ENGINEERED KILN STICKERS--A NEW WAY TO SAVE COSTS*

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Introduction

Ladies and gentlemen, it is both a pleasure and an honor to appear before you today and particularly to address you on my favorite subject, namely SEKS.

Now before we get too carried away and depart from the overall technological theme of this meeting, I should explain what SEKS is. SEKS is the abbreviation for Simpson Engineered Kiln Stickers which is the subject of this paper.

The purpose of my paper today will be to provide you with a status report on a product concept that we feel is extremely practical. Included in this status report are performance and economic data which we have experienced in our sawmill in Shelton, Washington.

The Product

The Simpson Engineered Kiln Sticker (SEKS) is a kraft reinforced thermosetting phenolic laminate. While this product description may be relatively unfamiliar to the kiln drying industry, it is a concept that is long established. Much of the early work that documented the high strength capabilities of combining kraft fibers with phenol-formaldehyde resin was done at the U. S. Forest Products Laboratory in the early years of the second World War. (1, 2, 3, 4)

While the technology of producing a phenolic paper laminate is fairly well established, the SEKS is a unique combination of a proprietary resin, impregnating technique, and laminating technique. This combination is designed to make this product more feasible for its intended use, namely as a lumber sticker for dry kiln operations.

Detailed strength value comparisons of this product can be found in our advertising literature. Suffice it to say that the product is significantly stronger than any wood species tested with its outstanding characteristic being compression. The SEKS is from 20 to 50 times stronger in compression perpendicular to the grain. It is also noteworthy that all strength properties are relatively unaffected by changes in humidity which also accounts for the high dimensional stability of the product (Figures 1 and 2). This resistance to moisture change accounts for the resistance to twisted warp in a typical kiln cycle.

In addition to the above strength and dimensional stability properties, the SEKS appears to be particularly well designed for temperature resistance. Product testing, both on a laboratory scale and in actual kiln drying operations, have exposed the product to a temperature range of from 50 below zero to 300 degrees Fahrenheit with no evident degradation.

*Presented at the 1972 National Meeting of the Forest Products Research Society, Anaheim, CA. Published by permission of the Forest Products Research Society.
Figure 1. Comparison between 5/8" wood kiln stickers after 5 cycles to 7/16" SEKS after 40 cycles.

Figure 2. Comparison between 5/8" wood kiln stickers after 5 cycles to 7/16" SEKS after 40 cycles.
Performance Objectives

In June of 1972 our lumber people in Shelton announced that they were going to begin evaluating a fiberglass sticker as a substitute for wood in their kiln drying operations. We investigated the cost aspects of fiberglass and it was felt at that time that we had a much more economical product from a cost viewpoint, namely our phenolic kraft SEKS. We were able to place 40 sticks into the evaluation of a comparative basis with fiberglass and wood. At the end of 15 cycles through the dry kiln, it was concluded that the performance characteristics of the SEKS were superior to both fiberglass and wood from a durability standpoint. It was decided at that time to begin a scale-up project to evaluate several performance characteristics of this proposed product.

Performance and Economics

I would now like to illustrate our actual experience with this product from both a performance aspect and economic impact. We will address ourselves to two major areas, namely those of hard economics where we will actually attach dollar savings figures and the remaining areas of significant performance measurement. The three areas of hard economics are as follows:

1. This is the area of volume increase or increase in productivity through the dry kilns by virtue of the use of a thinner sticker. Our Shelton operation dried 106.5 million board feet of lumber in 1972. Of that, approximately 82 percent was 2 inch-thick lumber and 18 percent was 1 inch thick. The shift to a 7/16 inch SEKS as compared to the former used 5/8 inch wood kiln sticker provides a 9 percent increase in productivity with 2 inch lumber and 12.5 increase in productivity with 1 inch lumber.

   In 1972 our drying costs were $2.86 per thousand board feet—this includes power, maintenance, labor, supplies, and steam costs. Using this drying cost figure and offsetting it by an increase in steam requirements, the net effect or net savings due to increased productivity is calculated at $25,700 based on 1972 volumes. This is a cost savings only and does not include marginal profitability available with the increased capacity. This will be covered later in this talk.

2. The next area of hard economics is in the reduction of sorter stacker downtime due to the more dimensionally stable SEKS.

   In 1972 we experienced 1,906 sticker hangups in our stick placer. This resulted in 151 hours of downtime. It should be noted that in our operation, downtime is recorded only when stick hangups occur with enough severity to allow the sorter trays to fill up. Our records show that we actually experience minor jam-ups in the sticker placer with a frequency of 9.6 times per hour, not all of which cause recorded downtime.

   The labor costs of the sorter stacker operation are calculated at $39.43 per hour. Thus, in 1972 we experienced $5,950 worth of actual downtime. Trials with the SEKS show nearly complete elimination of this downtime or we have reduced the frequency from 9.6 times per hour to 0.6 times per hour. Thus, it is felt that the entire downtime cost experienced in 1972 would be saved by the use of the SEKS.
It should be noted that a more closely linked sorter-stacker operation wherein any jam-up in the sticker placer would cause downtime in the whole operation, all jam-ups then become important. Based on our frequency of 9.6 jam-ups per hour and an average of 15 seconds per jam-up we would experience 307 hours of downtime per year. Using this calculation the savings would be $16,000 per year with the use of the SEKS. In our cost calculations, however, we have only included the $5,950 currently experienced in our present sorter-stacker operation.

3. The next area of savings has to do with the durability of the SEKS. In 1972 we used 352,000 wood stickers. This calculates out to 514,000 board feet at $120 per thousand or $61,680. On a cost-per-sticker basis, our cost in 1972 was 17.5 cents each for a 52-inch by 2 1/2 inch by 5/8 inch wood sticker. We dried 106.5 million board feet in 598 charges. Our records show that we lost 588 wood stickers per charge on an average. This calculates to be an average of 13.6 cycles per sticker in 1972. The breakage factor calculates to 7.35 percent breakage or lost stickers per cycle.

Our results to date with the SEKS show that we are experiencing an average breakage of 1 percent per cycle. Based on this percentage our annual usage of SEKS would be 48,000 stickers. At a cost of $0.49 per sticker, the annual dollars for replacement cost would be $23,520.

We have estimated that we require 180,000 wood kiln stickers on hand at any one time. At an average cost of 17.5 cents each and at an inventory cost of money charge of 12 percent annually, our inventory cost is $3,780. As a comparison, we calculate our requirements on hand for SEKS of 150,000. At a cost of $0.49 each and at an annual charge of 12 percent for cost of money, our inventory cost is $8,820 annually.

Table 1 summarizes the economics that we have illustrated thus far. The volume increase in kiln equals $25,730. The sorter-stacker downtime savings equals $5,950. The cost of wood stickers equals $61,680. This is offset by the breakage of SEKS of $23,520. A wood inventory cost of $3,780 offset by an SEKS inventory cost of $8,820. The total savings thus far is $64,800 annually. This is compared to an initial cost of 150,000 SEKS at $0.49 each of $73,500. As you can see, we are talking about an approximate 13-month payback so far.

Table 1. Summary of Benefits: Simpson Engineered Kiln Stickers.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume Increase in Kiln</td>
<td>$25,730</td>
</tr>
<tr>
<td>Sorter-Stacker Downtime</td>
<td>$5,950</td>
</tr>
<tr>
<td>Cost of Wood Stickers</td>
<td>$61,680</td>
</tr>
<tr>
<td>Breakage of SEKS</td>
<td>(23,520)</td>
</tr>
<tr>
<td>Inventory Cost of Wood Stickers</td>
<td>$3,780</td>
</tr>
<tr>
<td>Inventory Cost of SEKS</td>
<td>(8,820)</td>
</tr>
<tr>
<td><strong>Total Savings</strong></td>
<td><strong>$64,800</strong></td>
</tr>
<tr>
<td><strong>Initial Investment</strong></td>
<td><strong>$73,500</strong></td>
</tr>
</tbody>
</table>
I would now like to talk about some of the areas of economics that we have not documented but appear to be some of the most exciting:

1. Durability—So far, the durability of the SEKS appears to be almost entirely based or dependent upon breakage. Our breakage experience so far averages 1 percent per cycle; however, it should be noted that we are improving upon this breakage factor with experience. Nearly half of our breakage has been due to broken ends which we experience when the ends of the kiln stickers protrude from the stack when it is placed down by the forklift. Better adjustment at the sticker placer and/or shorter sticks would improve upon this record quite a lot. While we feel that we have virtually eliminated damage due to the environmental affect of the dry kiln, mechanical damage can still be a problem if the equipment is not adjusted properly. The dimensional stability of the SEKS allows much finer adjustments on the equipment and thus should improve upon current breakage record as we gain further experience.

2. Labor—Many mills do not formally recognize labor costs involved in stick cutting. However, unless sticks are cut by someone at a station-filled job, labor is not free. By eliminating stick cutting, a significant portion of a man’s labor can be eliminated.

3. Stick Inventory Levels—Total stick inventory may be held lower and more constant because of the longer life of the SEKS.

4. Mechanical Handling—Aside from the reduction of handling problems in present equipment, opportunities are open for further development in fully automated stick-handling equipment.

5. Opportunity Margins—While we did not include this figure in our general economics, it is certainly important now with the good lumber markets. The increase in productivity alone by virtue of thin SEKS would allow for an annual increase of 11 million feet. In today’s lumber markets, the profitability of that volume of lumber would be significant to say the least.

6. Drying Time and Subsequent Grade Recovery—Table 2 compares the average drying time for wood kiln stickers to the drying time hours actually experienced with the SEKS. As you can see, we have dried several sizes and species of lumber to form this comparison. The hourly averages for wood have been accumulated over a year’s usage. However, the SEKS data have only been accumulated since December of 1972. As a consequence, we are not ready to claim that drying times can be reduced by the use of SEKS but it is significant to note that every test so far has shown reduced time and the average is around 10 percent. Also, remember that at the same time we are putting from 9 to 12 percent more volume of lumber into the kiln.

Figure 3 shows a comparison between the 5/8 inch wood kiln sticker and the 7/16 inch plastic kiln sticker as regards moisture content distribution. It is quite evident that the distribution in moisture content by using the SEKS is much tighter than we have experienced with wood. Again a reminder that we are putting 9 to 12 percent more lumber in each kiln and drying at a faster schedule than experienced with wood kiln stickers. The tighter distribution obviously means less redry but it also means less downgrade on the low side of the moisture content.
Figure 3: Moisture Distribution Around Average 2" Hemlock vs 5/8 Wood vs 7/16 EKS

Figure 4: Air Velocity 5/8 Wood vs 7/16 EKS

Figure 5: Air Velocity 5/8 Wood vs 7/16 EKS
Table 2. Schedule Time Comparisons: 7/16" SEKS versus 5/8" Wood.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Material</th>
<th>SEKS Hours</th>
<th>Average for Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 x 4 Fir</td>
<td>80</td>
<td>90.25</td>
</tr>
<tr>
<td>2</td>
<td>1 x 4 Hem</td>
<td>86</td>
<td>80.1</td>
</tr>
<tr>
<td>3a</td>
<td>2 x 5 Fir Shop</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>3b</td>
<td>1 3/8 x 5 Fir Shop</td>
<td>88</td>
<td>N.A.</td>
</tr>
<tr>
<td>4</td>
<td>2 x 4 Fir</td>
<td>76</td>
<td>90.25</td>
</tr>
<tr>
<td>5a</td>
<td>2 x 10 Fir</td>
<td>92</td>
<td>97.4</td>
</tr>
<tr>
<td>5b</td>
<td>2 x 12 Fir</td>
<td>92</td>
<td>97.4</td>
</tr>
<tr>
<td>6</td>
<td>2 x 8 Hem</td>
<td>84</td>
<td>97.4</td>
</tr>
<tr>
<td>7</td>
<td>2 x 10 Hem</td>
<td>72</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

1 Booster coils out. 2 No data available. 3 Not comparable due to schedule change.

We all know that degrade is a high cost to any sawmill operation and that it increases substantially as wood is dried to lower and lower average moisture content. In Shelton it is estimated that drying related degrade reduces by at least one grade in at least 5 percent of the dry volume of output. The annual cost of this is estimated at $133,000. Unfortunately, we do not have adequate data of grade input versus grade output when using wood kiln stickers in order to compare the experience when using the SEKS. It is evident, however, that the tighter distributions of moisture content will provide a substantial reduction in degrade and may in fact be the most important economic benefit of the Engineered Kiln Sticker.

Figures 4 and 5 show some explanation for the faster drying times and more uniform moisture content distribution by comparing the air velocity of wood kiln stickers versus the air velocity of SEKS. Figure 4 compares the top, center, and bottom of a load at the door end, center end, and closed end of the kiln. Figure 5 compares the averages of wood versus the SEKS in the door, center, and closed end of the kiln. As you can see, we are experiencing from 115 to 150 feet per minute increase in velocity by using the SEKS. Remember once again that the SEKS is 7/16 inch thickness whereas the wood is 5/8 inch thickness. We feel that the increase in flexural strength plus the high resistance to compression provides a much straighter air passage thus allowing higher velocities and more uniform drying (Figures 6 and 7).

In summary, our documentation of hard economics shows that we are already experiencing a very adequate payback on the initial investment of the SEKS. In addition, however, we have other economics related to the drying characteristics that may in fact be much larger than all of the other savings combined. It is felt that as we gain experience with this product we will be able to optimize our drying operations to the point where we can experience a six month or less payback on the initial investment of this product.
Figure 6. Typical crib load with 5/8" wood kiln stickers.

Figure 7. Typical crib load with 7/16" SEKS.
What has been presented here is the actual experience with the SEKS in our own mill in Shelton, Washington drying fir and hemlock lumber. While other operations may not experience the same results that we have experienced here, I think you will agree that the data shown are quite exciting and we are excited about the product. We are gaining more and more experience in other mills as we have this product in some 30 sawmills primarily in the Pacific Northwest. We are looking forward to gathering additional data particularly with species other than those common to the Pacific Northwest and are particularly anxious to gain additional data in the high temperature dry kilns as the cycle time here is very rapid and provides even more payback on the durability of this product. We put the product on the market in March of 1973, and the response has been outstanding.

Literature Cited


