Winter 2004

CINTRAFOR NEWS

CENTER FOR INTERNATIONAL TRADE IN FOREST PRODUCTS

Structural Analysis of Post and Beam Homes in Japan

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Dr. Ivan Eastin, CINTRAFOR

The Japanese Post and Beam residential construction market makes up almost 40% of new housing starts in Japan. Despite this, most exporters are not aware of the broad range of structural components used to build post and beam homes in Japan. To address this problem, CINTRAFOR recently performed an evaluation of the technical specifications of the structural components used in post and beam construction. The results of this technical analysis provide a summary of the sizes and species of timber generally used for a wide range of post and beam structural components. CINTRAFOR also worked closely with a Japanese architect to develop a high quality color poster identifying the various structural components (in English and Japanese) used in the post and beam home (Figure 1). The poster and technical specifications can be viewed on the CINTRAFOR website and hard copies of the poster can be ordered directly from CINTRAFOR. We are currently working to link color photos of the various structural components with the website poster to allow viewers to see how each structural component looks within a post and beam house as it is being built in Japan.

The primary aims of this research were to: 1) provide a description of the individual structural components used to build a Japanese post and beam house, 2) detail the technical specifications of each structural component, and 3) provide an estimate of the size of the market demand that exists for specific structural components.

In contrast to the North American 2x4 construction system, the Japanese post and beam system has a larger number of structural components and component sizes. The major structural components of the post and beam system, including cross-sectional sizes and lengths, are summarized in Table 1. In addition, the approximate volume of lumber used for each end-use application is also provided in the table. Note that the lumber volume estimates are for a typical 30 tsubo post and beam house (which corresponds to a floor space of approximately 1,066 square feet).

The typical Japanese post & beam house is built on short concrete foundation walls over a concrete slab. The ground sills (*dodai*) are laid on the top of the foundation walls. Girders (*obiki*), which are placed on top of floor posts (*tsuka*), run the length of the house and provide support for the floor joists (*neda*). The *neda* are placed atop and perpendicular to the girders. This structure forms the platform for the first floor of a post and beam house and it should be noted that these structural components are all exposed to potential insect attack from beneath the house in the crawl space. Hence, the structural components of most post and beam homes are sprayed with an anti-termite chemical to a height of one meter above the ground.

The unique characteristics of US softwood species are well suited to the demands of the Japanese market in general and Japanese post & beam home builders in particular.

The main vertical structural posts of the house (often referred to as *hashira*) are comprised of balloon posts (*toshibashira*) and posts (*kudabashira*). *Toshibashira* extend up for two floors and are usually located at the corners of the house and in the mid-span along the length of the house. The *kudabashira* are located between the *toshibashira* and are used to frame in a single floor of the house. Non-structural studs (*mabashira*) are placed between the structural posts and are used primarily for attaching sheetrock to the walls. Finally, diagonal braces (*sujikai*) are inset into the posts (*hashira*) to provide lateral support for the wall system. Since exterior wall sheathing is often not used in post and beam houses, shear strength for the wall system is derived from both the diagonal bracing members and a system of metal connectors. Beams (*hirakaku*) are placed atop the first floor walls and across the width of the house. These beams provide the support for the upper floors of the house and tie the exterior walls of the house together. The same structural members used for the first floor are used to frame in the second floor of the house, although the height of the walls on the second floor is generally shorter than on the first floor. The roof system used for most post and beams houses is a type of rafter system, with roof trusses still being relatively rare in Japan. The top floor of the house is generally tied together with a combination of beams (*hirakaku*) and tie beams (*hari*) that are placed

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Director's Notes:

by Ivan Eastin

On December 31st Paul Boardman completed his highly productive tenure as the Director of CINTRAFOR. Hired in 2000, Paul came to CINTRAFOR during a challenging period as the US entered an economic recession. Tight budgetary constraints in Olympia resulted in the loss of virtually all state funding for CINTRAFOR. In response to this challenge, Paul provided strong leadership in working with CINTRAFOR faculty and staff to develop a more entrepreneurial focus to CINTRAFOR's research program. Over his three and a half year tenure, Paul achieved several significant accomplishments with CINTRAFOR.

In 2001 CINTRAFOR received funding for a research project to perform a competitive assessment of the Japanese forestry and forest products sectors. The results of this project were successfully used by the US Embassy in Japan and the American Forest and Paper Association to convince the Japanese government not to implement a proposed tariff on imported softwood lumber that would have had disastrous consequences for the US forest products industry. In 2002, CINTRAFOR received funding to identify new emerging market opportunities for US wood products. The results of this research helped to set the strategic focus of the Unified Export Strategy for the forest products program within the Foreign Agricultural Program within USDA. Also in 2002, CINTRAFOR was asked to provide programmatic support to the US China Build Program being implemented jointly by the Evergreen Building Products Association and the Washington State Office of Trade and Economic Development. Finally, in 2003 CINTRAFOR played host to two special topics forums that brought together industry experts and government policy makers to discuss strategic issues of great interest to the US forest products industry: the potential for a settlement to the long-standing US-Canada softwood lumber dispute and the market for wood products in the rapidly expanding Chinese market.

In his short time as director, Paul has had a great impact on CINTRAFOR as a research organization. His patience, humor and strategic perspective will be sorely missed by all of us. Most of all we will miss him as a friend. We would like to wish Paul the best of luck in his new job with the Softwood Export Council and we look forward to working with him in the future. ▲

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The Center for International Trade in Forest Products addresses opportunities and problems related to the international trade of wood and fiber products. Emphasizing forest economics and policy impacts, international marketing, technology developments, and value-added forest products, CINTRAFOR's work results in a variety of publications, professional gatherings, and consultations with public policymakers, industry representatives, and community members. Located in the Pacific Northwest, CINTRAFOR is administered through the College of Forest Resources at the University of Washington under the guidance of an Executive Board representing both large and small companies, agencies, and academics. It is supported by state, federal, and private grants. The Center's interdisciplinary research is carried out by university faculty and graduate students, internal staff, and through cooperative arrangements with professional groups and individuals.

CINTRAFOR News Editor: Nicole Stevens

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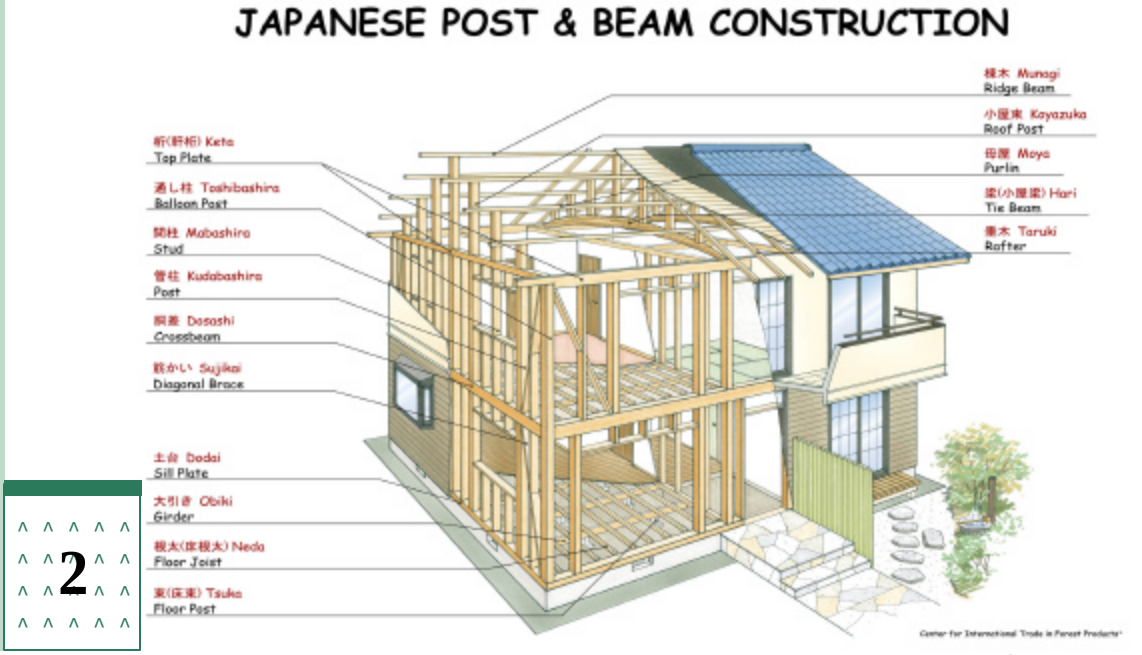

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"Post and Beam" continued from previous page

Table 1. Approximate volume and specifications for structural lumber used in ground contact applications for a typical 30 tsubo (1,066 square feet) Japanese post and beam house.

Structural Member	*English Translation*	*Cross-section size (millimeters)*	*Length (meters)*	*Lumber Volume*
Dodai	Ground sill	105x105 (80-90%) 120x120 (10-20%)	4.0* 3.65, 3.0	0.8 m^3
Tsuka	Floor post	90x90	Short lengths	0.2 m^3
Obiki	Girder	105x105 (80-90%) 90x90 (10-20%)	4.0* 3.65, 3.0	0.2 m^3
Neda	Joist	45x45, 45x60, 60x60, 45x105	4.0* 3.65, 3.0	0.7 m^3
Toshibashira	Balloon Post	120x120 105x105	6.0	0.7 m^3
Kudabashira	Post	105x105 (75%) 120x120 (25%)	3.0* 2.8 (2nd floor)	1.7 m^3
Mabashira	Non-structural stud	27x105 (70%) 30x105 (25%) 45x105 (5%) new size	3.0* 2.8 (2nd floor)	1.7m^3
Sujikai	Diagonal wall brace	45x90	3.0	0.5 m^3
Hirakaku	Structural beam	120x240, 105x210 105x180	4.0* (70-80%) 3.0 (20-30%)	5.0 m^3
Keta	Top Plate	105x105	4.0	0.4 m^3
Koyazuka	Roof support post	105x105, 90x90	Various short lengths	0.4 m^3
Moya	Purlin	90x90	4.0	0.7 m^3
Tarouki	Rafter	45x45, 30x40	4.0, 3.8 3.65, 3.0	0.5 m^3
Munagi	Ridge beam	105x105 90x90	4.0	0.1 m^3

across the width of the house. A top plate (*keta*) is laid along the top of second floor exterior walls and is used as a point of attachment for the rafters (*tarouki*). Roof posts (*koyazuka*) are placed atop the beams and tie beams to provide vertical support for the roof components. Purlins (*moya*) are placed atop the roof posts and run the length of the house. The central purlin that forms the ridge of the roof system is called the ridge beam (*munagi*). After the purlins have been set in place, the rafters are laid across the roof from the central ridge beam down to the top plate. The rafters are nailed to the ridge beam, each of the purlins and to the top plate.

Estimating potential demand for structural lumber in the post and beam industry

Estimates of the volume of structural lumber used annually within the Japanese post and beam industry were derived from a survey of the Japanese pre-cut industry conducted in 2002 (translated and analyzed by CINTRAFOR), as well as from residential construction statistics, and interviews with housing industry experts and Japanese home builders. The volume estimates are based on the 450,000 post and beam housing starts recorded in 2002.

The total volume of structural lumber used in post and beam houses in 2002 was approximately 7.1 million cubic meters. The end-use application that consumed the greatest volume of structural lumber was structural beams (*hirakaku*) representing 32% of structural lumber usage. Other important end-uses included posts (*kudabashira*: 11%), non-structural studs (*mabashira*: 11%), floor joists (*neda*: 9%), balloon posts (*toshibashira*: 9%) and purlins (*moya*: 9%).

Material use was also evaluated based on the four major structural end-use applications. Based on this analysis, the wall system consumed the largest volume of structural lumber (34%), followed by structural beams (32%), the roof system (18%), and the floor system (17%).

Conclusions

Despite the downturn in housing starts and the poor economy in Japan, there remain promising niche markets for US softwood lumber. However, identifying the appropriate niche market requires that US exporters develop a better understanding of the technical specifications of the structural components used in post and beam homes. The unique characteristics of US softwood species are well suited to the demands of the Japanese market in general and Japanese post and beam home builders in particular. US wood species, particularly Douglas-fir and Alaska yellow cedar, continue to enjoy a good reputation in Japan. However, recent regulatory changes in the residential construction sector and the trend towards pre-cutting structural components away from the job site, make it important that US exporters consider opportunities to supply kiln-dried lumber and glue-laminated beams milled to the specific dimensions required within the post and beam industry. Given that US lumber products cannot compete solely on the basis of price, a more effective strategy might be to differentiate these products using non-price attributes that are valued in Japan. ▲

Branding Douglas-fir Lumber in Japan: Shifting from Commodities to Niche Marketing

Dr. Ivan Eastin, CINTRAFOR and Craig Larsen, Softwood Export Council

Background

US exports of softwood lumber to Japan have been declining for more than a decade and, as a result, the US share of the softwood lumber imports has dropped from 28% in 1990 to just 4.1% in 2002, Figure 1. This trend has been attributed to a variety of factors including the strong dollar, the Asian Crisis, the extended economic recession in Japan, reduced housing starts, home builders increased price sensitivity, changes in the Japan Building Standards Law, the 10 year Housing Warranty included in the new Housing Quality Assurance Law, aggressive marketing by European suppliers, and the strong demand for softwood lumber in the US.

It is interesting to note that the two major lumber products exported to Japan from the US have had differing levels of success in recent years. Hemlock squares, used as posts in Japanese post and beam construction, have largely been displaced from the Japanese market by European whitewood and redwood posts. In contrast, Douglas-fir lumber used for beam applications (*hirakaku*) continues to enjoy some success in Japan. This success can largely be attributed to the superior performance of Douglas-fir relative to other timber species. Thus, Douglas-fir continues to enjoy a reputation as the premier species in *hirakaku* applications, where it enjoys a 76% market share, Table 1. Douglas-fir is also used fairly extensively for long length *toshibashira* where it has a 21% market share. Despite its strong reputation, Douglas-fir has seen its market share being slowly eroded by products such as European whitewood and European redwood glulam lumber. The primary causes for the loss of market share are the price sensitivity of Japanese builders and pre-cut manufacturers, concerns about the dimensional stability of solid sawn Douglas-fir *hirakaku* as well as the lack of an aggressive marketing effort on the part of the US forest products industry.

A cost analysis of the various *hirakaku* products in a typical Japanese post and beam house was conducted using the cost data provided by a home builder in Japan, Table 2. The results of the cost analysis suggest that solid sawn Douglas-fir lumber, both green and kiln-dried, is substantially lower than the cost of using imported European glulam lumber, while using Douglas-fir glulam lumber is approximately 30% higher than the imported European glulam products.

Table 1: Summary of species used by post and beam precutters for *hirakaku.*

	Volume (cubic meters)	Market Share
Sugi	37,771.8	
Sugi (EW)	2,811.4	2.3%
Sugi (KD)	1,526.4	
Hinoki	834.2	
Hinoki (EW)	175.2	0.1%
Hinoki (KD)	480.0	
Hemlock	6,092.2	0.4%
European Whitewood	8,142.7	
European Whitewood (EW)	190,324.6	12.1%
European Whitewood (KD)	4,467.8	
European Redwood	883.2	5.7%
European Redwood (EW)	93,913.3	
Douglas-fir	649,427.9	
Douglas-fir (EW)	132,437.6	76.3%
Douglas-fir (KD)	496,158.4	
Total	***1,674,245.6***	

Source: Japan Precutters Association 2002
Translation: CINTRAFOR 2003
Data Analysis: CINTRAFOR 2003
Note: EW: engineered wood (glue laminated beam);KD: kiln dried

Given Douglas-fir's history of superior performance and its stellar reputation as a *hirakaku* and *toshibashira* material, the US forest products industry has a real opportunity to develop a viable and valued brand identity for Douglas-fir *hirakaku* in Japan. Success in developing a Douglas-fir brand would allow US exporters to shift the basis of competition away from price alone and towards a combination of performance and price. In other words, branded Douglas-fir *hirakaku* and *toshibashira* would be marketed on the concept of value (the ratio of performance per unit price) rather than simply price. This strategy would provide the basis for the US industry to avoid selling Douglas-fir lumber as a commodity product and provide the basis for a more focused niche marketing strategy.

The challenge for the US industry is to develop a branding strategy that would allow them to communicate the value of Douglas-fir lumber to Japanese homebuilders and precutters. At the same time, the branding program should support Japanese homebuilders and precutters in communicating the benefits of using Douglas-fir to their customers, the homebuyers. More importantly, it should demonstrate the superior cost/performance combination of Douglas-fir to Japanese homebuilders and precutters and show how the competitive price is reinforced by the superior structural performance and long-term durability of Douglas-fir lumber. Finally, it is critical that the US industry demonstrate its commitment to supplying Douglas-fir products into the Japanese market.

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"Branding Douglas-fir" continued from previous page

The fundamental challenge of any branding strategy lies in identifying the specific product attributes that will form the foundation of the branding program. Thus, the objectives of the on-going research are to answer the following questions: 1) Can a branded US Douglas-fir *hirakaku* product be effectively marketed to post and beam home builders in Japan?, 2) What specific product attributes should a US Douglas-fir branding program be based upon? 3) What audience(s) should the branding program be targeted towards? 4) What type of promotional strategy would be most effective in communicating the benefits of a branded Douglas-fir lumber product to Japanese post and beam home builders? and 5) How could the effectiveness of a branding program be monitored and evaluated?

In order to answer the first four questions, a series of focus groups will be conducted with post and beam home builders in Japan. The focus groups will target large homebuilders and small-to-medium sized homebuilders separately and will seek to gain deeper insight into: a) the product attributes that are most important to home builders in Japan, b) builders perceptions of the comparative performance of the different *hirakaku* products typically used in Japan, and c) the most effective message and communication strategy for promoting a branded US Douglas-fir *hirakaku* product in Japan. It is expected that the first two focus groups will be held in February, 2004 followed by a second set of focus groups in mid-April, 2004. Assuming that the results of the focus groups indicate that a branded US Douglas-fir *hirakaku* product could be successfully introduced in Japan, it is anticipated that a promotion strategy would be developed and tested by the end of June, 2004 followed by implementation of the branding strategy sometime during the last half of 2004.

A methodology for measuring and monitoring the effectiveness of the branding program would be developed as a component of the promotion strategy. The evaluation of the effectiveness of the Douglas-fir branding program would be based on a combination of the following factors: 1) *Brand Awareness* (Is the target market aware of the brand and what it stands for?), 2) *Brand Identification* (How does the target market identify with the product?), 3) *Brand Preference* (Does the target market prefer Douglas-fir lumber products to the alternative products available?), 4) *Price Premium* (Is the target market willing to pay a premium for the branded product?), 5) *Customer Loyalty* (Is the target market less price sensitive with regard to the branded product?) and 6) *Market Share* (Does branding provide Douglas-fir lumber products with a competitive advantage and expanded market share?).

The results of the Japan focus groups will be summarized in an upcoming issue of the CINTRAFOR News. In the meantime, anyone interested in learning more about the US Douglas-fir branding program is encouraged to contact either CINTRAFOR or the Softwood Export Council. ▲

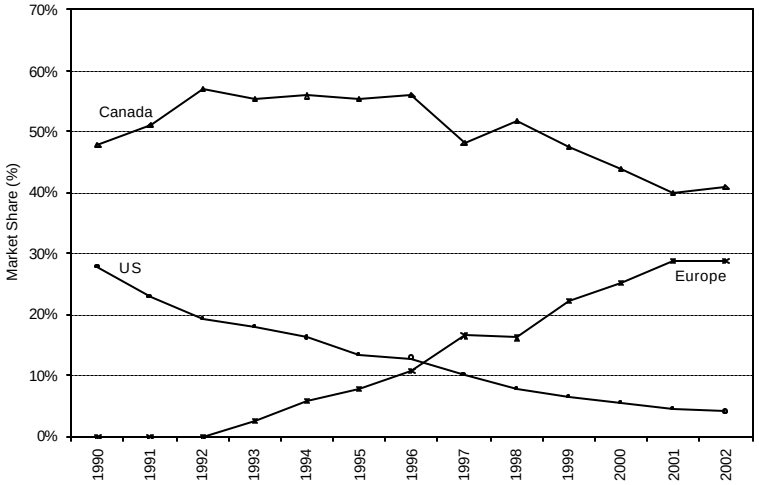


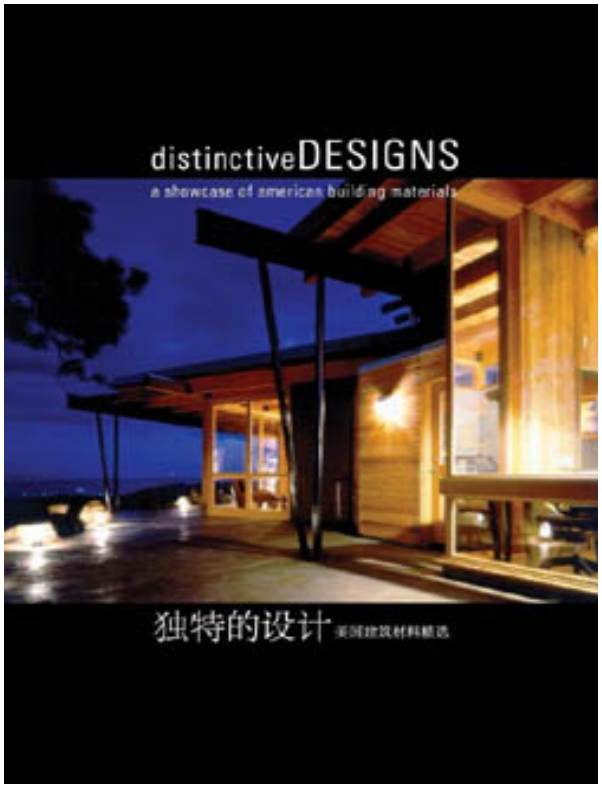
Figure 1. Softwood lumber market shares in Japan, 1990-2001.

Table 2. Cost analysis for *hirakaku* in a post and beam house.

Size (mmxmm)	Length (m)	Pieces	Unit Cost (¥)				
			DF-EW	DF-KD	DF-Green	Eur WW	Eur RP
120x120	4.0	40	172,800	119,808	87,552	129,024	133,632
150x120	3.0	1	4,050	2,808	2,052	3,024	3,132
150x120	4.0	10	54,000	37,440	27,360	40,320	41,760
180x120	3.0	1	4,860	3,370	2,462	3,629	3,758
180x120	4.0	3	19,440	13,478	9,850	14,515	15,034
240x120	3.0	2	12,960	8,986	6,566	9,677	10,022
240x120	4.0	1	8,640	5,990	4,378	6,451	6,682
270x120	3.0	8	58,320	40,435	29,549	43,546	45,101
270x120	4.0	4	38,880	26,957	19,699	29,030	30,067
330x120	4.0	3	37,066	26,136	19,483	28,037	28,987
360x120	3.0	3	30,326	21,384	15,941	22,939	23,717
360x120	4.0	9	121,306	85,536	63,763	91,757	94,867
Total Cost of Hirakaku			***562,648***	***392,328***	***288,655***	***421,949***	***436,759***
Percent of House Price			***2.9%***	***2.0%***	***1.5%***	***2.2%***	***2.2%***

Distinctive Architectural Designs Highlighted in New Book

The US-China Build Program, a cooperative of US wood products associations and government agencies, is publishing a wood frame design book as a means of introducing Chinese architects and construction professionals to wood frame construction and increasing the use of US building materials. ***Distinctive Designs: A Showcase of American Wood Building Materials,*** which will be released in April, will feature over 50 profiles of innovative uses of US building materials in residential and commercial projects. Intended to provide designers and end-users with ideas about how to integrate wood into projects in China, the full-color



book highlights the design flexibility of wooden building materials used in residential construction, auditoriums, libraries, museums, bridges, and interior design.

The bi-lingual publication will be distributed in China through the US-China Build Program's Shanghai office and at seminars and trade events. It can also be used in the US and China by US companies as a sales tool to illustrate the variety of ways US building materials can be used.

The design book is part of a comprehensive program implemented by US-China Build that includes annual sales missions, a semi-annual Chinese-language US Housing & Building Materials Newspaper with advertising, US Pavilions at Chinese trade shows, a quarterly US newsletter, and market research. Sales as a result of US company participation have totaled $3 million. For more information about the US-China Build Program and upcoming programs visit: www.uschinabuild.org or contact Rose Braden at 206-543-0700.

China Sales Mission Scheduled for May 2004

The US-China Build Program will lead a group of US building materials exporters on a one-week sales mission to Shanghai to establish sales contacts with end-users and home centers. Mission members will meet with purchasing agents at several of China's Do-It-Yourself home centers, single- and multi-family developers, and product representatives.

Retail home centers are one of China's fastest growing markets. Existing home centers such as B&Q, Homeway, OBI, Homemart and Orient Home are expanding and new stores are emerging to supply the burgeoning demand for home improvement and finishing materials. Relying on global purchasing power, the home centers have created a substantial niche for themselves by providing product and service guarantees, a range of products, and installation services. The latest government figures available show that net profit from the home furnishing industry in China reached US$1.4 billion in 2001, a 27% increased over 2000.

In addition to meetings with home center purchasing agents, the group will tour high rise and single family home developments that include concrete and wood frame construction. The group will also tour wholesale and retail markets, and the Shanghai International Building and Construction Trade Fair, one of China's largest building materials trade shows. One-on-one meetings with pre-screened product representatives, distribution companies, and end-users will also be arranged for the mission members.

The mission will take place May 24-28. The fee to participate is $650 for EBPA members, $750 for non-members. Meals, accommodations, and airfare costs are the responsibility of each participant. Hotel and in-country travel arrangements will be made by USCB. Packages that include hotel and travel costs are also available.

E-mail Rose Braden at rbraden@uschinabuild.org or call 206-543-0700 if you are interested in participating.

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