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Adoption of Engineered Wood Products in Alaska

Joseph A. Roos, Indroneil Ganguly, and Allen Brackley

Authors

Joseph A. Roos and **Indroneil Ganguly** are research associates, University of Washington, Seattle, WA 98105; and **Allen Brackley** is a research forester, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Alaska Wood Utilization Research and Development Center, 204 Siginaka Way, Sitka, AK 99835.

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Abstract

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Based on an in-grade testing program, the Ketchikan Wood Technology Center has registered three proprietary grademarks for Alaska species of hemlock (*Tsuga heteraphylla* (Raf.) Sarg.), yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach), and spruce (combined Sitka spruce [*Picea sitchensis* (Bong.) Carr.] and white spruce [*Picea glauca* (Moench) Voss]). The Ketchikan Wood Technology Center conducted tests to establish glulam beam manufacturing specifications. In conjunction with this program, there is a need to measure the market for glulam beams in Alaska. The purpose of this research was to compare Alaska residential builder adoption rates of glulam beams and other engineered wood products to those of the continental United States. The results showed that a higher percentage of Alaska builders use glulam beams compared with builders in the rest of the United States.

Keywords: Alaska, glulam, glu-lam, engineered wood, lumber.

Contents

Introduction

Since the closure of the Sitka Pulp Mill in 1993 and the Ketchikan Pulp Corporation in 1997, Alaska has been redefining its role in the forest products industry. Research has shown that Alaska forest products compete directly with other resources in the global market (Stevens and Brooks 2003). Thus, Alaska forest products must differentiate themselves in order to compete in the global market. The Ketchikan Wood Technology Center has undertaken an in-grade testing program to evaluate structural values unique to Alaska species. The results of this in-grade testing program are three Western Wood Products Association (WWPA) registered grademarks for Alaska species of hemlock (*Tsuga heteraphylla* (Raf.) Sarg.), yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach), and spruce (*Picea sitchensis* (Bong.) Carr.) (WWPA 2005). One potential use for Alaska species is as laminated stock (lamstock) lumber used to manufacture glulam beams. Glulam beams have a variety of residential construction applications including floor beams, headers, and roof beams (table 1). Additionally, glulam beams are used in nonresidential construction such as office buildings, stores, schools, and recreation facilities, and industrial construction such as bridges, utility poles, towers, and marinas (Adair 2007).

Glulam beams, which are laid up and glued together, are made from lamstock lumber. The grading system used for most lamstock is that of the American Institute of Timber Construction (AITC) Inspection Bureau Laminating Grades. The AITC designates laminating grades with an "L" with the exception of southern yellow pine (*Pinus palustris* Mill.), which uses an "N" (AITC 2004). The grade follows the letter, and then the density is designated with a letter (table 2). For example, L2D stands for "laminating grade 2, dense."

A significant amount of high-quality structural lumber can be produced from Alaska hemlock logs.

Green et al. (1999) demonstrated that a significant amount of high-quality structural lumber can be produced from Alaska hemlock logs. When graded as lamstock, approximately 28 percent made the highest grade (L1) and more than 85 percent of the L1 and L2 grades qualified as "dense" (table 3).

Table 1—Percentage of glulam beam end uses in Alaska, 2004

Application	Percentage
Residential floor beam	37
Nonresidential	25
Residential garage door header	19
Residential window and door header	11
Residential roof beams	4
Industrial	3

Source: Adair 2007.

Table 2—American Institute of Timber Construction Inspection Bureau laminating grades

			Knot sizes						
				Board size					
Lam grade	Growth rate	Slope of grain	Knot sizes	2 by 4	2 by 6	2 by 8	2 by 10	2 by 12	Knot spacing
			Inches						
L1	Dense	1:14	1/4	7/8	1 3/8	1 13/16	2 5/16	2 13/16	Well spaced
L1 CL	Close	1:12	1/4	7/8	1 3/8	1 13/16	2 5/16	2 13/16	Well spaced
L2D	Dense	1:12	1/3	1 3/16	1 13/16	2 7/16	3 1/16	3 3/4	Well spaced
L2	Medium	1:12	1/3	1 3/16	1 13/16	2 7/16	3 1/16	3 3/4	Well spaced
L3	Medium	1:8	1/2	1 3/4	2 3/4	3 5/8	4 5/8	5 5/8	Well spaced

Source: AITC 2004.

A feasibility study by the University of Alaska examined the return on investment of manufacturing glulam beams in Alaska (Allen and Gorman 2003). This study focused on the cost of inputs but did not examine what percentage of Alaska residential construction builders were using glulam beams. The purpose of this research is to build on the Allen and Gorman (2003) research and measure what percentage of Alaska's residential construction builders are using glulam and other engineered wood products compared with the rest of the United States.

Data were collected via a phone survey conducted by a local market research firm in fall 2005. The phone interviewers were familiar with the range of wood products included in the survey. The sample frame was obtained from infoUSA through a systematic random sampling based on the homebuilder standard industrial classification code.

The sample frame was divided into two categories. The first category was Alaska homebuilders, and the second category was homebuilders from all U.S. States excluding Alaska. For the non-Alaska U.S. homebuilder category, the sampling was proportional to the percentage of total U.S. housing starts in each respective state in 2003 (table 4). The states excluding Alaska are referred to in the paper as "the rest of the United States." For the Alaska category, the sampling was done at a higher percentage than Alaska's percentage of total U.S. housing starts. The oversampling for Alaska was necessary to obtain adequate degrees of freedom for statistical comparisons.

Table 3—Alaska hemlock lamstock yields

Grade	Yield percentage
L1	28.5
L2	16.8
L3	16.6

Source: Green et al. 1999.

Table 4—Regional sample frame summary based on 2004 housing starts

Western United States	Housing starts	U.S. starts	Respondents to call per state	Eastern United States	Housing starts	U.S. starts	Respondents to call per state
	No.	*Percent*	*No.*		*No.*	*Percent*	*No.*
Northwest:				Northeast:			
Alaska	3,003	0.17	37	Connecticut	9,731	0.56	1
California (North)[a]	95,744	5.48	15	Delaware	6,331	0.36	1
Idaho	13,488	0.77	2	Illinois	60,971	3.49	7
Iowa	14,789	0.85	2	Indiana	39,596	2.27	5
Minnesota	38,977	2.23	4	Maine	7,201	0.41	1
Montana	3,574	0.20	0	Maryland	29,293	1.68	2
Nebraska	9,278	0.53	1	Massachusetts	17,465	1.00	2
North Dakota	3,265	0.19	1	Michigan	49,968	2.86	6
Oregon	22,186	1.27	3	New Hampshire	8,708	0.50	1
South Dakota	4,816	0.28	1	New Jersey	30,441	1.74	3
Washington	40,200	2.30	5	New York	49,149	2.81	6
Wyoming	2,045	0.12	1	Ohio	51,246	2.93	6
Total Northwest	251,365	14	72	Pennsylvania	45,114	2.58	5
				Rhode Island	2,848	0.16	1
Southwest:				Vermont	3,072	0.18	1
Arizona	66,031	3.78	8	Washington, DC	1,591	0.09	1
Arkansas	12,436	0.71	1	West Virginia	4,890	0.28	1
California (South)[a]	63,829	3.65	7	Wisconsin	38,208	2.19	4
Colorado	47,871	2.74	5	Total Northeast	455,823	26	54
Hawaii	5,902	0.34	1				
Kansas	12,983	0.74	1	Southeast:			
Missouri	28,255	1.62	5	Alabama	18,403	1.05	2
New Mexico	12,066	0.69	1	Florida	185,431	10.61	20
Nevada	35,615	2.04	4	Georgia	97,523	5.58	11
Oklahoma	12,979	0.74	1	Kentucky	19,459	1.11	3
Texas	165,027	9.44	19	Louisiana	18,425	1.05	2
Utah	19,327	1.11	2	Mississippi	11,276	0.65	1
Total Southwest	482,321	28	55	North Carolina	79,824	4.57	9
				South Carolina	34,104	1.95	4
				Tennessee	34,273	1.96	4
				Virginia	59,445	3.40	7
				Total Southeast	558,163	32	63
Total West	733,686	42	127	Total East	1,013,986	58	117

[a] Estimates for northern and southern California obtained using California housing start data.

Table 5—Respondent mean annual revenue

Category	Mean	95 percent confidence interval: Lower bound	95 percent confidence interval: Upper bound	Standard deviation
		Dollars		
Alaska	1,863,000	165,931	3,560,069	3,412,645
Rest of the United States	1,155,604	944,705	1,366,503	1,520,126
Total sample	1,213,482	980,944	1,446,019	1,750,045

A total of 244 eligible homebuilders were successfully interviewed. The final sample consisted of 207 residential homebuilders from the rest of the United States category and 37 residential homebuilders from the Alaska category. The statistical analysis was done using SPSS statistical software.

Results

The two main demographic variables collected were annual revenue and number of employees. The mean annual revenue figure for the total sample was $1,213,482 with 95 percent confidence interval of $980,944 to $1,446,019 (table 5). Mean annual revenue for Alaska firms were $1.86 million with 95 percent confidence interval of $165,931 to $3,560,069. The Alaska mean revenue figures were higher than the rest of the U.S. category, which had mean annual revenue of $1.16 million.

The mean number of employees for the total sample was 6.27 with 95 percent confidence interval of 3.49 to 9.05 (table 6). The mean number of employees for Alaska firms was 8.89 with 95 percent confidence interval of 2.34 to 15.44. The Alaska employee mean was higher than the rest of the U.S. category, which had a mean of 6.03 employees.

Another interesting figure that can be derived from the data collected is sales per employee. Alaska sales per employee was $2.1 million compared with $1.9 million for the rest of the United States.

Glulam Beam Usage

Glued laminated (glulam) beams are engineered wood products used in a variety of structural and architectural applications. Glulam is made up of individual

Table 6—Respondent mean number of employees

Category	Mean	95 percent confidence interval: Lower bound	95 percent confidence interval: Upper bound	Standard deviation
Alaska	8.89	2.34	15.44	14.21
Rest of the United States	6.03	3.05	9.02	21.41
Total sample	6.27	3.49	9.05	20.68

Table 7—Use of glulam, wood I-joist, laminated veneer, Timberstrand, and Parallam in Alaska and other U.S. States, 2005

Category and region	Number	Mean use	Standard deviation	2-tailed significance
		Percent		
Glulam beam usage				
Alaska	37	94.6	22.9	
Rest of the United States	203	75.9	42.9	0.01
Wood I-joist usage				
Alaska	35	91.4	28.4	
Rest of the United States	204	81.9	38.6	.16
Laminated veneer lumber usage				
Alaska	37	86.5	34.6	
Rest of the United States	205	80.5	39.7	.39
Timberstrand usage				
Alaska	34	35.3	48.5	
Rest of the United States	205	58.5	49.4	.01
Parallam usage				
Alaska	32	40.6	50	
Rest of the United States	205	70.2	45.8	.00

pieces of lumber finger-jointed together into long laminations that are then bonded together with adhesives (Falk and Colling 1995). Structural applications include trusses, headers for windows, entry and garage doors, and structural members for commercial structures. Generally, glulam ranges in depth from 6 to 72 inches and can be manufactured in lengths up to 100 feet (APA EWS 2004). Architects often use glulam beams in their designs to bring the beauty of wood to the interior of a structure. Glulam beams can also be curved to bring unique symmetry to interiors. One example of how glulam can contribute both structurally and aesthetically to a building is the Beaverton City Library (APA EWS 2001). This design incorporates four glulam columns that are bound together at the base and then curve up and branch out to support the ceiling structure, creating the appearance of a forest of glulam trees.

Nearly 95 percent of Alaska's residential construction builders use glulam beams.

The survey results showed that 94.6 percent of Alaska's residential construction builders use glulam beams (table 7). This result was significantly higher than the rest of the United States, where 75.9 percent of builders responded that they had used glulam beams.

Wood I-Joist Usage

I-joists are "I" shaped engineered wood products designed for use in floor and roof construction (APA EWS 2004). I-joists are manufactured using sawn wood or composite lumber for flanges and plywood or oriented strand board for the web. Common depths are 9 1/2 inches, 11 7/8 inches, 14 inches, and 16 inches. Flange widths commonly range from 1 1/2 inches to 3 1/2 inches. The sample results showed that 91.4 percent of residential construction builders in Alaska and 81.9 percent of residential construction builders in the rest of the United States use wood I-joists (see table 7). In contrast to glulam beams, I-joists showed no significant difference between Alaska usage and the rest of the U.S. usage.

Laminated Veneer Lumber

Laminated veneer lumber (LVL) is manufactured by bonding layers of dried veneer similar to the process of plywood manufacturing. After the veneers are layed up with a waterproof adhesive, they are cured in a heated press creating blocks of materials called billets. Laminated veneer lumber is produced in various thicknesses and widths and is used in structural applications including headers, beams, valley rafters, and scaffold planking (APA EWS 2004). The survey results showed that 86.5 percent of Alaska's residential construction builders use laminated veneer lumber compared with 80.5 percent of residential construction builders in other states (see table 7). These results were not significantly different.

Timberstrand®[1]

Timberstrand is a laminated strand lumber product from Weyerhaeuser. The manufacturing process uses long strands of wood fiber bonded with special resins and cured with a steam injection process, producing large billets up to 64 feet long, 8 feet wide, and 3 1/2 inches thick (http://www.weyerhaeuser.com).

The sample results showed that 35.3 percent of Alaska's residential construction builders use Timberstrand compared with 58.5 percent of residential construction builders in other states (see table 7). Alaska builders used significantly less Timberstrand than the other U.S. states category. The reason for this difference may be that Weyerhaeuser has not marketed the Timberstrand as aggressively in Alaska compared with other states.

Parallam®

Parallam is also a proprietary Weyerhaeuser parallel strand lumber product. This product can be used for headers, beams columns, and posts and can also be treated for exterior applications. The sample results showed that 40.6 percent of Alaska's

[1] The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

residential construction builders use Parallam compared with 70.2 percent of residential construction builders in other states (see table 7). As with Timberstrand, Alaska builders used significantly less Parallam than the other states.

A clustered bar graph comparing the number of substitute products used by the homebuilders in Alaska and the rest of United States is presented in fig. 1. The figure reveals that the number of engineered wood products used by homebuilders in Alaska ranges from three to eight products. The usage of engineered wood products by the homebuilders from the rest of the United States ranges from 1 to 11 products. The results showed that more than 42 percent of the homebuilders from rest of the United States category indicated they used seven or more engineered wood products, whereas only 11.5 percent of the homebuilders from the Alaska category indicated usage of seven or more engineered wood products. Furthermore, 17 percent of the homebuilders from the rest of United States indicated usage of nine or more of the engineered wood products included in the survey, whereas none of the homebuilders from Alaska indicated usage of more than eight engineered wood products. Although there was a higher usage of engineered wood products in

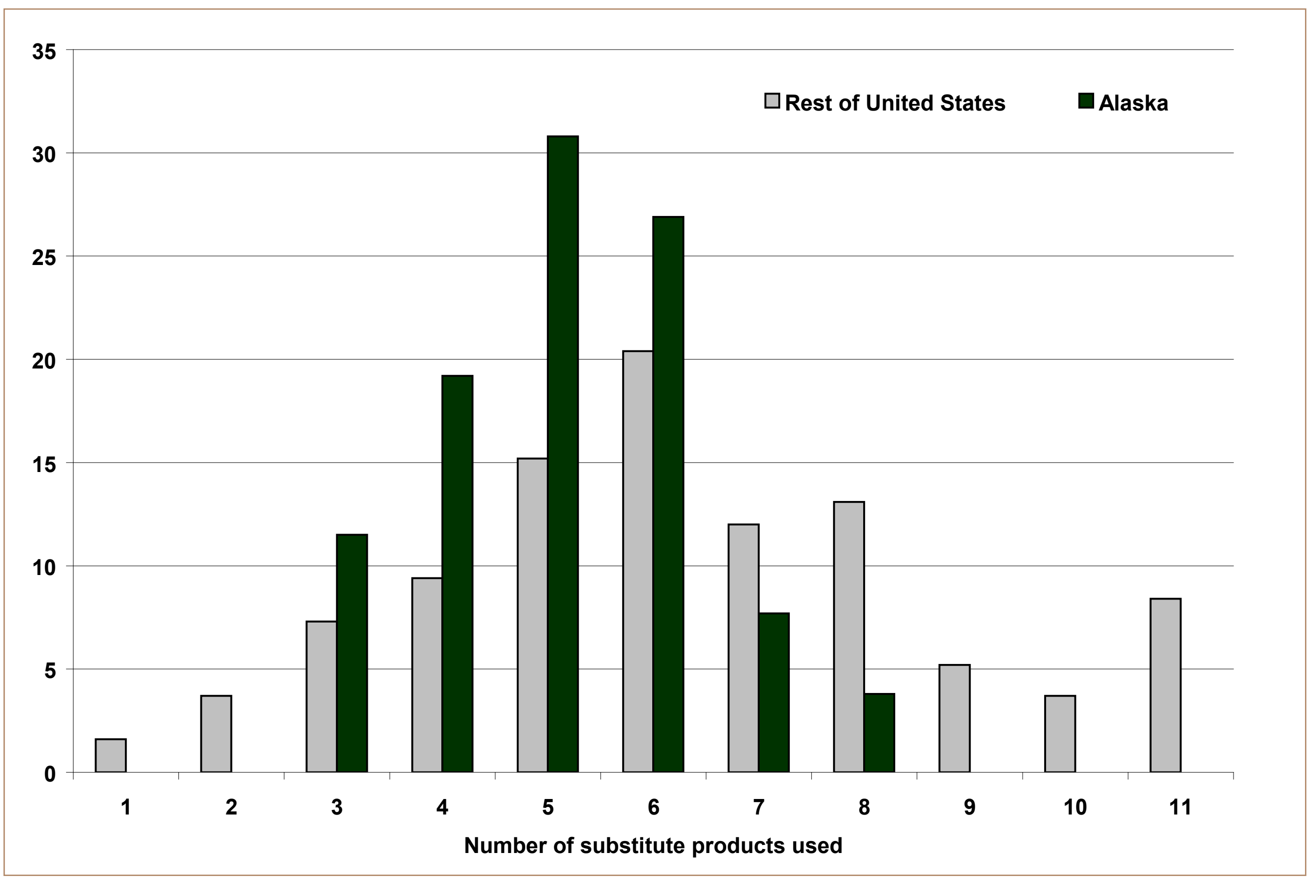

Figure 1—Cumulative number of engineered products used.

the rest of the U.S. category, multiple engineered wood product usage by all homebuilders surveyed in Alaska indicates a general acceptability of these products.

Conclusions

Builders in Alaska use a higher percentage of glulam beams than builders in other U.S. States.

The results of this research can be summarized into two main conclusions. The first is that Alaska builders do not use as many engineered wood products as builders in other U.S. States. The two products where Alaska's usage lagged behind that of the other U.S. States were the two Weyerhaeuser products Timberstrand and Parallam. This may indicate that Weyerhaeuser has not focused their marketing as strongly on Alaska as on other parts of the United States.

The second conclusion is that builders in Alaska (94.6 percent) use a higher percentage of glulam beams than builders in other U.S. States, despite the fact that they are not manufactured in Alaska.

Allen and Gorman (2003) examined the feasibility of producing glulam beams in Alaska considering raw materials, labor, and capital cost. This report found that the cost of producing glulam beams in Alaska appears to be relatively high and that the feasibility would depend on the market price for glulam beams. The Ketchikan Wood Technology Center has shown, through their in-grade testing program that Alaska timber has higher strength properties suitable for lamstock to manufacture glulam beams. Green et al. (1999) showed that a high percentage of Alaska hemlock qualifies for the lamstock grades listed in table 3. This study built upon previous research and showed that 94.6 percent of builders in Alaska sampled use glulam beams.

We estimate the annual Alaska glulam beam usage to be about 1 million board feet per year. This estimation is based on total U.S. production of glulam beams in 2007 being 414 million board feet (Adair 2007). Extrapolating that Alaska uses 0.24 percent of the total U.S. consumption, a price estimate of $900 per thousand board feet is used to calculate an annual market value of $900,000. It must be noted that these estimates are based on quantity and price figures that are very rough.

If Alaska wishes to enter the glulam beam industry, there are two options. The first is to produce lamstock graded lumber and sell to glulam beam manufacturers in the lower 48 States. The second option is to move one more step up the value-added chain and establish glulam beam manufacturing facilities in Alaska.

Our results showed that a large majority of Alaska builders are using glulam beams, so the market is established. Thus, marketing strategy could focus on penetrating this market with locally produced glulam beams and increasing the total glulam beam market. In addition to the residential construction market, there is ample opportunity in the commercial construction market to substitute glulam beams for steel beams (APA EWS 1999). Producers could also research markets beyond Alaska including the lower 48 States and Asia (Sasatani et al. 2005).

Producers in the Pacific Northwest (Washington and Oregon) also have an option for taking advantage of the high yields of lamstock from Alaska species. In March 2007, the Regional Forester for Alaska approved the limited sale of Sitka spruce and western hemlock to the lower 48 States.[2] The exportable material includes the low-grade pulpwood quality logs included in the report by Green et al. (1999). Purchase of this material for production of dimension lumber and lamstock in a segregated production line would allow grading by using the new Alaska grademarks.

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U.S. Department of Agriculture
Pacific Northwest Research Station
333 SW First Avenue
P.O. Box 3890
Portland, OR 97208-3890