preferences for Residential Decking Products

The literature pertaining to residential decking material was thoroughly examined in order to inventory the factors thought to influence the residential decking planning and purchase process. Factors were categorized into three distinct groups of decision makers: the wholesaler/retailer, the builder/contractor/designer, and the homeowner/do-it-yourself.

Within each of the three categories of decision makers, the factors were further broken down according to four general domains; the first being designated the *product qualities* domain. The items listed in this first domain were factors over which a producer of residential decking would have little control in terms of product design. The second set of factors was designated the *economic* domain. These items dealt with price and costs (e.g., maintenance costs, installation costs). The third set of factors, the *manufacturer services* domain, were those for which the manufacturer had considerable control in changing existing consumer perceptions of the factor (e.g., product availability, promotional material provided by manufacturer). The final set of factors was designated the *consumer perception* domain and reflected consumers' beliefs and perceptions about the residential decking material itself that were strongly-held and difficult to change.

Research conducted by the consulting firm of George Carter & Affiliates (1989a) was the only source of information found that examined wholesaler and retailer perceptions of residential decking materials. This study determined that the primary concern among wholesalers and retailers was the service provided by manufacturers of residential decking material, as summarized in Table 10. Retailers and wholesalers are also concerned about product and grade consistency, size variety, on-time delivery of products, and product pretreatment. In addition, manufacturer promotion of the product at the consumer level also ranks as highly important.

The George Carter & Affiliates report suggests that wholesalers and retailers have apprehensions regarding price stability. Exploration of wholesaler and retailer price perceptions, however, is nonexistent in the study. Also not fully researched were product quality and ultimate consumer perceptions that directly influence wholesaler and retailer perceptions of residential decking materials.

Table 10. Factors influencing wholesaler/retailer preferences for residential decking materials.

Factor	Reference(s)
Product Qualities	
Tighter Knots	George Carter & Affiliates 1989a
Economic	
Competitive and Consistent Price	George Carter & Affiliates 1989a
Manufacturer Services	
Product and Grading Consistency	George Carter & Affiliates 1989a
Size Variety	George Carter & Affiliates 1989a
On-time Delivery	George Carter & Affiliates 1989a
Packaging	George Carter & Affiliates 1989a
Product Knowledge	George Carter & Affiliates 1989a
Product Promotion by Manufacturer	George Carter & Affiliates 1989a
Accessories of Same Species Available	George Carter & Affiliates 1989a
Pretreatment	George Carter & Affiliates 1989a
Consumer Perceptions	
Natural Material	George Carter & Affiliates 1989a

Table 11 lists the factors influencing the perceptions of builders, contractors, and designers with regard to residential decking products. Please note, however, that some bias does exist in each of the studies cited in Table 11. First, the research conducted by Sinclair and Smith only explores the perceptions toward treated lumber. Second, a bias toward western red cedar products exists in the research carried out by George Carter & Affiliates.

The most important factors influencing the perceptions of builders, contractors, and designers in the residential decking market were those dealing with manufacturer and retailer services, for instance, product and grading consistency, product availability, warranties and guarantees, and whether the product is branded. Interestingly, a large number of factors influencing the perceptions of builders, contractors, and designers dealt with physical aspects of the decking products that could be easily changed by the manufacturer. These include product variety, delivery of material, size variety, moisture content, general appearance, surface cleanliness, radius edged boards, and precision square cut ends.

It should also be noted that product quality factors (*i.e.*, those factors that the manufacturer has little control over) were considered to have little influence on the perceptions of builders, contractors, and designers. Structural properties, durability, susceptibility to wear, and straightness were product quality factors bearing some impact on perceptions.

The primary consumer perceptions that builders, contractors, and designers felt influenced their preferences for residential decking materials were focused on product safety issues, most notably concerning treated lumber. These consumer perception factors included disposal of waste material, handling safety, safety for outdoor applications, and risk to children.

Table 12 displays a list of factors that influence homeowner and do-it-yourself consumer perceptions of residential decking materials. These factors are similar to those factors influencing builders, contractors, and designer perceptions. Perhaps the similarity is not surprising given that a majority of decks are homeowner-built.

Services that manufacturers and retailers provide with the sale of decking materials appear to have the greatest influence on homeowners and do-it-yourself consumer perceptions. This is advantageous to manufacturers since services provided by manufacturers and retailers are the most easily adjustable compared to issues regarding product quality, economics, and consumer perceptions.

Table 11. Factors influencing builder/contractor/designer preferences for residential decking materials.

Factor	Reference(s)
Product Qualities	
Odor Emissions	Sinclair and Smith 1990
Fade Resistance	George Carter & Affiliates 1989a
Structural Properties	George Carter & Affiliates 1989a
Durability	George Carter & Affiliates 1989a; Sinclair and Smith 1990
Susceptibility to Wear	George Carter & Affiliates 1989a
Straightness	Smith and Sinclair 1990
Manufacturer/Retailer Services	
Product Availability	George Carter & Affiliates 1989a
Product and Grading Consistency	George Carter & Affiliates 1989a; Smith and Sinclair 1990
Branded Product	Sinclair and Smith 1990; Smith and Sinclair 1990
Dealer Reputation	Smith and Sinclair 1990
Knowledgeable Salespeople	Smith and Sinclair 1990
Price Incentives	Smith and Sinclair 1990
Warranty/Guarantee	George Carter & Affiliates 1989a; Smith and Sinclair 1990
Product Knowledge	George Carter & Affiliates 1989a
Product Variety	Smith and Sinclair 1990
Convenient Distribution Location	Smith and Sinclair 1990
Delivery of Material	Smith and Sinclair 1990
Retailer Service and Promotion	Smith and Sinclair 1990
Color Selection	Smith and Sinclair 1990
Size Variety	George Carter & Affiliates 1989a
Moisture Content	Smith and Sinclair 1990
Quality Mark	Smith and Sinclair 1990
Chemically Treated	Sinclair and Smith 1990
Chemical Retention Level	Smith and Sinclair 1990
Kiln-Dried After Treatment	Smith and Sinclair 1990
Long Lengths	George Carter & Affiliates 1989a
General Appearance	Smith and Sinclair 1990
Surface Cleanliness	Smith and Sinclair 1990
Pretreated	George Carter & Affiliates 1989a
Radius Edged	George Carter & Affiliates 1989a
Precision Square Cut Ends	George Carter & Affiliates 1989a
Consumer Perceptions	
Disposal of Waste Material	Sinclair and Smith 1990
Handling Safety	Sinclair and Smith 1990
Inhalation of Sawdust	Sinclair and Smith 1990
Safe for Outdoor Applications	Sinclair and Smith 1990
Risk to Children	Sinclair and Smith 1990

Safety issues also appear to be a much larger issue with the homeowner and do-it-yourself residential decking market segment than for the builder, contractor, wholesaler, and retailer segments. Research by Sinclair and Smith (1990) reveals that disposal problems, handling safety, and risk to children and animals are important issues in the homeowner and do-it-yourself residential decking market. Note again, that Sinclair and Smith were investigating only the treated lumber market.

Table 12. Factors influencing homeowner/do-it-yourself consumer preferences for residential decking materials.

Factor	Reference(s)
Product Qualities	
Odor Emissions	Sinclair and Smith 1990
Flammable	Sinclair and Smith 1990
Durability	Sinclair and Smith 1990
Fire Resistance	D.G. Bell & Associates 1986
Straightness	Smith and Sinclair 1989
Economic	
Final Installed Price	D.G. Bell & Associates 1986; Smith and Sinclair 1989
Manufacturer/Retailer Services	
Product Availability	D.G. Bell & Associates 1986
Product and Grade Consistency	Smith and Sinclair 1989
Branded Product	Sinclair and Smith 1990; Smith and Sinclair 1989
Dealer Reputation	Smith and Sinclair 1989
Price Incentives	Smith and Sinclair 1989
Warranty/Guarantee	Smith and Sinclair 1989
DIY Plans	Smith and Sinclair 1989
Quality Mark	Smith and Sinclair 1989
Surface Cleanliness	Smith and Sinclair 1989
Chemical Retention Level	Smith and Sinclair 1989
Kiln-Dried After Treatment	Smith and Sinclair 1989
Moisture Content	Smith and Sinclair 1989
Product Variety	Smith and Sinclair 1989
Convenient Distribution Location	Smith and Sinclair 1989
Delivery of Material	Smith and Sinclair 1989
Color Variety	D.G. Bell & Associates 1986; Smith and Sinclair 1989
Chemically Treated	Sinclair and Smith 1990
Retailer Service and Promotion	Smith and Sinclair 1989
Knowledgeable Salespeople	Smith and Sinclair 1989
Consumer Perceptions	
Disposal of Waste Material	Sinclair and Smith 1990
Handling Safety	Sinclair and Smith 1990
Inhalation of Sawdust	Sinclair and Smith 1990
Safe for Outdoor Applications	Sinclair and Smith 1990
Risk to Children	Sinclair and Smith 1990
Risk to Animals	Sinclair and Smith 1990
Meets Building Code Requirements	D.G. Bell & Associates 1986

Results of Previous Residential Decking Preference Studies

Only three research papers exist in the literature that specifically examine the preferences and opinions of individuals toward various residential decking materials. George Carter & Affiliates (1989a, 1989b) examined treated lumber, redwood, and western red cedar decking materials. Meanwhile, Smith and Sinclair (1989, 1990) examined consumer and builder perceptions toward treated lumber. A brief summary of results from these three studies follows in this section.

In a document prepared for Fletcher Challenge Canada, George Carter & Affiliates (1989a, 1989b) report on the decking markets in North America. Specifically, the objective of their research was "*to talk to a cross section of builders and retailers to determine what they use or sell, their attitudes and perceptions of cedar products, and to search for product modifications or elements of service that would enhance the products currently offered by Fletcher Challenge.*"

For retailers, George Carter & Affiliates summarizes:

- Decking manufacturers can distinguish themselves most with retailers by providing a material of consistent quality. On-time delivery and product promotion are the second and third most important means for manufacturers to distinguish themselves.
- Roughly 20% of retailers would pay extra for improvements to western red cedar decking products.
- Few suggestions are provided to make decking grade lumber more desirable, other than to maintain consistent product quality, sell material with tighter knots, and sell it in longer lengths.
- Suggested changes for services and packaging included the development of "how to" books on building and finishing, color brochures displaying deck designs, and explanations of differing grades of lumber and how and when to use them.
- Most retailers did not consider home centers a threat to decking material sales. However, those retailers that did see home centers as a threat felt that they were losing sales due to lower prices and heavier advertising by home centers.

For builders, the following summary was made:

- Builders preferred deck lumber that was 6 inches wide, 16 feet long, and either 2 inches or 5/4 inches thick.
- Builders stressed the importance of having at least one face and edge with sound tight knots.
- Few suggestions are given to improve western red cedar decking other than to treat it to make it more durable.
- No suggestions were aimed at changing service or packaging that would help decrease the construction time for the builder or to improve the installation method.
- Interest was expressed among builders to develop technical and deck design information.

The conclusion drawn in the George Carter & Affiliates (1989a) report is far from encouraging. Specifically, it is stated (p.15) that "*There appears to be very little opportunity for creating a truly unique decking product that allows a manufacturer to stand out from the crowd. Too few builders express interest in any kind of feature that would allow a manufacturer to focus on as a marketable attribute*" [sic].

Table 13. Ratings of selected CCA-treated lumber product attributes by professional contractors and remodelers and do-it-yourself consumers.

Product Attribute[a]	Professional Contractor/Remodeler[b]	Do-It-Yourself Consumer[c]
Straightness	4.47	4.72
General Appearance	3.85	4.29
Price	3.83	4.12
Grade	3.82	4.22
Surface Cleanliness	3.47	4.05
Chemical Retention Levels	3.45	3.69
Kiln Dried After Treatment	3.30	3.67
Moisture Content	3.24	3.85
Quality Mark	2.99	3.71
Species	2.77	3.49
Color	2.57	2.99
Brand Name	2.28	2.98

[a] Attributes were rated on a five point Likert scale, where 1 = "not important at all" and 5 = "extremely important".
[b] Number of responses for professional contractors/remodelers was 434 from a survey with a 18% response rate.
[c] Number of responses for do-it-yourself consumers was 302 from a survey with a 17% response rate.
Source: Smith and Sinclair (1989, 1990)

Articles by Smith and Sinclair (1989, 1990) examine consumer and builder perceptions toward treated lumber. Specifically, their articles examine the perceptions of professional contractors and remodelers, as well as do-it-yourself consumers, toward CCA-treated lumber products. They report the ratings of selected product attributes, which are summarized in Table 13 above. A summary of ratings of selected service attributes is provided in Table 14.

Table 14. Ratings of selected CCA-treated lumber service attributes by professional contractors and remodelers and do-it-yourself consumers.

Service Attribute[a]	Professional Contractor/Remodeler [b]	Do-It-Yourself Consumer[c]
Pressure Treated Product Variety	3.52	4.09
Convenient Location	3.44	3.99
Short Delivery Lead Times	--	3.97
Delivery Service	2.76	--
Warranty	3.03	3.93
Dealer Reputation	--	3.85
Store Reputation	3.37	--
Price Incentives	3.17	3.74
Knowledgeable Salespeople	3.54	3.72
Promotional Materials	2.58	3.01
DIY Plans	3.08	--

[a] Attributes were rated on a five point Likert scale, where 1 = "not important/very unimportant at all" and 5 = "extremely important/very important".
[b] Number of responses for professional contractors/remodelers was 434 from a survey with a 18% response rate.
[c] Number of responses for do-it-yourself consumers was 302 from a survey with a 17% response rate.
Source: Smith and Sinclair (1989, 1990)

The results reported in Smith and Sinclair's articles led them to develop several strategic recommendations for manufacturers of treated lumber. From the professional contractor and remodeler perspective, Smith and Sinclair suggest that manufacturers increase usage among current users through innovative product modifications. Additionally, they recommend protecting the existing customer base for treated lumber through increased brand or company loyalty. Having the manufacturer stress the company or brand differences, as well as brand benefits relative to alternative products, materials, or competitors are suggested methods to increase loyalty. Finally, they recommend an aggressive defensive strategy against competitors producing substitutes such as natural durable species (*i.e.*, western red cedar, redwood). In this case, they suggest (p.14) that a manufacturer's defensive strategy consist of active promotional programs such as "*in-store presentations, advertising, improved service, and new product development such as radius edged decking, deck kits, or color tints.*"

From the do-it-yourself consumer perspective, Smith and Sinclair suggest that manufacturers concentrate on improving the appearance of treated lumber, which would ultimately lead to improved customer satisfaction and increased demand. Second, they suggest that a brand be developed in which the variability in appearance within a grade is minimized, so that the product has a uniform, high-end appearance. Finally, they suggest that retailers should have a sales force that has knowledge of treated lumber and the applications in which utilization of treated lumber is applicable.

Sinclair and Smith (1989, 1990) also had survey participants rate several opinion statements regarding treated lumber. Table 15 provides a summary of the results of these opinion statement ratings. These results provide two points of interest. The first is somewhat technical, but crucial in interpreting the results accurately. The scale used in this survey was balanced. In other words, a rating of 3.00 essentially means that the respondent, or in this case the average score of all survey respondents, neither agreed nor disagreed with the opinion statement. Unfortunately, Smith and Sinclair fail to perform a specific statistical test (*i.e.*, Hotelling's T^2) that could easily determine whether the aggregate response scores to the opinion statements were significantly different from a neutral response of 3.00. Thus, we have no way of determining whether the aggregate response scores for each opinion statement were in the positive (strongly agree) or negative (strongly disagree) direction. Therefore, some caution is advised when interpreting the results shown in Tables 13, 14 and 15.

Table 15. Ratings of opinions of CCA-treated lumber products by professional contractors and remodelers and do-it-yourself consumers.

Opinion[a]	Professional Contractor/Remodeler[b]	Do-It-Yourself Consumer[c]
Will pay more for higher quality/appearance-treated lumber	3.69	3.60
Am satisfied with quality/appearance of treated lumber	--	3.51
Brand named treated lumber is generally of superior quality	3.24	3.14
Retail salespeople are knowledgeable about treated lumber	2.51	2.99
Will pay more for brand named treated lumber	2.92	2.92
More concerned with appearance than grade or species of treated lumber	3.07	2.80
Will pay more for treated lumber versus cedar/redwood	--	2.73
Will pay more for kiln dried after treatment treated lumber	3.44	--

[a] Attributes were rated on a five point Likert scale, where 1 = "strongly agree at all" and 5 = "strongly disagree".
[B] Number of responses for professional contractors/remodelers was 430 from a survey with a 18% response rate.
[C] Number of responses for do-it-yourself consumers was 464 from a survey with a 17% response rate.
Source: Smith and Sinclair (1989, 1990)

The second point concerns the comparison of the scores of professional contractors and remodelers with those of do-it-yourself consumers. The two survey instruments used to evaluate these two groups of consumers of treated lumber products contained subtle but noticeable differences. Therefore, we suggest that direct comparisons between the two groups of consumers be made with some caution since the respondents were completing their surveys under slightly differing pretexts.

Competitive Position of Western Red Cedar Residential Decking Products

Given the lack of research, it is somewhat difficult to provide an accurate assessment of the competitive position of western red cedar materials in the residential decking market. One conclusion, however, is that treated lumber and redwood materials have negatively impacted the market share of western red cedar residential decking materials. Furthermore, market share erosion is likely to occur as Mobil Chemical Company increases promotional efforts directed at the consumer level for its Trex™ product.

The literature review suggests that individuals focus on product quality factors (e.g., structural properties, durability, susceptibility to wear) and manufacturer and retailer service factors (e.g., product availability, price incentives, moisture content) when selecting residential decking material. Unlike the residential siding market, image, beauty, and social status factors are not fundamental determinants in consumer choice for decking materials. Therefore, it is likely that western red cedar does not "sell itself" on its image and beauty characteristics. Marketing efforts designed to display only image and beauty characteristics of western red cedar decks will likely have a limited effect on changing consumer perceptions.

The authors of this report agree with conclusions reported by George Carter & Affiliates (1989a); namely, it appears that too few consumers express an interest in product features that would allow significant product differentiation. When choosing a material to use in building a deck, do-it-yourself consumers and builders generally see all solid wood materials as being direct substitutes for one another. Therefore, price, availability of

materials, and characteristics of in-stock products (e.g., warped boards) appear to be the major drivers of competition in the residential decking market.

There are several techniques firms can employ to create product differentiation for commodity products and increase both sales and market share. For instance, western red cedar producers could physically differentiate their residential decking products by improving quality and durability or providing additional accessories and additional elements of service.

Western red cedar producers could also differentiate their product through properly designed marketing efforts. Changing price, providing discounts, offering guarantees or warranties, improving packaging, improving service levels, changing advertising strategy, devising promotions, and changing the image of the product are several market-oriented strategies that can possibly increase sales and market share of western red cedar residential decking materials. The treated lumber industry has successfully used a positioning strategy to create consumer awareness and knowledge of their products. Essentially, their positioning strategy changed the image of a product once viewed as substandard to a naturally decay resistant species. Also, Mobil Chemical Company employs a marketing strategy for its Trex™ product that emphasizes attributes that Trex™ possesses that market research has found to be important to consumers.

A significant amount of market research has yet to be conducted on the residential decking product market. Such research would allow for a more accurate assessment of western red cedar relative to its substitutes. For example, the only market share estimates known to exist for various decking materials are nearly a decade old and are inaccurate due to a flawed sampling methodology. These poor estimates led the investigating consulting group to report that the market share for western red cedar in the residential decking market was as high as 23.3% and as low as 3.2% in 1987. Hence, we suggest analyses of the following areas before making any conclusive assessments of the residential decking market:

- Accurately determine the size of the residential decking market.
- Accurately determine the size of the replacement market for residential decks.
- Examine the distribution system utilized for residential decking materials on a national and regional scale.
- Collect accurate market share estimates on a national and regional scale.
- Examine consumer, builder, and installer preferences of all available residential decking materials in the market.
- Complete a competitor analysis for each of the major residential decking materials to determine elements of marketing success and failures.

REVIEW OF THE RESIDENTIAL SIDING MARKET

Nearly three dozen research studies have been conducted in the past twenty years that examine the residential siding market. The specific objectives of these studies have been extremely varied. Some studies specifically examine the residential siding market, while others investigate a host of building materials used in residential home construction. In this review, we pull together information from a variety of sources in order to provide an assessment of the current status of the North American residential siding market.

General Market Information

Demand for residential siding materials is a function of two factors; namely, the level of new residential home construction starts and the level of replacement, repair, remodeling, and addition activity taking place on existing residential housing units. While residential siding demand increases and declines with changes in the cycle of residential home building, the demand for siding materials is relatively stable when compared to many other building products. The stability is an outcome of the size of the replacement and remodeling markets, which have accounted from anywhere from 25% to 33% of all residential siding use (square foot basis) during the past decade (Breckling 1984; Stalling 1988).

As a whole, the residential siding industry can be characterized by the following: relatively aggressive price competition, low product differentiation despite the significant contrasts in the physical attributes of the materials

available, economies of scale, well-developed marketing and distribution systems, and intensification of competition among materials, manufacturers, and distributors (Breckling 1984). Manufacturers of residential siding materials are typically large, vertically integrated, and highly concentrated. As several individuals studying the residential siding market point out, these characteristics motivate siding producers to compete principally on the basis of high volume, mass distribution, and low cost.

Over the past 80 years, residential siding materials have changed rather gradually. Traditional residential siding materials such as solid wood, wood shingle, and brick are still important in providing distinct structural features and external appearance. Since the purchase of a house generally represents a household's single largest investment, it encompasses the need for tradition and durability. New materials and innovations introduced into the residential construction market are not quickly adopted.

Notwithstanding the strength of tradition and the superior structural performance of conventional residential siding materials, new innovative residential siding materials have made significant market penetration. These inroads into the residential siding market have typically begun in the residential siding replacement market. For instance, asbestos-cement and asphalt shingles gained significant market share in the 1950's (Predicasts 1967). Aluminum made a strong appearance in the 1960's, followed by vinyl in the 1970's and 1980's. In each case, these new materials gained a foothold into the new home siding market by first building market share in the residential siding replacement market.

Solid wood was the primary residential siding material prior to 1955, but since has experienced a continuous decline. In 1950, for example, over one-third of all new single family homes used some form of solid wood siding. During the 1950's, solid wood's market share climbed as high as 43% (Predicasts 1967). The use of alternative materials was the primary cause of solid wood's decline in use as residential siding. However, solid wood's vulnerability to fire and deterioration, heaviness, lack of versatility, difficulty in handling, and installation labor costs precipitated the decline.

Residential Siding Materials Available in the Market

Properly defined, residential siding is an exterior facing for low-rise structures. Larger structures, such as high-rise apartments and office buildings, use exterior facing usually referred to as "curtain-wall." While residential siding and curtain-wall have similar properties, their engineering characteristics, marketing channels, construction skills, and installation are substantially different (Predicasts 1967).

Estimates suggest that fifteen different materials are used for residential siding (Breckling 1984). For the most part, the competitive relationships between the materials used in the siding market are based on relative differences in material and installation costs. Product quality factors, such as longevity, durability, and maintenance requirements, are also a basis for competition, but to a lesser degree. Additionally, product aesthetics increasingly receive attention in the literature concerning residential siding.

In this section, we examine the characteristics of each of the major materials that compete in the residential siding market. Specifically, production and distribution, pricing and demand, and promotional characteristics are examined. These characteristics are then followed by product characteristics that are considered to differentiate each of the products from their competitors. Finally, a general outlook for each product market is made, provided enough information exists to make such an assessment.

Western Red Cedar

Western red cedar is a tree species that grows in significant number in the Pacific Northwest, most notably in Washington State and British Columbia. Due to resource location, nearly 100% of western red cedar siding production takes place in these two regions. Producers of western red cedar siding range from small firms to large corporate entities. Unlike other solid wood residential siding products (*e.g.*, cypress, redwood), distribution of western red cedar siding occurs on a national scale. However, there is an increasing concern among builders and designers of new homes regarding the availability of this material.

The demand for western red cedar siding has remained static over the past decade. According to representatives from the WRCLA, lack of demand for western red cedar siding is attributable to poor product promotion by producers and increased competition from substitute residential siding materials. However, some concern over the availability of western red cedar siding has been raised by retailers/wholesalers and builders/designers. For the national average monthly price of better grades of western red cedar siding, as shown in Figure 3 and Figure 4, has been somewhat unstable. Currently, prices of Clear VG Grade siding are nearly 25% greater than prices in January 1993, for both 1/2" x 6" and 1/2" x 8" sizes. According to reports by *Random Lengths*, prices have recently risen due to increased timber harvesting constraints in Canada and the US, as well as poor harvesting conditions in several areas.

As Table 16 displays, the installation cost of western red cedar is quite high, with only redwood residential siding having a higher cost. Both material costs and the time required to install western red cedar residential siding contribute to the high cost of installation. According to contractor and builder handbooks, siding installers need approximately 20 to 40% more time to install western red cedar residential siding relative to installing structural panel and vinyl siding materials.

The Western Red Cedar Lumber Association promotes western red cedar residential siding on an industry-wide basis. Though this association is quite small, it has relatively high quality promotional and technical information available. The quality of their promotional materials is similar to that of the California Redwood Association and the APA, and their technical information is similar in quality to that of the American Hardboard Association. Promotional materials tend to emphasize the beauty and quality of western red cedar siding relative to other residential siding materials.

The literature frequently mentions the attributes of appearance and durability as western red cedar siding's primary marketing advantages. In addition, the product tends to project a high status image among homeowners. Western red cedar has several disadvantages relative to non-wood residential siding materials. First, the siding requires periodic maintenance (*e.g.*, painting, refinishing). Second, the siding can weather unevenly, especially when left unfinished. Finally, like all other solid wood products, the siding can cup, check, and warp. Back-priming prior to installation, however, can alleviate many of these dimensional stability problems.

Redwood

Redwood is a tree species that grows in Central and Northern California and in some southern regions of Oregon. Producers of redwood are essentially small- to medium-sized firms, the majority located in California, who distribute residential siding nationally. The availability of the product on short notice, however, is extremely poor across all regions of North America.

According to *Crow's* and *Random Lengths*, the demand for redwood has remained stable for the past decade. As with other wood products, the price of redwood siding tends to fluctuate with changes in raw log supply. Although no private firms or public agencies track redwood siding prices or production, representatives from *Crow's* speculate that redwood siding price fluctuations reflect those of western red cedar. As Table 16 displays, installation costs of redwood are the highest of all common residential siding materials, excluding brick. The bulk of the high installation cost is directly attributable to the cost of the siding.

Industry-wide, the California Redwood Association promotes redwood residential siding. This association provides excellent promotional materials about redwood siding, as well as technical information regarding installation and care for the product over time. The association keeps no statistical records on redwood production or sales; therefore, the main purpose of the association is to promote redwood in several product markets.

Figure 3 National average monthly price ($) per MBF of 1/2" x 6" western red cedar siding by grade.

Note: Prices net, f.o.b. mill, full length bundling, 3' and longer.

Source: Random Lengths

Figure 4. National average monthly price ($) per MBF of 1/2" x 8" western red cedar siding by grade.

Note: Prices net, f.o.b. mill, full length bundling, 3' and longer.
Source: Random Lengths

Table 16. Estimated cost of selected residential siding material installations in 1995.

Siding Matrial	Crew[b]	Daily Output	Man-Hours	Unit	1995 Bare Costs ($)[a] Mat.	Labor	Equip.	Total
Aluminum								
0.24 thick, smooth/embossed, white, single, 8" wide	F-2	515	.031	sq.ft.	1.04	.45	.04	1.53
0.25 thick insulated back, smooth/embossed, white, single, 8"wide	F-2	515	.031	sq.ft.	1.13	.45	.04	1.62
0.26 thick insulated back, shake finish, 10" wide, white	F-2	550	.029	sq.ft.	1.25	.42	.03	1.70
For colors add				sq.ft.	.05			.05
Steel								
Beveled, vinyl coated, 8" wide	1-Carp.	265	.030	sq.ft.	.73	.50	N/A[c]	1.23
Beveled, vinyl coated, 10" wide	1-Carp.	275	.029	sq.ft.	.70	.48	N/A	1.18
Vinyl								
Smooth, white, single, 8" wide	F-2	495	.032	sq.ft.	.63	.47	.04	1.14
Smooth, white, single, 10" wide	F-2	550	.029	sq.ft.	.73	.42	.03	1.18
Smooth, white, double 4" pattern, 8" wide	F-2	495	.032	sq.ft.	.56	.47	.04	1.07
Embossed, white, single, 8" wide	F-2	495	.032	sq.ft.	.63	.47	.04	1.14
Embossed, white, single, 10" wide	F-2	550	.029	sq.ft.	.67	.42	.03	1.12
Embossed, white, double 4" pattern, 8" wide	F-2	495	.032	sq.ft.	.53	.47	.04	1.04
For colors add	F-2			sq.ft.	.05			.05
Western Red Cedar								
Board & batten, "B" grade, 1" x 10"	1-Carp.	400	.020	sq.ft.	1.51	.33	N/A	1.84
Bevel, short lengths, "A" grade, 1/2" x 6"	1-Carp.	250	.032	sq.ft	1.95	.53	N/A	2.48
Bevel, short lengths, "A" grade, 1/2" x 8"	1-Carp.	275	.029	sq.ft.	1.65	.48	N/A	2.13
Bevel, 3' to 16' lengths, clear grade, 3/4" x 10"	1-Carp.	300	.027	sq.ft	2.65	.44	N/A	3.09
Bevel, 3' to 16' lengths, "B" grade, 3/4" x 10"	1-Carp.	300	.027	sq.ft.	2.65	.44	N/A	3.09
Rough sawn, 1" x 4", "B & Btr." Grade, natural	1-Carp.	240	.033	sq.ft.	1.85	.55	N/A	2.40
Rough sawn, 1" x 4", "B & Btr." Grade, stained	1-Carp.	240	.033	sq.ft.	2.20	.55	N/A	2.75
Board & batten, "#3 & Btr." Grade, 1" x 12", natural	1-Carp.	260	.031	sq.ft.	2.25	.51	N/A	2.76
Board & batten, "#3 & Btr." Grade, 1" x 12", stained	1-Carp.	260	.031	sq.ft.	2.49	.51	N/A	3.00
Channel, "#3 & Btr." Grade, 1" x 8", natural	1-Carp.	250	.031	sq.ft.	.95	.53	N/A	1.48
Channel, "#3 & Btr." Grade, 1" x 8", stained	1-Carp.	250	.031	sq.ft.	1.28	.53	N/A	1.81
Redwood								
Board & batten, clear, vertical grain, 1"x10"	1-Carp.	400	.020	sq.ft.	1.96	.33	N/A[c]	2.29
Beveled, clear, vertical grain, 1/2" x 4"	1-Carp.	200	.040	sq.ft.	2.60	.66	N/A	3.26
Beveled, clear, vertical grain, 1/2" x 6"	1-Carp.	225	.036	sq.ft.	1.68	.59	N/A	2.27
Beveled, clear, vertical grain, 1/2" x 8"	1-Carp.	250	.032	sq.ft.	1.68	.53	N/A	2.21
Beveled, clear, vertical grain, 3/4" x 10"	1-Carp.	200	.040	sq.ft.	2.60	.66	N/A	3.26
Channel, clear, 1" x 10"	1-Carp.	285	.028	sq.ft.	2.90	.46	N/A	3.36
T&G boards, clear, 1" x 4"	F-2	300	.053	sq.ft.	3.25	.77	.06	4.08
T&G boards, clear, 1" x 8"	F-2	375	.043	sq.ft.	2.92	.62	.05	3.59
Hardboard								
Lap, prime painted, board finish, lap or grooved, 7/16" thick	F-2	750	.021	sq.ft.	.70	.31	.03	1.04
Lap, prime painted, board finish, lap or grooved, 7/16" thick, stained	F-2	750	.021	sq.ft.	.76	.31	.03	1.10
Oriented Strand Board								
Overlaid, 3/8" thick	F-2	750	.021	sq.ft.	.54	.31	.03	.88

(Continued next page)

Table 16 *(cont.)*. Estimated cost of selected residential siding material installations in 1995.

Siding Matrial	Crew[b]	Daily Output	Man-Hours	Unit	1995 Bare Costs (US$)[a] Mat.	Labor	Equip.	Total
Plywood								
Medium density overlaid, 3/8" thick	F-2	750	.021	sq.ft.	.96	.31	.03	1.30
Medium density overlaid, 1/2" thick	F-2	700	.023	sq.ft.	1.15	.33	.03	1.51
Medium density overlaid, 3/4" thick	F-2	650	.025	sq.ft.	1.45	.36	.03	1.84
Medium density overlaid, texture 1-11, cedar, 5/8" thick, natural	F-2	675	.024	sq.ft.	1.30	.34	.03	1.67
Medium density overlaid, texture 1-11, cedar, 5/8" thick, factory stained	F-2	675	.024	sq.ft.	1.50	.34	.03	1.87
Medium density overlaid, texture 1-11, fir, 5/8" thick, natural	F-2	675	.024	sq.ft.	.88	.34	.03	1.25
Medium density overlaid, texture 1-11, fir, 5/8" thick, factory stained	F-2	675	.024	sq.ft.	.99	.34	.03	1.36
Medium density overlaid, texture 1-11, SYP, 5/8" thick, natural	F-2	675	.024	sq.ft.	.71	.34	.03	1.08
Medium density overlaid, texture 1-11, SYP, 5/8" thick, factory stained	F-2	675	.024	sq.ft.	.81	.34	.03	1.18

[a] Material and equipment costs are increased by 10 percent to account for profit.
[b] A 1-Carp. Crew consists of 1 carpenter and 2 power tools. An F-2 crew consists of 1 carpenter, 1 carpenter helper, and 2 power tools.
[c] Not applicable.
Source: Means Consulting Services (1994)

Redwood siding essentially has the same product characteristics as western red cedar and is promoted in a similar fashion. The primary disadvantage of redwood siding is the lack of availability. For the most part, builders must allow substantial lead time to have the product delivered to the building site when needed. Despite their proximity to manufacturers, California regional markets also require substantial lead-time.

Redwood siding products do not appear to pose a threat to other residential siding materials currently available on the market. The product has traditionally been utilized only on the most expensive homes due to its high price. Furthermore, the California Redwood Association indicates that the use of redwood residential siding is, for the most part, confined to the West Coast market. While the product is distributed nationally, the cost of distribution typically prices the product out of the market that western red cedar siding producers tend to target. A speculation is that consumers perceive little difference between redwood and western red cedar siding materials. Therefore, consumers are likely to choose a product that is less expensive and readily available from the distributor.

Cypress

Bald cypress is a tree species that grows in significant numbers only in the southern tier of states of the US. The distribution of cypress siding is confined to the southern states of Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. A survey conducted by Marsinko, Syme, and Harris (1991) finds that 21% of the mills that processed cypress logs produced residential siding material, 14.2% of all cypress harvested is processed into residential siding material, and that over 25 million board feet of cypress residential siding was produced in 1988. Additionally, the availability of cypress to process was mentioned as a concern of manufacturers.

The Marsinko, Syme, and Harris survey found that several manufacturers felt that competition from other species was eroding the market share of cypress siding in local markets. Approximately one-half of the respondents note that increased western red cedar siding imports from Canada and redwood siding from California are reducing the market share for cypress siding materials in the regional markets of the US South. However, the results were inconclusive regarding whether the demand for cypress products was improving or declining. While price of cypress siding was not specifically examined in the survey, several manufacturers noted that the high market price of cypress siding inhibited product sales.

The Southern Cypress Manufacturers Association promotes cypress on an industry-wide basis. Staff size of this association's office is very limited, and, as a result, the promotional materials that this industry association provides are of rather poor quality when compared to other wood product manufacturing associations. Oversight of member manufacturers' product quality and consistency is nonexistent. The Marsinko, Syme, and Harris survey found that most manufacturers of cypress siding felt that the product was not being promoted within the market. In addition, manufacturers believed that users were not being properly instructed on how to install the product correctly. Promotion of cypress siding appears to be the major problem manufacturers face with regard to increased sales. As the survey reports (p. 64), "*Cedar manufacturers heavily promote their product while cypress manufacturers let the product sell itself.*"

Cypress has traditionally been considered to possess a high resistance to decay and above-average durability. However, research by Choong, Fogg, and Jones (1986) found that cypress can essentially be thought of as two distinct products; old growth with durability, and second growth without durability. These researchers concluded that caution should be taken in using second growth cypress in exposed situations, since resistance to decay is substantially less than that of old growth cypress. According to the Marsinko, Syme, and Harris survey, cypress manufacturers have been concerned about the differences between old growth and second growth cypress residential siding. Cypress siding manufacturers also expressed concern that their siding was being oversold based on its durability in the past and that durability in today's cypress is not as high.

No information exists about the costs associated with the installation of cypress siding. However, it is speculated that the costs are slightly greater than that of western red cedar (see Table 16). Cypress siding does not appear to pose a competitive threat to the other residential siding materials in the market. Unreliable supply of raw material coupled with poor promotional activity has led to a small, regional, and static market for cypress siding products. Note, however, that cypress has competed rather well with other solid wood residential siding products in those areas of the US South where it has been readily available.

Hardboard

Production of hardboard residential siding consists of breaking down wood chips into fibers and reconstituting the fibers into a composite board panel. The panel typically has a medium or high density overlay material to protect the exposed surface from the environment. Frequently, hardboard panels compose the base material to which other materials are attached as veneer (*e.g.*, western red cedar, redwood). Hardboard siding is often referred to as *Masonite* by builders and designers, a legacy of the individual who developed and commercialized the material. Five firms dominate the production of hardboard siding; namely, Abitibi-Price Corporation, Evanite Fiber, Georgia-Pacific Corporation, MacMillan-Bloedel Limited, and Masonite Corporation (a subsidiary of International Paper). The five firms' production facilities, which number less than a dozen that possess significant capacity, are evenly spread throughout North America. Consequently, distribution of hardboard siding is national and the product is readily available at nearly all distribution outlets.

Demand for hardboard siding has been relatively static over the past decade when product shipments are used as a proxy for product sales. In fact, shipments of hardboard siding have declined slightly over the past five years. The literature provides no explanation for the decline in hardboard demand. However, it is known that price is not the factor leading the decline. Relative to all other residential siding materials, hardboard siding is the least expensive to purchase and install. The price fluctuates similarly to that of pulp prices, but is somewhat more stable.

The American Hardboard Association promotes hardboard siding on an industry-wide basis. Although their marketing and promotion staff are quite small, the association prints some of the most comprehensive literature concerning their products. Since the market niche for hardboard siding is homes in the lower price ranges, the association tends to emphasize the cost attribute of their product to consumers while providing very detailed technical information for designers, builders, and installers.

As a residential siding product, hardboard has the distinct advantage of being the price leader in material and installation costs (see Table 16). In addition, the material requires the least amount of skilled labor relative to all

other siding materials (Frost & Sullivan 1980). Hardboard siding can simulate numerous textures and is available in a variety of finishes, giving it the ability to compete with other wood and non-wood residential siding products in the market. The product is generally delivered preprimed or finished, in 16-foot lengths with no knots or defects, and typically has a 25-year substrate guarantee.

The disadvantage of installing hardboard siding that many competing siding material producers tend to point out in their promotional literature is that it requires a significant amount of maintenance, especially painting. Furthermore, relative to solid wood and structural panel siding materials, hardboard residential siding imparts substantially less stiffness to the structure itself.

Currently, the hardboard residential siding market does not appear to be a significant competitive threat to the western red cedar residential siding market. These two siding products are essentially on the opposite ends of the product-niche spectrum; hardboard siding producers targeting the lower end of the home price range and western red cedar siding producers targeting homes in the upper end of the price range. Additionally, there are no foreseeable product innovations that would increase the use of hardboard in mid- to high-priced homes.

Structural Panels

Structural panel residential siding includes two subcatergories of products; namely, oriented strand board (OSB) and plywood. Furthermore, plywood siding includes siding that is completely plywood, as well as plywood faced with another wood-based material such as western red cedar or hardboard. Production of plywood siding occurs throughout North America. Two manufacturers produce OSB siding. Louisiana-Pacific manufacturers a product branded as Inner-Seal®, which possesses a high or medium density overlay face. Louisiana-Pacific's Inner-Seal® siding is the clear leader in the structural panel siding market. Meanwhile, Masonite Corporation (a subsidiary of International Paper) recently started producing its own OSB-backed hardboard-faced residential siding materials. Distribution of structural panel siding is national. While the product is readily available, distributors do not necessarily have it in stock.

According to reports prepared by Adair (1994, 1995) for the American Plywood Association (APA), the use of plywood-based siding products in all markets of the US has generally held steady. OSB-based siding products follow the same trend; however, APA field offices in the Southeast and North Central US indicated signs of growth in OSB-based residential siding use. The price of structural panel siding fluctuates similarly to the price of structural plywood, so its current price is relatively stable.

The APA—The Engineered Wood Association—promotes structural panel residential siding on an industry-wide basis. Relative to other wood industry associations, the APA has a large staff and over 20 field offices situated in six regions of North America. Promotional materials are excellent with regard to product design and use, product properties, and specifications. Oversight of member manufacturers' product quality and consistency is excellent. It appears from comments in APA reports prepared by Adair that word-of-mouth generated by consultants and the media greatly influence structural panel siding promotion. For example, bad publicity after Hurricane Andrew, consultant recommendations against the use of structural panel siding, and suspicion that structural panel siding will not hold up over time were some of the comments submitted by field office representatives concerning their regional market situations.

Structural panel siding has a distinct advantage in that it is a wood-based material with no knots or other visible defects, has excellent structural integrity (*i.e.*, stiff), and is delivered to the market with high product consistency. Additionally, it is produced to a uniform 16-foot length, which makes it much easier to install. Table 16 provides installation costs for several types of structural panel residential siding materials. Note, however, that Louisiana-Pacific has encountered problems with their Inner-Seal® residential siding, especially in Florida and Washington State, where some of their product has delaminated in high moisture environments.

OSB residential siding material has additional disadvantages in that it requires frequent repainting, requires caulking at butt joint gaps, and only a limited number of textures are available. Failure to provide an interior vapor barrier can lead to delamination, as can direct contact with the ground or masonry.

According to Adair's 1995 APA report, the major competition that structural panel siding faces is from hardboard, aluminum, steel, and vinyl siding materials. The report suggests that the majority of structural siding competition is from vinyl siding, while fiber-cement siding products are beginning to appear in the North Central, South Central, and Western American markets. In the Canadian market, APA field representative reports state that Classic Coat® solid cedar lap siding is beginning to make a mark for itself in the Quebec market at the expense of the vinyl and aluminum residential siding products.

Adair's 1995 APA report also provides product and market opportunities for structural panel residential siding. In terms of product opportunities, the report suggests that the manufacturers develop a lower-maintenance product, with low-maintenance finishes and fewer core voids. Additionally, the report suggests that manufacturers improve the production of panels so that they remain flat over time and are less susceptible to delamination. Finally, the report indicates that manufacturers should strive to improve the appearance of structural panel siding.

In terms of market opportunities, the APA report suggests that an increased effort needs to be made to educate builders on the properties of performance-rated panel sidings. Cost-share arrangements with the prefinishing industry should be pursued, vertical residential siding designs should be promoted, and prefinished APA-certified lap siding should be brought to residential construction markets.

Structural panel siding products appear to be somewhat of a threat to the western red cedar residential siding industry. Although structural panel siding materials have traditionally been used on homes in the lower to middle price ranges, they have slowly begun to enter the market for upscale homes. This increased use in upper price range homes can likely be attributed to significantly lower material and installation costs relative to solid wood and brick residential siding materials. Additionally, the consistency of the product has led to its increasing favor among a larger proportion builders.

Vinyl

Vinyl residential siding was introduced in 1963 as an alternative to aluminum and steel residential siding materials. There are currently several producers of vinyl siding; small capacity producers serve local market areas while a few large-capacity producers distribute their residential siding products nationally.

The demand for vinyl siding has increased tremendously in the past five years. The Freedonia Group estimates that the vinyl siding market will increase at 5.5% per year in the US through 1997, exceeding the annual growth projected for the entire siding market (Anonymous 1993). The price of vinyl siding fluctuates to some extent with the price of oil; recently, however, the price of vinyl siding has been relatively stable.

The Vinyl Siding Institute and The Society of the Plastics Industry promote vinyl residential siding industry-wide. These two associations provide technical information for builders and designers. Additionally, they provide some marketing support for manufacturers, but not as aggressively as the APA. As a result, individual vinyl siding manufacturers tend to conduct their own promotional campaigns without assistance from these two associations. Vinyl siding producers and the two associations aggressively pursue the repair/remodel/retrofit market, and much of the vinyl residential siding industry's growth is attributable to this strategy.

Vinyl siding is manufactured with polyvinyl chloride (PVC). As a result, the vinyl industry has a distinct advantage in the residential siding market since siding can be molded into a wide assortment of shapes, textures, sizes, and colors. Installation costs are much lower than that of solid wood and installation of the product is relatively rapid when compared to alternative siding materials (see Table 16). No painting or finishing of vinyl siding is necessary. In addition, the product is corrosion resistant, light, and typically comes with extended warranties.

Vinyl siding does have some disadvantages relative to alternative residential siding materials (Gibson 1993). First, the product lacks stiffness and adds little to the structural integrity of a house. Second, simulated wood textures are poor imitators of real wood. Third, butt joints are not nearly as clean and attractive as that of real wood. Fourth, nailing the product too tightly to the substrate results in buckling due to inadequate room for thermal expansion. Fifth, due to the material's high coefficient of thermal expansion, dark colors are typically not manufactured.

Vinyl siding producers have benefited from decreased log harvesting in the Pacific Northwest as builders have become uncertain about future wood-based residential siding costs and availability (Gardner 1993; Munk 1994). However, price stabilization of timber in 1995 may have decreased builder as well as supplier uncertainty.

Western red cedar siding producers currently do not appear to be significantly threatened by the vinyl siding industry. Vinyl siding competes in the lower price range market of new homes and in the repair and remodeling market. Additionally, builders typically classify vinyl siding as a low-cost, low-image product that is inappropriate to use on more upscale residential homes.

Aluminum

Several producers in North America manufacture aluminum residential siding. Aluminum siding production requires considerable amounts of electrical energy. Nearly 75% of aluminum siding production is located in the Pacific Northwest, where inexpensive hydro-electric power is the primary source of energy (Frost & Sullivan 1980). As a result of a relatively inexpensive and stable source of energy, aluminum siding prices have remained rather steady. The range of distribution of aluminum siding is somewhat scattered relative to solid wood and vinyl siding materials. Distribution coverage is most complete in the North Central and North Eastern sections of the US due to a greater proportion of farming structures that are sided with aluminum. Aluminum siding distribution coverage is even more scattered than the distribution coverage of general aluminum siding (*i.e.*, corrugated sheet aluminum for farm structures and industrial buildings).

The American Architectural Manufacturers Association, which absorbed the Aluminum Siding Association in 1971, promotes aluminum residential siding on an industry-wide basis. This association heavily promotes aluminum siding and provides technical literature to residential home builders and designers. As with vinyl siding, aluminum manufacturers tend to take the lead in promoting their products, leaving the association the duties of compiling and distributing technical information and industry statistics.

Aluminum entered the residential siding market as a result of the material shortages during the Korean War (Predicasts 1967). The siding was originally manufactured as a replacement material but became a strong competitor in the new residential construction market during the last half of the 1970's (Frost & Sullivan 1980). During the first half of the 1990's, however, aluminum residential siding use declined by approximately 50%. Much of the decline is attributable to unfavorable product characteristics. First, the texture of aluminum siding poorly imitates wood relative to vinyl and wood-based composite residential siding materials. There tends to be a strong negative consumer reaction to aluminum residential siding's "metallic" appearance (Predicasts 1967). Second, as Table 16 displays, the cost of installing aluminum siding is greater than that of steel, vinyl, hardboard, OSB, and plywood residential siding materials. While the cost of production has been fairly stable relative to the cost of production for other siding materials, aluminum siding still does not possess a price advantage. Third, aluminum siding is much more limited in the number of profiles, texture, and colors available relative to vinyl siding products. Fourth, improper installation with regard to nailing can cause aluminum siding to buckle and tear. Also, homeowners frequently complain about crackling noises that occur when aluminum siding materials expand and contract with changes in temperature. Fifth, the poor thermal expansion properties often create installation problems at soffitts, gables, flashings, and trim joints. Finally, aluminum siding has distinct problems with color fading, scratching, and dent resistance.

Aluminum, however, does possess some competitive advantages as a residential siding material. The product is durable, noncorrosive, and relatively maintenance free. Additionally, installation of the product is faster than

other residential siding materials and it can installed directly over existing siding. As a result, aluminum siding is a common material for residing and renovation work. Finally, compared to all other siding materials, aluminum has a historically stable price history. Any increases and declines in aluminum siding prices are attributable to changes in vinyl siding prices as aluminum siding manufacturers meet the price changes of the vinyl siding producers.

Aluminum is not a competitive threat to western red cedar residential siding producers. Vinyl has balanced the decline of aluminum as a residential siding material. Speculation is that aluminum siding use will continue to decline as more installers switch to vinyl siding products. As such, the competitive threat of aluminum siding materials should continue to decline over time.

Brick and Stucco

Brick and stucco have a long tradition as residential siding materials. Both siding materials are readily available but are used infrequently due to their cost of installation and the lack of necessary skilled labor in many regions of the US. In most cases, brick is used as an accent siding material. However, a substantial portion of residential homes in the upper price ranges are completely sided with brick or brick veneer.

Promotion of brick and stucco residential siding is poorly organized. It does not appear that any single industry association exists to specifically to address the brick or stucco residential siding industries. Very little promotional literature exists for brick and stucco compared with vinyl, wood, and wood-based panel siding materials. Additionally, the bulk of technical information on brick available for builders and designers comes directly from materials and building handbooks rather than from association or manufacturer literature.

In terms of product characteristics, brick is very expensive as well as much more durable than other residential siding materials. Durability is also a product characteristic of stucco siding when properly installed. Installation costs are high for both brick and stucco siding materials. These two, however, are considered to be the top siding materials by far for projecting a high image/status appearance.

Miscellaneous Materials

Miscellaneous materials infrequently installed in the residential siding market include asphalt shingles, sandwich panels, concrete and cinder block, stone, and asbestos-cement. In the late 1960s, these materials accounted for over one-third of the residential siding market; by 1983, they had declined to about 7% (Breckling 1984). Today, the market share of these materials is less than 1%. Two factors led to the decline in use of these siding materials. First, asbestos was heavily displaced in the market by other residential siding materials and, ultimately, the entire asbestos market collapsed after health concerns were made an issue. Second, the number of new homes constructed with concrete or cinder block exteriors dropped significantly during the 1970s and 1980s.

Market Share and Brand Share of Residential Siding Materials

Using product shipment data as a proxy for sales, the market shares of various residential siding materials can be determined for the North American market. Contacts were made with several industry associations to compile the market share database. The only portion of the data that was not available through industry sources was that for brick. US Department of Commerce product shipment data was used as a proxy for brick sales for single unit detached homes.

The data for brick should be used with caution because it has not been disaggregated in terms of type of residential structure (*e.g.*, single unit detached, multi-unit). Therefore, the data in this report is likely to present an upward bias with regard to brick use as a residential siding material.

Figure 5 displays the product shipments of selected residential siding materials in the North American market based on millions of square feet of surface coverage. Table 17 displays the average annual rates of market share

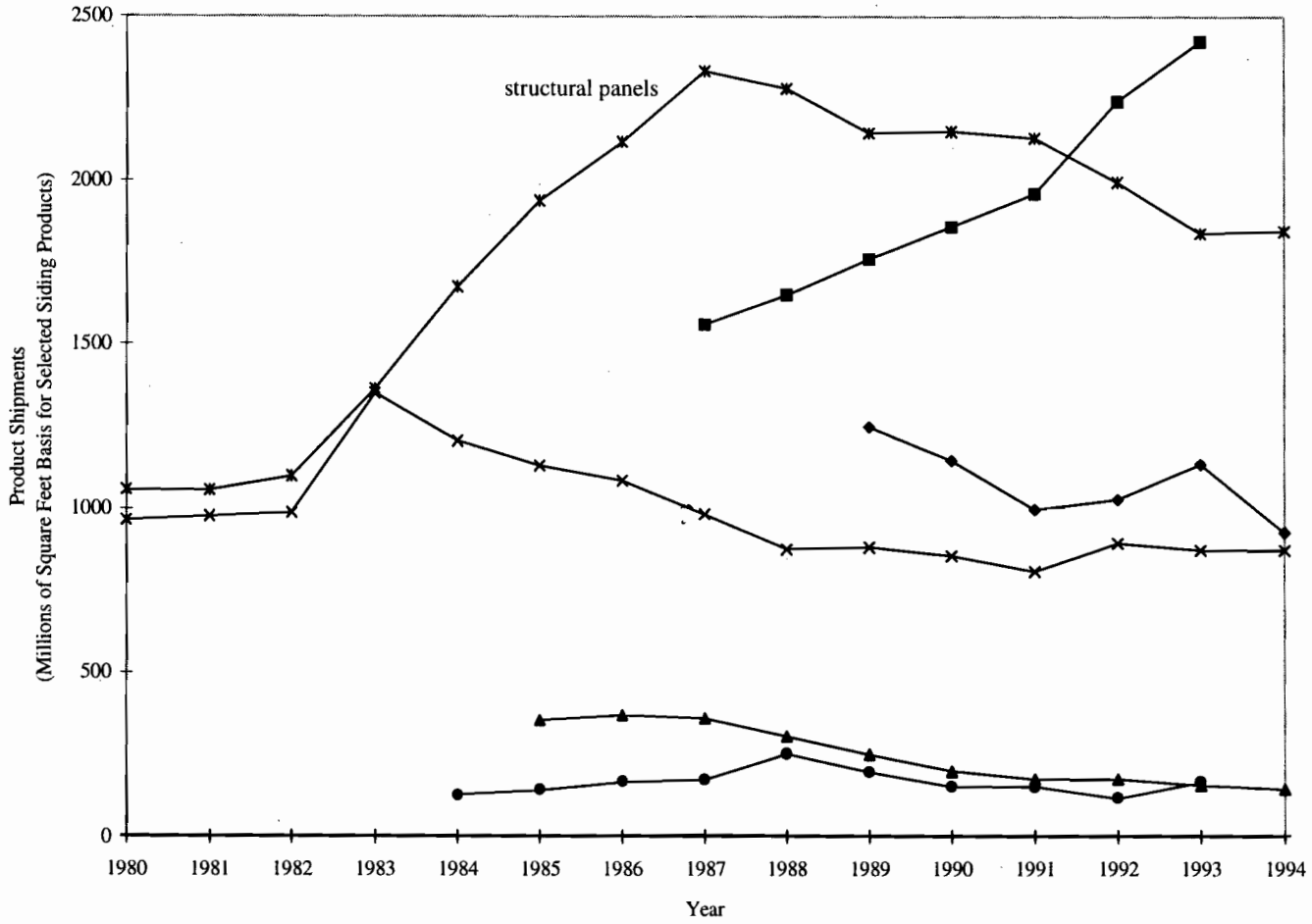

Figure 5 Product shipments of selected residential siding materials in the North American market in millions of square feet of surface coverage, 1980-1994.

Sources: American Plywood Association [structural panels]; Vinyl Siding Institute and The Society of the Plastics Industry [vinyl]; American Hardboard Association [hardboard]; American Architectural Manufacturers Association [aluminum]; Western Red Cedar Lumber Association [western red cedar]; Southern Cypress Manufacturers Association [cypress]; US Department of Commerce, International Trade Administration, *Construction Review* [brick]

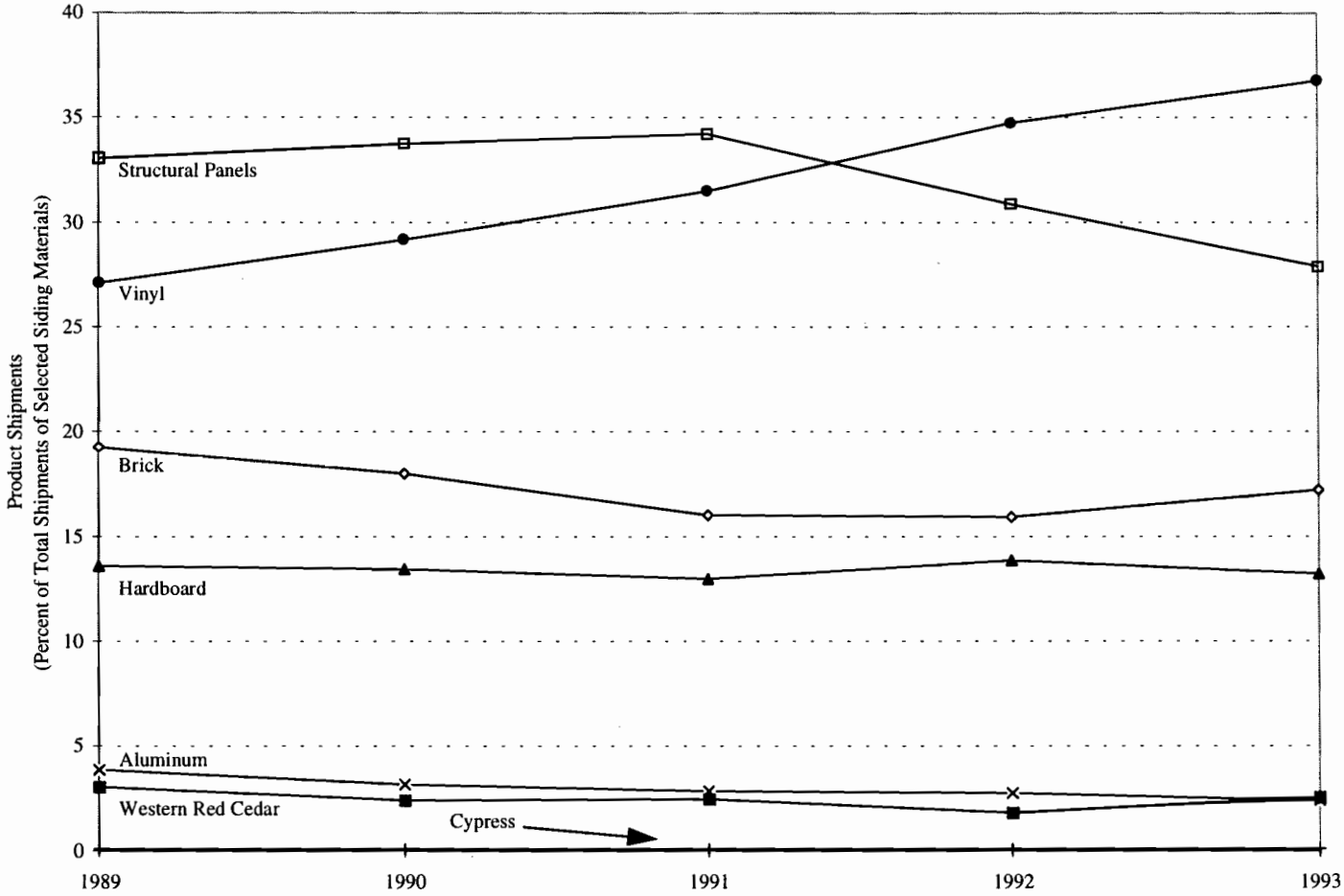

Figure 6. Product shipments as a percent of total market shipments of selected residential siding materials in the North American market, 1989-1993.

Note: Structural panels include OSB and plywood siding materials.

Sources: American Plywood Association [structural panels]; Vinyl Siding Institute and The Society of the Plastics Industry [vinyl]; American Hardboard Association [hardboard]; American Architectural Manufacturers Association [aluminum]; Western Red Cedar Lumber Association [western red cedar]; Southern Cypress Manufacturers Association [cypress]; US Department of Commerce, International Trade Administration, *Construction Review* [brick]

Table 17. Average annual rate of market share growth for selected residential siding materials, 1987-1994.

Residential Siding Material	Average Annual Rate of Market Share Growth (percent)[a]
Vinyl	+10.25
Western Red Cedar	+3.52
Structural Panels	-1.58
Cypress	-2.25
Hardboard	-2.49
Brick	-5.22
Aluminum	-10.94
Total Siding Market	0.46

[a] Usage based on the increase or decrease in product shipments between 1987 and 1994.
Sources: American Plywood Association [structural panels]; Vinyl Siding Institute and The Society of the Plastics Industry [vinyl]; American Hardboard Association [hardboard]; American Architectural Manufacturers Association [aluminum]; Western Red Cedar Lumber Association [western red cedar]; Southern Cypress Manufacturers Association [cypress]; US Department of Commerce, International Trade Administration, *Construction Review* [brick]

growth for several residential siding materials. The overall average annual market growth rate for the selected residential siding materials in this study has been 0.46% since 1987. Vinyl residential siding market share has increased dramatically, experiencing a 10.25% average annual rate of growth since 1987. The only other residential siding material that has experienced increased market share since 1987 is western red cedar, with a modest average annual rate of growth of 3.52%. Structural panels, hardboard, and cypress residential siding materials have experienced modest decreases in market share, while brick and aluminum have incurred significant declines in market share.

Figure 6 displays the market shares for several residential siding materials from 1989 to 1995. Again, note that product shipment data is a proxy for market share. As of 1993, vinyl had the largest share of the residential siding market, at approximately 36.7%. Structural panel siding appears to have experienced the largest decline in market share at the expense of vinyl siding. All other siding products have had a relatively stable or slightly declining market share.

Previous Assessments of Residential Siding Material Market Shares

Table 18 provides an overview of eight studies reporting the market shares of various residential siding materials. Direct comparison between the eight studies is difficult since the data collection methods between studies differed considerably. Investigation of these eight studies does, however, provide some insight into the trends of residential siding use. First, aluminum appears to be fading from the market in favor of vinyl. Second, brick siding is likely to be overestimated by all studies except that by George Carter & Affiliates (1989a).

Residential Siding Material Market Shares in the Remodeling and Replacement Market

The remodeling and replacement markets cannot be ignored when examining market share figures. Together, these two markets account for over 34% of the market for residential siding. US Department of Commerce data indicates that total expenditures for the residential siding alteration and repair market has been between $2.97 and $3.08 billion over the past five years (Figure 7). Between the years of 1970 and 1991, the total expenditures for the residential siding remodel and repair market increased at an annual rate of 13.67%. The annual rate of increase for the major replacement market has been 15.57% during this same time period.

According to data compiled and reported by Stalling (1988), distinctly different materials are used for remodeling and replacement residential siding projects. In the remodeling market, the amount of residential siding sold was approximately 529 million square feet in 1986, representing about 11% of the residential siding market. The amount for the replacement market was approximately 1.1 billion square feet, representing approximately 23% of

Table 18. Market shares reported in the literature for selected residential siding materials.

	Reported Market Shares of Selected Residential Siding Material (percent)								
Material	1966 (Benson 1968)	1980 (Frost & Sullivan 1980)	1983 (Breckling 1984)	1985 (Stalling 1988)	1988 (Geo. Carter & Affiliates 1989b)	1992 (*Builder Magazine* 1993)[a]	1992 (Irland 1993)	1993 (current study)	1995 (Geo. Carter & Affiliates 1995)[b]
Aluminum	9	15.9	17.4	1	11.3	1.4	5	2.4	1.8
Asbestos-Cement	4	10.6	--[c]	--	--	--	--	--	--
Brick	28	--	22.1	26	8.5	20.5	21	17.2	2.8
Concrete Block	--	--	--	--	--	0.4	--	--	--
Cypress	--	--	--	--	--	--	--	0.1	--
Hardboard	21	43.3	17.9	21	18.2	15.7	--	13.2	14.1
Other	5	--	7.5	8	13.1	--	4	--	2.2
Steel	--	--	2.7	--	--	0.5	--	--	2.5
Structural Panels[d]	5	--	16.2	27	14.8	15.8	--	27.9	20.1
Stucco	8	--	--	--	--	16.9	14	--	7.2
Vinyl	--	12.2	13.7	4	22.3	16.1	23	36.7	32.9
Western Red Cedar	--	--	--	--	--	--	--	2.5	7.0
Wood/Lumber	9	5.9	2.5	13	11.8	11.4	33	--	--
Wood Shake/Shingle	11	12.2	--	--	--	1.3	--	--	--

[a] Data contained in *Builder Magazine* report was sourced from F. W. Dodge Residential Statistics, 1992

[b] A 1995 George Carter & Affiliates study cited by Taylor (1996)

[c] Material not reported in particular study.

[d] Structural panels include OSB and plywood residential siding materials.

the residential siding market. Wood-based siding materials comprise 75% of the market for residential siding remodeling as distinct from the replacement market, of which vinyl and aluminum materials hold an estimated 85%, with wood-based materials accounting for only 5%. Figure 8 displays the market shares for remodeling and replacement market segments.

Market Shares of Selected Residential Siding Brands

A survey conducted by *Builder Magazine* (1994) developed a "market share index" of brands of residential siding used by the top 100 builders of homes in the US. Specifically, the builders were asked, "*Which* [residential siding] *brands does your company use the most in each of the listed product categories for entry-level and move-up houses*?" It appears from the results of the survey that hardboard and OSB siding materials are the most frequently used residential siding materials among the largest home builders, as displayed in Table 19.

Table 19. Brands of residential siding used in entry-level and move-up homes according to the top 100 home builders in the US, 1994.

Siding Brand	Entry-Level (percent)	Move-Up (percent)	Siding Brand	Entry-Level (percent)	Move-Up (percent)
Masonite	19	15	Olympic	2	2
Louisiana-Pacific	12	9	Norandex	2	2
Reynolds	10	5	Celotex	2	2
Alcoa	10	7	Heartland	2	2
Wolverine	7	3	Alside	2	2
Alsco	3	2	Hardie	2	2
Rollex	5	2	Temple-Inland	--	5
Abitibi-Price	3	7	Local Manufacturer	2	2
Georgia-Pacific	3	3	Commodity	12	9
Weyerhaeuser	3	2			

Source: *Builder Magazine* 1994

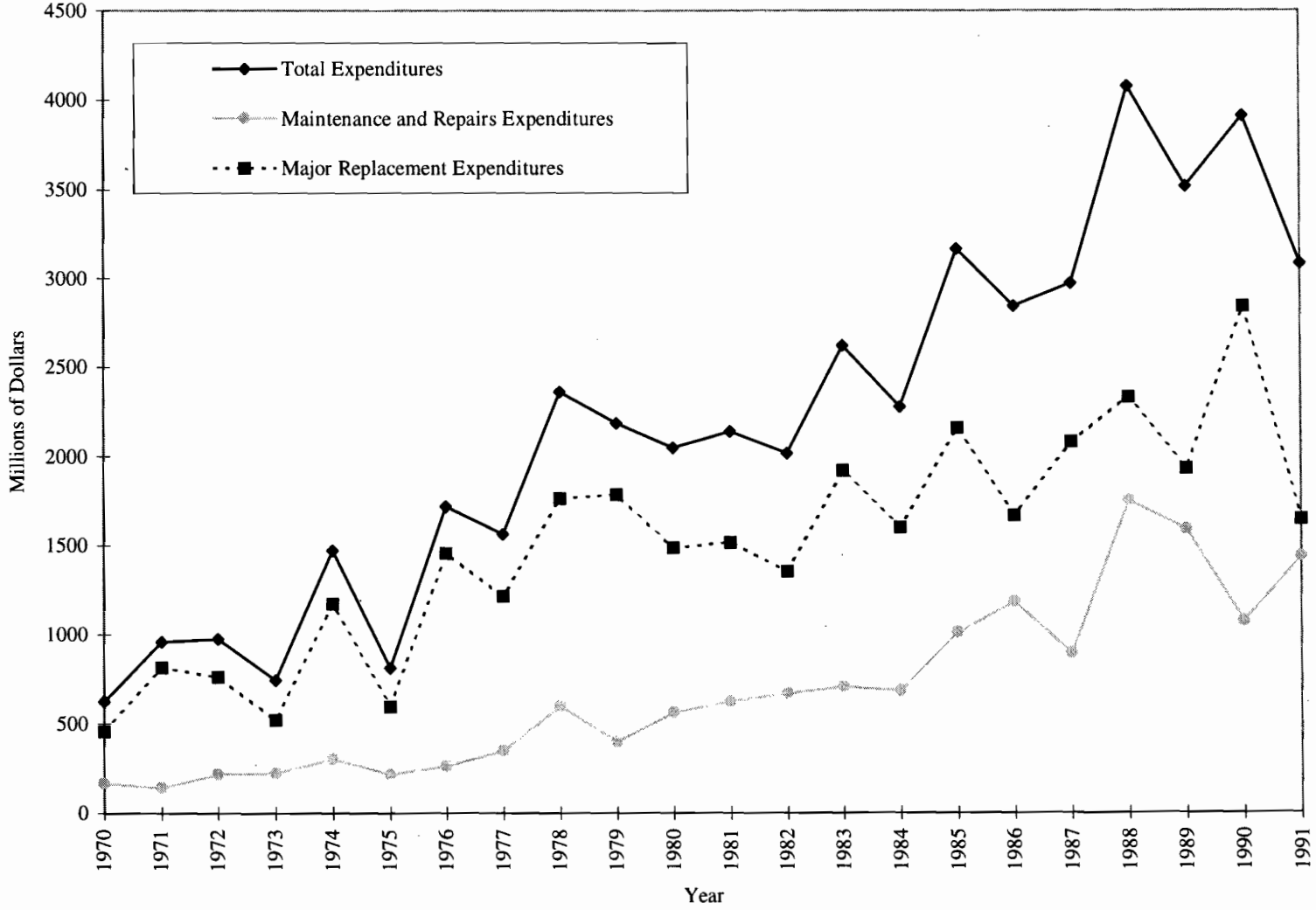

Figure 7. Residential siding alteration and repair expenditures in millions of dollars in the US, 1970-1991.

Source: US Department of Commerce, Bureau of the Census, Residential Alterations and Repairs, C50 Series

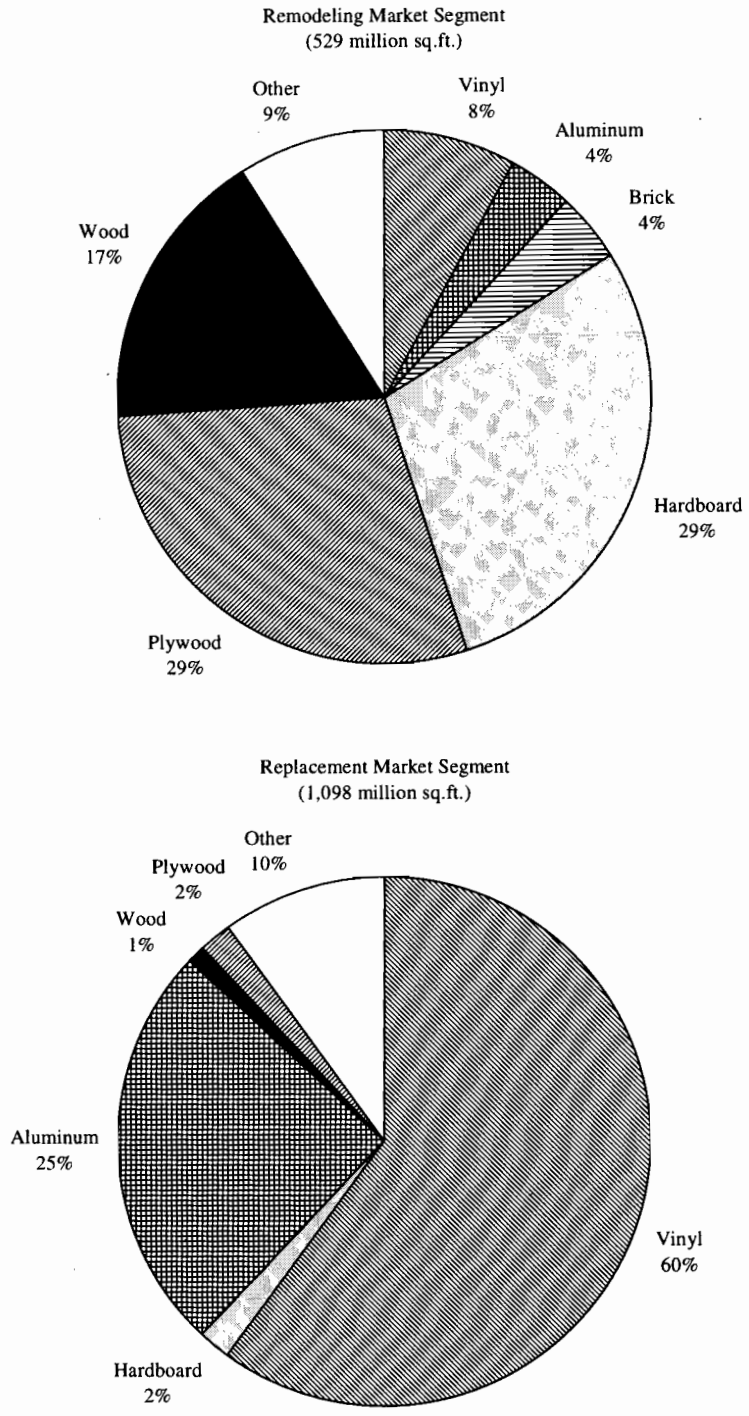

Figure 8. Market shares of selected residential siding materials for the remodeling and replacement market segments in the US, 1986.

Source: Stalling 1988

An earlier survey by *Builder Magazine* (1992b) evaluated product and brand trials for several building materials. Results of the survey indicated that 34% of residential home builders had added or changed brands of residential siding. Of the 34% of residential home builders that indicated adding or changing brands of siding, 26% had changed brands in the past year, 54% had added brands in the past year, and 20% indicated that they would be considering changing brands in the coming year.

Buyers and Specifiers of Residential Siding Materials

In the sale of residential siding products, the installer, specifier, and the individual paying for the material and installation are typically different individuals. However, it often occurs where the same individual performs all three functions. Therefore, it is important to understand each of the three functions in the context of the four types of buyers and specifiers of residential siding products as they relate to purchase planning and product choice. After a description of the four types of buyers and specifiers in the siding market, we will later outline the perceptions cited in the literature as influencing their product choices.

Architects and Designers

For the most part, architects and designers have little involvement in the purchase and construction of new residential homes. However, these individuals are often employed as consultants or in-house architects for large builder organizations. Furthermore, many of these individuals produce home plans that are sold through syndication to builders and homeowners.

Architects and designers also have relatively little involvement in the residing market. For the most part, hiring an architect for a residing job is is reserved for larger-scale and more costly or historical structures. Frost & Sullivan (1980) provide a summary of reasons why architects are important to siding producers and to the building industry:

- They handle major projects.
- They design leading custom-built homes.
- They innovate.
- They use new materials and concepts.
- They use old materials in new ways.
- They design projects that often lead to trends in the building industry.

As a result, it is easy to understand why architects and designers are considered important agents in the entire building materials industry. The impact of changes brought about by design and specification today usually appear within several months or even years later.

Advertisements placed in leading trade and professional publications are the primary mode that residential siding manufacturers use to reach architects and designers. Furthermore, several residential siding manufacturers and industry associations provide architects and designers with technical and promotional literature.

Leads on new residential home building by various builders and contractors are available from TRW Marketing Services and F. W. Dodge Scan (a McGraw Hill Information Services Company). The F. W. Dodge Scan report provides contract listings, estimated project cost, square footage, and other detailed information when the information becomes available. Furthermore, the F. W. Dodge Scan report provides information on the builder, primary contractor, and architects for each project. This report has the potential of being an extremely useful database for developing target marketing strategies.

Although the architect or designer specifies the residential siding material, the specification is often not carried through by the builder or contractor due to other factors. In many building contracts, the home builder and purchaser agree to an "or equal" clause. This clause allows the builder or contractor erecting the structure the flexibility to use alternative residential siding products that are "equal or greater" than the specified siding product when changes in product availability or price occur.

Survey results from *Builder Magazine* (1992a) found that 31% of all architects involve themselves in the selection and purchase of residential siding materials for new home construction. Nearly 14% of all architects become very involved with siding material selection and purchase, while 17% of all architects are at least somewhat involved. Approximately 66% of all architects were found to recommend a siding material, 79% specify the type and style, 25% select the brand, 4% purchase the material, 3% install the material, and 29% initiate substitution of residential siding materials.

Builders

Builders can be classified into two categories; speculative and contractual builders (Frost & Sullivan 1980). A majority of builders, however, perform work in both of these categories. Generally, the speculative builder will construct anywhere from one to dozens of homes in a tract development. These builders usually receive substantial service on their display unit(s) from supply sources, including firms that supply siding materials. A contractual builder is typically the prime contractor for an owner, group, or consortium involved in building homes, frequently custom homes. Frost & Sullivan (1980) note that while the number of contractual builders and projects is small relative to speculative builders, their work is influential since they have a tendency to use higher grades of materials on innovative, architect-designed homes.

Builders appear to be the primary target for promotional materials developed by residential siding manufacturing firms and their associated industry groups. Manufacturers and industry groups also target builders at regional and national home shows. The targeting of builders to increase residential siding sales appears justified. A survey conducted by *Builder Magazine* (1992a) found that 100% of builders have some involvement in the selection and purchase of siding materials for new residential homes. The survey also found that 95% have some involvement with residential siding material selection with 5% at least somewhat involved. Finally, the survey found that 71% recommended the residential siding material to be used, 80% specified the type and style, 81% selected the brand, 81% purchased the material, 42% installed the material, and 53% initiated substitution of residential siding materials.

While architects and designers are known for their innovativeness, builders are not. Several factors influence builders' reluctance to use different siding materials in residential homes. First, builders have to deal directly with building codes. In many instances, strict building codes pressure builders to utilize residential siding materials that are common and standardized within the jurisdiction of the building code agency of their operation. Second, larger-scale builders employ union laborers who may discourage the use of certain residential siding materials. Additionally, laborers may not possess the skills to install particular types of sidings. Finally, the switching costs associated with new tools and equipment for different types of residential siding materials are too great for many builders to afford.

Builders have a strong impact on the products that wholesaling and retailing agents stock. As a result, the promotional efforts directed at builders by manufacturers and industry groups should be well developed and target those perceptions that builders see as being the most important in their residential siding purchase decisions.

Contractors and Installers

Contractors and installers warrant attention in the residential siding market since estimates indicate that these individuals complete nearly one-half of all residential siding installations (Frost & Sullivan 1980). Two categories of contractors and installers exist: those who work for large builders and those who are independent. Most of the smaller, independent contractors and installers work exclusively with residential siding.

Contractors and installers of residential siding are to some extent controlled by the builder, prime contractor, or the owner when choosing what siding material to install. They typically purchase their materials from a wholesaler, but may purchase directly from a factory outlet or the manufacturer. A survey of contractors and installers (Frost & Sullivan, 1980) found that the contracting or installer firm's owner was the primary decision maker on what type and brand of residential siding material would be utilized on a job. Table 20 displays some of the results from this survey. The survey's results are similar to another survey conducted by Stalling (1988). This

more recent survey found that the builder (*i.e.*, firm owner) specified the residential siding to be used 50% of the time, followed by the homeowner (32%), architect (11%), and the developer (7%).

Table 20. Choice decisions for residential siding materials according to contractors and installers in the US, 1979.

	Type of Siding Material		Brand of Siding Material	
Function	**Percent Having First Decision**	**Percent Having an Advisory Role**	**Percent Having First Decision**	**Percent Having an Advisory Role**
Firm's Owner	46.1	13.2	53.1	8.8
Homeowner	33.5	27.6	16.7	40.9
Contractor	16.8	23.7	22.8	20.1
Architect	3.0	17.1	4.3	17.0
Subcontractor	0.6	18.4	3.1	13.2

Source: Frost & Sullivan (1980)

Another survey indicates that 56% of all contractors have some involvement with the selection and purchase of residential siding materials (*Builder Magazine* 1992a). Nearly 21% of contractors are very involved with selection and purchase, while 35% are at least somewhat involved. The survey results also indicates that 26% recommend the residential siding material to be used, 14% specify the type and style to be used, 14% select the brand to be used, 28% purchase the material, 91% install the material, and 28% initiate substitution of residential siding materials.

The contractor and installer are important elements in developing a marketing strategy for several reasons. First, they provide a wealth of information to the wholesalers and retailers concerning the characteristics of different residential siding materials since they are more likely to work with a wider assortment of materials over the course of time than other buyers and specifiers. Second, they share many attributes of both new home builders and repair/remodel/retrofit contractors, since they branch into both areas of home construction. Finally, these individuals tend to have more contact with the homeowner regarding the residential siding material installation than builders and architects.

Homeowners and Do-It-Yourself Homeowners

Homeowners and potential homeowners are likely to be the most important decision makers affecting residential siding sales, since they determine new construction starts and initiate repair and remodeling contracts. Given certain constraints (*e.g.*, financial, product availability), homeowners will attempt to use the best possible residential siding materials in the market in order to protect their greatest single investment (Frost & Sullivan, 1980). As a result, replacement residential siding is typically of higher quality than the original material installed.

Manufacturers and industry associations traditionally have not targeted the homeowner or do-it-yourself market when promoting their residential siding products. One exception is the vinyl siding industry, where the benefits of low maintenance (long-term cost advantage) and relatively low cost installation (short-term cost advantage) are promoted in several popular press publications. Retailers and wholesalers have also tended to neglect the homeowner and do-it-yourself residential siding market.

Frost & Sullivan (1980) report that advertising directed at the homeowners and do-it-yourself market by residential siding manufacturers has had little impact on brand preferences. This is in concurrence with responses to a survey conducted by George Carter & Associates (1989a). Frost & Sullivan conclude that while consumer awareness is a desirable goal, "*it is not the paramount concern for marketing success.*" Furthermore, the report indicates that the homeowner and do-it-yourself market segment easily switches brands without difficulty when opinions about different products change during the planning and prepurchase stage.

To summarize, while the number of different types of buyers and specifiers of residential siding materials is relatively small, they differ markedly on how they choose to purchase. Architects and designers focus on the image and style of the home, builders on the costs and availability of the residential siding, contractors and installers on the familiarity they have with the material and the material specified by the prime contractor or homeowner, and the homeowner on the top quality material in the market given certain constraints. Figure 9 provides a diagram of the relationship between buyers and specifiers of residential siding materials.

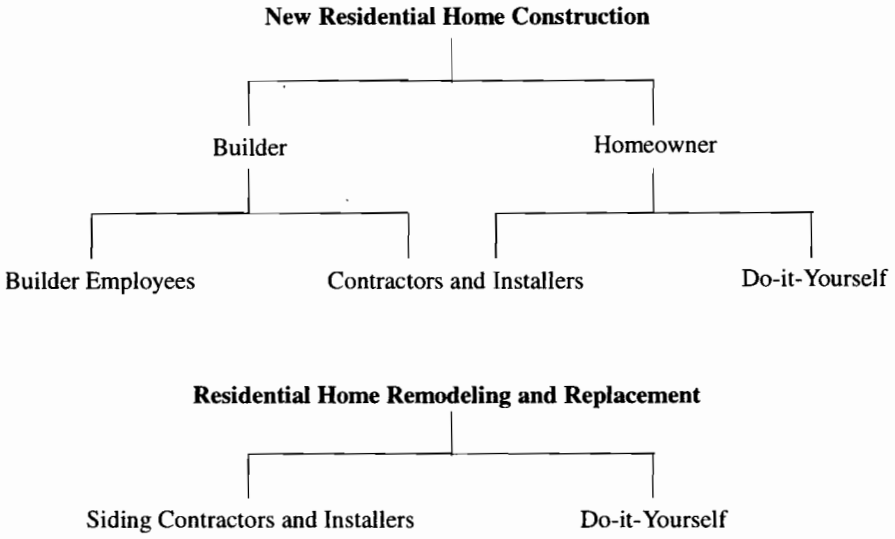

Figure 9. Relationship between buyers and specifiers of residential siding materials.

A survey study by *Builder Magazine* (1992a) also examines the influence that dealers of residential siding materials have on residential siding selection and purchase. These survey results indicate that 32% of dealers are active participants in the selection and purchase of residential siding materials. Roughly 8% of all surveyed dealers indicate that they have very high involvement in residential siding material selection and purchase, while 24% indicate at least some involvement. Most involvement appears to be in recommending the type of residential siding material; the survey results indicate that nearly 66% of all dealers perform this function. About 20% of all dealers specify the type and style of residential siding material, 28% select the brand, 3% purchase the material, 6% install the material, and 48% initiate material substitution.

Distribution Channels for Residential Siding Materials

Figure 10 displays the common distribution channels utilized for residential siding materials. One survey found that the various residential siding materials use considerably different channels of distribution (Stalling 1988). For instance, the retail level of distribution (*i.e.*, lumber yards, independent building supply retailers, and home center chains) accounts for more than 60% of structural panel, western red cedar, and hardboard residential siding materials distributed nationally. Meanwhile, the wholesaler level of distribution accounts for over 60% of vinyl and aluminum residential siding materials distributed nationally. The survey results indicate that approximately 25% of bricks used in siding are distributed directly from the manufacturer, another 25% from lumber yards, and the remaining 50% from wholesalers.

A survey conducted by *Builder Magazine* (1992a) resulted in figures extremely similar to those of Stalling's. However, the 1992 survey also provided information on the number of sources builders sought during the year for residential siding materials. According to the results, about one-half of the respondents indicated that they use a single supply source, the other half use multiple sources. This 50-50 split was essentially the same across the four US census regions and also across the average sales prices of the homes being constructed by the builders. These

results suggest that one-half of all builders in the US are either "captive" or "loyal" to their distributors, while the other half use a broader number of distribution channels to obtain residential siding materials. Captive builders are likely to be those builders operating in rural areas, whereas loyal builders are likely to be operating near suburban and urban regions.

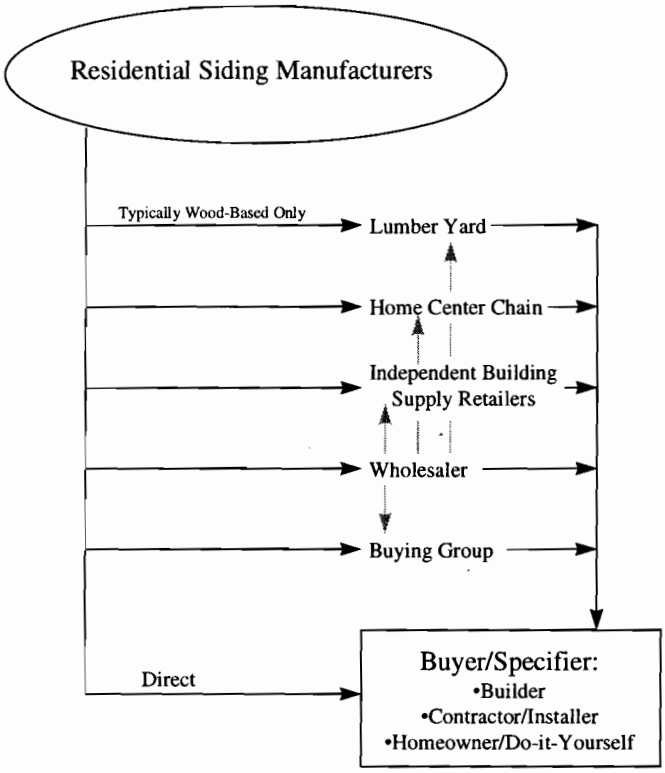

Figure 10. Common distribution channels in the residential siding market.

Stalling's survey also provides an in-depth view of the channels of distribution for six residential siding products, categorized by builder types (residential home builder, siding contractor, repair and remodel contractor). Table 21 reveals the distribution channels utilized by these three builder types across six residential siding products. For the most part, western red cedar distribution is through lumber yards and wholesalers. Home center chains provide a limited amount of distribution for western red cedar to the repair and remodeling market segment. Unfortunately, Stalling's results provide little insight as to whether the distributors carry each of the residential siding materials surveyed. Therefore, it is unknown whether builders are (1) purchasing their residential siding materials from certain distributors due to lack of availability of the materials elsewhere or (2) purchasing at distribution outlets in which they purchase a significant portion of their other construction materials.

A final glimpse of distribution channels utilized for residential siding is offered by the 1994 National Association of Home Builders Annual Industry Survey. This survey indicates that as the number of units produced per builder per year increases, the distribution of residential siding materials switches from utilization of lumber yards and specialty retailers to factory direct distribution, as can be seen in Table 22.

Since residential siding materials are heavy and bulky, most distributors do not carry all the materials that are available in the market. Frost & Sullivan (1980) found that as a result of distributors' selective inventories of siding materials, the residential siding distribution business is not as concentrated when compared to other businesses. As a result of less concentration in the residential siding distribution, distributors may stock only those materials that move quickly, thereby economizing on inventory space and costs.

Table 21. Distribution outlets used by buyers and specifiers of residential siding materials by product and builder type.

		Buyer and Specifier Use of Distribution Outlets (percent)			
Siding Material	**Builder Type**	**Lumber Yard**	**Home Center Chain**	**Wholesaler**	**Factory Direct**
Hardboard	Home Builder	80	1	17	1
	Siding Contractor	68	4	24	4
	R & R Contractor	78	11	11	0
Structural Panels	Home Builder	76	3	21	0
	Siding Contractor	73	7	18	2
	R & R Contractor	73	14	14	0
Vinyl	Home Builder	34	6	57	3
	Siding Contractor	0	0	86	14
	R & R Contractor	18	3	75	4
Aluminum	Home Builder	34	4	57	6
	Siding Contractor	0	0	86	14
	R & R Contractor	18	4	69	10
Western Red Cedar	Home Builder	70	1	27	2
	Siding Contractor	63	0	37	0
	R & R Contractor	72	10	15	3
Brick	Home Builder	22	1	60	18
	Siding Contractor	20	2	56	22
	R & R Contractor	24	0	51	26

Source: Stalling 1988

Table 22. Channels of distribution for residential siding materials by number of units started in 1993.

Distribution Outlet	**Channels of Distribution Used by Number of Units Started in 1993 (percent of respondents)[a]**		
Builder Utilizes	**Less than 25**	**25 to 99**	**100 or More**
Factory Direct	1	2	11
Manufacturer's Distribution Center	10	10	11
Home Improvement Center	4	1	--
Lumber Yard	58	43	39
Specialty Retailers	11	6	5
Subcontractor Does Siding	19	37	35
Modular/Panel Home Producer	2	2	--
Number of Respondents	1,167	258	98

[a] Columns do not sum to 100% due to rounding.
Source: National Association of Home Builder's 1994 Annual Industry Survey

Perceptions of Residential Siding Materials

Measuring and evaluating the perceptions that consumers have for substitutable materials is a powerful technique that can be used to guide new product development and product positioning strategies. In this section, we examine past studies that have measured and evaluated consumer (*e.g.,* builder, contractor, homeowner) perceptions of residential siding materials.

It is difficult, if not impossible, to make general conclusions concerning the several studies assessing consumer perceptions of siding materials. Much of the difficulty is due to the nature of the studies themselves. Considering that the evaluation of specific materials is contingent upon the other materials being evaluated in each study, and that each study has focused on one type of residential siding material more heavily than other studies, biases tend to develop in how materials are perceived relative to one another on a study by study basis. Furthermore, many material attributes may be examined in one study, but only a few material attributes in another. Since residential siding materials can be thought of as a "bundle of attributes," the decision of which attribute to include in each study tends to become contingent upon each study's objective(s). In an attempt to reduce the bias in what several studies perceive as being important factors in evaluating perceptions of residential siding materials, we have categorized all the factors that have been mentioned to influence the planning, selection, and purchase process for residential siding materials. We then review the results of one particular study that has attempted to thoroughly assess the perceptions of builders with respect to residential siding materials.

Factors Influencing Preferences for Residential Siding Materials

The literature pertaining to residential siding materials was examined to inventory the factors thought to influence the residential siding material planning and purchasing process. Factors were categorized into three distinct groups of decision makers: the wholesaler/retailer, the builder/contractor/designer, and the homeowner/do-it-yourselfer.

Within each of the three categories of decision makers, the factors were further broken down into four general domains, the first being designated the *product qualities* domain. Listed in this first domain were factors that a producer of residential siding would have little control over in terms of product design. The second set of factors, designated the *economic* domain, dealt with price and costs (*e.g.,* maintenance costs, installation costs). The third set of factors, designated the *manufacturer services* domain, were those over which the manufacturer had a considerable amount of control to change existing consumer perceptions (*e.g.,* product availability, product prefinished, promotional material provided by manufacturer). The final set of factors was designated the *consumer perception* domain. These reflect consumers' beliefs with regard to the residential siding material itself (*e.g.,* the siding projects a high image or status, the siding is environmentally friendly) which were described as strongly-held and difficult to change.

Only one research study has attempted to critically assess the perceptions of wholesalers and retailers with regard to residential siding materials (George Carter & Affiliates 1989a). According to the results of this study, wholesaler/retailer perceptions were primarily influenced by factors listed in the manufacturer services domain, for example, product availability. Products that were reliably supplied to the distributor would generally be the products kept in stock (Anonymous 1995). Increasing the amount of information, manufacturer support and training, and product and grade consistency that a manufacturer provided all positively influenced the perception that the wholesaler or retailer had about the particular residential siding material. Additionally, wholesalers and retailers were more likely to promote and recommend materials that provided a greater margin of return.

Wholesaler/retailer agents were also influenced by consumer perception factors. The literature mentioned that the image that the residential siding projected to the consumer also influenced the perception that the wholesaler/retailer had for the material. An inventory of the factors influencing wholesaler/retailer perceptions of residential siding materials can be found in Table 23.

Table 23. Factors influencing wholesaler/retailer preferences for residential siding materials.

Factor	Reference(s)
Product Qualities	
Weather Resistant	George Carter & Affiliates 1989a
Holds Stains/Paints/Other Finishes	George Carter & Affiliates 1989a
Durability	George Carter & Affiliates 1989a
Dimensional Stability	George Carter & Affiliates 1989a
Economic	
Competitive and Consistent Price	Anonymous 1995; George Carter & Affiliates 1989a
Maintenance Requirements Over Time (variable costs)	George Carter & Affiliates 1989a
Manufacturer Services	
Product Availability	Anonymous 1995; George Carter & Affiliates 1989a
Product and Grading Consistency	George Carter & Affiliates 1989a
Warranty/Guarantee from Manufacturer	George Carter & Affiliates 1989a
Size Variety	George Carter & Affiliates 1989a
Siding Prefinished	George Carter & Affiliates 1989a
Packaging	George Carter & Affiliates 1989a
Product Knowledge	George Carter & Affiliates 1989a
Product Promotion by Manufacturer	George Carter & Affiliates 1989a
Manufacturer Support and Training	George Carter & Affiliates 1989a
High Margin Product	George Carter & Affiliates 1989a
Consumer Perceptions	
High Status/Quality Image	George Carter & Affiliates 1989a
Natural Material	George Carter & Affiliates 1989a
Versatile Product	George Carter & Affiliates 1989a
Homeowner's Preference	George Carter & Affiliates 1989a

The majority of research that has assessed consumer perceptions of siding materials has examined the builder/contractor/designer group of decision makers. In fact, over 40 distinct factors were inventoried from the residential siding literature for this group (Table 24). Several factors received considerable attention in the literature. These factors were:

- Ease of application/installation
- Fire resistance
- Structural properties
- Durability
- Competitive and consistent price
- Maintenance requirements over time
- Product availability
- Texture and profile variety
- High status/quality image

Again, any interpretation of factors that influence the perceptions of builders/contractors/designers with regard to residential siding materials is confounded by the specific factors that each of the researchers assessed. Since this category of decision makers has been found to have the most significant influence on the choice of siding to be used on new residential homes, a study incorporating all these factors may yield more meaningful results. Collectively, however, it appears that the builders/contractors/designers group places considerable weight on product characteristics and manufacturer/retailer services.

Table 24. Factors influencing builder/contractor/designer preferences for residential siding materials.

Factor	Reference(s)
Product Qualities	
Life Expectancy	Anonymous 1994; Frost & Sullivan 1980; Gibson 1993; Stalling 1988; Stalling and Sinclair 1989a
Ease of Application/Installation	Benson 1968; Frost & Sullivan 1980; Gibson 1993; Marketing Strategies 1995; Moslemi 1993; Stalling 1988; Stalling and Sinclair 1989a; Trombley 1985
Working Characteristics	Brookes 1980
Ease of Repairing	Frost & Sullivan 1980; Stalling 1988
Corrosion Resistant	Gibson 1993; Shepherd, Brookes, and Robbins 1982; Trombley 1985
Dent and Impact Resistant	Benson 1968; Frost & Sullivan 1980; George Carter & Affiliates 1989a; Marktrend Marketing Research 1985; Stalling 1988
Fire Resistant	Brookes 1980; Frost & Sullivan 1980; Irland 1993; Marktrend Marketing Research 1985; Marketing Strategies 1995; Moslemi 1993; Stalling 1988
Mildew Resistant	Stalling 1988
Moisture Resistant	Gibson 1993
Termite Resistant	Gibson 1993; Moslemi 1993
Weather Resistant	George Carter & Affiliates 1989a; Gibson 1993; Stalling 1988
Finishing Characteristics	Benson 1968, Brookes 1980, Trombley 1985
Holds Stains/Paints/Other Finishes	Benson 1968, Brookes 1980, Gibson 1993, Irland 1993, Stalling 1988, Trombley 1985
Fade Resistant/Color Fastness	Benson 1968; Brookes 1980; Irland 1993; Marktrend Marketing Research 1985; Stalling 1988; Stalling and Sinclair 1989a
Acoustic Properties	Brookes 1980; Moslemi 1993
Insulating Properties	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Irland 1993; Shepherd, Brookes, and Robbins 1982; Stalling 1988
Structural Properties	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Marketing Strategies 1995; Moslemi 1993; Shepherd, Brookes, and Robbins 1982; Stalling 1988
Does Not Split	Benson 1968; Marktrend Marketing Research 1985
Dimensionally Stable	Benson 1968; Gibson 1993; McWilliams 1988; Moslemi 1993; Stalling 1988; Stalling and Sinclair 1989a
Durability	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Irland 1993; Marktrend Marketing Research 1985; Marketing Strategies 1995; Marsinko, Syme, and Harris 1991; Moslemi 1993
Weight of Material	Benson 1968; Brookes 1980; Irland 1993; Trombley 1985
Economic	
Building Code Requirements	Irland 1993; Marktrend Marketing Research 1985
Competitive and Consistent Price	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Gibson 1993; Irland 1993; Marktrend Marketing Research 1985; Marketing Strategies 1995; Marsinko, Syme, and Harris 1991; Moslemi 1993; Shepherd, Brookes, and Robbins 1982; Stalling 1988; Stalling and Sinclair 1989a

Table 24. Factors influencing builder/contractor/designer preferences for residential siding materials *(continued)*.

Factor	Reference(s)
Cost of Application/Installation	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Moslemi 1993; Stalling 1988; Stalling and Sinclair 1989
Maintenance Requirements Over Time (variable cost)	Benson 1968; Brookes 1980; Frost & Sullivan 1980; Gibson 1993; Irland 1993; Marktrend Marketing Research 1985; Stalling 1988; Stalling and Sinclair 1989a
Manufacturer/Retailer Services	
Product Availability	Benson 1968; Frost & Sullivan 1980; George Carter & Affiliates 1989a; Gibson 1993; Marktrend Marketing Research 1985; Marsinko, Syme, and Harris 1991; Moslemi 1993; Shepherd, Brookes, and Robbins 1982; Stalling 1988
Product and Grading Consistency	George Carter & Affiliates 1989a; Irland 1993; Marketing Strategies 1995; Shepherd, Brookes, and Robbins 1982
Warranty/Guarantee	Frost & Sullivan 1980; Gibson 1993; Stalling 1988
Product Knowledge	George Carter & Affiliates 1989a; Marktrend Marketing Research 1985
Delivery of Material	Marktrend Marketing Research 1985
Manufacturer Service	Stalling 1988
Retailer Service and Promotion	Benson 1968; Marsinko, Syme, and Harris 1991; Stalling 1988
Color Selection	Irland 1993; Marktrend Marketing Research 1985; Stalling 1988; Stalling and Sinclair 1989a
Size Variety	Brookes 1980; Frost & Sullivan 1980; George Carter & Affiliates 1989a; Marktrend Marketing Research 1985; Stalling 1988
Texture and Profile Variety	Brookes 1980; Irland 1993; Marktrend Marketing Research 1985; Shepherd, Brookes, and Robbins 1982; Stalling 1988; Stalling and Sinclair 1989a
Long Lengths	Frost & Sullivan 1980; Marktrend Marketing Research 1985
Minimizes Product Waste	Benson 1968; Irland 1993; Marktrend Marketing Research 1985
Compatibility With Other Materials	Brookes 1980
Consumer Perceptions	
High Status/Quality Image	Benson 1968; Frost & Sullivan 1980; George Carter & Affiliates 1989a; Gibson 1993; Marktrend Marketing Research 1985; Marketing Strategies 1995; Stalling 1988; Stalling and Sinclair 1989a
Type of Home Construction	Marketing Strategies 1995
Price of Home	Benson 1968; Stalling 1988; Stalling and Sinclair 1989b
Appearance	Moslemi 1993; Stalling 1988
Environmentally Friendly	Gibson 1993; Irland 1993; Marketing Strategies 1995; Moslemi 1993
Natural Material	Gibson 1993; Marketing Strategies 1995; Stalling 1988
Homeowner's Preference	Benson 1968; Marktrend Marketing Research 1985

The number of factors mentioned in the literature as influencing the perceptions of the homeowner/do-it-yourself group of decision makers for residential siding materials is quite limited (Table 25). The items listed in the product qualities and consumer perception domains tended to receive the most attention. Unfortunately, these two domains list factors that are typically more difficult for a siding manufacturer to change. Additionally, the factors in the consumer perception domain are usually used to form strongly-held beliefs and attitudes.

Table 25. Factors influencing homeowner/do-it-yourself consumer preferences for residential siding materials.

Ease of Cleaning	Frost & Sullivan 1980
Durability	Frost & Sullivan 1980; Williams 1982
Weathering Properties	Williams 1982
Holds Stains/Paints/Other Finishes	Almgren 1988
Fire Resistant	Moslemi 199; Williams 1982
Termite Resistant	Moslemi 1993; Williams 1982
Insulating Properties	Frost & Sullivan 1980
Economic	
Final Installed Price	Williams 1982
Maintenance Requirements Over Time (variable cost)	Benson 1968; Williams 1982
Manufacturer/Retailer Services	
Color Variety	Williams 1982
Consumer Perceptions	
Architectural Style/Image/Appearance	Benson 1968; Frost & Sullivan 1980
Building Code Requirements	Benson 1968
Natural Material	Fuhrman and Bock 1993
Disposal of Waste Materials	Fuhrman and Bock 1993
Environmentally Friendly	Almgren 1988; Moslemi 1993

Results of Previous Residential Siding Material Preference Studies

Research by Stalling (1988) has been the most extensive examination of the perceptions that builders and home buyers have regarding residential siding materials. Specifically, Stalling assessed the competitive position of wood as a residential siding material in the professional consumer market by utilizing several multivariate statistical techniques (*e.g.*, factor analysis, multidimensional scaling, perceptual mapping). Professional consumers included in the study were homebuilders, repair and remodeling contractors, and siding contractors.

A brief overview of the analytical methodology employed in Stalling's study provides a much greater understanding of his results. The statistical procedure of perceptual mapping was used to form a geometric representation of how products are perceived relative to one another. For example, if one dimension of a geometric space represents costs, and Product X is found to be high on the cost dimension while Product Y is found to be low, then Product X has a higher cost *relative* to Product Y. A useful outcome of perceptual mapping is that the results can be used to determine which materials consumers perceive as being substitutes for one another along different dimensional attributes.

Stalling also uses multiple discriminant analysis to determine the "ideal point" of homes in four different price ranges. The ideal point defines the ordered preference relationship among the group of materials for a set of

respondents. The position of the ideal point relative to the position of the materials conveys the preferences that the set of respondents has for the materials. For example, the farther the ideal point is from a given material, the less the material meets the respondents' ideal measure of the given factor being evaluated (*e.g.*, durability).

The statistical procedures used by Stalling indicated that four perceptual functions, or dimensions, could be defined for professional consumers of residential siding. The first two dimensions, maintenance/weathering and appearance/status, accounted for most of the variance (61%) in the rating; the remaining two dimensions, dent resistance and application/economy, accounted for 28%. Thus, professional consumers were found to evaluate residential siding materials along four major dimensions.

Stalling also identified the ideal points related to new residential homes in four different price ranges. These price ranges were: < $70,000; $70,000 to $100,000; $100,000 to $150,000; $150,000 to $200,000.

Using the ideal points, interpretation can be made as to where homes in a given price range would "fit" in the product attribute space relative to other homes in different price ranges. As such, the ideal points can be used to generate valuable market segmentation information.

Figure 11 and Figure 12 represent the perceptual maps developed in Stalling's study. As Stalling points out, the distance between any two residential siding materials can be loosely interpreted as a measure of the professional consumers' perception of substitutability of one material for another. Theoretically, the closer a residential siding material approaches an ideal point for homes in a particular price category, the greater the market share that particular siding material should have for that home price segment.

Hardboard, plywood, vinyl, and aluminum residential siding materials were found to occupy the negative portion of the appearance-status dimension and the positive half of the application-economy dimension. These results suggest that builders feel that these four residential siding products are economical to install but lack a status image. As the ideal points reveal, these products are the most competitive in the segment of homes occupying the lower price ranges (*i.e.*, ideal points 1 and 2).

As Stalling's results suggest, plywood and hardboard residential siding materials occupy an undesirable position, being negative along both dimensions in Figure 11. Aluminum and vinyl residential sidings, however, occupy positions much closer to the ideal points. Plywood residential siding was found to have an advantage in installation economy and dent resistance. Hardboard residential siding was found to have only one perceived advantage, that being dent resistance. The position of the ideal points indicates that dent resistance is not a very important attribute or material advantage, however.

The results obtained in Stalling's study suggest that vinyl, hardboard, and plywood residential siding materials are close substitutes for one another. The differentiation of these three siding materials along the eleven material attributes was found to be minimal. Despite the lack of differentiation between these siding materials, it should be noted that vinyl residential siding is a considerable threat to both plywood and hardboard residential siding producers since it more closely approaches the ideal points of homes in the lower price market segment.

The results for solid wood siding revealed that these residential siding products fell into their own niche. Solid wood residential siding was found to have one competitive strength; namely, a beautiful appearance and a high status image. Of all seven residential siding materials investigated in Stalling's study, western red cedar siding was found to rate the highest along the beauty and image dimension. Compared to pine residential siding materials, it was found that professional consumers perceived that western red cedar residential siding was easier to maintain and more weather resistant.

Brick was found to be an important competitor of solid wood for homes in the upper price categories. Stalling reports that brick was perceived as possessing a beautiful appearance and high status image, as well as being easy to maintain and weather resistant. Brick's main disadvantage was that it was found to be difficult to install and expensive relative to all other residential siding materials investigated.

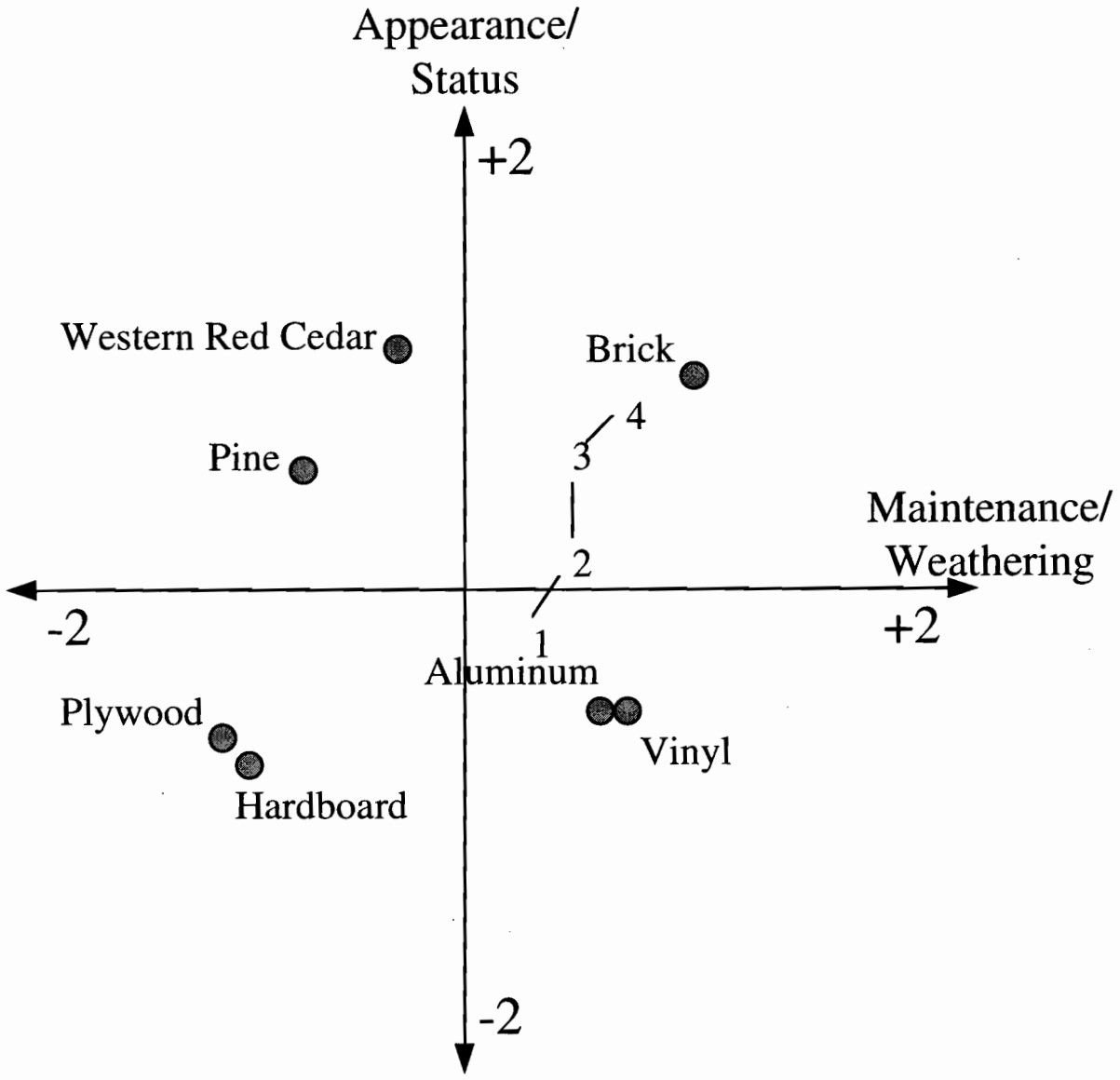

Figure 11. Professional consumer perceptions of residential siding materials and ideal points along the dimensions of appearance/status and maintenance/weathering.

Note: Ideal points are related to preferences for homes priced (1) < $70,000; (2) $70,000 - $100,000; (3) $100,000 - $150,000; and (4) $150,000 - $200,000.

Source: Stalling 1988

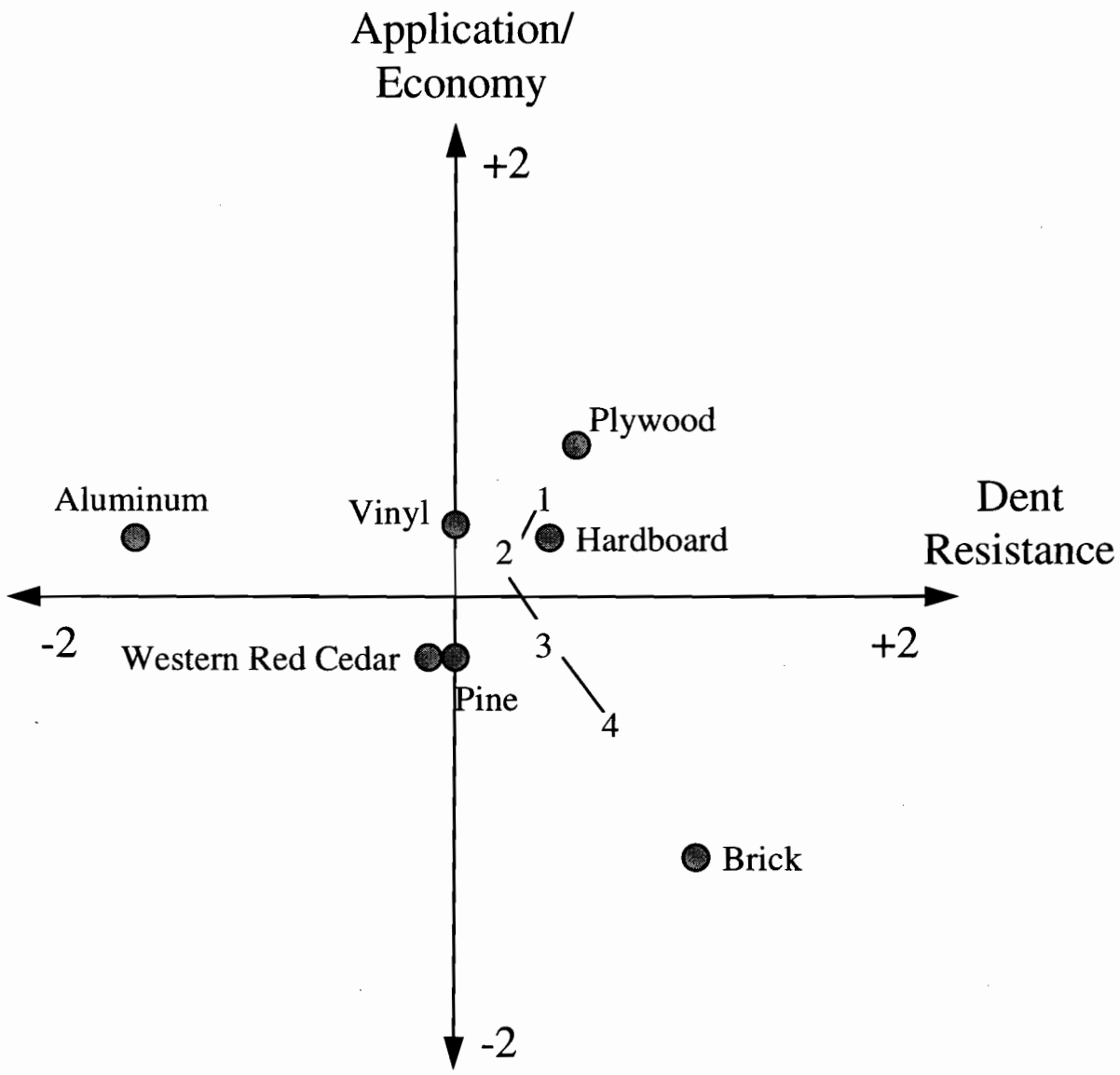

Figure 12. Professional consumer perceptions of residential siding materials and ideal points along the dimensions of application/economy and dent resistance.

Note: Ideal points are related to preferences for homes priced (1) < $70,000; (2) $70,000 - $100,000; (3) $100,000 - $150,000; and (4) $150,000 - $200,000.

Source: Stalling 1988

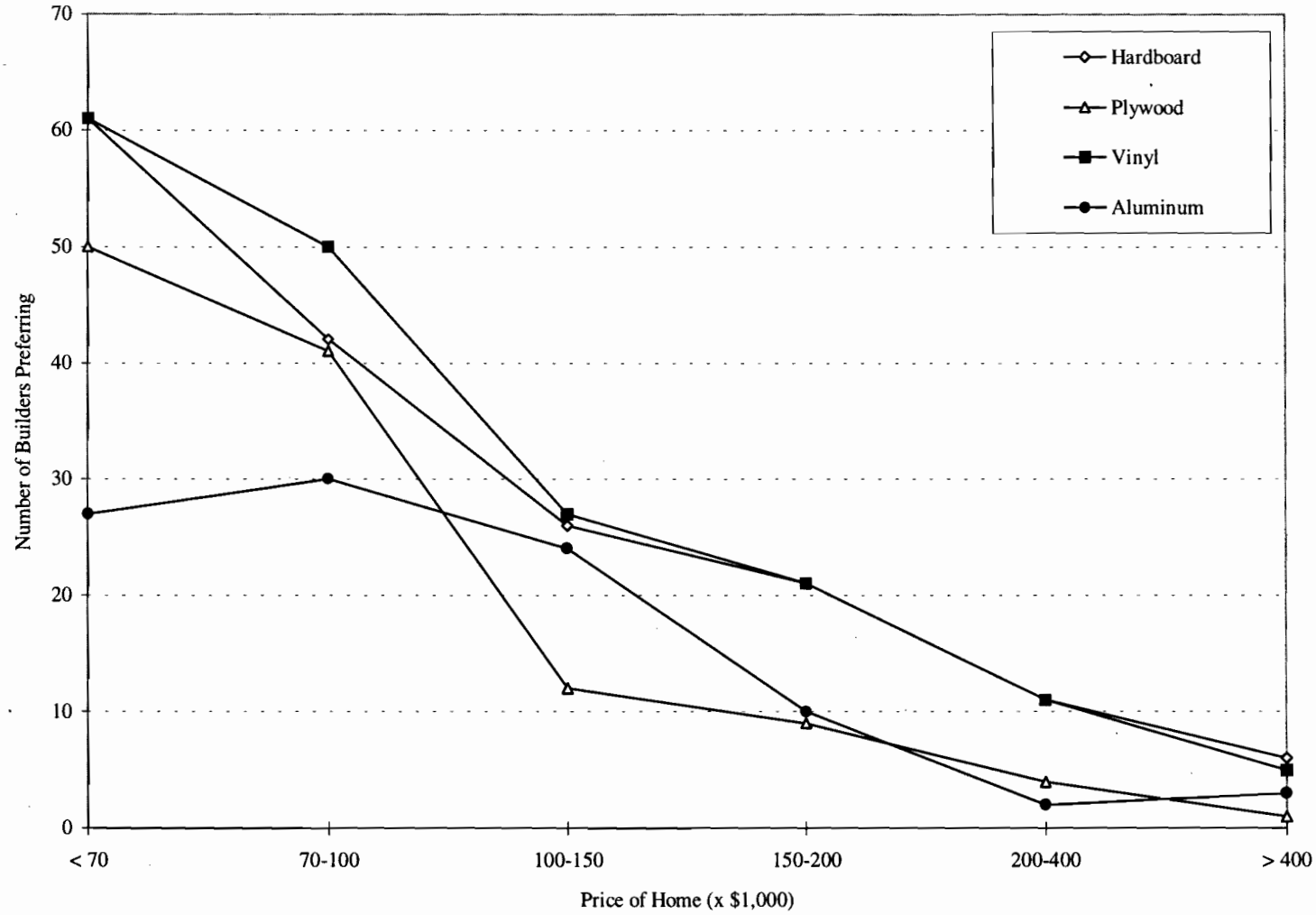

Figure 13. Residential siding materials that builders have a negatively related preference for as home price increases.

Note: Builders were permitted to check as many preferred products as desired.

Source: Stalling 1988

Stalling makes some conclusions as to what the results of his study indicate about the future of several residential siding materials. For western red cedar he states, "[western red cedar siding appears] *to hold a niche for those seeking a high-status, quality image over easy maintenance, and remain*[s] *competitive against brick because of brick's weak rating on application/economy.* " In addition he suggests that vinyl residential siding is currently not a major competitive threat to western red cedar residential siding due to the differences in perceptions professional consumers have for the two materials. He warns, however, that if vinyl producers "*successfully repositioned vinyl in the appearance/status dimension, vinyl's threat to solid wood. . . would increase.*"

Also examined in Stalling's study was the preference that homebuilders had for different siding materials according to the price of the home that was being built. Specifically, builders were asked which residential siding material they would prefer if they were to construct a single family home in each of six price categories. Hardboard, plywood, vinyl, and aluminum residential siding materials were found to be negatively related to home price, as depicted in Figure 13. Conversely, brick, cedar/redwood, stucco, and cedar shingle residential siding materials were found to be positively related to home price, as displayed in Figure 14.

Figure 13 and Figure 14 provide several insights. First, hardboard, plywood, vinyl, and aluminum residential siding materials are much more preferred by builders for homes constructed below $100,000. Below this price there appears to be little threat of substitution from cedar/redwood, stucco, and cedar shingle residential siding materials. Second, at prices greater than $150,000, brick, cedar/redwood, stucco, and cedar shingle are the builders' preferred residential siding materials. Similarly, above this price range, there appears to be little threat of substitution from hardboard, plywood, vinyl, and aluminum residential siding materials. At prices between $100,000 and $150,000, builder preference of residential siding material becomes indistinct, with all materials except brick and cedar/redwood essentially being preferred on an equal basis. Thus, residential siding materials in this price range can be thought of as direct substitutes, competing strongly for market share. Finally, brick was the preferred residential siding material for homes priced greater than $70,000. This suggests that brick siding poses a significant threat to all other residential siding materials since builders consistently prefer it over other competing materials over a very broad range of home prices.

Competitive Position of Western Red Cedar Residential Siding

Current economic projections reveal that the residential construction market will experience increased activity through the year 2000. As a result, the total volume of residential siding material will grow as well. One forecast reports that the residential siding market will grow at an average annual rate of 7.3% through 2004. However, given the increase in the variety of residential siding materials available in the market, coupled with rising prices of wood and declining prices of plastics, the residential siding industry will experience substantial structural changes in the future.

Given the anticipated increase in residential housing demand, expectations are that wood lap siding and other reconstituted wood materials will see modest to strong gains in the coming years. Past market research reveals that consumers perceive vinyl as being a direct substitute for aluminum, hardboard, and OSB. As a result, expectations are that the vinyl residential siding market share will grow due to increased cost competitiveness and superior product maintenance characteristics.

Western red cedar siding appears to be making some headway relative to competing residential siding materials. In fact, western red cedar and vinyl are the only two residential siding products that have experienced a positive average annual rate of growth during the past eight years, western red cedar market share increasing at an average annual rate of 3.52% and vinyl market share increasing at 10.25% annually. Anticipation is that western red cedar residential siding sales will continue growing at an annual rate greater than 3% over the next decade.

The perceptions that consumers have regarding various residential siding materials vary considerably. Relative to competing siding materials, consumers perceive that western red cedar is expensive and time-consuming to install. Consumers also perceive that the price and quality of western red cedar residential siding is highly variable. Consumers, however, believe that western red cedar has a tremendous curb appeal and a high status image, being

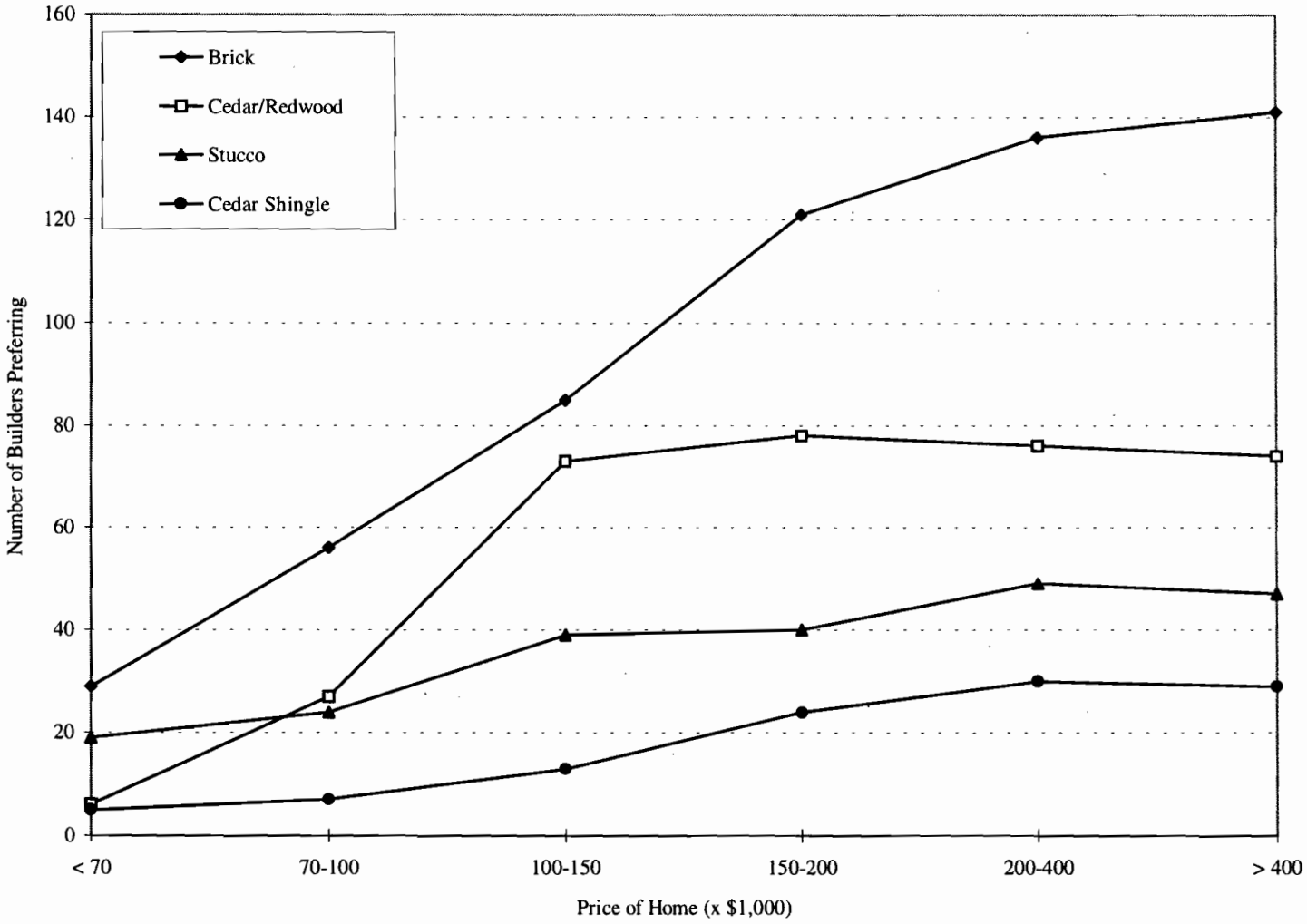

Figure 14. Residential siding materials that builders have an positively related preference for as home price increases.

Note: Builders were permitted to check as many preferred products as desired.
Source: Stalling 1988

nearly equal to that of brick. Unfortunately, image and beauty characteristics of western red cedar residential siding are canceled out by consumer perceptions that western red cedar is a high cost product.

In assessing the extant residential siding literature, it appears that the position of western red cedar siding in the market is far from optimal relative to other residential siding materials. For instance, promotional literature for western red cedar residential siding heavily stresses its quality image, while other important characteristics such as price and durability tend to be infrequently mentioned. While the actual cost of installation for western red cedar siding is greater than that of competing residential siding materials, speculation is that most consumers perceive the cost as being substantially more than it actually is in the marketplace.

RESIDENTIAL SIDING SURVEY RESEARCH METHODOLOGY

Survey Sample Selection

Since the Western Red Cedar Lumber Association's primary concern was with the perceptions, attitudes, and usage patterns of western red cedar siding relative to other residential siding materials in the Puget Sound market, the sample population was considered to encompass a wide variety of types of builders and contractors. These types included builders of new single family and multi-family homes, contractors of siding, repair and remodeling, and nonresidential building, as well as architects/designers.

To be considered in the survey population the firm had to be physically operating within either King, Pierce, or Snohomish Counties. In addition, the firm had to have built (or subcontracted) at least two residential units within King, Pierce, or Snohomish Counties during 1994.

A sample frame of builders and contractors was constructed by obtaining the membership lists of two builder associations located in the Puget Sound area. The Puget Sound area is defined as the counties of King, Pierce, and Snohomish. Some builders in peripheral counties, however, were also surveyed, including some in Skagit and Thurston Counties. The Master Builders Association of King and Snohomish Counties and the Master Builders Association of Pierce County both provided complete membership lists that consisted of the aforementioned builder and contractor types. These membership lists were modified to remove all non-builder firms (*e.g.*, law firms, title companies, consultants, drywall contractors, flooring contractors, painting contractors, property management firms).

A total of 641 residential construction firms met the sample frame criteria described previously. Members of the Master Builders Association of King and Snohomish County comprised 77% of the survey population while the remaining 23% of the survey population were members of the Master Builders Association of Pierce County.

The sample size required to meet the study's reliability criteria was calculated to be 118 firms (APPENDIX A). However, given a reasonable nonresponse rate and the likelihood of sending a questionnaire to an incorrect or nonexistent address, a total of 521 surveys were mailed. To maximize the reliability of the survey, it was decided that the sample of residential construction builders would be proportional to the size of the total population that they each represented in the Puget Sound area. Therefore, 401 residential construction builders and contractors were randomly sampled from the Master Builders Association of King and Snohomish Counties membership list and 120 residential construction builders and contractors were randomly sampled from the Master Builders Association of Pierce County membership list.

Survey Data Collection

Mail surveys provide the most efficient and cost-effective means of gathering data from a large sample that is geographically dispersed (Dillman 1978). The questionnaire was constructed to be similar in structure to a survey conducted by Stalling in 1988, so as to decrease the time required to develop a reliable survey instrument.

The questionnaire was pretested by two sets of individuals. The first set of five individuals, who were familiar with residential siding materials, were asked to pretest the questionnaire in order to determine whether the

questionnaire was comprehensive. The second set of five individuals, who were unfamiliar with residential siding materials, were asked to pretest the questionnaire in order to check for clarity and ease of use. Finally, the research sponsors were asked to review the survey instrument. Suggestions for improvement were carefully considered and a final eight-page questionnaire was constructed.

One week before the initial mailing, each participant was sent a prenotification letter informing them of the objectives of the research and asking for their participation (APPENDIX B). The initial survey mailing consisted of a cover letter, the questionnaire, and a self-addressed stamped business reply envelope. A follow-up mailing was made two weeks after the initial mailing. This second mailing consisted of a follow-up letter encouraging the participant to complete and return the survey, another copy of the questionnaire, and a self-addressed stamped business reply envelope. Firms failing to reply to the follow-up letter and questionnaire were then contacted by phone and/or fax to encourage their participation. A summary of the sampling plan and the response rates associated with the mail survey are presented in Figure 15.

Survey Response Rate

A total of 96 usable questionnaires was received, corresponding to a response rate of 18.8%. While the response rate may appear to be low, it is within the range typically observed in industrial market research. Additionally, it is substantially higher than a similar study conducted by Stalling (1988), where the response rate was 14.6%. Thirty-four of the firms (35.4%) were members of the Master Builders Association of Pierce County. The remaining 62 firms (64.6%) were members of the Master Builders Association of King and Snohomish Counties. While the target number of 118 respondents was not met, the effect on the error bound in this study was not substantial. In fact, the error of estimation bound of 5% increased marginally to 5.64% with this slightly lower response rate (APPENDIX A). Thus, the results of this survey are considered to be a relatively accurate reflection of the views and perceptions of builders located in the Puget Sound area.

Survey Nonresponse Bias

The use of prenotification letters, follow-up letters, and personal contacts with the firms by phone and/or fax was designed to maximize the rate of response to the survey. In general, higher rates of response imply lower rates of nonresponse bias (Malhotra 1993). Nonresponse bias can significantly influence the results and conclusions of a mail survey given the fact that nonrespondents can be very different from respondents. As a result, it was essential that the data be evaluated to determine if nonresponse bias was present.

Bias caused by nonresponse was first evaluated using a method developed by Armstrong and Overton (1977). This methodology uses late respondents as a proxy for nonrespondents. A statistical test was used to compare the information obtained from late respondents with that of early respondents. No significant difference was found between the two groups, and, as a result, nonresponse bias was not considered to influence the results of the survey.

An additional methodology was utilized to determine if response bias influenced the results. This methodology involved the comparison of responses from firms who replied to the initial survey with those that replied to the follow-up survey. The purpose of this methodology was to determine if a statistical difference existed in how firms responded to the initial and follow-up surveys. A statistical test similar to the Armstrong and Overton nonresponse methodology was used to compare the two groups of respondents. Again, T-tests revealed that there were no substantial differences in how firms responded to the initial and follow-up surveys.

GENERAL RESIDENTIAL SIDING SURVEY DATA ANALYSES AND RESULTS

Respondent Profile

The initial question on the survey prompted firms to specify their *primary* business. As expected, the majority of firms were builders of single family homes (84.4%). Multi-family homebuilders comprised 5% of the

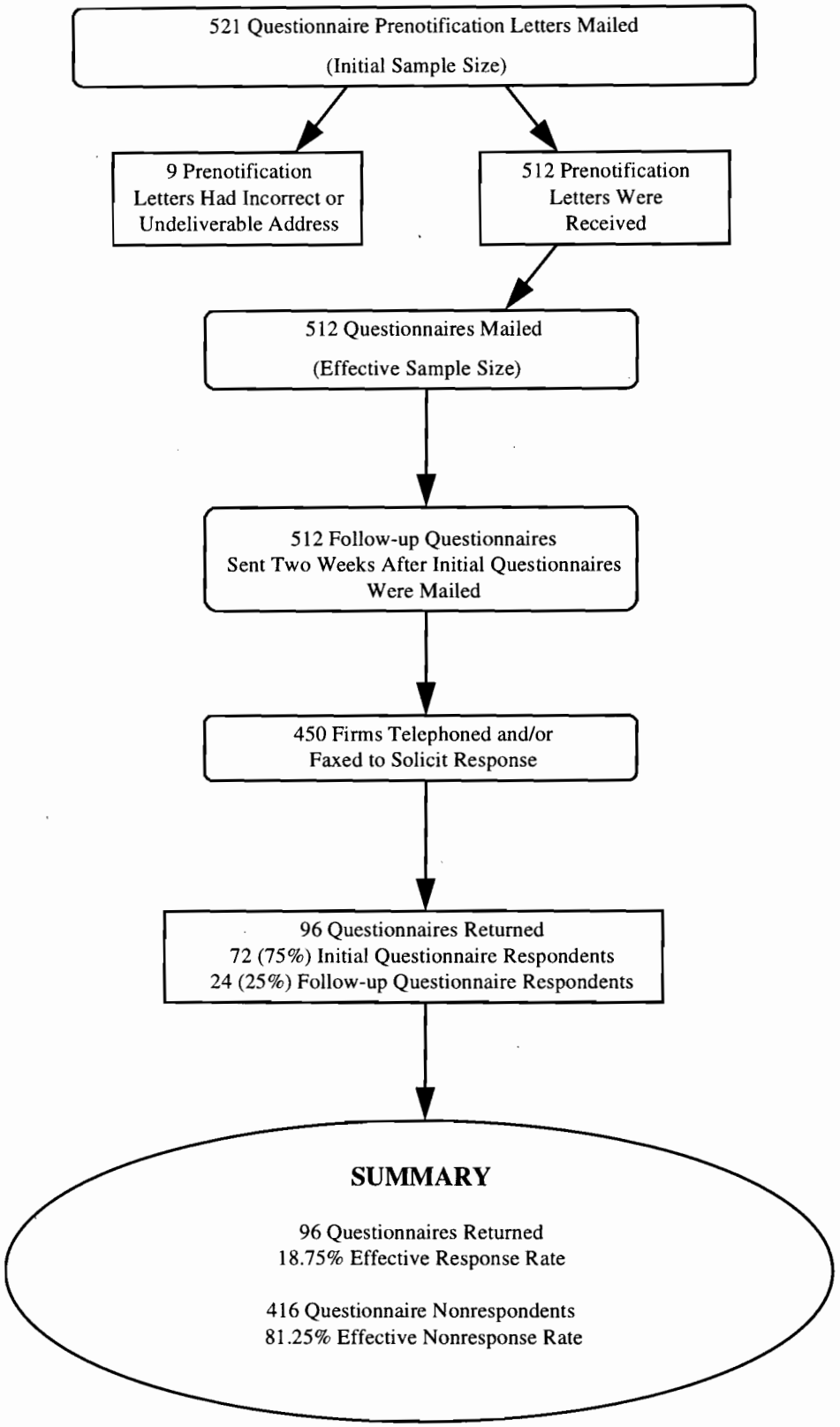

Figure 15. Schematic of mail survey execution for the Puget Sound residential siding materials survey.

respondents. Repair and remodel contractors, residential developers, architects, and nonresidential building contractors represented 4.2, 3.1, 2.1, and 1.0% of the remaining firms, respectively.

Table 26 provides a list of projects that builders indicated they performed in the past year that involved residential siding materials. Nearly all firms (93.8%) indicated that they were involved with the siding of single family residential construction projects within the past year. In addition, approximately one-fourth of all firms indicated that they were involved with some aspect of siding in the construction of home additions and multi-family residential homes.

Table 26. Number of survey respondents performing various construction activities which involved residential siding materials, by builder type.

	Construction Activity					
Builder Type	**Single Family Residential Construction**	**Multi-Family Residential Construction**	**Construction of Additions**	**Residing of Existing Homes**	**Repair of Existing Homes**	**New Non-Residential Construction**
Single Family	80 (98.8%)[a, b]	12 (14.8%)	17 (21.0%)	9 (11.1%)	7 (8.6%)	6 (7.4%)
Multi-Family	2 (40.0%)	5 (100.0%)	0 (--)	0 (--)	0 (--)	0 (--)
Repair & Remodel Contractor	4 (100.0%)	0 (--)	3 (75.0%)	2 (50.0%)	4 (100.0%)	0 (--)
Developer	2 (66.7%)	3 (100.0%)	1 (33.3%)	0 (--)	1 (33.3%)	1 (33.3%)
Architect	2 (100.0%)	2 (100.0%)	1 (50.0%)	1 (50.0%)	0 (--)	2 (100.0%)
Total Responses	90 (93.8%)	22 (22.9%)	22 (22.9%)	12 (12.5%)	12 (12.5%)	9 (9.4%)

[a] Percentages represent the percent of builders within each builder type that performed the particular construction activity.
[b] Note that percentages within rows and columns do not total 100% because respondents could specify more than one type of construction activity.

Average revenue per firm was calculated to be slightly greater than $1 million during fiscal year 1994. Table 27 displays a breakdown of estimated 1994 revenue for the survey respondents. Approximately 30% of the survey respondents can be classified as small residential construction firms, with annual revenue less than $500,000. Nearly 47% of the surveyed firms can be considered mid-size residential construction firms, with annual revenue between $500,000 and $5 million. Another 16% of the firms are large residential construction firms, with annual revenue between $5 million and $10 million, while the remaining 7% of respondents are extremely large residential construction firms, with annual revenue exceeding $10 million. Further examination of the survey database indicates that five of the six largest firms, in terms of annual revenue, are publicly held corporations.

Table27. Estimated total revenue for surveyed residential construction firms in 1994.

1994 Firm Revenue	**Number of Firms[a]**	**Percent of Firms**
Less than $100K	4	4.6
$100K to $500K	23	26.2
$500K to $1 Million	15	17.0
$1 to $5 Million	26	29.5
$5 to $10 Million	14	15.9
More than $10 Million	6	6.8

[a] Data represents responses from 88 of the 96 firms.

For the most part, firms responding to the survey have been in operation for a substantial number of years. For instance, the average firm was found to have been in operation for 15.4 years (median = 13 years). The number of

years of operation varied widely, however, ranging from 2 to 88 years. Table 28 represents a breakdown of the number of years of operation for respondents prior to 1995.

Table 28. Number of years surveyed firms have been in operation prior to 1995.

Years Firm Has Been in Operation	Number of Firms	Percent of Responding Firms	Cumulative Percent of Responding Firms
2-5	15	16.1	16.1
6-10	23	24.7	40.8
11-15	18	19.4	60.2
16-20	20	21.5	81.7
21-25	4	4.3	86.0
26-30	6	6.5	92.5
31-35	4	4.3	96.8
More than 35	3	3.2	100.0
Firms Not Responding	3	--	--

Table 29 displays the average price of homes built by respondents. Over 80% of single family residential home builders indicated that they built homes that averaged less than $250,000 in selling price. In fact, slightly over one-third of the builders indicated that the average price of their homes was in the $150,000 to $199,000 range. These results are similar to 1994 permit data obtained from King, Pierce, and Snohomish Counties. For example, the permit data shows that nearly 35% of all homes constructed in 1994 had an asking price between $150,000 and $200,000.

Table 29. Average price of homes built by surveyed firms, by builder type.

	Builder Type					
Average Price of Homes Currently Built by Firm	Total Responses[a]	Single Family	Multi-Family	Repair & Remodel Contractor	Developer	Architect
$100,000 to $149,000	19 (20.9%)	18	0	0	1	0
$150,000 to $199,000	32 (35.2%)	30	0	1	0	1
$200,000 to $249,000	19 (20.9%)	16	2	1	0	0
$250,000 to $400,000	17 (18.7%)	12	1	2	1	1
Over $400,000	4 (4.4%)	4	0	0	0	0
Total Responses	91 (100.0%)	80 (87.9%)	3 (3.3%)	4 (4.4%)	2 (2.2%)	2 (2.2%)

[a] Based on responses from 91 firms.

Builders were asked to estimate the new home selling price for homes selling in the top one-third price range in the Puget Sound market. Responses ranged from a low of $130,000 to a high of $500,000. On average, builders felt that a new, top one-third price range home started at a price of $269,538 (standard deviation = $70,966). Utilizing this information and the data provided in Table 29, it was calculated that at least one-quarter of the surveyed firms typically built residential homes in the top one-third price segment of the market.

Builders were questioned as to who decides which siding material to use on the firm's new residential construction projects. Collectively, respondents indicated that the builder determines the siding material 68% of the time. The homeowner decides on the siding material to be used 15.8% of the time, followed by the architect (10.8%) and developer (4.7%). Local code rules dictated the siding material to be used in less than 1% of all residential

construction projects. Further examination of the data found that firms building homes in the top one-third price range specify the residential siding material to be used nearly 90% of the time.

Demand for Residential Housing

Demand for residential housing appears to be improving in the Puget Sound market. Table 30 shows the number of single family, multi-family, and town houses built by surveyed firms in 1994. In addition, Table 30 displays the number of residential structures firms intend to build in 1996. A conservative estimation technique was utilized to determine the total number of homes constructed in 1994 and homes to be constructed in 1996. Table 31 displays the results from this estimation procedure. Approximately 65% of all residential structures built by firms in 1994 were single family homes. Slightly more than 26% of the structures were multi-family homes, while the remaining 9% were town houses.

If the survey results are accurate, then a conservative estimate indicates that nearly 6,800 new single family homes will be built in 1994. Approximately 1,700 multi-family structures are estimated to be built in 1996, a gain of 22% over the number of similar structures built in 1994. The construction of town houses, however, is expected to see the largest growth in the Puget Sound market. Estimates indicate that over 2,200 town houses will be constructed in the Puget Sound market in 1996, a net gain of 379% over the number built in 1994.

Table 30. Number of survey respondents building single family, multi-family, and town homes in 1994 and 1996 (estimated).

	Number of Firms Building				
	1 to 5 Units	**6 to 15 Units**	**16 to 50 Units**	**51 to 100 Units**	**Over 100 Units**
Built in 1994:					
Single Family Detached	28	28	20	7	1
Town House	2	2	3	0	2
Multi-family	5	3	4	1	2
Intend to Build in 1996:					
Single Family Detached	33	24	21	9	3
Town House	3	3	3	1	2
Multi-family	4	2	3	3	2

Table 31. Estimation of the number of residential structures constructed in the Puget Sound market in 1994, and the number expected to be constructed in 1996.

Year	Estimated Number of Residential Structures Constructed			Total
	Single Family	**Multi-Family**	**Town House**	
Surveyed Firms				
1994	651	262	87	1,000
1996	1,272	320	417	2,009
Increase from 1994 to 1996	95%	22%	379%	101%
Extrapolating to Entire Puget Sound Market				
1994	3,472	1,397	464	5,333
1996	6,784	1,707	2,224	10,715

Market Share Estimates

The average firm installed 55,908 square feet of residential siding material in the past 12 months (median = 20,000 square feet). However, the data is biased upward by a half-dozen firms which each installed over 290,000 square feet of residential siding material in the past year. Further breakdown of the data revealed that 25% of the firms installed less than 10,000 square feet of residential siding material in the past 12 months. Nearly 35% of the firms installed between 10,000 and 30,000 square feet, 28% installed between 30,000 and 100,000 square feet, and 12% installed more than 100,000 square feet.

Table 32 displays the estimates of market shares for various residential siding materials in the Puget Sound and national markets. OSB controls one-half of the Puget Sound residential siding market. Hardboard, plywood, and western red cedar also command substantial portions of the market, with market shares of 12.5, 10.3, and 8.9%, respectively. Vinyl, the dominant residential siding material in the US Midwest, and brick, a very dominant residential siding material in the US South, collectively represent less than 8% of the Puget Sound residential siding market.

Table 32. Estimated market share of residential siding materials in Puget Sound and national markets.

Siding Material	Square Feet Installed	Puget Sound Market Share (percent)	National Market Share (percent)[a]
OSB	2,630,465	49.53	27.9[b]
Hardboard	662,296	12.47	13.2
Plywood	548,900	10.33	--[b]
Western Red Cedar	470,805	8.86	2.5
Stucco	232,475	4.38	--
Vinyl	202,770	3.82	36.7
Brick	189,880	3.58	17.2
Cedar Shakes/Shingles	177,275	3.34	--
Wood Fiber-Cement	170,340	3.21	--
Other (e.g., metal)	13,500	0.25	--
Spruce (solid)	12,500	0.24	--
Aluminum	650	0.01	2.4
Redwood (solid)	0	0.00	--
Total	5,311,256	100.00	99.9

[a] National market share statistics represent 1994 data collected specifically for this study.
[b] Plywood and OSB residential siding materials are combined in the OSB category to represent a national market share of 27.9%.

Again, a conservative estimation procedure was used to determine the total area of various residential siding materials installed in the Puget Sound market in the past year (specifically, August 1994 through July 1995). Table 33 displays the results of this procedure. On a national basis, it appears that the Puget Sound market is extremely important to producers of OSB and plywood residential siding materials. The Puget Sound area represents 7.6% of the total OSB residential siding market and 2.5% of the total plywood residential siding market. It is currently unknown, however, whether OSB and plywood residential siding producers have gained a strong presence in the Puget Sound market due to promotional activities or simply due to builder preferences for their products.

Statistics presented in Table 34 show the percentage of surveyed firms who indicated that their use of various residential siding materials has either increased, decreased, or remained the same over the past five years. In addition, Table 34 displays the percentage of survey respondents who indicated that they had not used specific residential siding materials during the past five years.

Table 33. Estimated square footage of various residential siding materials installed in the past year in the Puget Sound market, and the estimated percentage of market share that the Puget Sound market represents for each residential siding material nationally.

Siding Material	Estimated Square Feet Installed (August 1994 through July 1995)	Estimated Share of the National Market Represented by the Puget Sound Market (percent)[a]
OSB	14,029,146	7.60
Hardboard	3,532,245	0.40
Plywood	2,927,467	2.48
Western Red Cedar	2,510,960	1.51
Stucco	1,239,867	NA[b]
Vinyl	1,081,440	0.04
Brick	1,012,693	NA
Cedar Shakes/Shingles	945,467	NA
Wood Fiber-Cement	908,480	NA
Other (e.g., metal)	72,000	NA
Spruce (solid)	66,667	NA
Aluminum	3,467	0.24
Redwood (solid)	0	NA

[a] Calculated using 1994 product shipment data provided by various industry associations.
b Not available due to lack of data or unreliable product shipment data.

Patterns of Residential Siding Use

The information surveyed firms provided regarding their use of western red cedar residential siding was far from favorable. While western red cedar has nearly a 9% market share in the Puget Sound market, it is likely that its market share was somewhat greater in the past. Firms indicated that western red cedar residential siding was used more often than any other residential siding material over the past five years except OSB. This is shown in Table 34, where only 7.6% and 20.2% of the respondents indicated that they had never used OSB and western red cedar over the past five years, respectively. However, 54.8% of the firms indicated that their use of western red cedar

Table 34. Usage patterns for residential siding materials that surveyed firms have utilized over the past 5 years.

	Percent of Firms Indicating That Their Use of Siding Material Has[a]				Ratio of Increased to Decreased Use of Siding[b]
Siding Material	Increased	Decreased	Remained the Same	Never Used	
OSB	56.5	16.3	19.6	7.6	3.47
Hardboard	26.8	7.3	6.1	59.8	3.67
Cedar Shakes/Shingles	20.0	21.3	21.3	37.4	0.94
Stucco	16.9	14.3	19.5	49.3	1.18
Wood Fiber-Cement	16.9	1.3	2.6	79.2	13.00
Vinyl	16.5	3.8	10.1	69.6	4.33
Brick	13.4	18.3	46.3	22.0	0.73
Plywood	8.3	27.5	32.1	32.1	0.16
Western Red Cedar	3.6	54.8	21.4	20.2	0.07
Aluminum	1.3	6.7	5.3	86.7	0.20
Spruce (solid)	1.3	2.6	2.6	93.5	0.50
Redwood (solid)	0.0	5.3	4.0	90.7	--

[a] Based on the responses of 96 firms.
[b] A value greater than 1 indicates that the installation of the siding material has generally increased among builders during the past five years, while a value less than 1 indicates that the installation of the siding material has generally decreased among firms in the past five years.

decreased over the past five years, while only 3.6% of the firms indicated an increase in their use of western red cedar. These results provide an alarming statistic: for every builder who has increased use of western red cedar over the past five years, 15.3 builders have reduced use.

Table 35 displays statistics on the amount of western red cedar residential siding installed by the average price of homes currently being constructed by the surveyed firms. Slightly over 34% of all surveyed firms indicated that they had installed western red cedar residential siding over the past year. As this table reveals, the use of western red cedar residential siding increases as the average home price increases; 50% of firms building homes averaging more than $250,000 indicated that they had used western red cedar as a residential siding material in the past 12 months.

Table 35. Western red cedar residential siding installed by average price range of homes surveyed firms build.

	Number of Firms Installing Western Red Cedar by Average Home Price[a]					
Western Red Cedar Siding Installed in 1994 (ft^2)	**Total**	**$100,000 - $149,999**	**$150,000 - $199,999**	**$200,000 - $249,999**	**$250,000 - $400,000**	**Over $400,000**
None	59	14	23	12	9	1
1-2,499	6	0	3	3	0	0
2,500-4,999	11	3	3	2	2	1
5,000-7,499	2	0	0	0	2	0
7,500-9,999	3	0	1	1	1	0
10,000-24,999	3	0	2	0	1	0
25,000-50,000	4	1	0	0	1	2
More than 50,000	2	1	0	1	0	0
Total square foot area of cedar installed	470,805	113,850	62,325	121,280	78,350	95,000
As a % of all cedar installed	100.0	24.2	13.2	25.8	16.6	21.2
As a% of all siding types installed	8.9%	9.1%	4.4%	7.3%	12.3%	37.3%
Total number of firms installing cedar	31	5	9	7	7	3
Percent of firms installing cedar	34.4%	26.3%	28.1%	36.8%	41.2%	75.0%

[a] Data represents information provided by 90 firms.

Firms were asked to indicate what residential siding material(s) they felt would be the most appropriate for new homes within six different price categories. Table 36 displays their responses. For new low-end homes (priced below $150,000) the predominant residential siding materials builders stated that they would find most appropriate were OSB, plywood, hardboard, and vinyl. For new mid-range homes, priced between $150,000 and $250,000, builders indicated that they would favor OSB, western red cedar, cedar shakes and shingles, stucco, and brick residential sidings. Finally, for new high-end homes, priced over $250,000, builders indicated that they were inclined to use brick, stucco, western red cedar, and cedar shakes and shingles residential siding materials.

The residential siding material preferences that builders expressed for new homes in six different price ranges are graphically represented in Figure 16, Figure 17, and Figure 18. Figure 16 represents preferences for residential siding materials that were found to be positively related to new home price. In other words, builders became more inclined to prefer the use of these residential siding materials as the price of the new home increased. These residential siding materials included brick, stucco, western red cedar, cedar shakes and shingles, and solid redwood. Figure 17 displays those residential siding materials where the builders' preferences were inversely

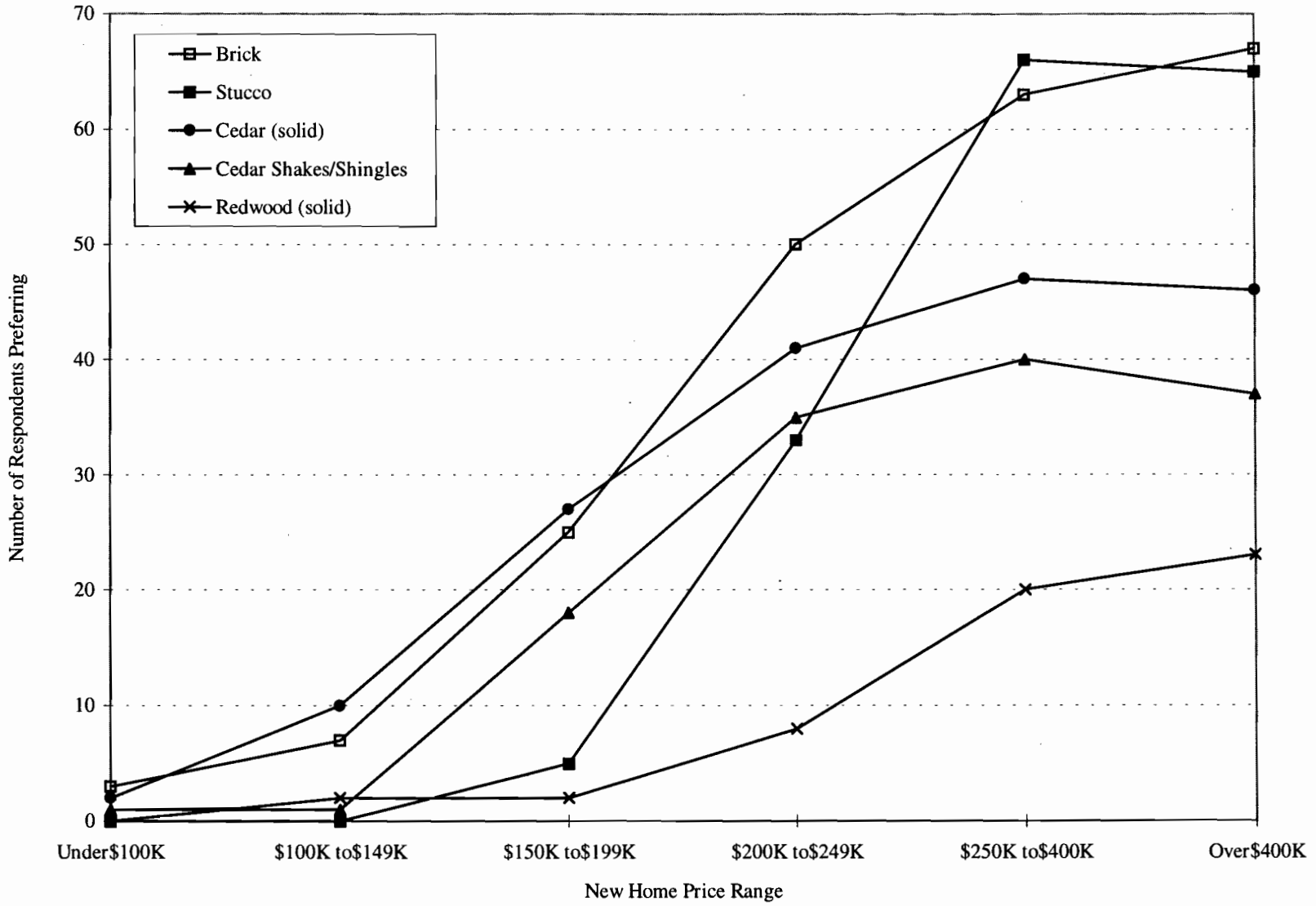

Figure 16. Builders preferences for various residential siding materials in which preferences for the materials are positively related to new home price.

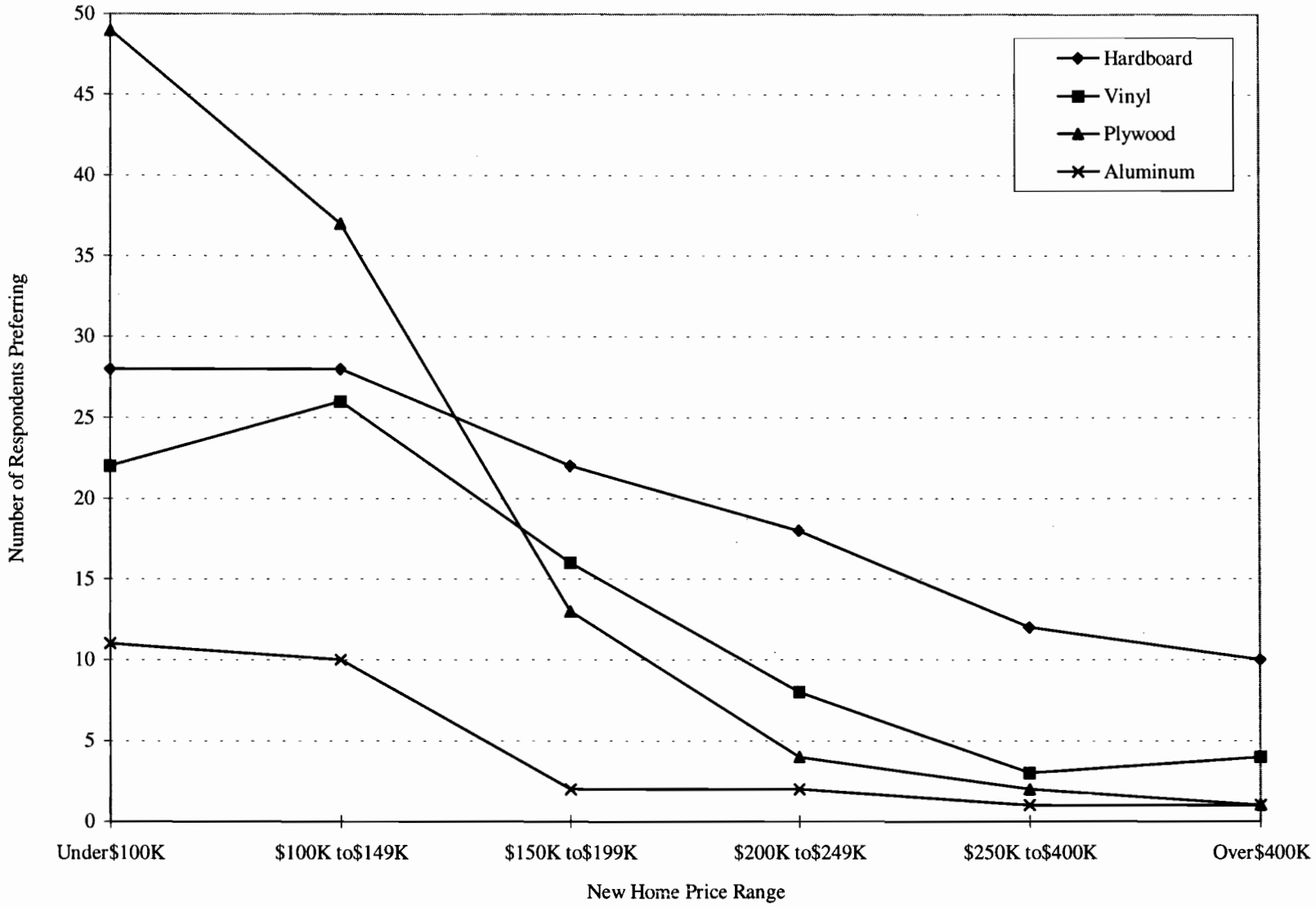

Figure 17. Builders preferences for various residential siding materials in which preferences for the materials are inversely related to new home price.

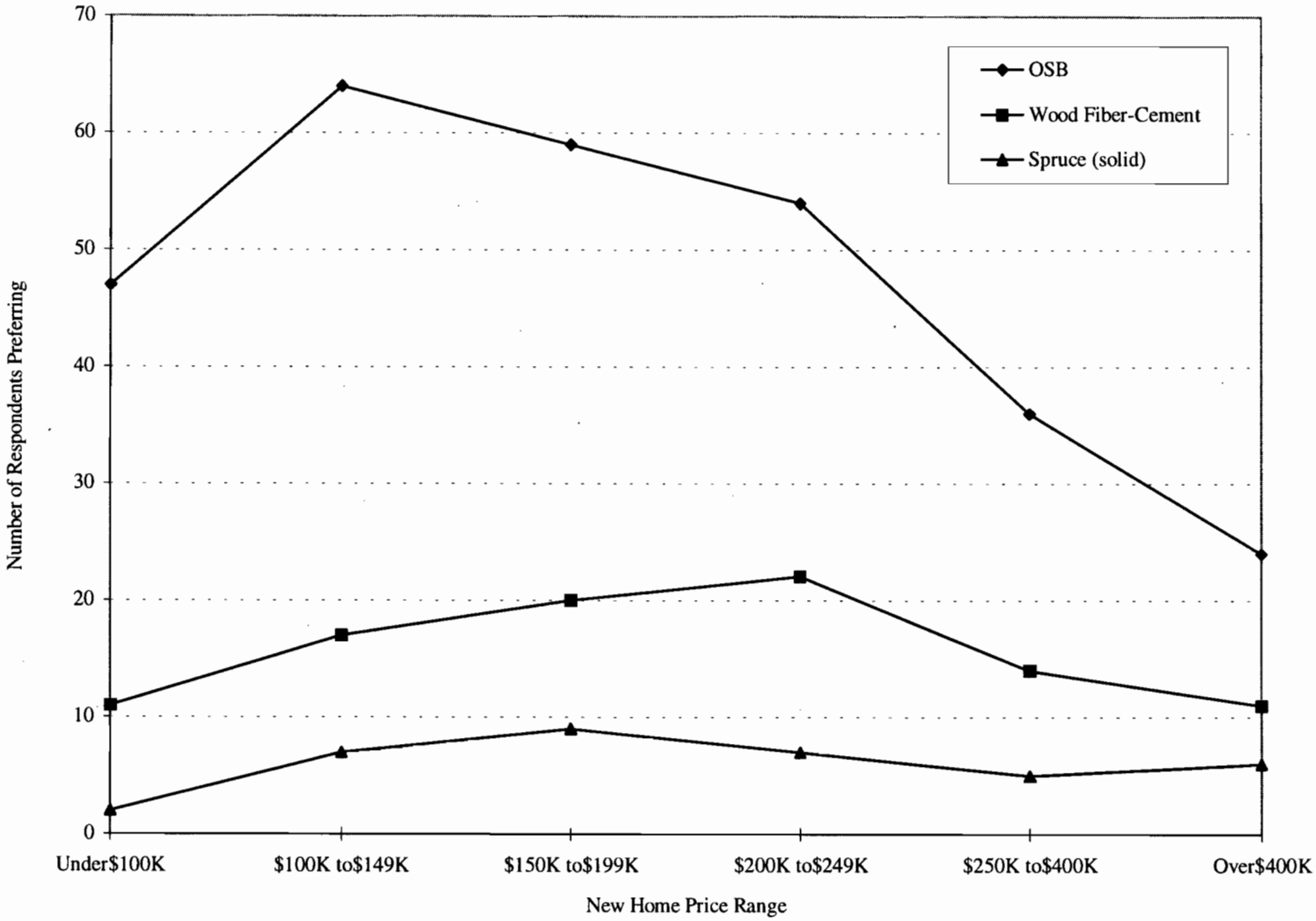

Figure 18. Builders preferences for various residential siding materials in which preferences for the materials display a slightly negative quadratic trend in relation to new home price.

Table 36. Residential siding materials that surveyed firms indicated would be most appropriate for new homes in six price ranges.

	Percent of Firms Indicating Siding Material is Appropriate for Use on New Homes in the Price Range of[a]					
Siding Material	Under $100K	$100,000 - $149,999	$150,000 - $199,999	$200,000 - $249,999K	$250,000 - $400,000	Over $400K
Brick	3.0	7.3	26.0	52.1	65.6	69.8
Stucco	0.0	0.0	5.2	34.4	68.8	67.7
Western Red Cedar	2.1	10.4	28.1	42.7	49.0	47.9
Cedar Shakes/Shingles	1.0	1.0	18.8	36.5	41.7	38.5
OSB	49.0	66.7	61.5	56.3	37.5	25.0
Redwood (solid)	0.0	2.1	2.1	8.3	20.8	24.0
Wood Fiber-Cement	11.5	17.7	20.8	22.9	14.6	11.5
Hardboard	29.1	29.1	22.9	18.8	12.5	10.4
Spruce (solid)	2.1	7.3	9.4	7.3	5.2	6.3
Vinyl	22.9	27.1	16.7	8.3	3.0	4.2
Plywood	51.0	38.5	13.5	4.2	2.1	1.0
Aluminum	11.5	10.4	2.1	2.1	1.0	1.0

[a] Based on the responses of 96 firms.

related to new home price, which include hardboard, vinyl, plywood, and aluminum residential siding materials. Figure 18 represents those residential siding materials in which a slightly negative quadratic trend in preference existed as new home price increased. These included OSB, wood fiber-cement, and solid spruce residential siding materials.

Distribution Channels

For each residential siding material, respondents were asked to indicate the source of the majority of their purchases, as reported in Table 37. For the most part, both wood-based and nonwood-based residential siding materials were purchased at either a local retail yard or from a wholesaler. For firms indicating that they had purchased western red cedar residential siding, one-half typically purchased the siding at their local retail lumber

Table 37. Survey respondents' suppliers for various residential siding materials.

	Number of Firms Indicating that Siding Material is Generally Purchased at				
Siding Material	Local Retail Lumber Yard	Large Home Center Chain	Wholesaler	Direct from Manufacturer	Never Purchased
OSB	51	0	37	0	11
Plywood	38	0	29	0	29
Brick	6	0	45	11	34
Western Red Cedar	30	0	30	0	36
Cedar Shakes/Shingles	24	0	29	1	42
Stucco	4	0	36	6	50
Hardboard	18	0	18	0	60
Vinyl	3	0	19	3	71
Wood Fiber-Cement	14	0	10	1	71
Redwood (solid)	7	0	7	1	81
Spruce (solid)	5	0	7	1	83
Aluminum	2	0	7	3	84

yard while the other half typically purchased through a wholesaler. Brick was the only residential siding material to be purchased in large measure directly from the manufacturer. No builders indicated that they purchased their residential siding materials from large home center chains.

RESIDENTIAL SIDING SURVEY DETERMINANT ATTRIBUTE ANALYSIS

Determinant Attribute Theory

Extensive research has been performed examining how individual attitudes can be measured. One out-growth of this research has been the development of multi-attribute attitude models that are used to measure consumers' attitudes (Wilkie and Pessemier 1973). As Stalling (1988, p.61) points out, "*underlying these models is the assumption that the consumers view products as bundles of attributes, features, or benefits, and that the attributes differ in their contribution to* [final] *product evaluation and choice.*" Attributes that influence consumer choice are called "determinant" (Myers and Alpert 1968). While a particular attribute may be important to the consumer, if the consumer feels that other products are equal with regard to that attribute, then the attribute is not considered a determinant factor in the purchase decision. Therefore, determinant attributes can be thought of as attributes that influence a consumer's purchase decision, as well as attributes that discriminate well between competing products.

Determinant Attribute Methodology

A dual question methodology was utilized in this study to identify the determinant attributes used by consumers of residential siding materials in making their purchase decision. The dual question method required the respondents to rate attributes in terms of how important each was in determining material choice and how much of a difference was perceived to exist among competing materials with regard to each attribute. Each respondent was asked to indicate the importance of 25 siding attributes using a Likert scale for which 1 = "Not Important At All" to 5 = "Of Critical Importance". Afterward, respondents were asked to indicate the extent to which each of the competing residential siding materials differed for the 25 siding attributes. Differences were measured on a Likert scale where 1 = "Very Similar" to 4 = "Very Different". The residential siding materials examined were: hardboard, plywood, OSB, vinyl, aluminum, western red cedar, cedar shakes and shingles, solid redwood, solid spruce, wood fiber-cement, brick, and stucco.

The determinance score was calculated by weighting the importance of a given attribute by the perceived difference for that attribute. For example, if x represents the importance rating and y the difference rating of a particular attribute provided by a survey respondent, then xy represents the "degree of determinance" for the given attribute and respondent. The determinance scores range from 1 to 20, since attribute importance was measured on a five-point scale while attribute difference was measured on a four-point scale.

In determinant attribute analysis, attribute scores are examined to determine those which are best able to discriminate between products. Since individual respondents use scales differently (for example, some respondents may respond using only the upper end of the scales where others will typically answer using the lower end of the scales), the scores for each respondent were standardized (t-score). As such, the determinance scores for each individual respondent had a mean of 50 and a standard deviation of 10.

Algebraically, the determinance score can be calculated as follows:

$$D_i = 10((P_iI_i - X) / s) + 50$$

where
- D_i = Determinance score for attribute i
- P_i = Perceived difference between siding materials along attribute i
- I_i = Importance of attribute i
- X = Respondent's grand determinance mean, or the sum of all $(P_i)(I_i)$ divided by 25
- s = Standard deviation of X
- 10 and 50 = z-score to t-score conversion factors

To determine whether an attribute is to be considered determinant, a one-tailed z-test is used to determine which attributes are significantly greater than the mean. The population mean and standard deviation are approximated using the grand mean and standard deviation from the survey sample. This method, developed by Alpert (1971), has been implemented in numerous market research studies.

Results of Determinant Attribute Analysis and Importance Ratings

A profile of the average determinance scores for all survey respondents along the 25 attributes is displayed in Figure 19. Thirteen of the 25 attributes were found to have means significantly greater than the grand mean of 50. These 13 attributes should therefore be considered as determinant attributes.

Competitive price, beautiful appearance, and high status/quality image were found to be the most determinant attributes. The second grouping of determinant attributes included: holds stains and paints, fast/easy installation, high durability, low/easy maintenance, and dimensional stability. The final grouping of determinant attributes included: mold/mildew resistance, availability, easy to repair, impact/dent resistance, and warranty/guarantee. The attribute scores for thermal insulation, brand name product, wide color selection, material is "natural," and structural strength were ranked lowest among the 25 residential siding material attributes.

A better understanding of determinant attribute analysis is possible by comparing Figure 19 against Figure 20. Figure 20 displays the average *importance* scores as reported by all respondents for each of the 25 residential siding material attributes. As is evident from this comparison, determinance and importance do not readily coincide. For instance, the attribute of service from retailer received the seventh highest average importance score, but was ranked fifteenth in determinance score. In addition, service from retailer was not found to be statistically determinant. Interestingly, the attribute of availability was found to have the second highest average importance score among the 25 residential siding material attributes, but was ranked tenth in determinance score (it was a determinant attribute, however). This comparative example clearly illustrates an interpretation problem that exists in traditional market research when simply evaluating the importance that respondents place on a range of product attributes. The importance rating for availability suggests that this attribute is extremely important in defining how builders' evaluate residential siding materials against one another. The differences that builders perceive in availability among the residential siding materials are minimal, however, indicating that builders are unlikely to base a substantial amount of their purchase decision on this attribute. Rather than purchasing an alternative residential siding material simply because it is available, it is more likely that the builder would seek out the preferred product elsewhere (*e.g.*, another wholesaler or retailer).

Strategic Ramifications of Determinant Attribute Results

The results of the determinant attribute analysis identified 13 out of the 25 residential siding material attributes as being significant. In particular, these 13 attributes should be given considerable weight in the formulation and execution of a marketing strategy. The analysis indicates that competitive price should be emphasized in the promotion of western red cedar siding, but only in relation to other residential siding materials which have similar beauty, high status, and quality image characteristics. In addition, western red cedar residential siding's installation, durability, maintenance, and dimensional stability attributes should be emphasized to some extent in promotional efforts. How these attributes are emphasized, however, is contingent on how builders currently perceive the residential siding materials relative to one another. The identification of the determinant attributes now allows for further investigation into how builders perceive each of the 12 residential siding products along the 13 determinant attributes (an analysis of builders perceptions follows this section).

Several different promotional and product positioning strategies can be developed for increasing the sales of a particular residential siding material. The success of the strategy depends in large measure on how the purchaser (*e.g.*, the builder) perceives the product on the determinant attributes. A successful and creative strategy, however, should begin with a thorough understanding of the purchaser's attitude structure.

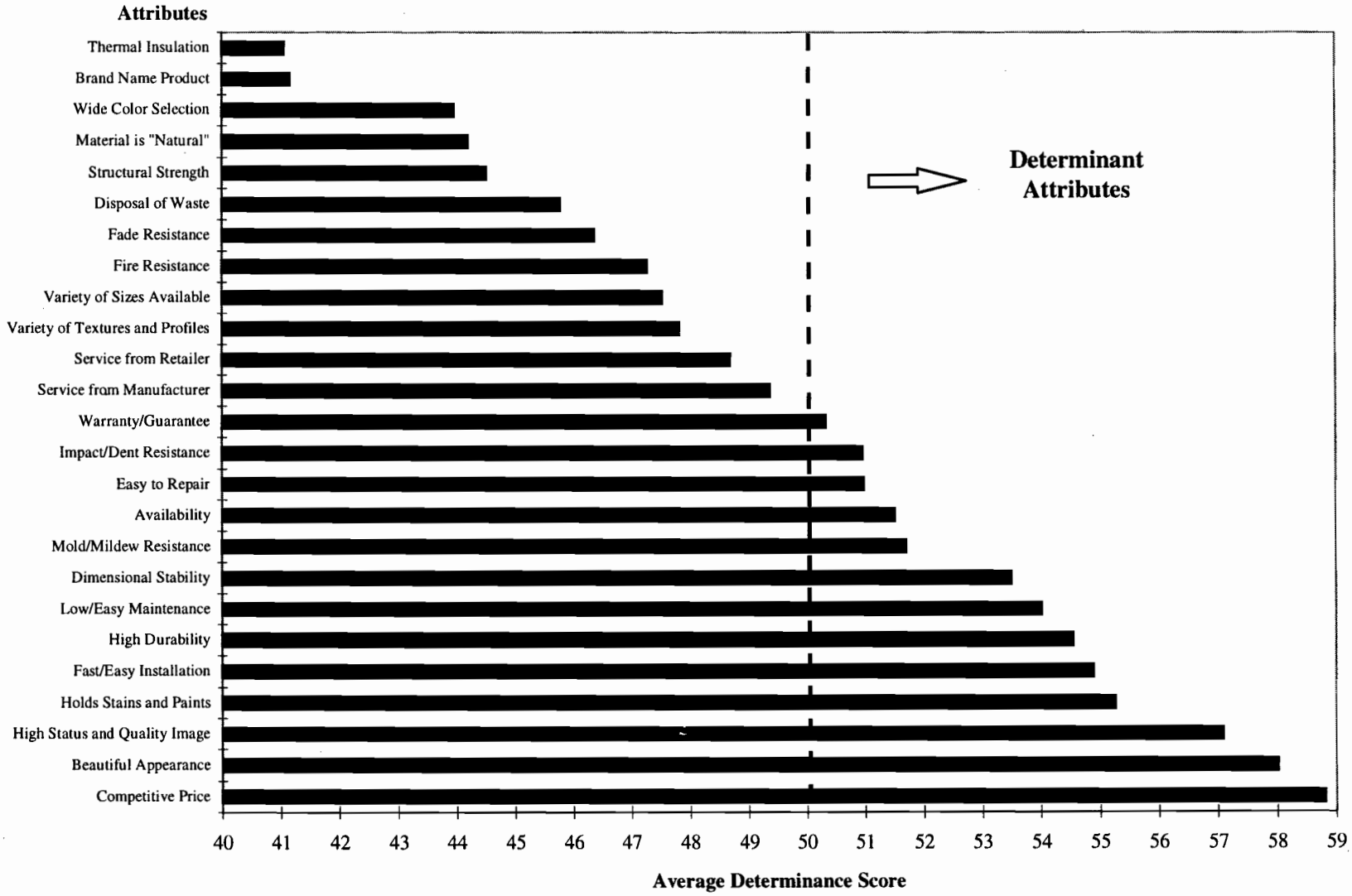

Figure 19. Average determinance score ratings for 25 residential siding material attributes.

Note: Those attributes to the right of the dashed line are "determinant," and are significantly greater than the mean score of 50.

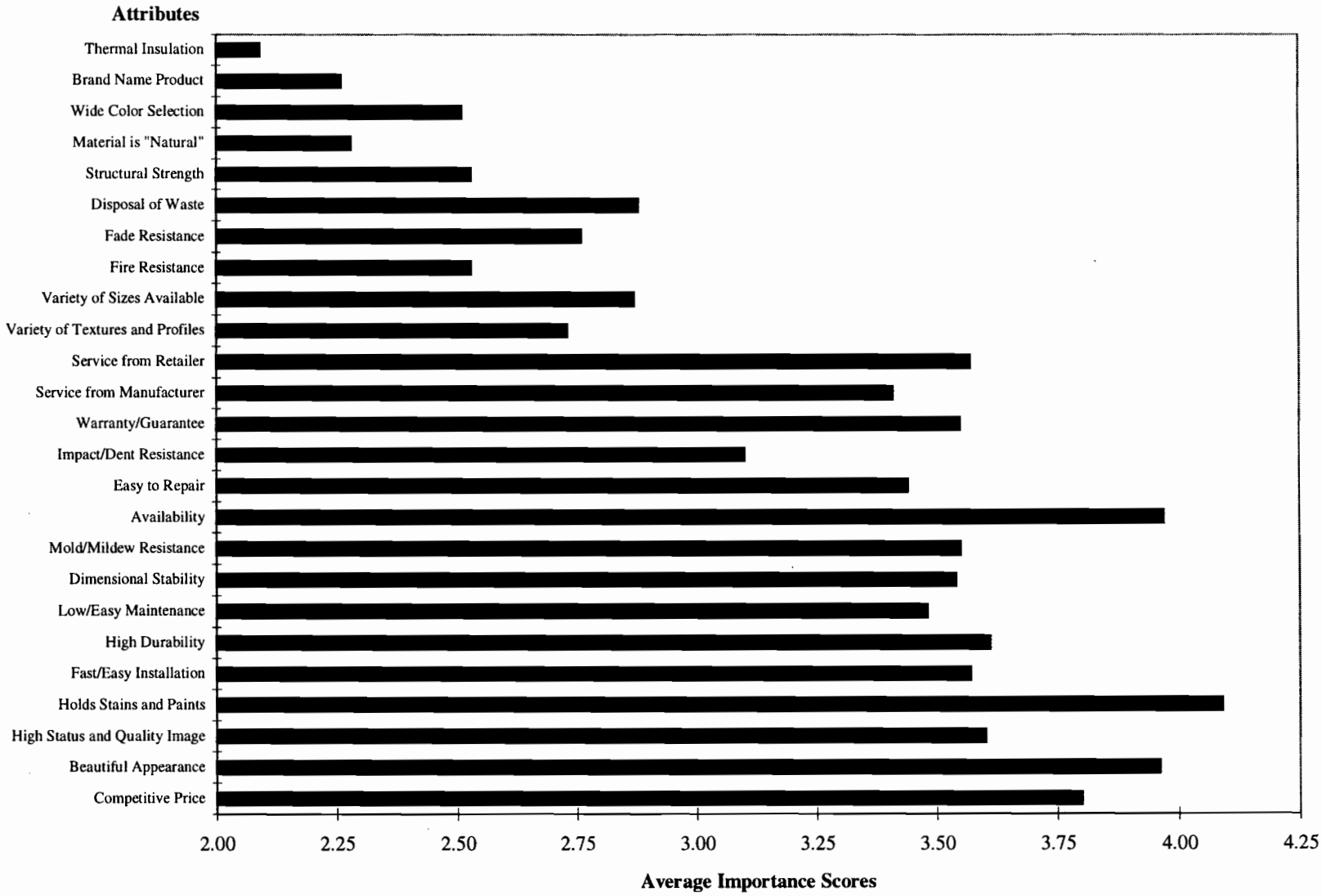

Figure 20. Average importance ratings for 25 residential siding material attributes.

Note: Attributes are arranged in order of determinance to allow direct comparison with Figure 19.

RESIDENTIAL SIDING SURVEY PERCEPTUAL MAPPING ANALYSIS

Foundations of Perceptual Mapping

Perceptual mapping, also known as multidimensional scaling (MDS), is a procedure used to determine the perceived image that an individual has regarding a set of products (Hair, Anderson, Tatham, and Black 1992). The goal of perceptual mapping is to transform consumer judgments of similarities or preferences (*e.g.*, preference for various residential siding materials) into distances that are represented in a multidimensional space. Suppose, for instance, OSB and plywood residential siding materials are perceived by respondents as being most similar when compared with all other possible pairs of residential siding materials. Perceptual mapping techniques will position OSB and plywood in such a way that the distance between the two residential siding materials in multidimensional space will be shorter than the distance between any other pair of residential siding materials. Graphically, OSB and plywood could be represented by 1 and 5 in Figure 21.

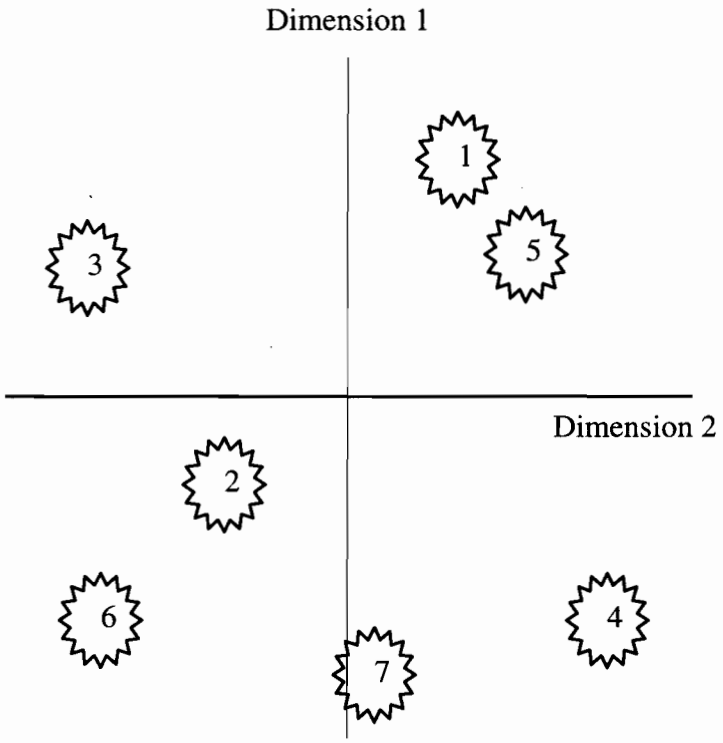

Figure 21. Example of a multidimensional map of perceptions for seven hypothetical industrial products along two dimensions.

Products such as residential siding materials can be thought of as possessing both perceived and objective dimensions. Objective dimensions are physical or tangible characteristics such as color, weight, or shape. Perceived dimensions are subjective characteristics that individuals attach to an object. Perceived dimensions would include such subjective characteristics as image, beauty, and value. It should be noted that in many cases perceived and objective dimensions do not correspond.

As Hair, Anderson, Tatham, and Black (1992) note, "*Perceptual mapping is most appropriate in two situations*: (1) *as an investigative technique to identify unrecognized dimensions affecting behavior, or* (2) *as a means of obtaining comparative evaluations of objects when the specific bases of comparison are unknown or undefinable.*" In this analysis of builders perceptions, our goal was to make comparative evaluations of 12 residential siding

materials so as to develop a more successful marketing strategy for western red cedar residential siding manufacturers, wholesalers, and retailers.

To make the perceptual maps useful to managers, however, perceptions should be related to the builders' general behavior or intended behavior. This linking of products in multidimensional space to behavior is typically achieved by superimposing onto the perceptual map the "ideal point(s)." An ideal point represents that position in the dimensional space that the "ideal product" would occupy, assuming such a product exists. As Stalling (1988) indicates, the ideal points should serve as a reference for the products being evaluated, indicating how much of an attribute is desired by the respondents, since increasing the amount of given attribute does not necessarily equate to a better or improved product.

Perceptual Mapping Methodology

The compositional approach to perceptual mapping used in this analysis derives preference evaluations from a series of separate evaluations by each of the respondents. These individual evaluations are then combined using a multivariate statistical technique called multiple discriminant analysis (MDA) to form an overall evaluation. MDA provides an advantage in that it allows for the identification of differences among two or more market segments. In this analysis, 12 attributes were used as the independent (predictor) variables and 12 residential siding materials represented the dependent variable. The 12 attributes included: competitive price, easy and low cost maintenance, fast and easy installation, resistance to impacts and denting, beautiful appearance, high status and quality image, high durability, wide color selection, variety of textures and profiles, fade resistance, dimensional stability, and high product consistency/uniformity. It should be noted that the data gathered for perceptual mapping analysis was distinct from the data gathered from the determinant attribute analysis. Hence, conclusions made from the two analytical techniques should be made independently from one another.

A measure of each respondent's preferred residential siding material rating for each of six home price ranges was used as a proxy for the ideal points. If multiple preferences were indicated, then the average rating for each attribute was used. Employing the functions derived from the MDA, the ideal points were fitted into the same multidimensional space as the residential siding materials.

Results of Perceptual Mapping Analysis

Seventy builders rated all twelve residential siding materials on the twelve attributes. To determine which of the twelve attributes differentiated best between the various residential siding materials, a multiple discriminant analysis (MDA) was performed on the data. The analysis determined that seven functions were statistically significant. To increase the interpretability of the MDA results, a varimax rotation was also used in the analysis. The varimax-rotated transformation matrix is shown in Table 38. This table also shows the amount of variance that is accounted by each of the seven functions. Function I was the most important in terms of discriminating the siding materials, accounting for 32.8% of the explained variance. Functions II, III, IV, V, VI, and VII accounted for 17.3, 10.3, 10.1, 9.3, 8.5, and 3.6% of the total explained variance, respectively. While Function VII was considered statistically significant, it was dropped from the interpretation portion of the analysis since it accounted for very little of the total explained variance.

The MDA reduced the twelve residential siding material attributes to seven dimensions. Each of the dimensions can be described by a function that represents those attributes in which the residential siding materials differ the most. Each discriminant function represents a linear combination in which a discriminant score can be calculated for each of the respondents, which is very similar to a regression analysis. Examination of each of the attributes having the highest attribute loadings on the function allows for the interpretation and labeling of each of the functions.

Table 39 displays the rotated discriminant function loadings. Each loading represents the amount of correlation between each residential siding material attribute and the discriminant dimension. The correlation between beautiful appearance and Function I, for instance, was .724. This means that 72.4% of the variance in the residential siding material attribute of beautiful appearance was accounted for in Function I. Examination of

Table 38. Results for varimax rotated discriminant analysis showing percent of variance accounted by each function.

	Rotated Transformation Matrix[a]						
	Function I	**Function II**	**Function III**	**Function IV**	**Function V**	**Function VI**	**Function VII**
Function 1	.746	-.533	.172	.217	.045	-.124	.081
Function 2	-.293	-.202	-.031	.475	.546	.490	.235
Function 3	-.126	.004	.901	-.068	-.118	.117	.163
Function 4	.265	.393	.091	.525	.063	.143	-.565
Function 5	.087	.018	-.137	.098	-.433	.302	.462
Function 6	.356	.633	-.002	.011	.169	-.132	.401
Function 7	-.328	.126	.137	.420	-.057	-.587	.114
Percent of Variance Explained	32.83	17.27	10.32	10.09	9.32	8.54	3.58

[a] Factors were rotated using a varimax rotation.

attributes that loaded high on the same functions allows for the grouping of attributes that discriminate the materials similarly. The MDA revealed that high status/quality image and beautiful image loaded high on Function I, fast/easy installation on Function II, impact/dent resistance on Function III, fade resistance on Function IV, easy/low cost maintenance on Function V, high product consistency on Function VI, and dimensional stability on Function VII. The remaining four residential siding material attributes were not found to load high on any of the seven statistically significant attributes, suggesting that they do not effectively discriminate between the various residential siding materials.

Table 39. Rotated discriminant function loadings (correlations) between residential siding material attributes and discriminant dimensions (functions).

	Rotated Discriminant Function Loadings[a]						
Siding Attribute	**Function I**	**Function II**	**Function III**	**Function IV**	**Function V**	**Function VI**	**Function VII**
High Status/Quality Image	***.946***	.061	.032	.074	-.002	.076	.132
Beautiful Appearance	***.724***	.023	.080	.002	.270	.034	-.054
Fast/Easy Installation	.058	***.975***	.056	.067	.072	.059	.021
Impact/Dent Resistance	.066	.056	***.976***	.048	.066	.065	.062
Fade Resistance	.057	.067	.048	***.938***	.123	.062	.099
Easy/Low Cost Maintenance	.135	.085	.074	.146	***.921***	.158	.097
High Product Consistency	.078	.061	.067	.064	.139	***.935***	.101
Dimensional Stability	.073	.020	.061	.097	.079	.096	***.902***
High Durability	.191	.047	.151	.130	.201	.154	.118
Variety of Textures/Profiles	.095	.045	.033	.060	.034	.028	.057
Competitive Price	.074	.131	.048	.029	.070	.052	.012
Wide Color Selection	.013	-.014	.032	.041	.066	-.052	-.091

[a] Factors were rotated using a varimax rotation.

The mean discriminant scores, or group centroids, for each of the twelve residential siding materials are displayed in Table 40. The discriminant scores in this table are standardized. As such, the group centroids can be interpreted to be the number of standard deviations for each residential siding material from the average of all materials on each function. Plotting these scores in a multidimensional space (*e.g.*, two dimensions) allows for a comparison of the residential siding materials relative to one another along the attributes that were found to be statistically significant.

The solution to the MDA can be plotted in a seven-dimensional space. However, to make interpretation of the results more understandable, three two-dimensional plots were constructed. The first plot is shown in Figure 22, where the high status image/beautiful appearance and fast and easy installation functions accounted for 50.1% of the total explained variance in the analysis. The second plot is shown in Figure 23, where the functions of impact/dent resistance and fade resistance accounted for 20.4% of the total explained variance. Finally, the third plot is shown in Figure 24, where the functions of easy/low cost maintenance and high product consistency and uniformity accounted for 17.9% of the total explained variance. The ideal point for each new home price range have also been superimposed onto each of the three plots. These points represent the spot that would be occupied by the "ideal product."

Table 40. Average discriminant scores (group centroids) for residential siding materials.

	Rotated Discriminant Function Centroids[a]						
Siding Material	**Function I**	**Function II**	**Function III**	**Function IV**	**Function V**	**Function VI**	**Function VII**
Aluminum	-1.5007	.5245	-1.9109	.4186	.8413	.7797	.0915
Brick	1.6614	-1.7242	1.0361	1.4890	.8531	.2352	.7032
Western Red Cedar	1.0521	.2779	-.0378	-.5711	-.7331	-.9752	-.3456
Cedar Shakes/Shingles	1.1328	-.7690	-.0704	-.5472	-.4809	-.9353	-.4110
Hardboard	-1.2010	.6014	.3758	-.1387	-.2341	.4512	-.2941
OSB	-.4634	.8120	.3257	.0034	-.0663	.3430	-.4500
Plywood	-1.6229	1.2716	.2221	-.7961	-.5606	-.0038	.2729
Redwood (solid)	1.2028	.0922	-.2287	-.5776	-.7489	-.7362	-.2306
Spruce (solid)	.1031	.1986	-.1788	-.5303	-.8213	-.7884	-.3685
Stucco	1.4950	-1.4243	.0027	.8640	.4705	.3850	.4330
Vinyl	-1.3039	.5576	-.4567	.4566	1.0132	.5608	-.0997
Wood Fiber-Cement	-.8518	-.2154	.7128	-.2894	.3836	.6374	.6391

[a] Factors were rotated using a varimax rotation.

Interpretation of the Perceptual Maps

The three perceptual maps can be utilized to evaluate each of the residential siding materials. The distance between any two siding materials can be considered as a measure of the substitutability between the two materials. In other words, two siding materials located next to one another are considered substitutes by the surveyed builders. Theoretically, as a siding material becomes located closer to an ideal point, the larger its market share should be for homes in the price segment.

The attribute dimensions that builders indicated were the most relevant to them when making their residential siding purchase decision were (1) high image status and beautiful appearance and (2) fast and easy installation, as seen in Figure 22. Western red cedar residential siding was found to occupy the positive halves of both dimensions, indicating that builders felt that western red cedar siding possessed a high image status, a beautiful appearance, and was somewhat fast and easy to install. Brick, stucco, cedar shakes and shingles, and redwood siding materials were found to possess slightly greater preference ratings in the high image status and beautiful appearance dimension than western red cedar. The differences between these materials and western red cedar, however, are so marginal that it is likely that builders perceive western red cedar to possess the same image and beauty characteristics as brick, stucco, redwood, and cedar shakes and shingles (see Tables 45 and 46 in APPENDIX C).

Plywood, OSB, hardboard, aluminum, and vinyl siding materials were perceived to be the fastest and easiest to install. Surprisingly, western red cedar was seen as being somewhat fast and easy to install, being perceived as nearly equal to that of vinyl, aluminum, and hardboard siding materials. The differences among the high image products in the fast and easy to install dimension were substantial. Of the five siding materials that were perceived as possessing high image status and beautiful appearance, western red cedar ranked the highest on the fast and easy to install dimension. In fact, all other high image residential siding materials were located in the

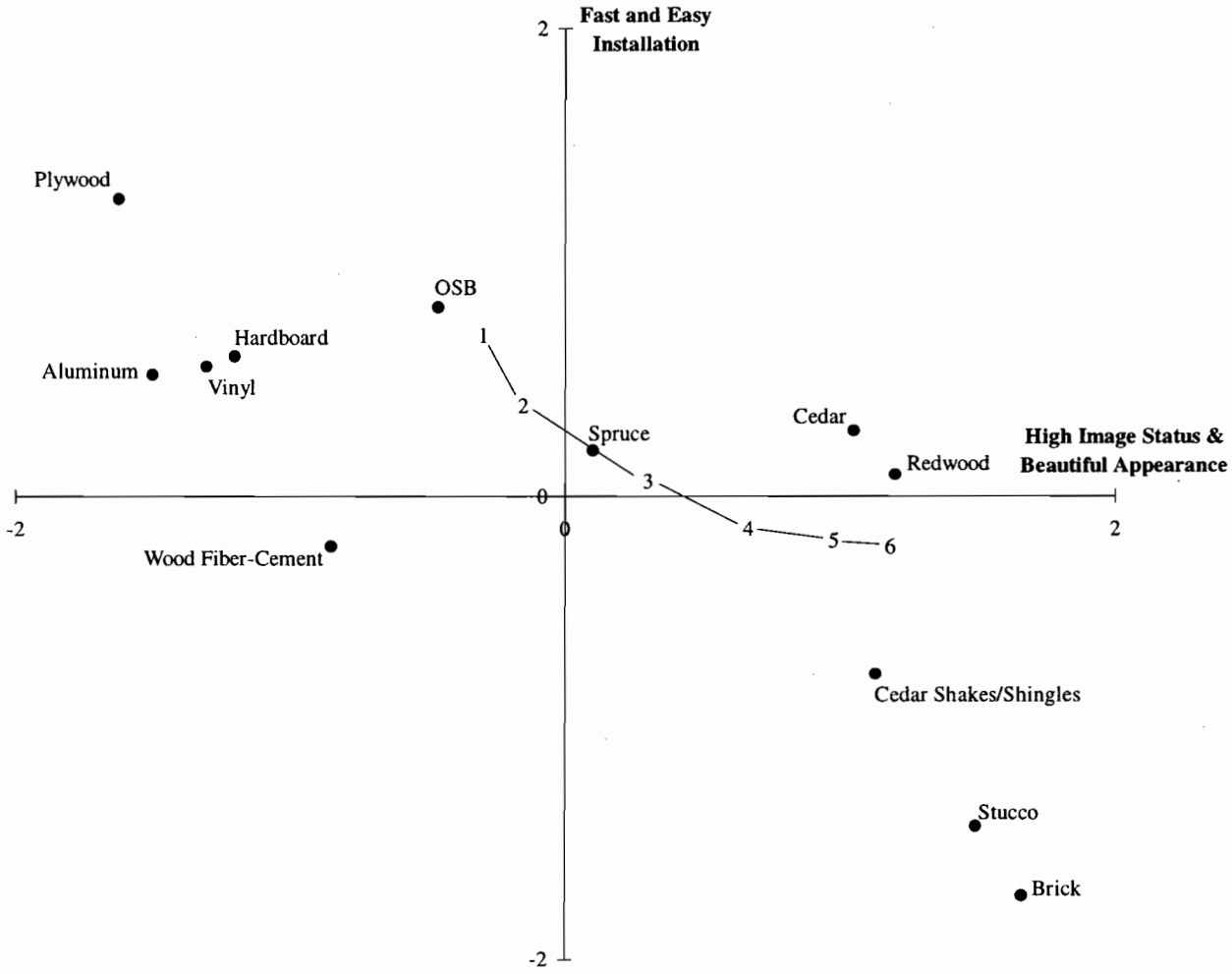

Figure 22. Puget Sound builders' perceptions of residential siding materials, and ideal points along the dimensions of high status image/beautiful appearance and fast and easy installation.

Notes:

The two dimensions accounted for 50.1 percent of the total explained variance in the analysis.

Ideal points are indicated by the connected numbers 1-6 and relate to preferences for new homes priced:

1 Under $100,000
2 $100,000 - $149,999
3 $150,000 - $199,000
4 $200,000 - $249,000
5 $250,000 - $400,000
6 Over $400,000

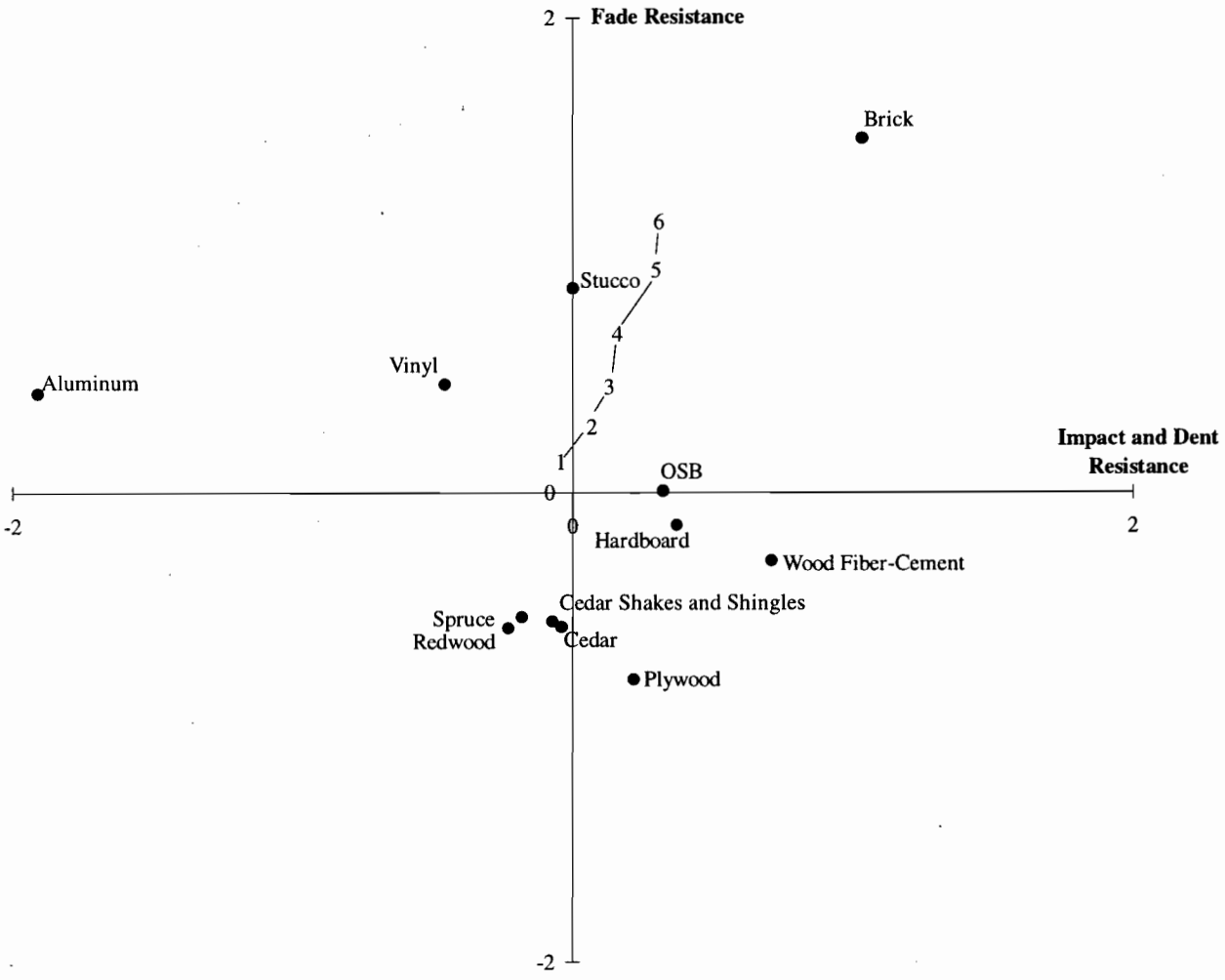

Figure 23. Puget Sound builders' perceptions of residential siding materials, and ideal points along the dimensions of impact/dent resistance and fade resistance.

Notes:

The two dimensions accounted for 20.4 percent of the total explained variance in the analysis.

Ideal points are indicated by the connected numbers 1-6 and relate to preferences for new homes priced:

1 Under $100,000
2 $100,000 - $149,999
3 $150,000 - $199,000
4 $200,000 - $249,000
5 $250,000 - $400,000
6 Over $400,000

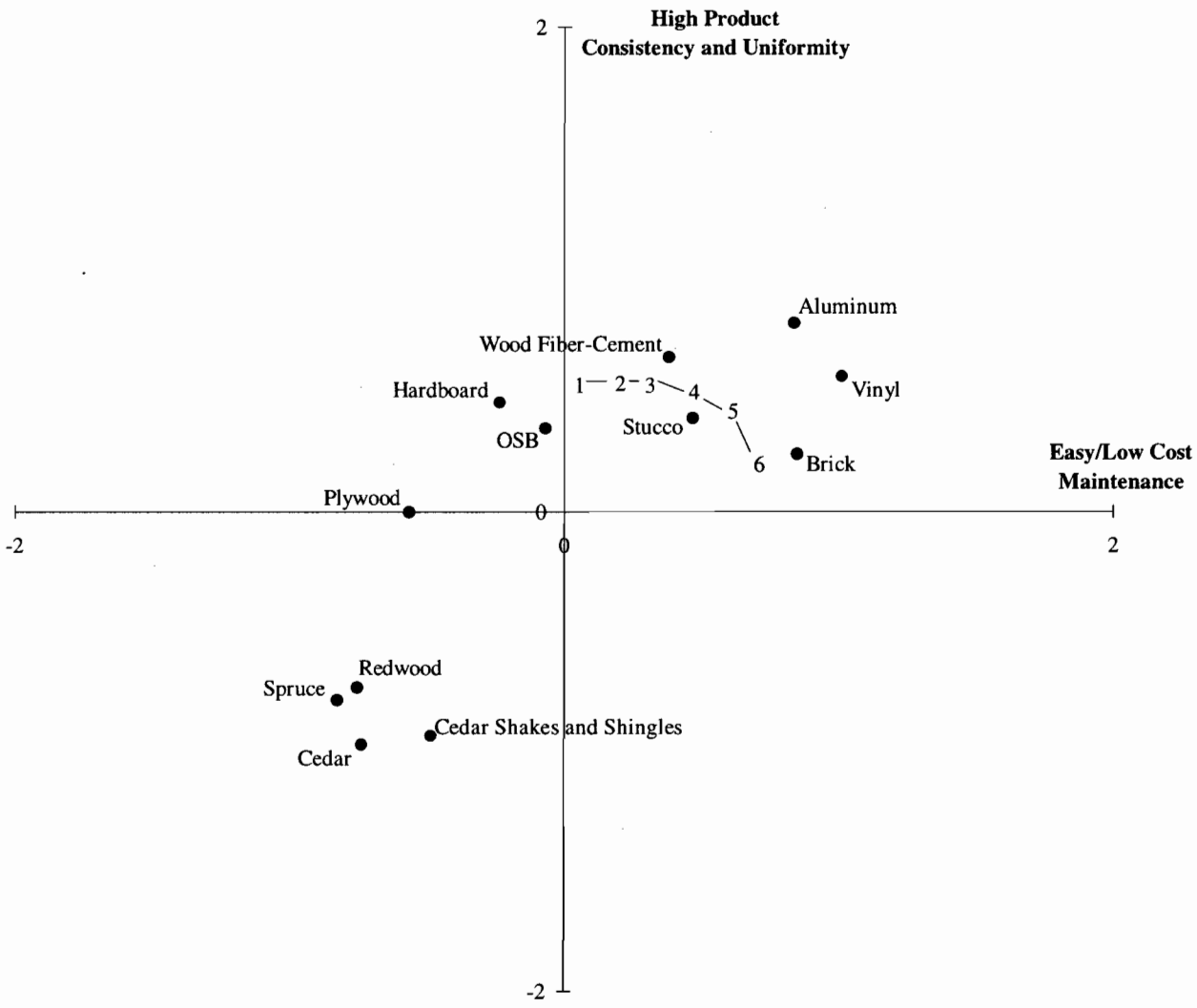

Figure 24. Puget Sound builders' perceptions of residential siding materials, and ideal points along the dimensions of easy/low cost maintenance and high product consistency and uniformity.

Notes:

The two dimensions accounted for 17.9 percent of the total explained variance in the analysis.

Ideal points are indicated by the connected numbers 1-6 and relate to preferences for new homes priced:

1 Under $100,000
2 $100,000 - $149,999
3 $150,000 - $199,000
4 $200,000 - $249,000
5 $250,000 - $400,000
6 Over $400,000

negative half of the perceptual map, with the exception of redwood. The high image status of redwood, while being perceived as nearly the same as western red cedar, is relatively unimportant since redwood siding has virtually no presence in the Puget Sound market.

The plotted ideal points in Figure 22 indicated that redwood siding was positioned closest to what builders suggested was the ideal product for new homes priced over $200,000 (ideal points 4, 5, and 6) with respect to the high image status/beautiful appearance and fast and easy installation dimensions. However, of the materials with a presence in the Puget Sound market, western red cedar and cedar shakes and shingles were found to be the materials most closely positioned toward the ideal points for new homes priced over $200,000.

Western red cedar siding was found to be positioned in the negative half of both the fade resistance and impact/dent resistance dimensions, as shown in Figure 23. Residential siding materials perceived to have a more advantageous position than western red cedar along these two dimensions included hardboard, wood fiber-cement, OSB, stucco, and brick. Stucco was found to be positioned closest to the ideal points for new homes priced over $200,000, while OSB and hardboard were the most closely positioned materials for new homes in the lower price ranges.

It is unlikely that many of the residential siding materials examined can be repositioned toward the ideal points for the various price ranges of new homes since fade and dent resistance are physical properties of the materials that would be extremely difficult to change. It is interesting, however, that these two dimensions ranked high in the builders' preference structure. However, if western red cedar manufacturers can determine a method to increase the fade resistance of the residential siding they produce (for example, through a chemical treatment), they would likely reposition the perception of western red cedar into a more favorable location on the perceptual map.

The final two dimensions that rated high in the builders' preference structure were easy/low cost maintenance and high product consistency and uniformity, as shown in Figure 24. As the ideal points in the figure indicate, the most advantageous position for a siding material to possess would be in the upper right hand quadrant of the preference map. The close proximity of each of the ideal points to one another suggests that builders prefer (or expect) residential siding materials that possess easy/low cost maintenance and high product consistency and uniformity.

Aluminum, wood fiber-cement, vinyl, and hardboard residential siding materials were perceived by respondents to possess the highest product consistency and uniformity among the twelve materials surveyed. Western red cedar, spruce, redwood, and cedar shakes and shingles were perceived to possess the lowest product consistency and uniformity, with western red cedar siding ranking the lowest of all twelve residential siding materials.

Western red cedar siding occupies the worst possible position in Figure 24. A strategy to reposition western red cedar toward the upper right quadrant in the figure, however, is quite feasible. For instance, western red cedar siding manufacturers could increase the grade reliability within and between each lift sold. In addition, eliminating poor quality material from reaching the market in the first place would likely improve builders' perceptions of western red cedar to the point that they would at least rate it as being on average with all other siding materials in terms of consistency and uniformity (a position now held by plywood siding).

In terms of increasing builders' perceptions of western red cedar as an easy/low cost maintenance product, manufacturers could prefinish their products. It is also likely that by eliminating poor quality material from reaching the market, existing perceptions that western red cedar is a high maintenance product would improve. It should be noted, however, that the western red cedar manufacturer's ability to increase the perception along the easy/low cost maintenance dimension is much more difficult than in the high product consistency and uniformity dimension. This is due to properties that are inherent with solid wood products (*e.g.*, frequent painting).

In summary, this research effort indicates that western red cedar residential siding is perceived by builders to possess high image status, beautiful appearance, and relatively fast and easy installation characteristics. However, it is also perceived as possessing relatively poor fade resistance, impact and dent resistance, product consistency and uniformity, and maintenance characteristics.

STRATEGIC RECOMMENDATIONS FOR WESTERN RED CEDAR SIDING MANUFACTURERS

The models developed in this study have so far been used only as diagnostic tools rather than strategic ones. Several strategies are available to the manufacturers, wholesalers, and retailers of solid western red cedar residential siding materials and the Western Red Cedar Lumber Association that could increase western red cedar's competitive position among the residential siding materials currently being used in the Puget Sound market. For the most part, these strategies involve (1) changing the properties/characteristics of the siding currently produced and shipped, (2) increasing the level of quality control mechanisms in place that are used to ensure product quality and uniformity, and (3) changing the current promotional message.

The analyses in this study indicate the following:

Western red cedar manufacturers, wholesalers, and retailers should capitalize on the perception among builders that western red cedar residential siding is fast and easy to install. This attribute should be emphasized in a promotional message comparing western red cedar to other high-end residential siding materials, such as brick and stucco. In other words, manufacturers should simultaneously market western red cedar's high image status appeal and the perception among builders that western red cedar is fast and easy to install. Comparing western red cedar with lower-end residential siding materials on the fast and easy installation dimension may erode perceptions builders have regarding western red cedar's high image status and beautiful appearance, and should therefore be avoided. Also, a promotional strategy should be considered in which the ideal points displayed in the perceptual map in Figure 22 are repositioned closer to western cedar siding's position. For example, a promotional strategy stressing fast and easy application of a high-end residential siding product (*e.g.*, time is money) should be considered by western red cedar manufacturers.

The final perceptual map shown in Figure 24, which reveals western red cedar residential siding's lowest rating along the product consistency and uniformity attribute and very low rating along the easy/low cost maintenance attribute is disturbing. However, it offers western red cedar siding manufacturers, wholesalers, and retailers considerable opportunity, since these perceptions can be altered with changes in current manufacturing methods, quality control, and distribution.

Western red cedar manufacturers should make a concerted effort to change the quality of their shipped product. In particular, product consistency and uniformity should be addressed. In addition, strong consideration should be given to repositioning western red cedar so that builders, architects, and designers perceive it as being distinct in quality and image relative to competing residential siding materials. A high-grade western red cedar residential siding material would hopefully be promoted and produced in such a way that it is perceived as having a nearly equal product consistency and uniformity perception among builders as brick, hardboard, stucco, and OSB siding materials (as shown in Figure 24). Improving western red cedar's current product consistency and uniformity attribute will also improve the perception that builders have of western red cedar's image status and beautiful appearance. As such, a premium price could be charged for an improved, high-end western red cedar product.

A promotional effort should be made to address the perception that western red cedar is expensive and difficult to maintain. How can the perception of this attribute be improved? First, the product can be prefinished using a high grade stain or primer. In addition, the product should be grade consistent and not placed on the market in green condition. Third, promotional literature addressing long-term maintenance issues should be considered. This literature should accompany every lift of western red cedar sold and should also address the proper method of installing western red cedar siding.

Finally, western red cedar siding manufacturers, wholesalers, and retailers should make a strong attempt to avoid price competition. The analyses in this study indicate that price competition (*i.e.*, price wars) conflicts with builders' perception of a residential siding material's high status/quality image and beautiful appearance attributes. Creating a conflicting image of western red cedar has likely decreased its demand among high-end home builders while at the same time increased the use of western red cedar among lower-end home builders.

This shift in the market, however, has not been significant enough for western red cedar manufacturers, wholesalers, and retailers to recoup profits that are typically made in the high-end market.

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APPENDIX A
CALCULATION OF RESIDENTIAL SIDING SURVEY SAMPLE SIZE

Calculation of Residential Siding Survey Sample Size

Implicit assumptions:

1. Normally distributed population.
2. Error of estimation is bounded at 5%.
3. Confidence interval is set at 95%, which is the standard for survey research.
4. The proportion of builders/contractors, p, who have used residential siding materials is estimated to be at least 0.90. This is like to be a very conservative estimate. A similar study obtained results where p was greater than 0.99.

Equation:

$$n = \frac{N(p)(q)}{(N-1)\frac{\beta^2}{4} + (p)(q)}$$

n = sample size
N = builder/contractor population size
p = proportion of builders/contractors who have used residential siding materials
q = (1 - p)
β = Error bound on estimation (0.05)

Estimation of sample size:

$$n = \frac{(641)(0.90)(0.10)}{(640)\left[\frac{(0.05)^2}{4}\right] + (0.90)(0.10)} = 117.734$$

Results:

A minimum of 118 returned surveys are required in order to meet the error of estimation bound at the 95% confidence level. Assuming a 25% response rate and a 5% undeliverable rate, a minimum 496 surveys must be mailed. A 5% "cushion" will be added to the minimum, resulting in a total of 521 that must be mailed.

Although a minimum of 496 surveys must be mailed, the actual mailing will consist of 521 surveys.

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APPENDIX B
RESIDENTIAL SIDING SURVEY PRENOTIFICATION
LETTER, COVER LETTER, FOLLOW-UP LETTER AND QUESTIONNAIRE

Prenotification Letter

July 28, 1995

Builder/Organization
Dear :

I am asking for your participation in a research project being conducted by the Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington. The purpose of this project is to assess the opinions that construction professionals like yourself have regarding the advantages and disadvantages of various siding materials currently being used in residential construction. The results of the questionnaire will be used to help both siding manufacturers and building materials distributors to better understand the needs of residential home builders and siding contractors.

In about one week, I will be sending you a questionnaire. I ask that it be completed by the person in your firm who is most involved in decisions relating to the purchase and use of siding products. It should only take a few minutes to complete.

The answers that your firm provides will be of *significant* importance to the success and accuracy of this research since your firm is one of only a small number of firms in which individuals are being asked to give their opinions on residential siding materials.

All information that you provide will be held in the strictest confidence and will only be used in combination with the information provided by other firms in the Puget Sound area. When you receive your questionnaire, you will notice an identification number on the front page. This number is for mailing purposes only. It provides me with a means of removing your name from a follow-up mailing list once your questionnaire has been returned.

Again, the questionnaire will arrive in about one week. I would greatly appreciate it if you could complete and return it at your earliest possible convenience. I would be happy to answer any questions you might have. Please contact me at the phone or fax number below.

Sincerely,

Steve Shook
Project Leader
Center for International Trade in Forest Products
University of Washington
Telephone: (206) 543-0827
Fax: (206) 685-0790

Cover Letter

August 3, 1995

Builder/Organization
Address
City, WA Zip

Dear:

Recently, I sent you a letter requesting your company's participation in a project being conducted by the Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington.

The purpose of this project is to identify the opinions of professionals like yourself on the advantages and disadvantages of various siding materials utilized in residential construction. The results of this project will be used to help both siding manufacturers and building materials distributors better meet the siding needs of residential builders and siding contractors.

Your firm is only one of a small number of firms in which individuals are being asked to give their opinions on residential siding materials. Therefore, the answers that your firm provides will be of *significant* importance to the success and accuracy of this research.

I hope that you can spare approximately 10 minutes to help with this project by completing the enclosed questionnaire. I ask that it be completed by the person in your firm most involved in decisions relating to the purchase and use of siding products.

All information that you provide will be held in the strictest confidence and will only be used in combination with the information provided by other firms in the Puget Sound area. You will notice an identification number on the front page of your questionnaire. This number is for mailing purposes only. It provides me with a means of removing your name from a follow-up mailing list once your questionnaire has been returned.

If you are interested in receiving a summary of results, please check the appropriate space on the back of the questionnaire and print your name and address on the back of the postage-paid return envelope; or if you prefer, request the information in a separate letter.

Again, your participation is very important to the success and reliability of this project. I would be more than happy to answer any questions you might have. Please write or call.

Thank you for your assistance!

Sincerely,

Steve Shook
Project Leader
Center for International Trade in Forest Products
University of Washington
Telephone: (206) 543-0827
Fax: (206) 685-0790

Follow-up Letter

August 16, 1995

Builder/Organization
Address
City, WA Zip

Dear :

I recently sent you a letter requesting your company's participation in a survey being conducted by the Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington about residential siding products. If you have already returned your questionnaire, you can disregard this letter — thank you for your help!

I realize that you are likely to be busy and may not yet have found the time to complete your questionnaire. However, I would like to encourage you to do so. The questionnaire takes about 10 minutes to complete, and you need not identify yourself or your company. The information you supply for this study may also benefit you, the contractor, either directly or indirectly in the future, by providing information that will enable siding manufacturers and building materials distributors to better meet your needs.

Your participation in this project is important. Your firm is only one of a small number of firms in which individuals are being asked to give their opinions on residential siding materials. Therefore, the answers that your firm provides will be of *significant* importance to the success and accuracy of this research. I have enclosed another questionnaire in case you have misplaced the one sent previously. Please return your completed questionnaire in the postage-paid return envelope at your earliest convenience.

If you are interested in receiving a summary of results from this study, simply check the appropriate space on the back of the questionnaire and print your name and address on the back of the return envelope; or if you prefer, request the information in a separate letter.

Please be reminded that all information that you provide will be held in the strictest confidence and will only be used in combination with information provided from other firms in the Puget Sound area.

Once again, thanks for your cooperation and help!

Sincerely,

Steve Shook
Project Leader
Center for International Trade in Forest Products
University of Washington
Telephone: (206) 543-0827
Fax: (206) 685-0790

PUGET SOUND HOMEBUILDERS SURVEY

Siding Materials in Residential Construction

1. Please check the one category that *best* describes your business. (***check one only***)

   - ☐ New Homebuilder (single family)
   - ☐ New Homebuilder (multi-family)
   - ☐ Siding Contractor
   - ☐ Repair and Remodeling Contractor
   - ☐ Nonresidential Building Contractor
   - ☐ Retailer/Wholesaler
   - ☐ Residential Developer

2. Please indicate the types of projects that your firm undertook in the past year which involved siding. (***check all that apply***)

   - ☐ Single Family Residential Construction
   - ☐ Multi-Family Residential Construction
   - ☐ New Nonresidential Construction
   - ☐ Residing Existing Homes
   - ☐ Repair of Existing Siding
   - ☐ Construction of Home Additions

IF YOU HAVE NOT PURCHASED OR USED ANY SIDING PRODUCTS WITHIN THE PAST 12 MONTHS, PLEASE SKIP TO QUESTION 5 ON THE NEXT PAGE AND COMPLETE THE REST OF THE SURVEY

3. Please estimate the total number of square feet of siding materials your firm purchased in the past 12 months:

   _____ Square Feet of Siding

4. Of the total area of siding products your firm installed in the past 12 months, what percent would you estimate consisted of the following materials? (*Total = 100%*)

   - ____% Hardboard Siding (Masonite)
   - ____% Plywood Siding
   - ____% OSB Siding (Inner-Seal)
   - ____% Vinyl Siding
   - ____% Aluminum Siding
   - ____% Solid Cedar Siding
   - ____% Cedar Shakes/Shingles
   - ____% Solid Redwood Siding
   - ____% Solid Spruce Siding
   - ____% Brick
   - ____% Stucco
   - ____% Wood Fiber-Cement Siding (Hardi Plank)
   - ____% Other

     Please specify:

     _____

     _____

   100% = Total

^ ^ ^ ^ ^
^ ^ ^ ^ ^
^ ^ ^ ^ ^
^ ^ ^ ^ ^

C I N T R A F O R
CENTER FOR INTERNATIONAL TRADE IN FOREST PRODUCTS
COLLEGE OF FOREST RESOURCES
UNIVERSITY OF WASHINGTON

5. Over the past 5 years, has your use of each of the following siding materials increased, decreased, or remained the same? (***please check <u>one</u> box for <u>each</u> of the siding materials***)

Siding Material:	MY FIRM'S USE HAS: INCREASED	DECREASED	REMAINED THE SAME	NEVER USED
Hardboard Siding (Masonite)	☐	☐	☐	☐
Plywood Siding	☐	☐	☐	☐
OSB Siding (Inner-Seal)	☐	☐	☐	☐
Vinyl Siding	☐	☐	☐	☐
Aluminum Siding	☐	☐	☐	☐
Solid Cedar Siding	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood Siding	☐	☐	☐	☐
Solid Spruce Siding	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐
Wood Fiber-Cement Siding (Hardi Plank)	☐	☐	☐	☐

6. Assuming you were going to build a home in each of the following price ranges below, please check the siding material(s) you feel would be the most appropriate for ***<u>each</u>*** of the price ranges. (***you may check more than one siding material within each price range***)

Siding Material:	New Home Price Ranges: Under $100K	$100K to $149K	$150K to $199K	$200K to $249K	$250K to $400K	Over $400K
Hardboard (Masonite)	☐	☐	☐	☐	☐	☐
Plywood	☐	☐	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐	☐	☐
Wood Fiber-Cement Siding	☐	☐	☐	☐	☐	☐
Brick	☐	☐	☐	☐	☐	☐
Stucco	☐	☐	☐	☐	☐	☐

7. Where does your firm purchase the **majority** of their siding materials? (**for ***<u>each</u>*** siding material, please check only ***<u>one</u>*** box or check the last column if your firm never purchases the siding material**)

Siding Material:	Local Retail Lumber Yard	Large Home Center Chain	Wholesaler	Direct from Manufacturer	Never Purchase
Hardboard (Masonite)	☐	☐	☐	☐	☐
Plywood	☐	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐	☐
Wood Fiber-Cement	☐	☐	☐	☐	☐
Brick	☐	☐	☐	☐	☐
Stucco	☐	☐	☐	☐	☐

8. In your opinion, how do each of the siding products rate in terms of each attribute? For ***each*** product, indicate whether the product possesses the attribute to a HIGH DEGREE (4), CONSIDERABLE DEGREE (3), LIMITED DEGREE (2), or NOT AT ALL (1). ***Please indicate how you feel about each siding product regardless of whether you have experience with the product or not - your opinion is important!***
Note: Assume that all wood products have been properly finished.

SIDING MATERIAL POSSESSES ↳COMPETITIVE PRICE	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳EASY AND LOW COST MAINTENANCE	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳FAST AND EASY INSTALLATION	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

Question 8 continued.....

SIDING MATERIAL POSSESSES ↳RESISTANCE TO IMPACTS AND DENTING	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳BEAUTIFUL APPEARANCE	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳HIGH STATUS AND QUALITY IMAGE	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳HIGH DURABILITY	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

Question 8 continued.....

SIDING MATERIAL POSSESSES ↳WIDE COLOR SELECTION	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳VARIETY OF TEXTURES AND PROFILES	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳FADE RESISTANCE	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

SIDING MATERIAL POSSESSES ↳DIMENSIONAL STABILITY	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

Question 8 continued.....

SIDING MATERIAL POSSESSES HIGH PRODUCT CONSISTENCY/UNIFORMITY	NOT AT ALL (1)	LIMITED DEGREE (2)	CONSIDERABLE DEGREE (3)	HIGH DEGREE (4)
Hardboard (Masonite)	☐	☐	☐	☐
Plywood	☐	☐	☐	☐
OSB (Inner-Seal)	☐	☐	☐	☐
Vinyl	☐	☐	☐	☐
Aluminum	☐	☐	☐	☐
Solid Cedar	☐	☐	☐	☐
Cedar Shakes/Shingles	☐	☐	☐	☐
Solid Redwood	☐	☐	☐	☐
Solid Spruce	☐	☐	☐	☐
Wood Fiber-Cement (Hardi Plank)	☐	☐	☐	☐
Brick	☐	☐	☐	☐
Stucco	☐	☐	☐	☐

9. When deciding on the type of siding to use, what product attributes do you feel are the most important? Please indicate the degree of importance for *each* of the attributes on a scale of 1 = NOT IMPORTANT AT ALL to (5) OF CRITICAL IMPORTANCE. (***check only one box per attribute***)

ATTRIBUTES:	NOT IMPORTANT AT ALL (1)	OF LITTLE IMPORTANCE (2)	IMPORTANT (3)	VERY IMPORTANT (4)	OF CRITICAL IMPORTANCE (5)
Competitive Price	☐	☐	☐	☐	☐
Low/Easy Maintenance	☐	☐	☐	☐	☐
Fast/Easy Installation	☐	☐	☐	☐	☐
Impact/Dent Resistance	☐	☐	☐	☐	☐
Beautiful Appearance	☐	☐	☐	☐	☐
High Durability	☐	☐	☐	☐	☐
Wide Color Selection	☐	☐	☐	☐	☐
Variety of Textures and Profiles	☐	☐	☐	☐	☐
Fade Resistance	☐	☐	☐	☐	☐
Dimensional Stability	☐	☐	☐	☐	☐
High Status and Quality Image	☐	☐	☐	☐	☐
Availability	☐	☐	☐	☐	☐
Holds Stains and Paints	☐	☐	☐	☐	☐
Thermal Insulation	☐	☐	☐	☐	☐
Structural Strength	☐	☐	☐	☐	☐
Warranty/Guarantee	☐	☐	☐	☐	☐
Easy to Repair	☐	☐	☐	☐	☐
Mold/Mildew Resistance	☐	☐	☐	☐	☐
Fire Resistance	☐	☐	☐	☐	☐
Variety of Sizes Available	☐	☐	☐	☐	☐
Service from Manufacturer	☐	☐	☐	☐	☐
Service from Wholesaler/Retailer	☐	☐	☐	☐	☐
Material is "Natural"	☐	☐	☐	☐	☐
Brand Name Product	☐	☐	☐	☐	☐
Disposal of Waste	☐	☐	☐	☐	☐

10. How much of a *difference* do you feel there exists between all the siding materials you could choose to use when siding a home? (***please check the <u>one</u> box that best corresponds to your opinion, for <u>each</u> attribute***)

ATTRIBUTES:	VERY SIMILAR (1)	SIMILAR (2)	DIFFERENT (3)	VERY DIFFERENT (4)
Competitive Price	☐	☐	☐	☐
Low/Easy Maintenance	☐	☐	☐	☐
Fast/Easy Installation	☐	☐	☐	☐
Impact/Dent Resistance	☐	☐	☐	☐
Beautiful Appearance	☐	☐	☐	☐
High Durability	☐	☐	☐	☐
Wide Color Selection	☐	☐	☐	☐
Variety of Textures and Profiles	☐	☐	☐	☐
Fade Resistance	☐	☐	☐	☐
Dimensional Stability	☐	☐	☐	☐
High Status and Quality Image	☐	☐	☐	☐
Availability	☐	☐	☐	☐
Holds Stains and Paints	☐	☐	☐	☐
Thermal Insulation	☐	☐	☐	☐
Structural Strength	☐	☐	☐	☐
Warranty/Guarantee	☐	☐	☐	☐
Easy to Repair	☐	☐	☐	☐
Mold/Mildew Resistance	☐	☐	☐	☐
Fire Resistance	☐	☐	☐	☐
Variety of Sizes Available	☐	☐	☐	☐
Service from Manufacturer	☐	☐	☐	☐
Service from Wholesaler/Retailer	☐	☐	☐	☐
Material is "Natural"	☐	☐	☐	☐
Brand Name Product	☐	☐	☐	☐
Disposal of Waste	☐	☐	☐	☐

FOR STATISTICAL PURPOSES, I WOULD LIKE TO KNOW MORE ABOUT YOU AND YOUR FIRM

11. Please estimate your firm's total revenue for 1994. (***please check only <u>one</u> box***)

- ☐ Less than $100K
- ☐ $100K to $500K
- ☐ $500K to $1 Million
- ☐ $1 Million to $5 Million
- ☐ $5 Million to $10 million
- ☐ Over $10 Million

12. How many dwelling units did your firm build in 1994? (***please check <u>one</u> box for <u>each</u> building category***)

Number of Units	Single Family Detached	Town House	Multi-Family Houses
None	☐	☐	☐
1 to 5	☐	☐	☐
6 to 15	☐	☐	☐
16 to 50	☐	☐	☐
51 to 100	☐	☐	☐
Over 100	☐	☐	☐

13. How many dwelling units does your firm plan on building in 1996? (***please check <u>one</u> box for <u>each</u> building category***)

Number of Units	Single Family Detached	Town House	Multi-Family Houses
None	☐	☐	☐
1 to 5	☐	☐	☐
6 to 15	☐	☐	☐
16 to 50	☐	☐	☐
51 to 100	☐	☐	☐
Over 100	☐	☐	☐

14. Who decides which siding material to use on your new residential construction projects? Please estimate how often (%) this decision is made by *<u>each</u>* of the following persons:

___% Home Owner Specifies
___% Architect Specifies
___% Builder Specifies
___% Developer Specifies
___% Specified by Local Code Rules

100% = Total

OR ☐ I have no experience in new construction

15. What is the average price of the homes that your firm currently builds? (***check only <u>one</u> category***)

☐ Do Not Build Homes
☐ Under $100K
☐ $100K to $149K
☐ $150K to $199K
☐ $200K to $249K
☐ $250K to $400K
☐ Over $400K

16. How long has you business operated within the Puget Sound market?

_____ years

17. What is your job title (or position) within your firm?

Title/Position:

_____

18. In your opinion, where do homes selling in the upper-third price range start in price in the Puget Sound area?

$_____,000

I SINCERELY APPRECIATE YOUR COOPERATION AND PATIENCE IN FILLING OUT THIS SURVEY. I STRONGLY BELIEVE THAT THE ANSWERS YOU HAVE PROVIDED WILL IMPROVE THE MANNER IN WHICH RESIDENTIAL SIDING IS CURRENTLY MARKETED TO BUILDERS AND CONTRACTORS IN THE PUGET SOUND AREA.

YOU CAN RETURN THE SURVEY TO ME IN THE SELF-ADDRESSED STAMPED ENVELOPE THAT WAS PROVIDED.

If you would like a summary of results from this study, please check the box below *AND PRINT YOUR NAME ON THE BACK OF THE RETURN ENVELOPE* (please ***<u>NOT</u>*** on the questionnaire). All replies are strictly confidential.

☐ Summary of Residential Siding Survey Requested

APPENDIX C
RELEVANT RESIDENTIAL SIDING SURVEY
RAW DATA AND CROSS TABULATION SUMMARIES

Means and Standard Deviations For Survey Questions 3, 8, 9 and 14

Table 41. Builders' rankings of residential siding materials along competitive price attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	OSB	2.96	.79
2	Plywood	2.83	1.00
3	Wood Fiber-Cement	2.65	.93
4	Hardboard	2.62	.91
5	Vinyl	2.46	.90
6	Western Red Cedar	2.33	.82
7	Brick	2.29	1.20
8	Stucco	2.18	1.11
9	Aluminum	2.08	.89
10	Cedar Shakes/Shingles	2.07	.91
11	Spruce (solid)	1.91	.81
12	Redwood (solid)	1.87	.96

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 42. Builders' rankings of residential siding materials along easy and low cost maintenance attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.82	.51
2	Vinyl	3.53	.70
3	Stucco	3.38	.87
4	Aluminum	3.30	.79
5	Wood Fiber-Cement	3.13	.91
6	OSB	2.72	.86
7	Hardboard	2.53	.90
8	Cedar Shakes/Shingles	2.29	.67
9	Plywood	2.26	.72
10	Western Red Cedar	2.24	.66
11	Redwood (solid)	2.23	.68
12	Spruce (solid)	1.99	.56

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree".

Table 43. Builders' rankings of residential siding materials along fast and easy installation attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Plywood	3.47	.58
2	OSB	3.24	.62
3	Hardboard	3.04	.82
4	Vinyl	2.99	.72
5	Aluminum	2.86	.74
6	Western Red Cedar	2.74	.67
7	Redwood (solid)	2.61	.67
8	Spruce (solid)	2.59	.73
9	Wood Fiber-Cement	2.54	.71
10	Cedar Shakes/Shingles	2.05	.86
11	Brick	1.67	.75
12	Stucco	1.72	.84

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 44. Builders' rankings of residential siding materials along resistance to impacts and denting attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.76	.57
2	Wood Fiber-Cement	3.36	.77
3	Hardboard	3.01	.78
3	OSB	3.01	.79
5	Stucco	2.94	.96
6	Plywood	2.87	.64
7	Western Red Cedar	2.69	.71
8	Cedar Shakes/Shingles	2.64	.70
9	Redwood (solid)	2.59	.74
9	Vinyl	2.59	.97
11	Spruce (solid)	2.52	.72
12	Aluminum	1.49	.67

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 45. Builders' rankings of residential siding materials along beautiful appearance attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.88	.42
2	Stucco	3.58	.71
3	Cedar Shakes/Shingles	3.41	.70
4	Redwood (solid)	3.32	.68
5	Western Red Cedar	3.26	.66
6	Spruce (solid)	2.79	.74
7	OSB	2.64	.82
8	Wood Fiber-Cement	2.48	.79
9	Hardboard	2.27	.88
10	Vinyl	2.21	.81
11	Aluminum	1.96	.75
12	Plywood	1.84	.58

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 46. Builders' rankings of residential siding materials along high status and quality image attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.90	.34
2	Stucco	3.75	.51
3	Redwood (solid)	3.27	.77
4	Cedar Shakes/Shingles	3.25	.69
5	Western Red Cedar	3.24	.61
6	Spruce (solid)	2.56	.76
7	OSB	2.26	.78
8	Wood Fiber-Cement	2.20	.72
9	Vinyl	1.86	.87
10	Hardboard	1.80	.68
11	Aluminum	1.72	.81
12	Plywood	1.60	.56

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 47. Builders' rankings of residential siding materials along high durability attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.93	.25
2	Stucco	3.40	.79
3	Wood Fiber-Cement	3.32	.63
4	Vinyl	3.13	.76
5	Redwood (solid)	2.88	.62
6	Cedar Shakes/Shingles	2.80	.65
7	Western Red Cedar	2.79	.64
8	Aluminum	2.65	.80
9	Hardboard	2.62	.86
10	OSB	2.60	.82
11	Spruce (solid)	2.48	.71
12	Plywood	2.34	.71

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 48. Builders' rankings of residential siding materials along wide color selection attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Stucco	3.15	.91
2	Brick	3.13	.74
3	Vinyl	2.82	.79
4	Western Red Cedar	2.69	1.31
5	Aluminum	2.68	.80
6	OSB	2.58	1.29
7	Plywood	2.57	1.29
7	Cedar Shakes/Shingles	2.57	1.28
9	Hardboard	2.54	1.27
10	Spruce (solid)	2.51	1.28
10	Wood Fiber-Cement	2.51	1.26
12	Redwood (solid)	2.48	1.26

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 49. Builders' rankings of residential siding materials along variety of textures and profiles attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	2.91	.83
2	Stucco	2.80	.90
3	Cedar Shakes/Shingles	2.37	.69
4	Western Red Cedar	2.35	.75
5	Redwood (solid)	2.20	.68
6	Hardboard	2.15	.65
7	Vinyl	2.13	.70
8	Spruce (solid)	2.10	.59
9	Wood Fiber-Cement	2.05	.56
10	OSB	2.00	.62
11	Plywood	1.98	.59
11	Aluminum	1.98	.60

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 50. Builders' rankings of residential siding materials along fade resistance attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.78	.49
2	Stucco	3.25	.79
3	Vinyl	2.89	.83
4	Aluminum	2.75	.86
5	OSB	2.44	.83
6	Wood Fiber-Cement	2.43	.83
7	Hardboard	2.29	.82
8	Western Red Cedar	2.02	.60
8	Cedar Shakes/Shingles	2.02	.60
8	Redwood (solid)	2.02	.67
11	Spruce (solid)	1.99	.61
12	Plywood	1.93	.64

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 51. Builders' rankings of residential siding materials along dimensional stability attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.58	.72
2	Stucco	3.23	.95
3	Wood Fiber-Cement	3.20	.74
4	Vinyl	2.76	.93
5	Aluminum	2.73	.90
6	Plywood	2.72	.69
7	Hardboard	2.50	.84
7	Redwood (solid)	2.50	.63
9	Cedar Shakes/Shingles	2.43	.71
10	OSB	2.41	.87
11	Western Red Cedar	2.40	.60
12	Spruce (solid)	2.33	.67

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 52. Builders' rankings of residential siding materials along high product consistency and uniformity attribute (Question 8).

Rank	Siding Material	Mean Score[a]	Standard Deviation
1	Brick	3.44	.66
2	Aluminum	3.39	.62
3	Stucco	3.37	.75
3	Vinyl	3.37	.65
5	Wood Fiber-Cement	3.36	.70
6	Hardboard	3.19	.76
7	OSB	3.12	.74
8	Plywood	2.80	.74
9	Redwood (solid)	2.47	.65
10	Spruce (solid)	2.36	.66
11	Cedar Shakes/Shingles	2.35	.65
11	Western Red Cedar	2.35	.63

[a] Mean score is based on a four-point Likert scale in which the siding material possesses the attribute: 1="Not At All," 2="Limited Degree," 3="Considerable Degree," and 4="High Degree"

Table 53. Builders' material attribute importance ratings along 25 residential siding material attributes (Question 9).

Rank	Product Attribute	Mean Score[a]	Standard Deviation
1	Holds Stains and Paints	4.09	.74
2	Availability	3.97	.85
3	Beautiful Appearance	3.96	.69
4	Competitive Price	3.80	.85
5	High Durability	3.61	.68
6	High Status and Quality Image	3.60	.88
7	Service From Wholesaler/Retailer	3.57	1.10
7	Fast/Easy Installation	3.57	.86
9	Warranty/Guarantee	3.55	.93
9	Mold/Mildew Resistance	3.55	.89
11	Dimensional Stability	3.54	.77
12	Low/Easy Maintenance	3.48	.65
13	Easy to Repair	3.44	.87
14	Service From Manufacturer	3.41	1.13
15	Impact/Dent Resistance	3.10	.77
16	Disposal of Waste	2.88	1.01
17	Variety of Sizes Available	2.87	.74
18	Fade Resistance	2.76	.96
19	Variety of Textures and Profiles	2.73	.82
20	Structural Strength	2.53	1.08
20	Fire Resistance	2.53	.91
22	Wide Color Selection	2.51	1.01
23	Material is "Natural"	2.28	.93
24	Brand Name Product	2.26	.92
25	Thermal Insulation	2.09	.86

[a] Mean score is based on a five-point Likert scale in which the importance of the siding attribute is: 1="Not Important At All," 2="Of Little Importance," 3="Important," 4="Very Important," and "Of Critical Importance."

Table 54. Builders' perceptions of differences between 25 siding material attributes (Question 9).

Rank	Product Attribute	Mean Score[a]	Standard Deviation
1	High Status and Quality Image	3.42	.79
2	Competitive Price	3.35	.77
3	Fire Resistance	3.24	.79
4	Material is "Natural"	3.20	.80
5	Beautiful Appearance	3.17	.80
6	Low/Easy Maintenance	3.13	.77
7	Fast/Easy Installation	3.08	.76
7	Impact/Dent Resistance	3.08	.72
9	High Durability	3.03	.70
10	Variety of Textures and Profiles	3.01	.71
11	Dimensional Stability	2.99	.65
12	Variety of Sizes Available	2.91	.69
13	Structural Strength	2.86	.74
14	Easy to Repair	2.84	.79
15	Fade Resistance	2.81	.68
16	Mold/Mildew Resistance	2.77	.78
17	Wide Color Selection	2.76	.73
18	Thermal Insulation	2.74	.73
18	Holds Stains and Paints	2.74	.78
20	Warranty/Guarantee	2.67	.80
21	Disposal of Waste	2.59	.90
22	Brand Name Product	2.55	.71
22	Service From Manufacturer	2.55	.78
24	Availability	2.45	.79
25	Service From Wholesaler/Retailer	2.42	.70

[a] Mean score is based on a four-point Likert scale in which difference in the attribute among the various siding materials is: 1="Very Similar," 2="Similar," 3="Different," and 4="Very Different."

Table 55. Square feet of residential siding material installed by builders in past year (Question 3).

Square Feet of Siding Installed	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	1	1.1	1.1
2,200	1	1.1	2.1
3,000	2	2.1	4.2
4,000	2	2.1	6.3
4,500	1	1.1	7.4
5,000	1	1.1	8.4
5,600	1	1.1	9.5
6,000	1	1.1	10.5
7,000	2	2.1	12.6
8,000	1	1.1	13.7
8,500	1	1.1	14.7
9,000	2	2.1	16.8
10,000	8	8.4	25.3
10,368	1	1.1	26.3
12,000	6	6.3	32.6
12,288	1	1.1	33.7
12,400	1	1.1	34.7
14,000	1	1.1	35.8
15,000	6	6.3	42.1
15,400	1	1.1	43.2
16,000	1	1.1	44.2
18,000	2	2.1	46.3
20,000	7	7.4	53.7
21,000	1	1.1	54.7
24,000	1	1.1	55.8
25,000	2	2.1	57.9
30,000	2	2.1	60.0
32,000	1	1.1	61.1
36,000	1	1.1	62.1
38,000	1	1.1	63.2
40,000	7	7.4	70.5
48,000	1	1.1	71.6
50,000	2	2.1	73.7
56,000	1	1.1	74.7
60,000	6	6.3	81.1
65,000	1	1.1	82.1
75,000	1	1.1	83.2
77,000	1	1.1	84.2
80,000	1	1.1	85.3
100,000	3	3.2	88.4
150,000	2	2.1	90.5
175,000	1	1.1	91.6
180,000	1	1.1	92.6
190,000	1	1.1	93.7
292,500	1	1.1	94.7
297,500	1	1.1	95.8
300,000	1	1.1	96.8
316,000	1	1.1	97.9
324,000	1	1.1	98.9
650,000	1	1.1	100.0
Mean:	55,908		
Standard Deviation:	95,090		
Median:	20,000		
n:	95		

Table 56. Percent of occasions homeowner decides on residential siding material to be installed on new home (Question 14).

Percent of Occasions Homeowner Decides on Siding To Install (According to Builders)	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	40	42.6	42.6
1	1	1.1	43.6
2	1	1.1	44.7
5	6	6.4	51.1
10	12	12.8	63.8
13	1	1.1	64.9
15	2	2.1	67.0
20	5	5.3	72.3
25	8	8.5	80.9
30	2	2.1	83.0
40	3	3.2	86.2
50	6	6.4	92.6
60	2	2.1	94.7
70	1	1.1	95.7
75	2	2.1	97.9
80	1	1.1	98.9
90	1	1.1	100.0
Weighted Mean:	15.81%		
n:	94		

Table 57. Percent of occasions architect decides on residential siding material to be installed on new home (Question 14).

Percent of Occasions Architect Decides on Siding To Install (According to Builders)	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	69	73.4	73.4
2	1	1.1	74.5
5	1	1.1	75.5
6	1	1.1	76.6
10	1	1.1	77.7
20	4	4.3	81.9
25	4	4.3	86.2
30	3	3.2	89.4
40	1	1.1	90.4
50	2	2.1	92.6
60	1	1.1	93.6
70	2	2.1	95.7
90	1	1.1	96.8
95	1	1.1	97.9
100	2	2.1	100.0
Weighted Mean:	10.72%		
n:	94		

Table 58. Percent of occasions builder decides on residential siding material to be installed on new home (Question 14).

Percent of Occasions Builder Decides on Siding To Install (According to Builders)	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	7	7.4	7.4
3	2	2.1	9.6
10	1	1.1	10.6
20	4	4.3	14.9
25	5	5.3	20.2
30	3	3.2	23.4
35	1	1.1	24.5
50	11	11.7	36.2
60	2	2.1	38.3
65	1	1.1	39.4
70	1	1.1	40.4
75	7	7.4	47.9
80	5	5.3	53.2
90	9	9.6	62.8
95	4	4.3	67.0
100	31	33.0	100.0
Weighted Mean:	67.72%		
n:	94		

Table 59. Percent of occasions developer decides on residential siding material to be installed on new home (Question 14).

Percent of Occasions Developer Decides on Siding To Install (According to Builders)	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	81	86.2	86.2
2	1	1.1	87.2
5	1	1.1	88.3
10	3	3.2	91.5
15	1	1.1	92.6
20	2	2.1	94.7
25	1	1.1	95.7
50	1	1.1	96.8
80	1	1.1	97.9
100	2	2.1	100.0
Weighted Mean:	4.76%		
n:	94		

Table 60. Percent of occasions local code rules dictate the residential siding material to be installed on new home (Question 14).

Percent of Occasions Local Code Rules Dictate the Siding To Install (According to Builders)	Number of Respondents	Percent of Respondents	Cumulative Percent of Respondents
0	86	91.5	91.5
1	1	1.1	92.6
5	2	2.1	94.7
10	3	3.2	97.9
12	1	1.1	98.9
20	1	1.1	100.0
Weighted Mean:	0.78%		
n:	94		

Residential Siding Survey Cross Tabulations

Table 61. Cross tabulation of firm's total 1994 revenue by average price of homes built by firm.

	Average Price of Homes Built by Firm						
1994 Revenue	Do Not Build Homes	$100,000 to $149,999	$150,000 to $199,999	$200,000 to $249,999	$250,000 to $400,000	Over $400K	Row Total
Under $100,000	0	2	2	0	0	0	4
$100,000-$499,999	1	5	7	2	8	0	23
$500,000-$1 million	1	3	6	2	3	0	15
$1-$5 million	0	2	8	8	6	2	26
$5-$10 million	0	5	4	3	0	2	14
Over $10 million	1	0	2	3	0	0	6
Column Total	3	17	29	18	17	4	88

Table 62. Cross tabulation of firm's total 1994 revenue by number of years firm has operated in Puget Sound market.

	Number of Years Firm Has Operated in Puget Sound Market						
1994 Revenue	0 to 5 Years	6 to 10 Years	11 to 15 Years	16 to 20 Years	21 to 25 Years	> 25 Years	Row Total
Under $100,000	0	2	1	1	0	0	4
$100,000-$499,999	4	5	6	4	1	2	22
$500,000-$1 million	3	4	2	3	1	2	15
$1-5 million	6	5	4	9	0	2	26
$5-10 million	2	1	3	2	1	5	14
Over $10 million	0	3	1	0	0	2	6
Column Total	15	20	17	19	3	13	87

Table 63. Cross tabulation of firm's total 1994 revenue by business category.

	Business Category						
1994 Revenue	New Single Family Home Builder	New Multi-Family Home Builder	Repair and Remodeler	Non Residential Builder	Residential Developer	Architect	Row Total
Under$100,000	4	0	0	0	0	0	4
$100,000-$499,999	18	1	2	0	2	0	23
$500,000-$1 million	13	1	1	0	0	0	15
$1 million-$5 million	23	1	1	0	0	1	26
$5 million-$10 million	13	0	0	0	1	0	14
Over$10 million	4	1	0	1	0	0	6
Column Total	75	4	4	1	3	1	88

Table 64. Cross tabulation of average price of homes built by firm by business category.

	Business Category						
Average Price of Homes Built by Firm	New Single Family Home Builder	New Multi-Family Home Builder	Repair and Remodeler	Non Residential Builder	Residential Developer	Architect	Row Total
Do Not Build Homes	0	1	0	1	1	0	3
$100,000 to $149,999	18	0	0	0	1	0	19
$150,000 to $199,999	30	0	1	0	0	1	32
$200,000 to $249,999	16	2	1	0	0	0	19
$250,000 to $400,000	12	1	2	0	1	1	17
Over$400K	4	0	0	0	0	0	4
Column Total	80	4	4	1	3	2	94

Table 65. Cross tabulation of number of years firm has operated in Puget Sound market by business category.

	Business Category						
Number of Years Firm Has Operated	**New Single Family Home Builder**	**New Multi-Family Home Builder**	**Repair and Remodeler**	**Non Residential Builder**	**Residential Developer**	**Architect**	**Row Total**
0 to 5	14	0	1	0	0	0	15
6 to 10	21	1	1	0	0	0	23
11 to 15	16	0	0	1	1	0	18
16 to 20	15	2	1	0	0	2	20
21 to 25	3	1	0	0	0	0	4
Over 25	12	0	1	0	2	0	15
Column Total	81	4	4	1	3	2	95

APPENDIX D
SOURCES FOR PRICING, PRODUCT, AND DISTRIBUTION INFORMATION USED IN THE LITERATURE REVIEW

Sources for Pricing, Product, and Distribution Information Used in the Literature Review

American Architectural Manufacturers Association
1540 East Dundee Road, Suite 310
Palatine, IL 60067
Tel.: (708) 202-1350

American Hardboard Association
1210 West Northwest Highway
Palatine, IL 60067
Tel.: (708) 934-8800
Fax: (708) 934-8803

American Plywood Association
PO Box 11700
Tacoma, WA 98411
Tel.: (206) 565-6600
Fax: (206) 565-7265

C.C. Crow Publications, Inc.
PO Box 25749
Portland, OR 97225
Tel.: (503) 646-8075
Fax: (503) 646-9971

California Redwood Association
405 Enfrente Drive, Suite 200
Novato, CA 94949
Tel.: (415) 382-0662
Fax: (415) 382-8531

Canadian Institute of Treated Wood
506 - 75 Albert Street
Ottawa, ON K1P 5E7
Tel.: (613) 234-9456
Fax: (613) 234-1228

National Building Material Distributors Association
401 North Michigan Avenue
Chicago, IL 60611
Tel.: (312) 321-6845

National Lumber and Building Material Dealers Association
40 Ivy Street S.E.
Washington, DC 20003
Tel.: (202) 547-2230
Fax: (202) 547-7640

Random Lengths, Inc.
PO Box 867
Eugene, OR 97440-0867
Tel.: (503) 686-9925
Fax: (800) 874-7979

The Society of the Plastics Industry, Inc.
1275 K Street, N.W., Suite 400
Washington, DC 20005-4006
Tel.: (202) 371-5200
Fax: (202) 371-1022

Southern Cypress Manufacturers Association
[affiliated with ***Wood Manufacturers Association***]
400 Penn Center Boulevard, Suite 530
Pittsburgh, PA 15235
Tel.: (412) 829-0770
Fax: (412) 829-0844

Southern Pressure Treaters Association
PO Box 2389
140 Cove Avenue
Gulf Shores, AL 36547
Tel.: (205) 968-5726
Fax: (205) 968-6008

Western Red Cedar Lumber Association
1100 - 555 Burrard Street
Vancouver, BC, Canada V7X 1S7
Tel.: (604) 684-0266
Fax: (604) 682-8641

Western Wood Preservers Institute
PO Box 2913
Vancouver, WA 98668
Tel.: (206) 696-4007