SHINGLES AND SHAKES FROM ALBERTA JACK PINE AND ASPEN A FEASIBILITY STUDY

Silvacom Ltd.[1]

1988

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DISCLAIMER

The study on which this report is based was funded in part under the Canada/Alberta Forest Resource Development Agreement.

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ACKNOWLEDGEMENTS

A number of individuals were instrumental in the completion of this project. Especially helpful in the production of prototype shingles were Mr. and Mrs. William Tkachuk, and Mr. Reuben Pruden, of Aspen Mills, McRae. Mr. Brian Buchanan, of the Texas Forest Service Laboratory in Lufkin, Texas was a tremendous source of information and advice in the analysis of the prototype shingles, and in pointing out the path to follow in future development of this product. Mr. Ted Langford, Mr. Derek Pachal, and Mr. Dave McArthur, from the REDC, provided cooperative guidance, as well as encouragement. Finally, the authors gratefully acknowledge the cooperation of Mr. John Mrklas (Canadian Forestry Service), and thank him for his concern for top quality results.

1.0 EXECUTIVE SUMMARY

The purpose of this project was to determine whether or not any real potential exists for the production of shingles or shakes from Alberta pine and aspen. In order to determine this potential, prototype aspen and pine shingles from the Lac La Biche area were evaluated and also subjected to preservative (CCA) treatment. Other Alberta work on shingles and shakes was reviewed, as was the development of a southern pine shake industry in Texas.

It was determined that the prototype shingles produced for this project are not suitable for roofing applications. Numerous changes must be made to make this product perform properly. Improvements must be made to both quality (knots, insect holes, flat sawn portions, etc.) and dimensions (primarily increasing the thickness of the shingle, turning it into a *taper sawn shake*, and controlling the width). The taper sawn shake does show potential as a good roofing product. Shake production has the potential to be a high value added, good employment sector of the Lac La Biche regional economy. Using a cursory analysis, it was shown that real economic potential does exist for the production of Alberta taper sawn shakes. It was also concluded that building code approval, via the proxy of a CMHC Building Material Evaluation Report, would be relatively easy to obtain for pine shakes, and more difficult for aspen shakes.

A series of recommendations are presented which relate to both technical aspects (eg. shake dimensions, quality control, etc.) as well as strategic aspects. The strategic recommendations are centered around the development of an Alberta Shake Development Program. Sponsored by the REDC, a Shake Development Program would assist in the establishment of a shake industry by addressing a series of technical and marketing issues. Pine shakes should be developed first, aspen shakes second. Benefits from the Alberta shake development program would flow to all Alberta forested regions, but development would likely be experienced first, and to a greater degree, by companies in the Lac La Biche region.

2.0 INTRODUCTION

The Lac La Biche Regional Economic Development Council (REDC) commissioned Silvacom Ltd. to perform a study which would determine whether or not any real potential exists for the production of shingles or shakes from the local wood supply. This interest had been spawned by local entrepeneurs who had set up a shingle mill, and were producing small quantities of pine shingles for the local market. Silvacom began the project in November of 1987, and completed the work in March of 1988. This report describes our findings.

3.0 OBJECTIVES

The overall objective of this project was to answer the question "DO WE HAVE A PRODUCT?". We sought to determine whether there is real potential in manufacturing shakes from local timber. Markets were not addressed in this project. Of primary importance were the following questions:

- Can shakes physically be manufactured from local timber?
- What will be the likely grade and yield?
- What are the costs of production (rough estimate only)?
- Given these costs, yields, and grades, is there any possibility of competing with other wood roofing materials?

4.0 METHODS

Our evaluation of Alberta shingles and shakes included several components. First, we examined the jack pine shingle product being produced by Aspen Mills Ltd. of McRae, Alberta. This product was evaluated, and tested for preservative treatability, at the Texas Forest Service Laboratory in Lufkin, Texas. To our knowledge, there are no other shingle or shake producers in Alberta. The second component of the project involved the review of previous Alberta work, primarily undertaken by the Alberta Research Council (ARC) and the Canada Mortgage and Housing Corporation (CMHC). The last component involved a review of the taper sawn shake development program currently being undertaken by the Texas Forest Service.

The original work plan for this project called for an investigation of a particular shake producer in Arizona who had reportedly been producing and marketing an aspen shake. Numerous attempts were required to locate and contact this producer. The producer was finally contacted, but the likely results of continuing to pursue this lead were judged to be of low value. The Arizona portion of the project was subsequently dropped.

4.1 Alberta Shingle Prototype

For the past two years Aspen Mills Ltd. has owned, and sporadically operated, a shingle mill at McRae, Alberta. The prototype shingles manufactured were typically 16" long, 4"-12" wide, and tapered from a butt thickness of 3/8"-1/2" down to approximately 1/8" on the thin end. The shingles produced have been sold primarily to the local, north-central Alberta marketplace. Lack of CMHC approval (and, subsequently, lack of building code approval) has hampered marketing efforts. The owners of Aspen Mills, William Tkachuk and Reuben Pruden, were instrumental in having the current project proceed so that their prototype shingle product could be tested.

One square each of jack pine and trembling aspen shingles were produced by Aspen Mills during February of 1988. The following sequence of photographs (Figures 1 to 10) illustrates the production of the sample shingles:

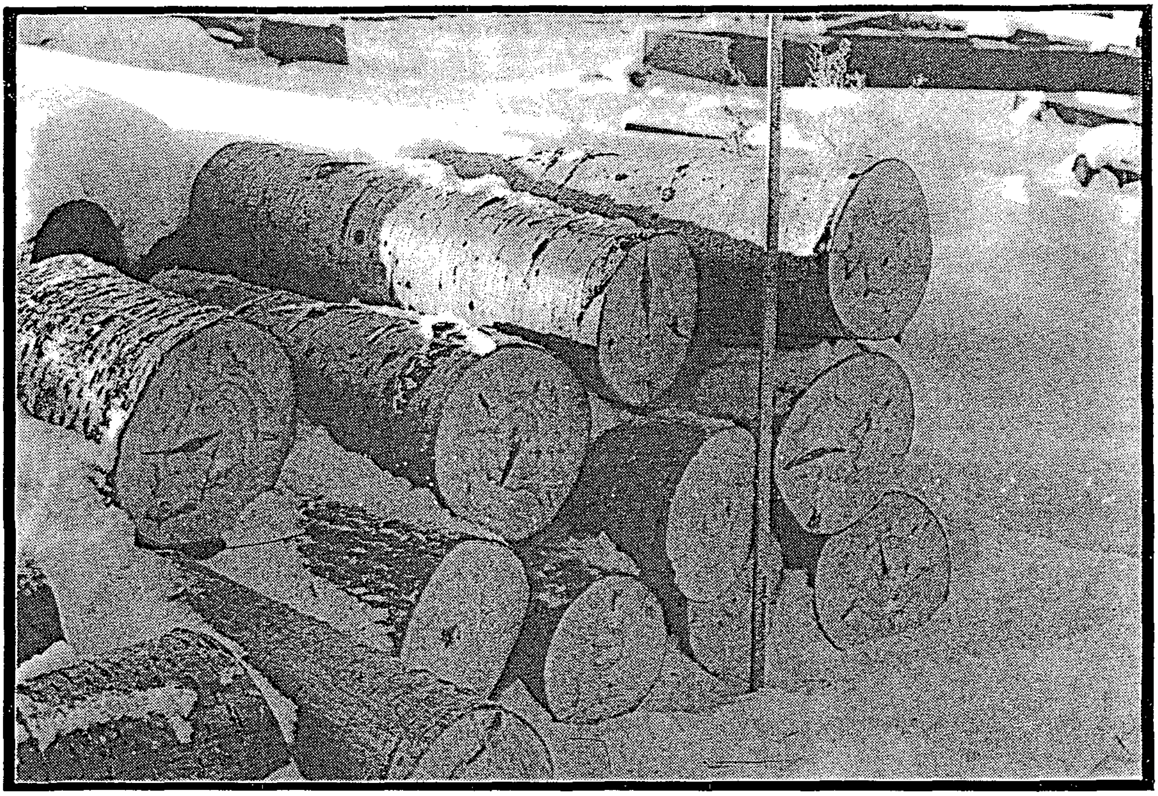


Figure 1. Aspen Blocks Prior to Final Bucking

Figure 2. Pine Blocks - Ready for the Shingle Machine

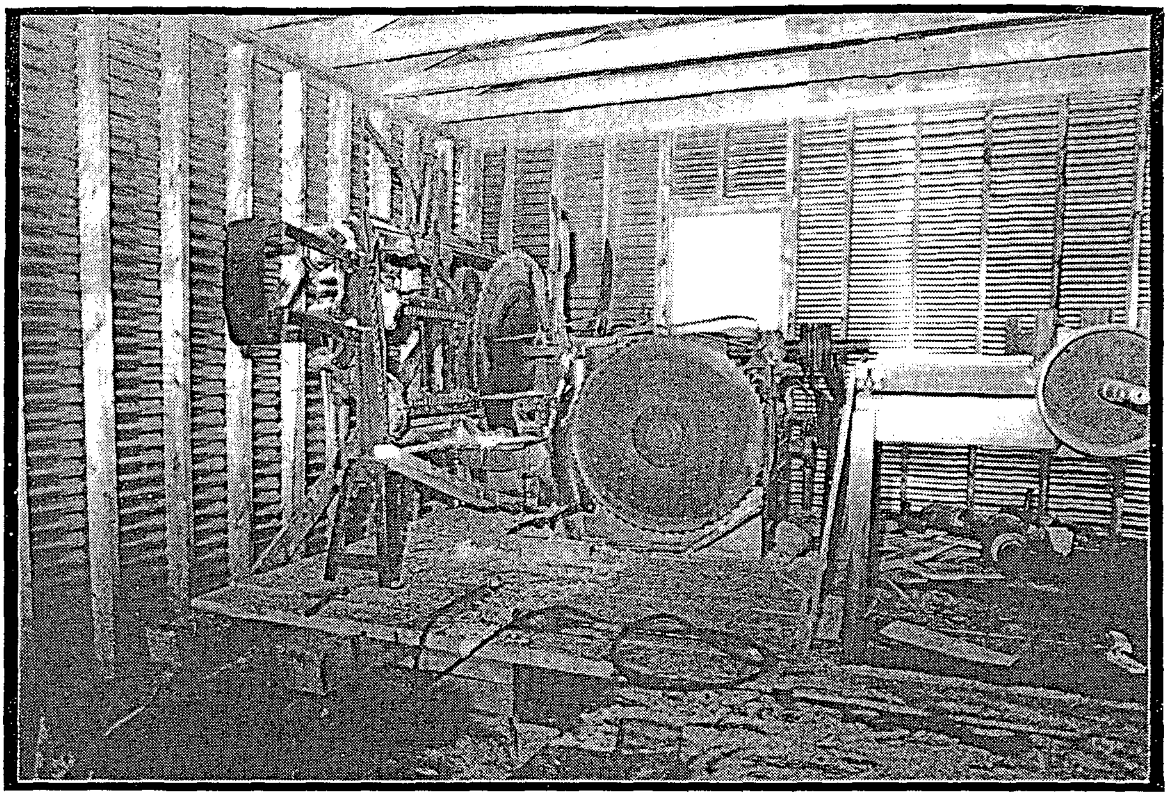


Figure 3. The Aspen Mills Shingle Machine

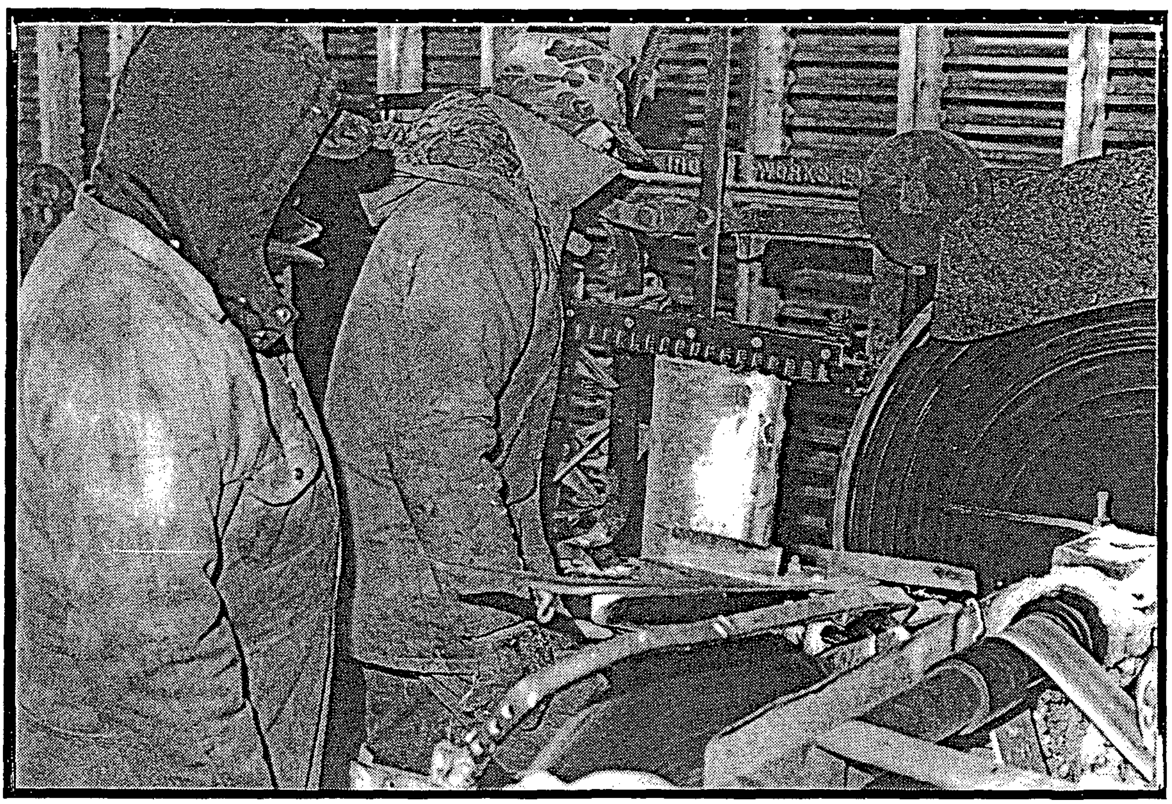


Figure 4. Aspen Block - First Cut; "Live Sawing"

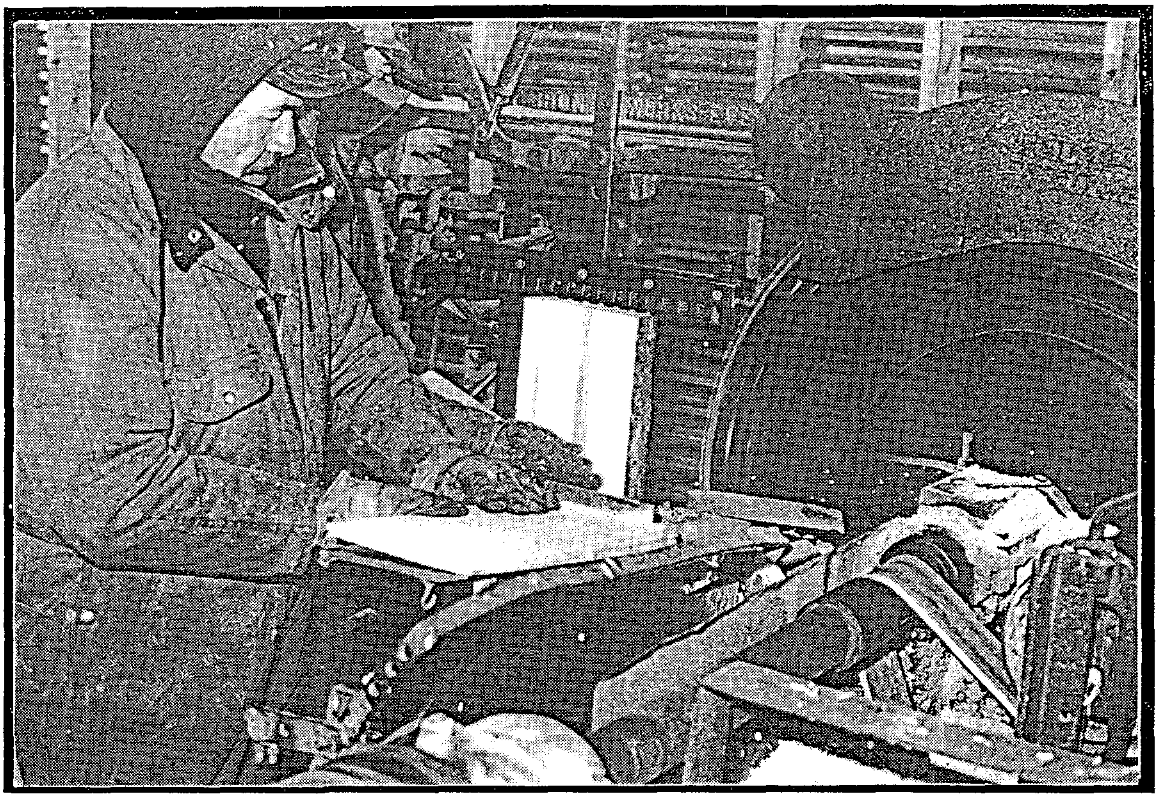


Figure 5. Aspen Block - Shingle Sawing and Trimming

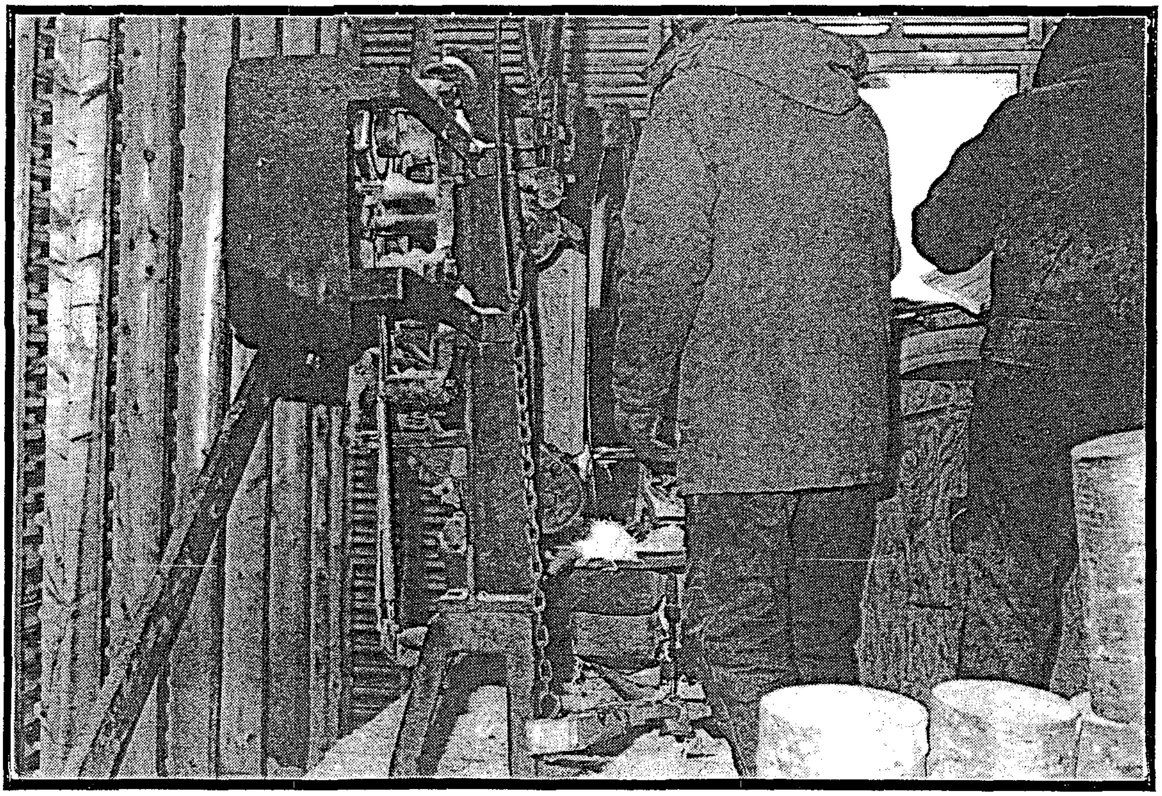


Figure 6. End View - Creating the Taper

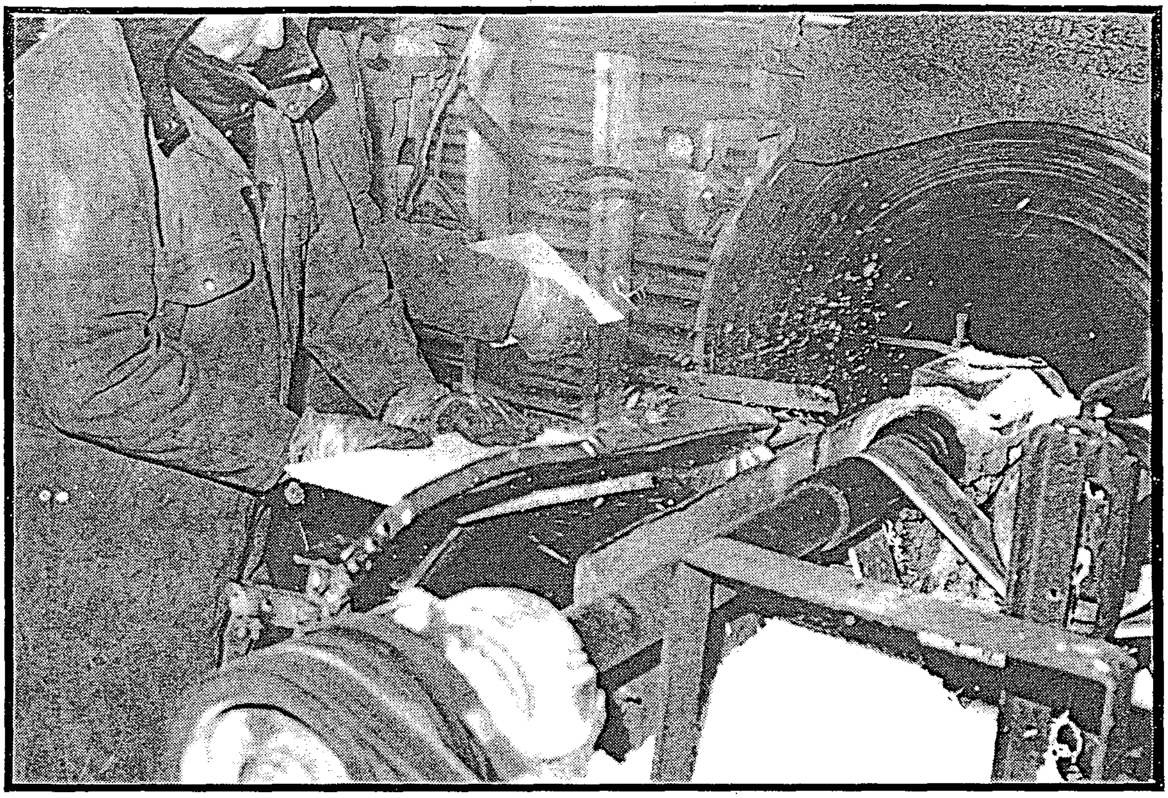


Figure 7. Trim Saw

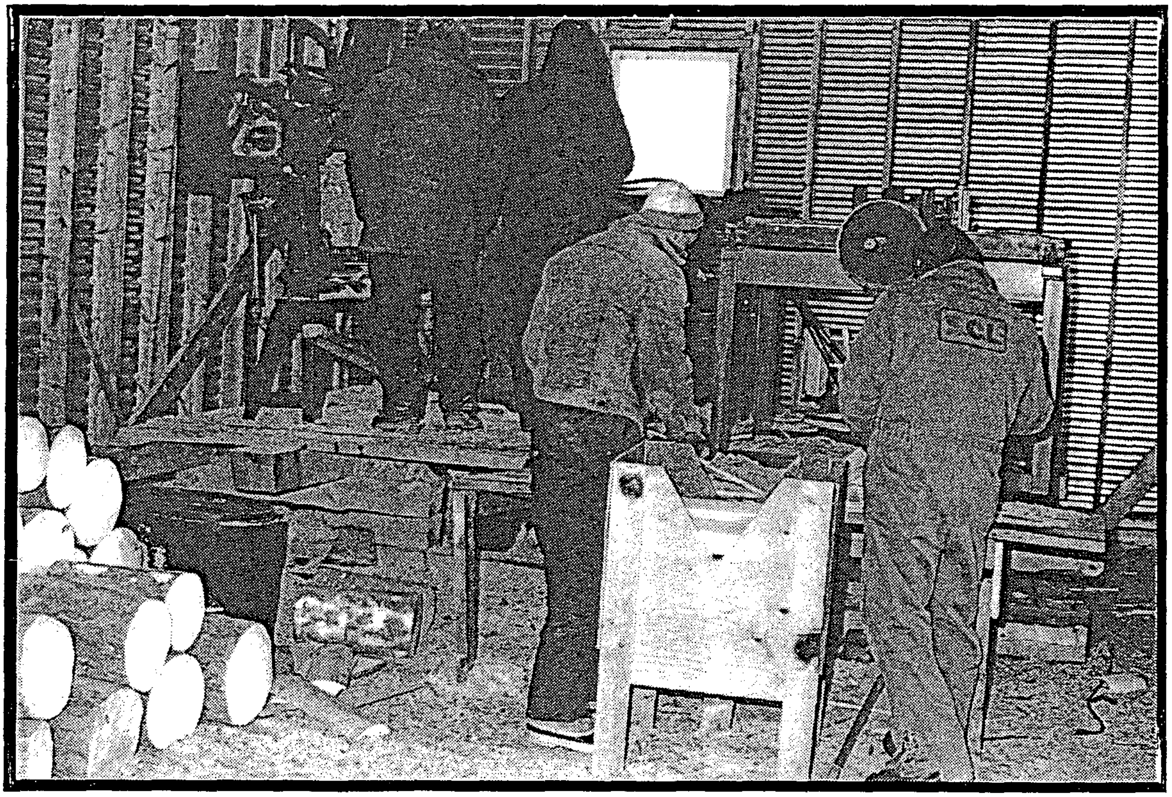


Figure 8. Assembling a Bundle of Shingles

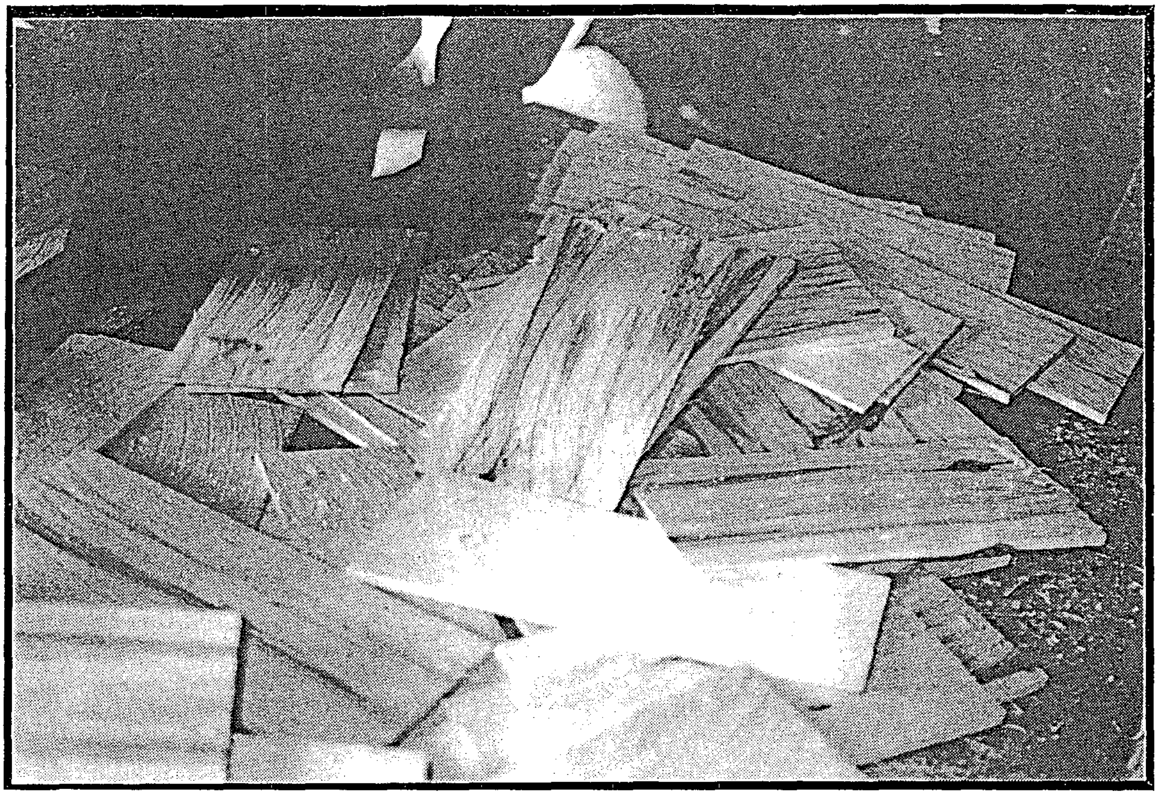


Figure 9. The Final Product - Aspen Shingles

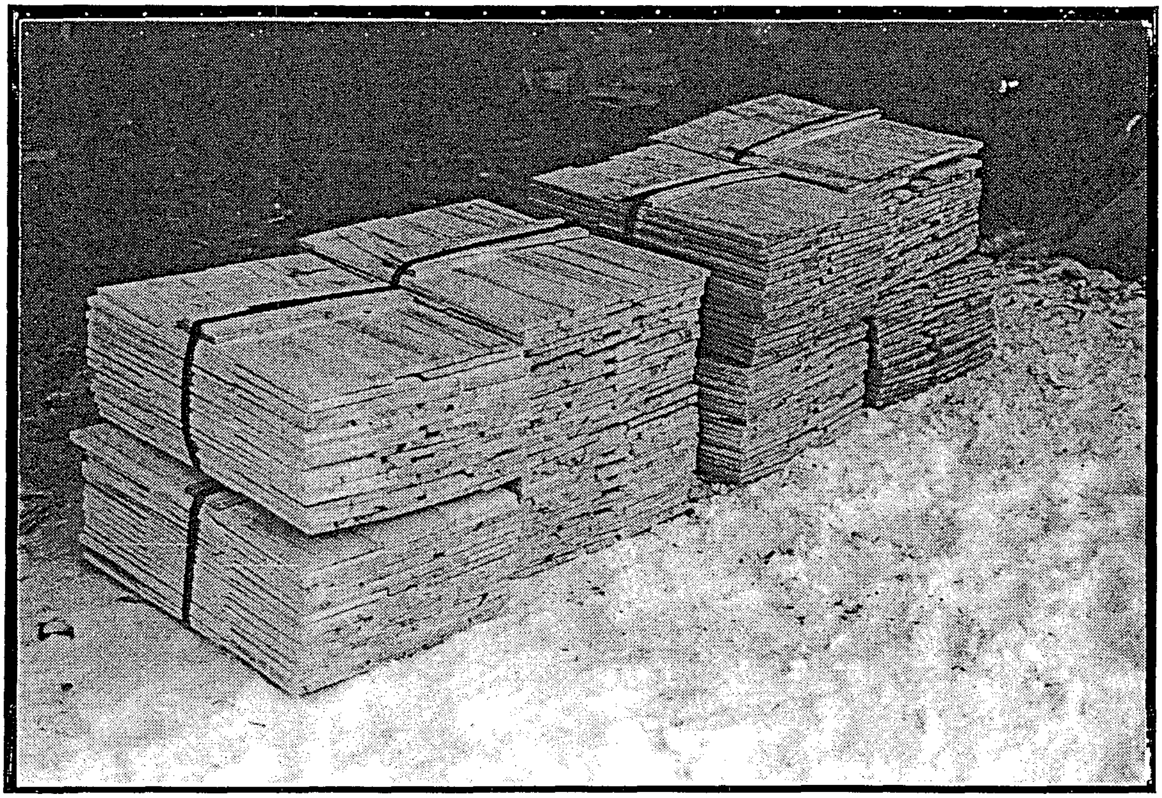


Figure 10. Aspen Bundles (Left); Pine Bundles (Right)

5.0 RESULTS

The RESULTS section of this report duplicates the pattern adopted in the METHODS section. First, we present the results of our evaluation of the Alberta pine shingle prototype. Second, we present the results of our investigation into previous Alberta experience with shingles and shakes. Finally, we discuss the Texas taper sawn shake program.

5.1 Alberta Shingle Prototype - Results

The Alberta pine and aspen shingles produced at McRae by Aspen Mills were evaluated by the Texas Forest Products Laboratory at Lufkin, Texas. The objective was to judge the overall quality and treatability of the jack pine and aspen shingles, and to evaluate the suitability of these shingles as a roofing product. Recommendations related to improving these prototype shingles were also made, and are presented in 7.0 RECOMMENDATIONS.

5.1.1 Wood Quality

Close inspection of the shingles showed they contained a number of "defects" which could have a profound effect on the stability of the roof once installed. The most obvious defects were knots. Knots can be a problem in roofing if they are exposed and can cause leakage if they split or pop out. Past experience has shown that tight knots will not cause too many problems if the total knot area per shingle is less than 1 - 1.5 inches. Larger knots can cause excessive cupping and curling across the face. Loose knots will eventually pop out during weathering, resulting in leaks. "Black ring" knots are particularly liable to loosen and pop out. These loose knots should not be allowed in the exposed portion of the shingle. The presence of other visible defects such as cross-grain and insect holes is a concern. Under no circumstance should the shingles contain any insect holes. Cross-grain can be allowed but should be minimized wherever possible.

5.1.2 Shingle Quality

The majority of both shingle groups (pine and aspen) showed large percentages of "flat grain" (horizontal grain). Shingles with flat-grain in the middle of the shingle will cup, curl and split once exposed. By minimizing the amount of flat-grain in the shingles, these problems can be greatly reduced. Realizing that smaller diameter logs will produce shingles with flat grain, the best approach is to cut the shingles where the flat-grain is at least 1.5" away from the center of the shingle. This almost eliminates the splitting problem and greatly reduces the tendency for the shingles to cup and curl.

Both shingle groups showed considerable amounts of heartwood which is not noted to have any natural resistance to insect or decay. In addition, these heartwoods cause problems in treating, particularly with the aspen.

5.1.3 Treatability

Both the aspen and the pine shingles were evaluated for their "ease of treatment" with a standard wood preservative CCA (chromium-copper-arsenate). Prior to pressure impregnation, the shingles were oven dried to 8-12% moisture content.

Following drying, the shingles were pressure impregnated with CCA using the standard full-cell treating cycle. Target retentions were for 0.25 and 0.40 pcf (pounds per cubic foot) CCA. Following treatment, the shingles were air dried amd subsequently sampled for both retention and penetration of the preservative (refer to APPENDIX A - Southwestern Laboratories Report 3-28-88).

Results from the analysis indicate that both species, and particularly the aspen, will be difficult to treat because of their heartwood content. It is felt that the jack pine shingles will accept enough preservative to insure good decay and insect resistance. The aspen, on the other hand, will only be protected by a thin "encasement treatment" at best using the CCA preservative. It may be possible, however, to obtain better retentions and penetration by using the preservative ACA (ammoniacal copper arsenite) or ACZA (ammoniacal copper zinc arsenite) when treating aspen.

5.1.4 Overall Assessment

In general, the quality of the aspen and pine prototype shingles was very poor. It must be remembered, however, that no grading or pre-selection of raw material or shingles was undertaken. Treatability of the pine shingles was satisfactory, however, alternate treating methods might prove more efficient (refer to 7.0 RECOMMENDATIONS). Treatability of the aspen shingles was poor, particularly in the heartwood. Alternative methods of treating aspen should be investigated (refer to 7.0 RECOMMENDATIONS).

The following series of photographs illustrates some of the quality and treatability concerns discovered by the current evaluation.

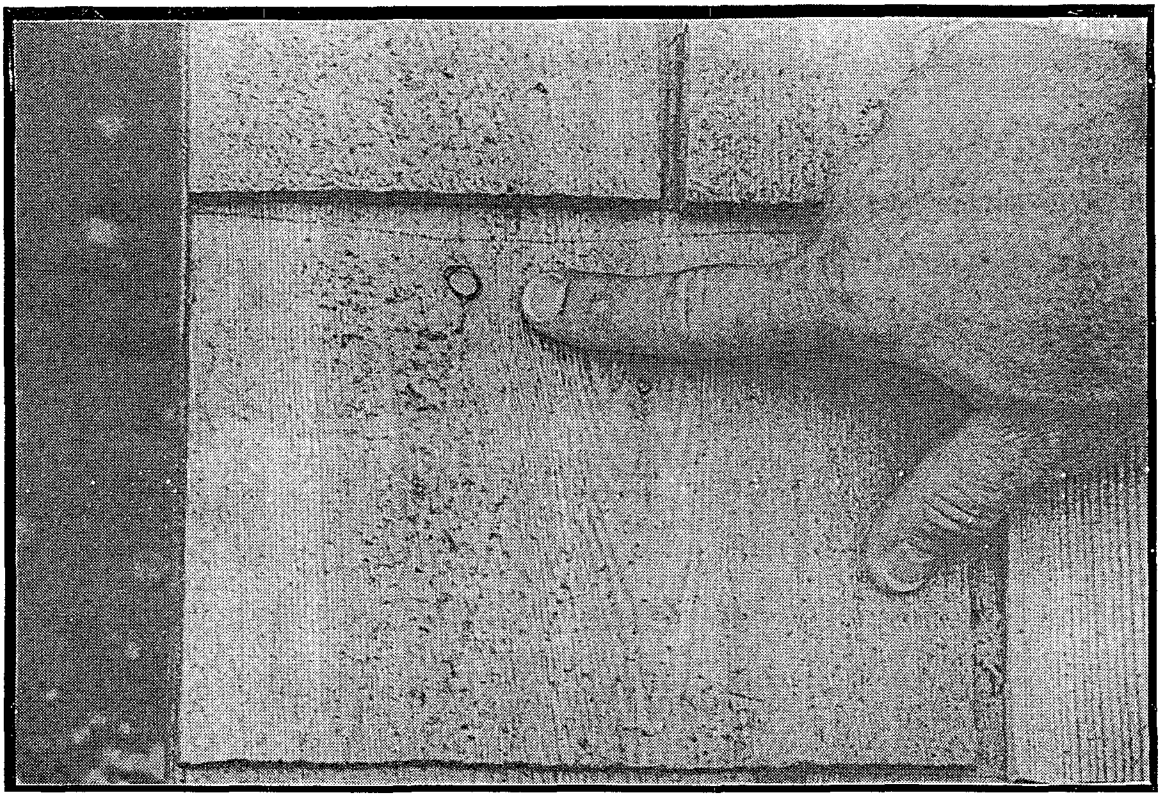


Figure 11. "Black Ring Knot" in Pine Shingle

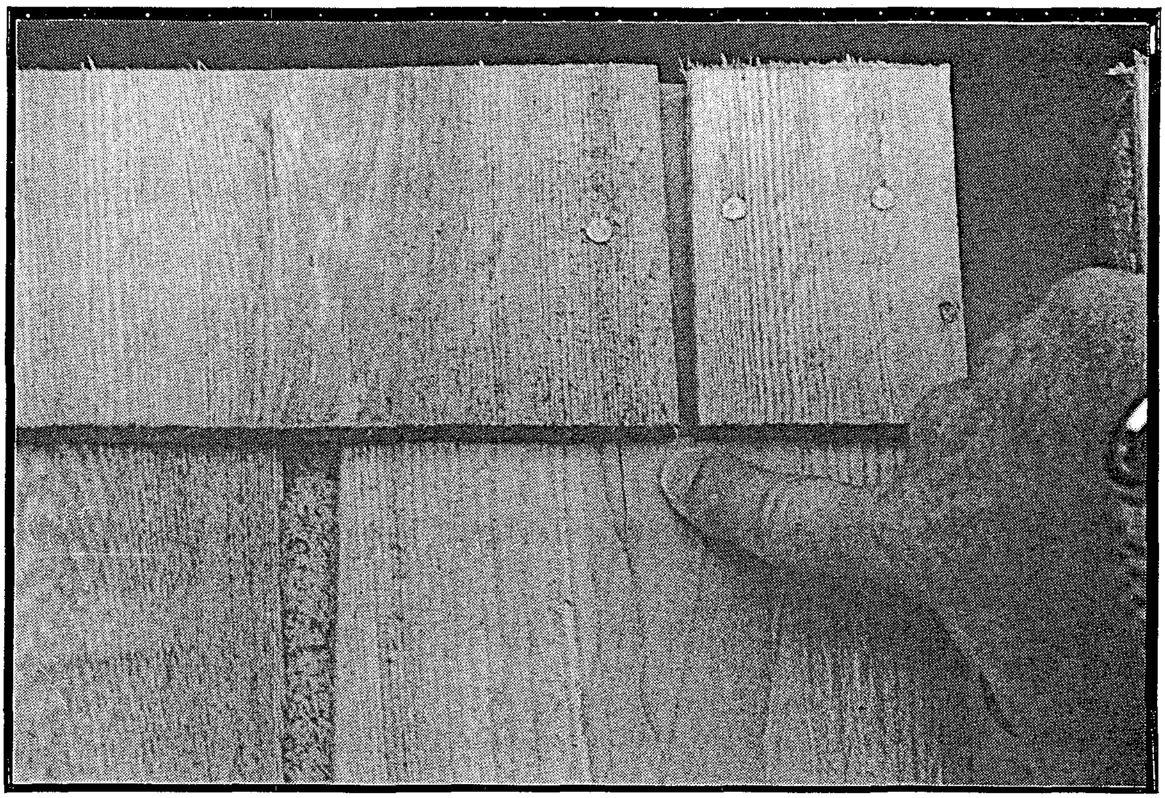


Figure 12. Nail Induced Crack Starting in Flat Sawn Portion of Pine Shingle

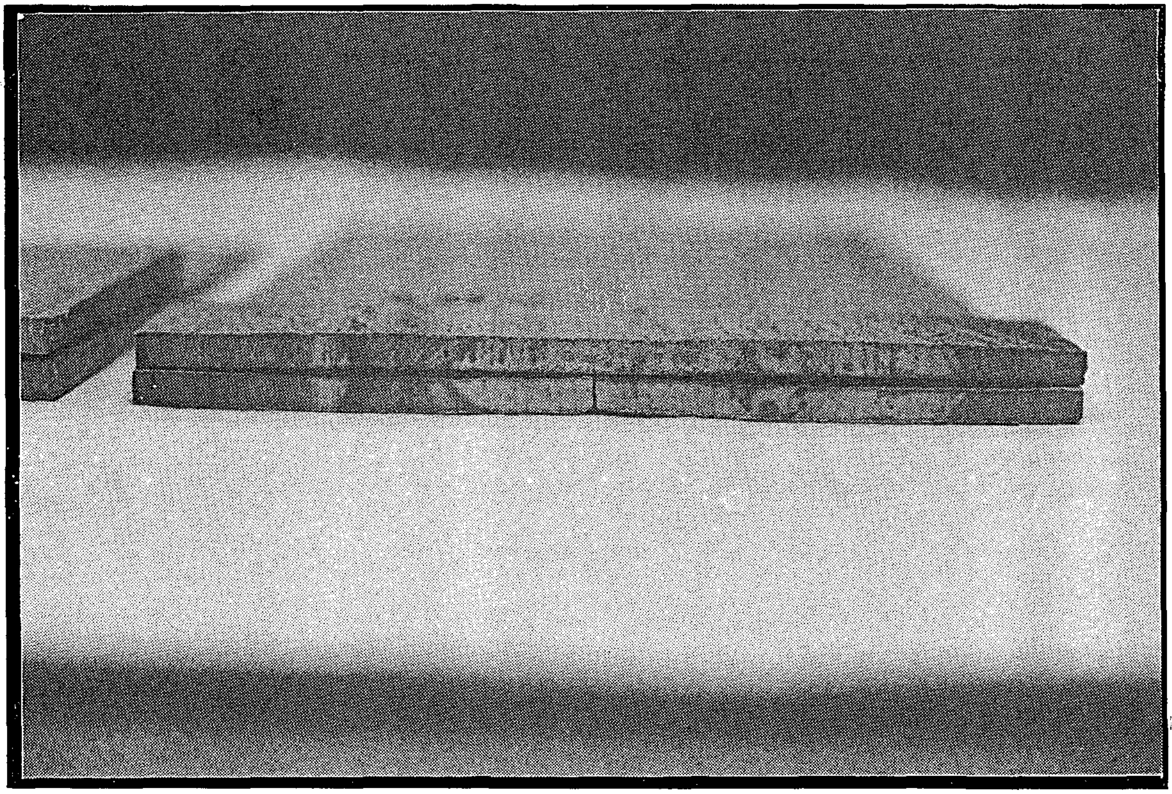


Figure 13. Flat Sawn Aspen Shingle Showing Poor Treatability, Especially in Heartwood

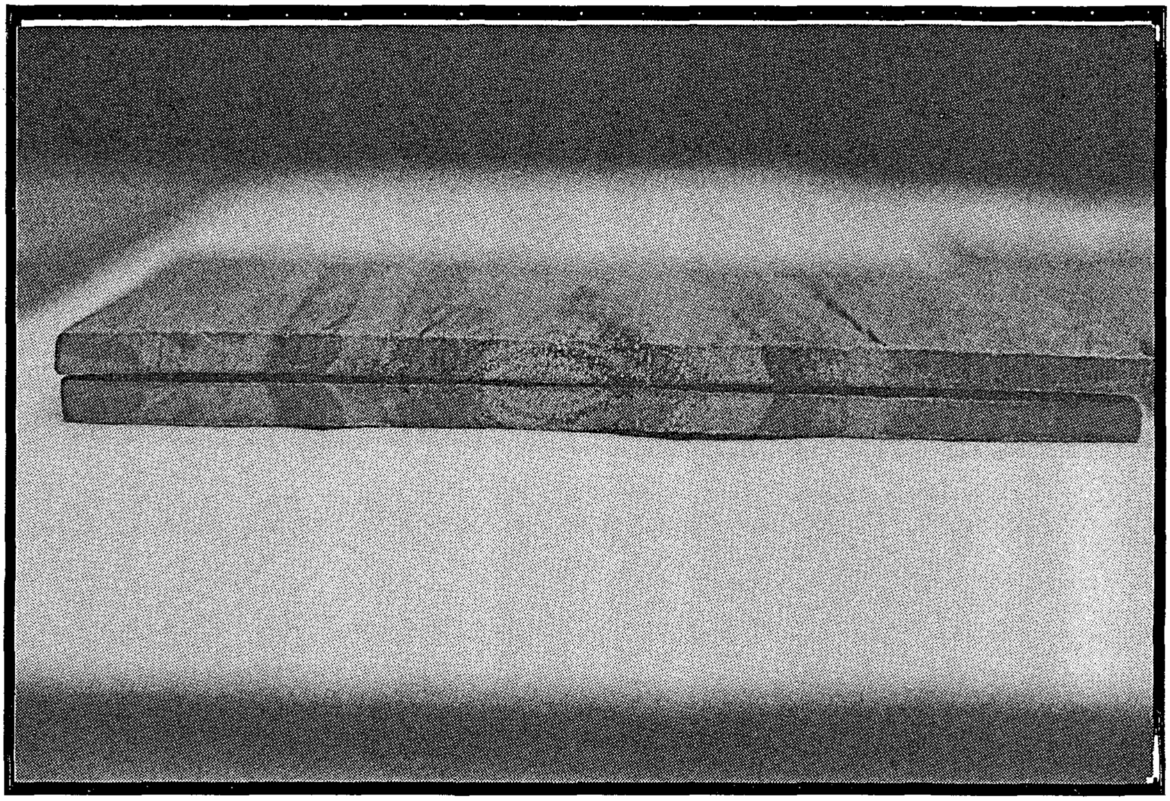


Figure 14. Flat Sawn Aspen Shingle Showing Poor Treatability, Especially in Heartwood

Figure 15. Pine (left), Aspen (right) Shingles on Panel for Exposure Test

Figure 16. Colorado Lodgepole Pine Shake Test Panel - Numerous Defects

5.2 Previous Alberta Experience - Results

During the course of this study, several relevant pieces of earlier work performed in Alberta came to light. Both the Alberta Research Council (ARC) and the Canada Mortgage and Housing Corporation (CMHC) have investigated shingles and shakes manufactured from Alberta wood. The Alberta Research Council investigated a number of old roofs still in service in north-central Alberta. Pine shingle roofs 50 years and older were found which were still performing well, indicating that pine certainly can succeed as a roofing product in this region. Aspen roofs were much harder to find. In 1983 the ARC had shingles cut from lodgepole pine and aspen (fire killed, green, dried, preservative treated) and set them out on a south exposure test roof on the University of Alberta farm (south of Ellerslie Road, near Edmonton). Figures 17 through 23 show some results from this experiment. Clearly, the performance of the aspen shingles is poor, with severe cupping, curling, twisting, cracking, etc. The pine shingles, although better, still exhibited unfavorable performance characteristics (severe cracking, especially over shingle gaps). Preservative treated shingles performed better than untreated shingles (although, in our opinion, they still do not perform satisfactorally). The difference in performance between these test roofs and the pine shingle roofs in service across north-central Alberta is probably the result of differences in raw material supply and in quality control of the finished product. The log supply available today is, on average, much poorer than what was available 50 years ago. Today's smaller logs result in more flat sawn material, and more defect. This is reflected in the ARC shingles. In addition, the ARC shingles were not graded in any way before being applied to the test roof. Thus, defective shingles and portions of shingles were not weeded out before application to the test roof. The cedar shingle test roof (Figure 23) exhibits much better performance than the pine or aspen, but was constructed out of graded shingles. A comparison is not applicable without taking this into consideration.

Figures 17 through 23 illustrate some of the test panels constructed by the ARC:

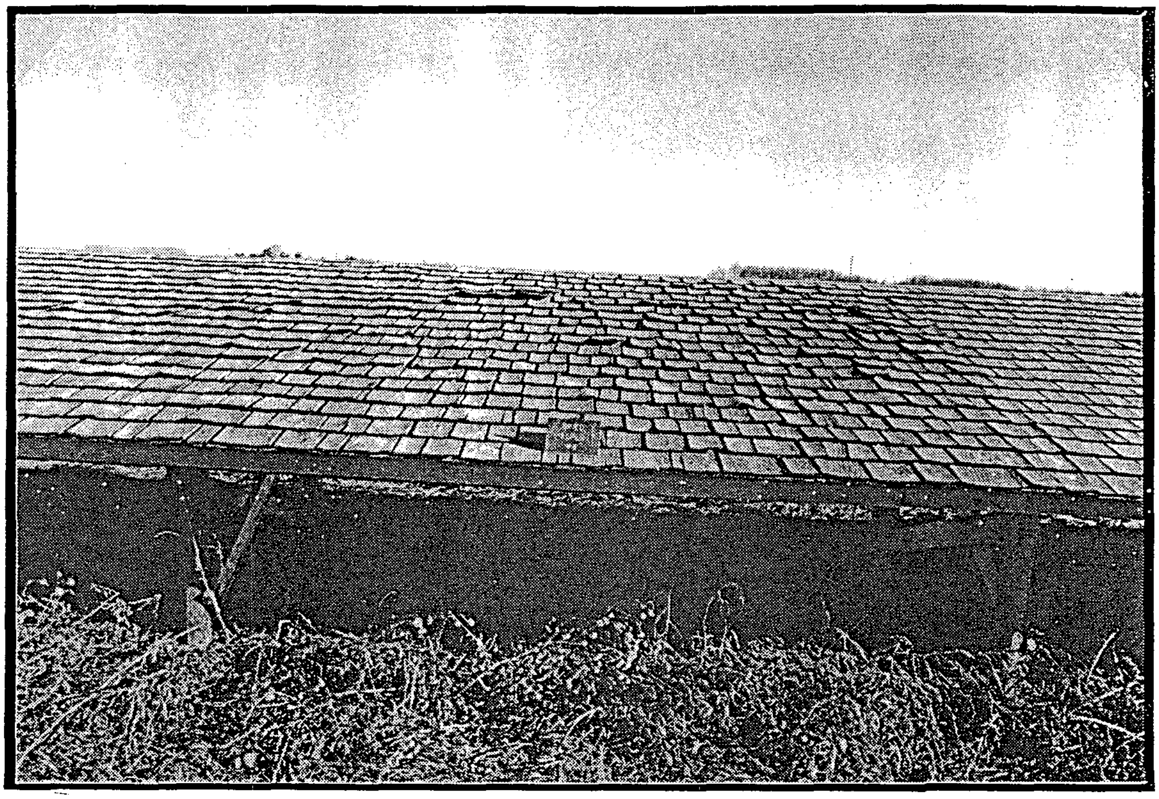


Figure 17. Aspen Test Roof; ARC (ungraded material)

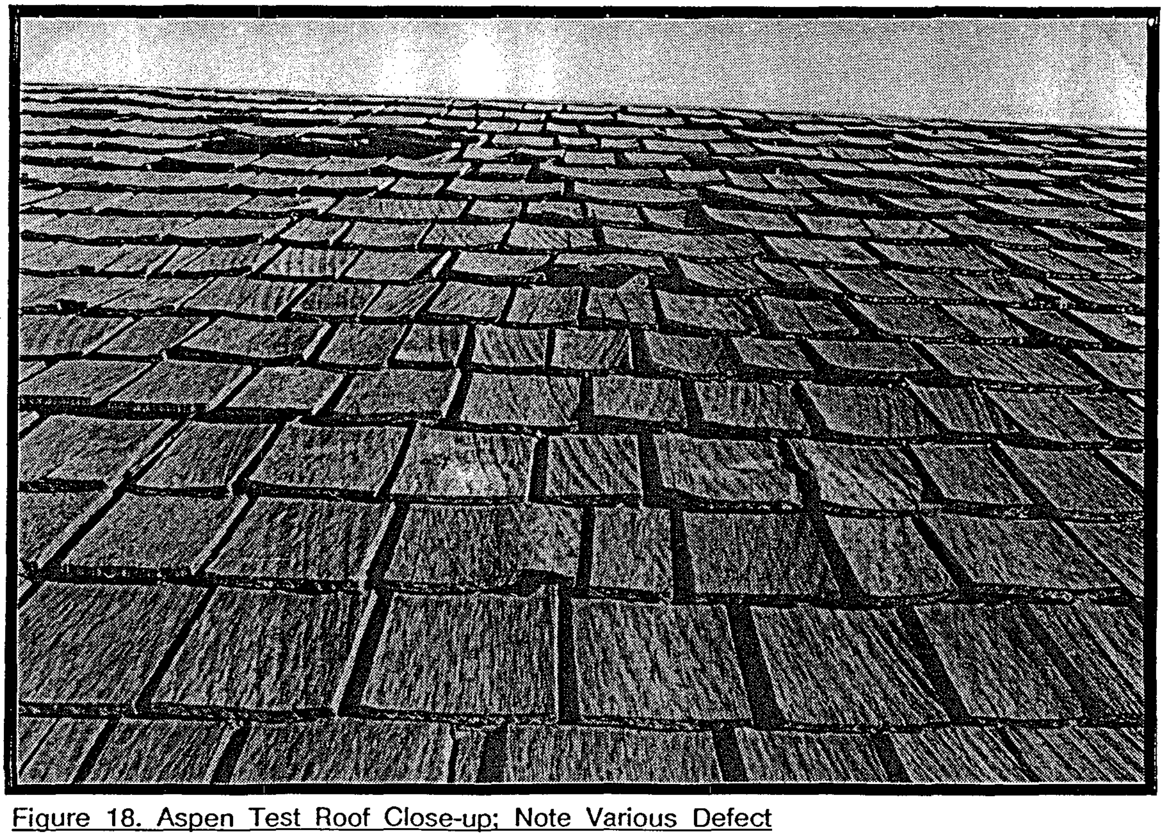


Figure 18. Aspen Test Roof Close-up; Note Various Defect

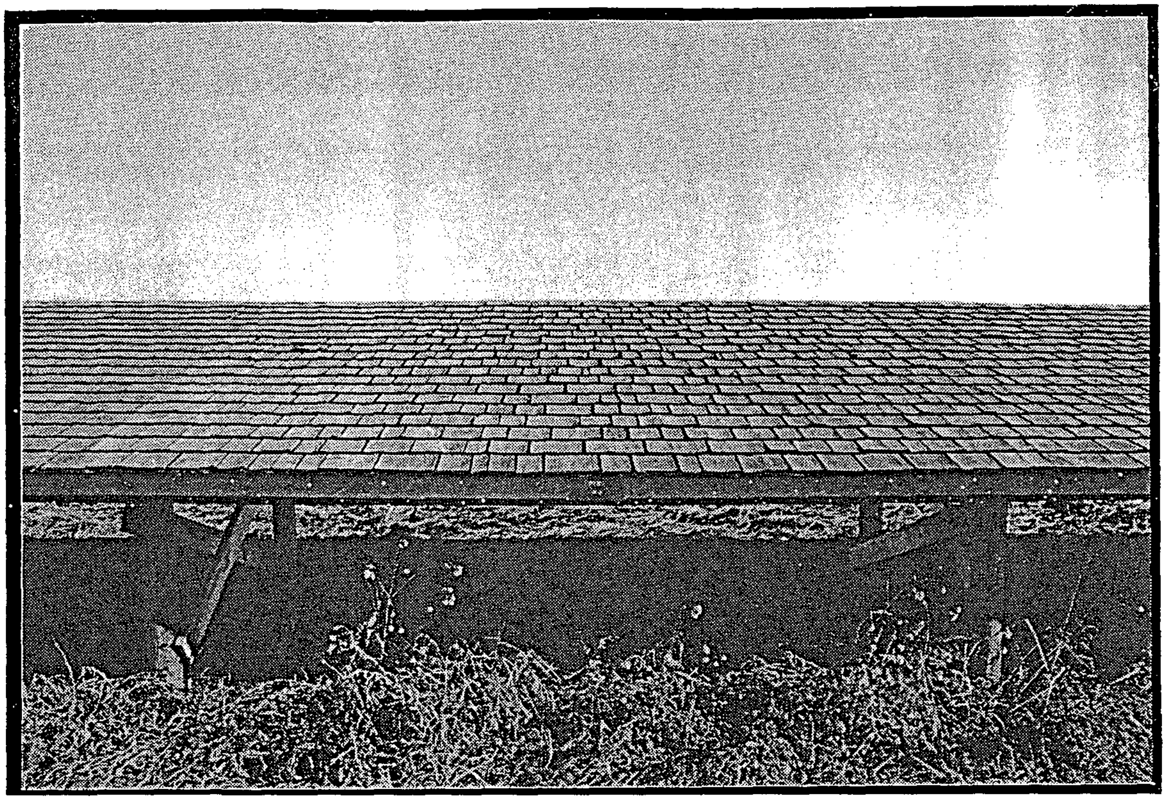


Figure 19. Pine Test Roof; ARC (ungraded material)

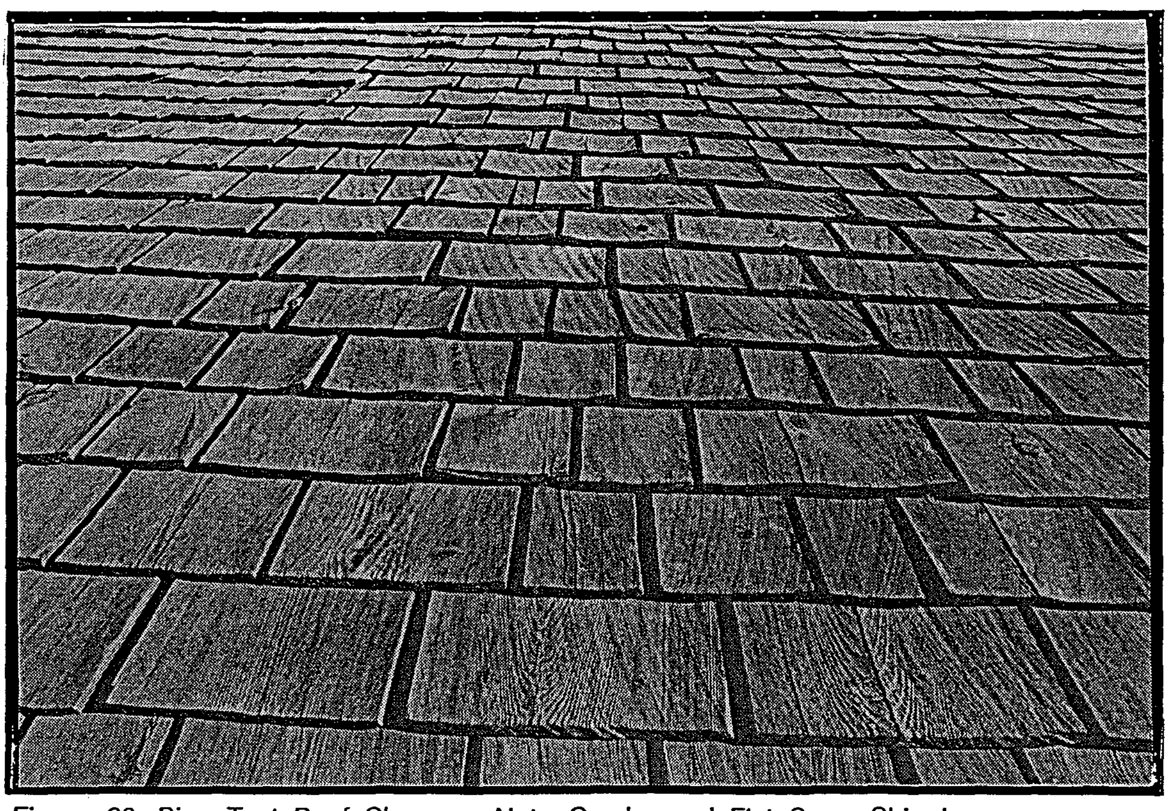


Figure 20. Pine Test Roof Close-up; Note Cracks and Flat Sawn Shingles

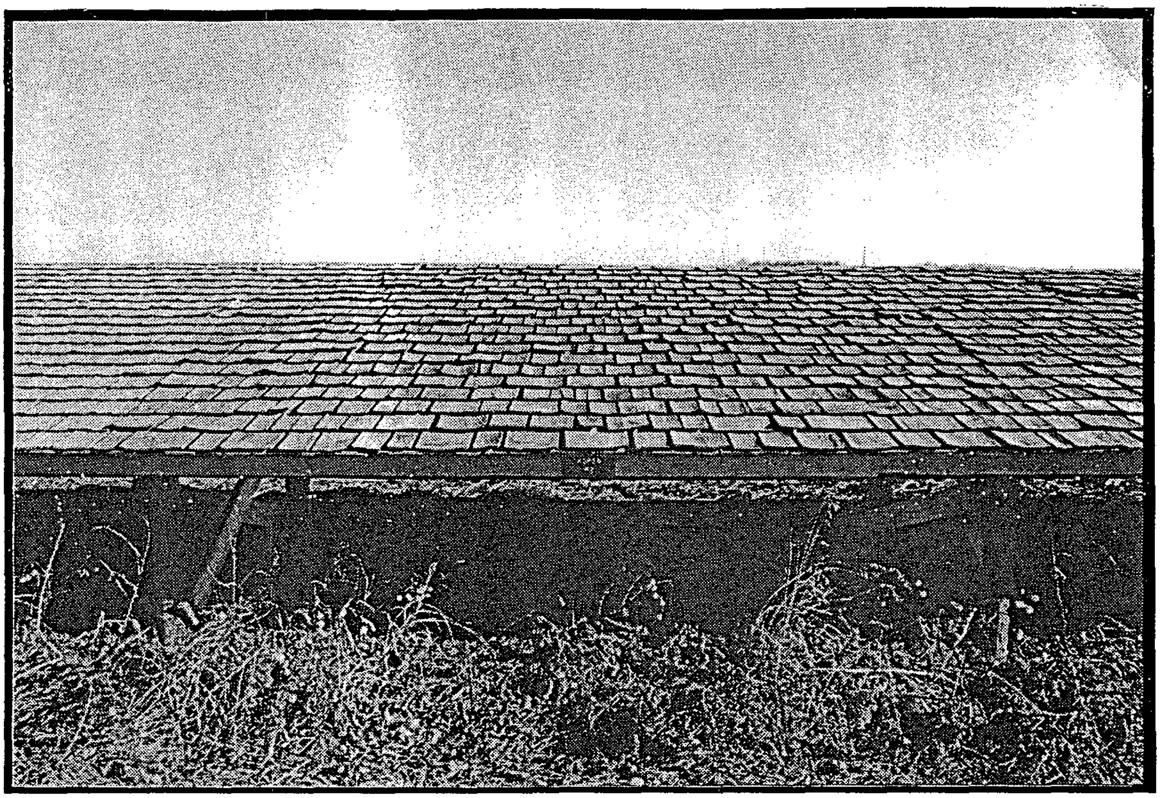


Figure 21. Treated Aspen Test Roof; ARC (ungraded material)

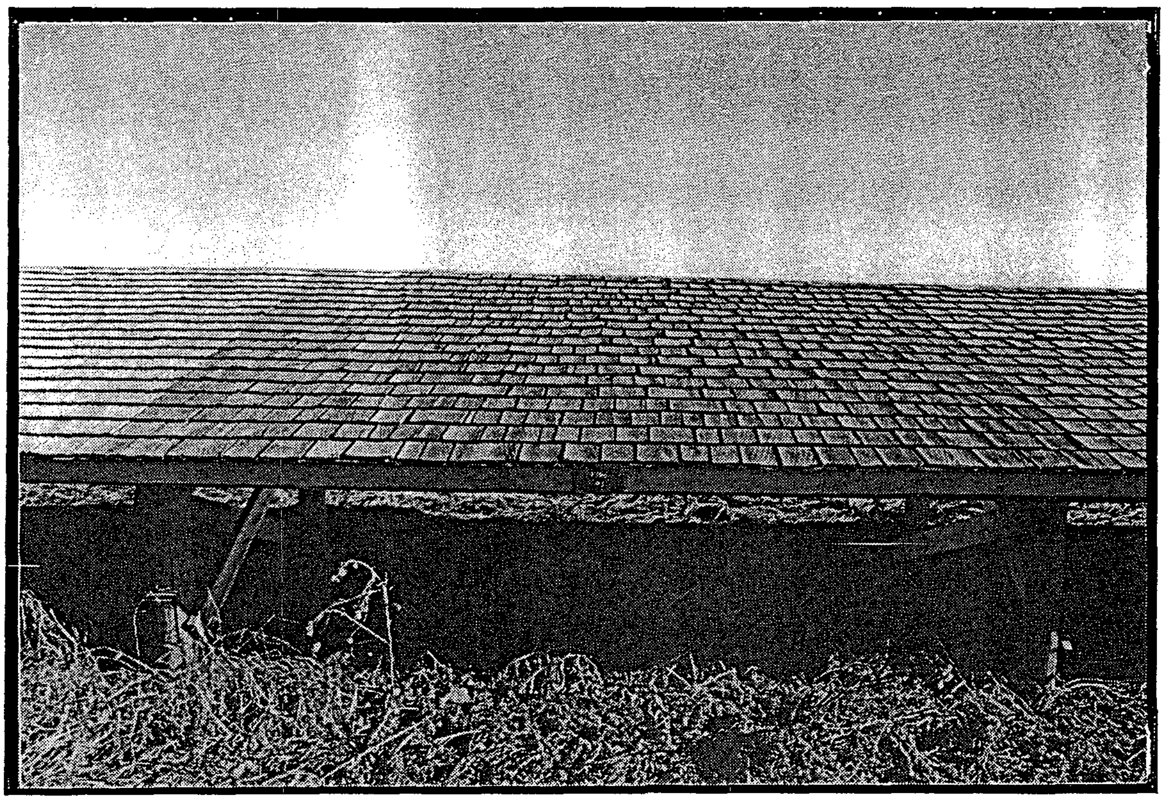


Figure 22. Treated Pine Test Roof: ARC (ungraded material)

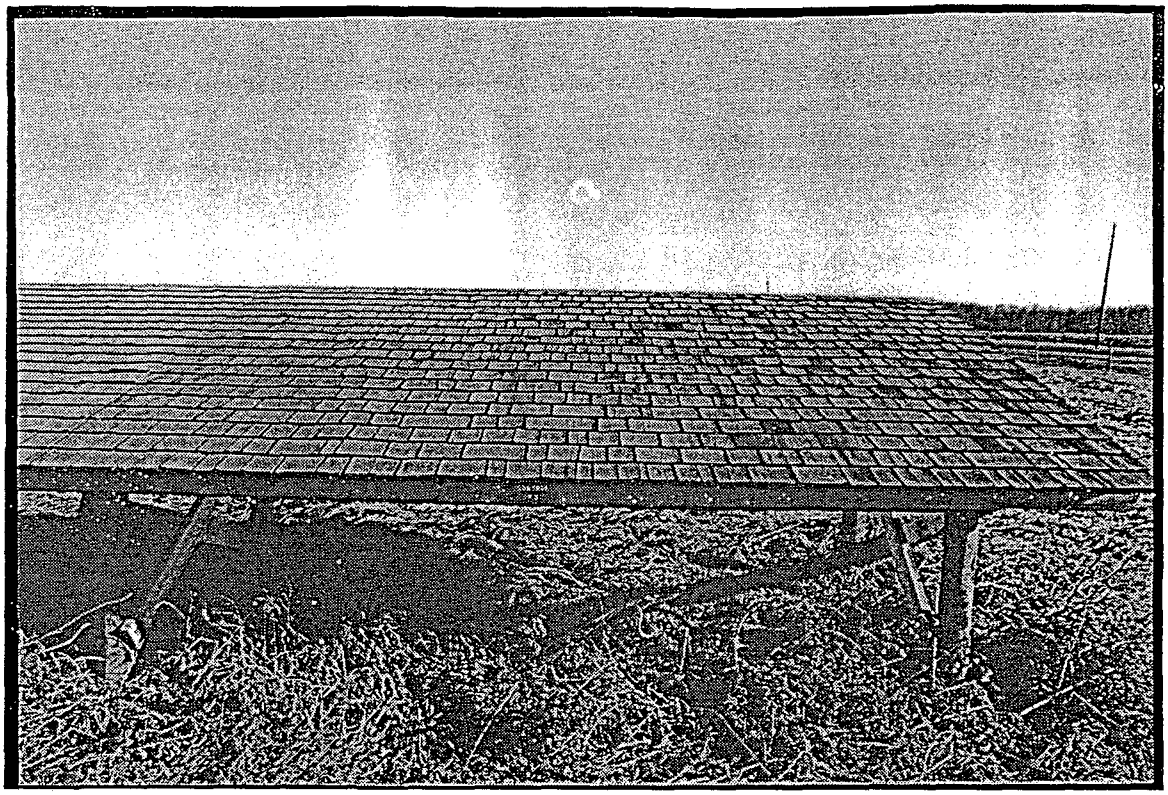


Figure 23. Cedar "Control" Test Roof: ARC (graded material)

The Canada Mortgage and Housing Corporation has also examined several pine roofs in service in Alberta. To our knowledge, at least three CMHC Building Material Evaluation Reports covering pine shingles and shakes have been issued based on this examination of buildings (Report No: 10904, 85-03-26; Report No: 11148, 86-03-07; Report No: 11644, 87-11-26; See Appendix B for a sample of one CMHC Evaluation Report). The proponents of these reports have been two Saskatchewan companies, and the Cold Lake First Nations Indian Band at Grand Centre, Alberta.

The CMHC reports all seem to be based on the same 10 buildings, built in 1930, 1938, 1939, 1940, 1942, 1945, and 1953. In summary, the CMHC inspection found that "... apart from being stained and showing signs of wear on the exposed portion, there was no decay to the point of having roof failure. The samples were about 7.5 mm at the thickest... The roof decks underneath the shingles were still in good condition showing that the shingles performed well."

From the basis of these CMHC reports, it appears that a proponent of pine shingles would have little difficulty getting a CHMC Building Material Evaluation Report Number, with no actual testing of the product. Proponents of an aspen shingle would likely have greater difficulty in obtaining approval.

The significance of the CMHC Evaluation Report No. is that local bulding inspectors will usually accept the CMHC evaluation in lieu of the product's inclusion into the National Building Code (NBC; which is the basis of most local codes). Making changes to the NBC, or local building codes, can be a very lengthy, expensive, and frustrating procedure. Non-cedar wood shingles and shakes are not included in the NBC. Obtaining a CMHC Evaluation Report No., therefore, is critical to a proponent of pine or aspen shingles and shakes.

5.3 Texas Taper Sawn Shakes - Results

Besides testing the Alberta prototype shingles, the Texas Forest Service provided an excellent example of how to develop a non-cedar wood roofing product. The Texas Forest Products Laboratory has been involved in the development of a pressure treated southern pine shake for over 10 years. Western red cedar shakes have traditionally been very popular roofing materials in Texas. Due to the intense heat, and extreme humidity, especially in the high population areas of east Texas (Houston, Dallas, Fort Worth, etc.), the life of cedar roofs rarely exceeds 15 years. The main problems are decay, curling, and splitting.

The initial high cost of cedar stumpage, the declining raw material supply and difficulty of achieving chemical treatment to extend service life dictated the need for alternative wood species for shake and shingle production. In 1977, the Texas Forest Products Laboratory launched a research and development program aimed at developing southern pine shakes that would have all the advantages of cedar, but in addition, be far more durable, stronger and more affordable to the homeowner.

Preliminary work in Texas ruled out the production of handsplit-resawn shakes (common in cedar) as impractical and not economically feasible. Efforts were concentrated on sawing shingles of various widths, lengths, and thicknesses. Those with a butt thickness in excess of 3/8" were referred to as "taper-sawn shakes". Thousands of prototype shingles and shakes were sawn in the late 1970's, in all possible configurations, included all possible defect. Twelve month outdoor exposure tests, as well as indoor accelerated exposure tests, revealed that most problems could be attributed to one, or more, of the following:

1. Shakes too wide (over 8 inches).
2. Shakes too thin (under 3/4" on butt)
3. Presence of large exposed knots.
4. Excessive flat-grain.
5. Non-uniform butt thickness.
6. Density less than 4 rings per inch.

In Alberta, we can profit from these exhaustive efforts undertaken in Texas. All of the problems listed above, with the exception of #6, were significant problems in our prototype shingles. Alberta producers can shortcut the long process of developing shake specifications by adopting the rigorous work undertaken in Texas, and refining the results to fit the Alberta situation.

The Texas Forest Service tested various preservative treatments, recommending one (pressure impregnated CCA), and then developed complete grading rules, organized an inspection system, and spearheaded the long and expensive task of obtaining approval for the southern pine shakes in the three model building codes used in the U.S. (they are referred to as "model" because almost all municipalities in the U.S. use one, or more, of these codes as a basis for the local building code). Southern pine taper sawn shakes now are accepted into the model codes of the U.S.. Several mills are operating in east Texas, and more mills are setting up. A grading and inspection system is in place. The product works, and is rapidly gaining acceptance. The next task, say the researchers at the Texas Forest Products Laboratory, is the development of a southern hardwood shake (black gum, sweet gum, etc.). Figures 24 to 39 further illustrate the success story of the southern pine shake. Appendix C contains an example of a brochure now being used by the southern pine shake industry. In our opinion, Alberta could experience similar success with jack and lodgepole pine. In addition, some of the research efforts currently being devoted to southern hardwoods could help Alberta develop an aspen shake.

Figure 24. Cedar Roof; 12-15 Years Old; East Texas

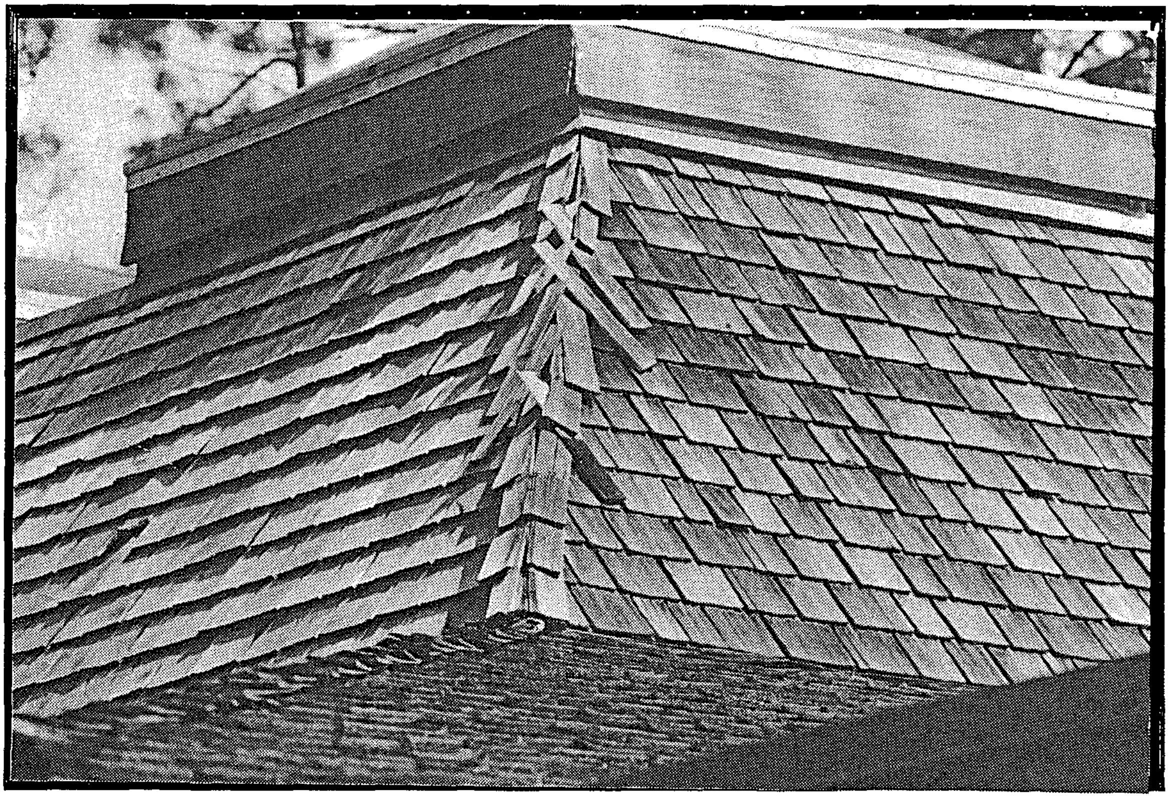


Figure 25. Cedar Roof; 12-15 Years Old; East Texas

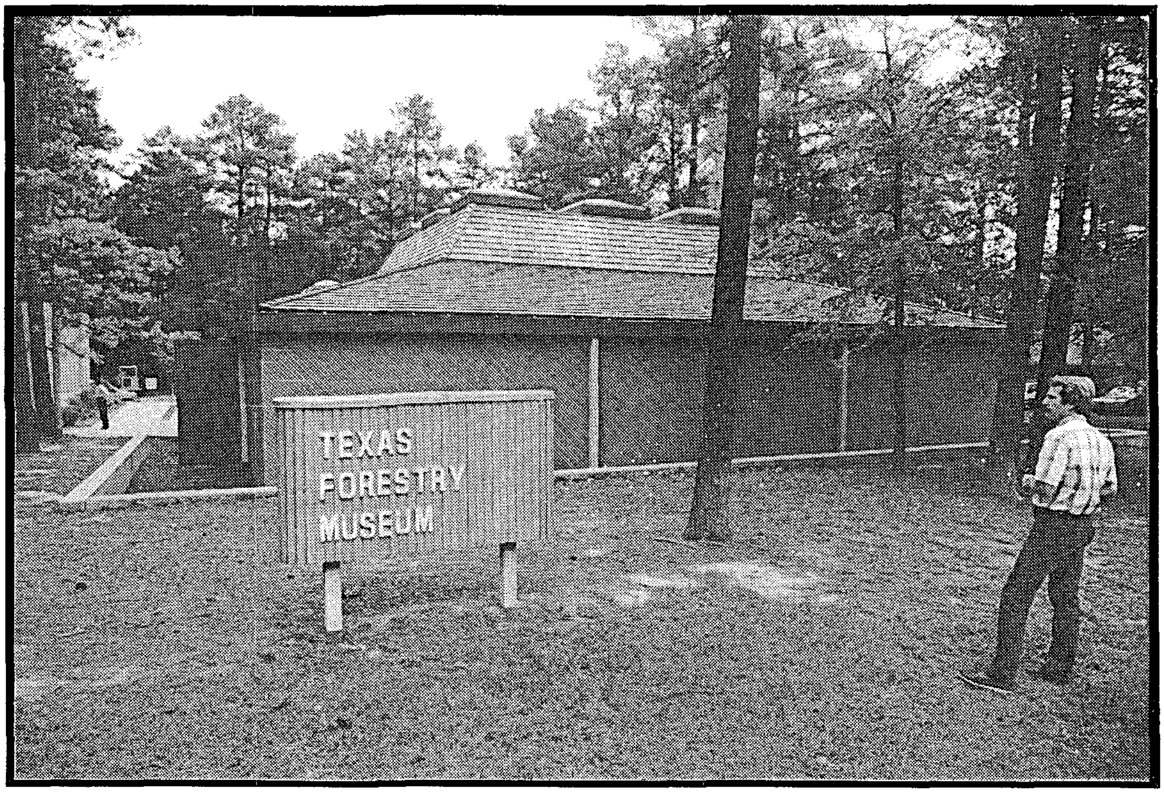


Figure 26. Pressure Treated Southern Pine Roof; 3 Years Old; East Texas

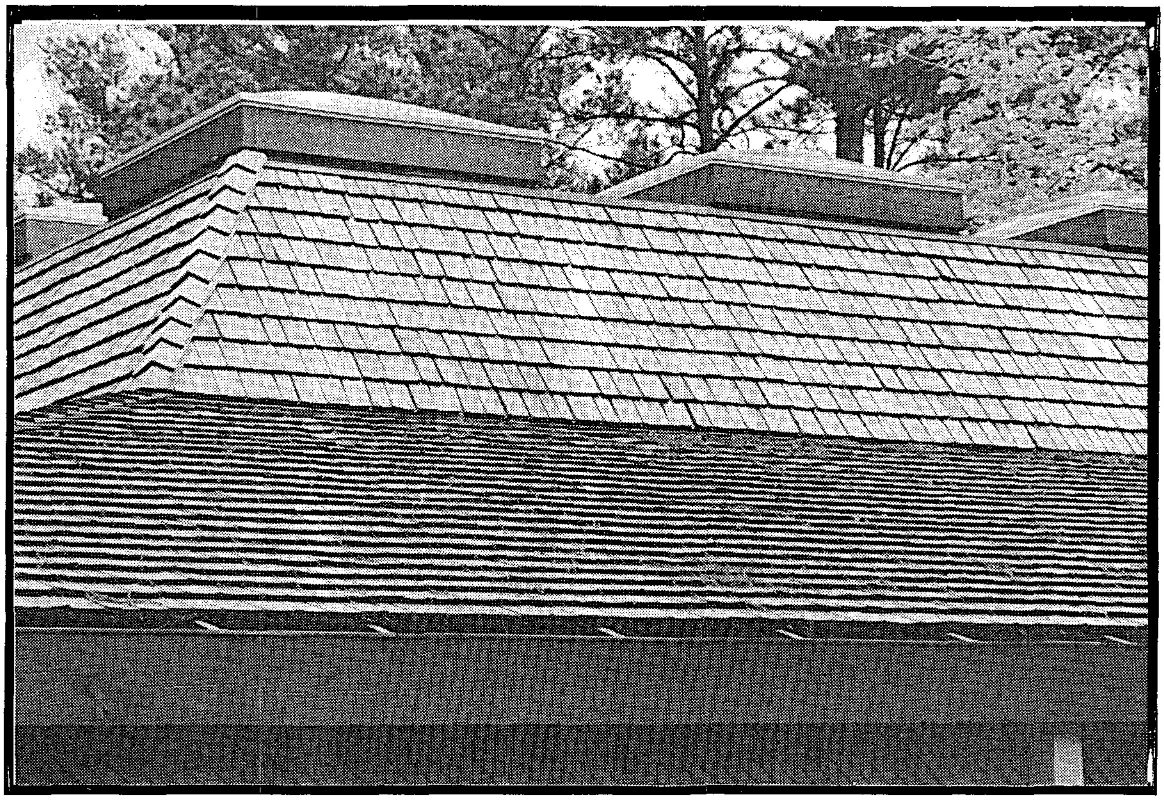


Figure 27. Pressure Treated Southern Pine Roof; Close-up

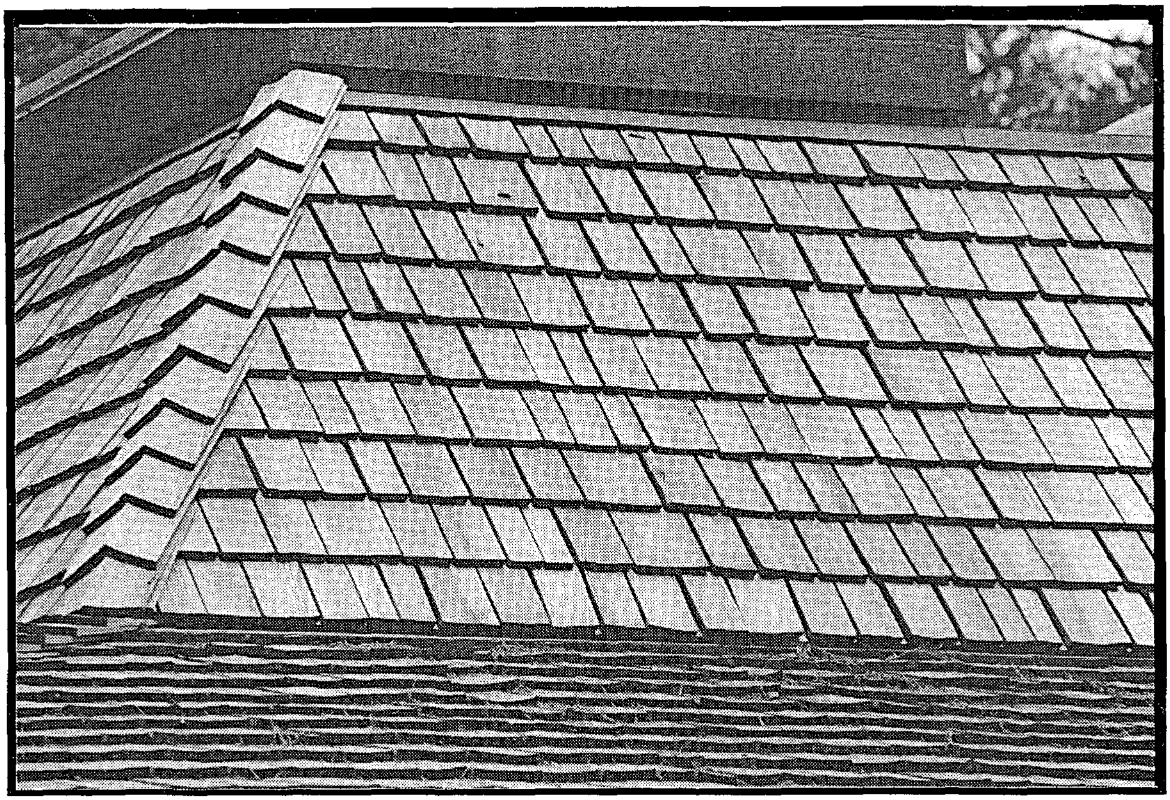


Figure 28. Pressure Treated Southern Pine Roof; Close-up

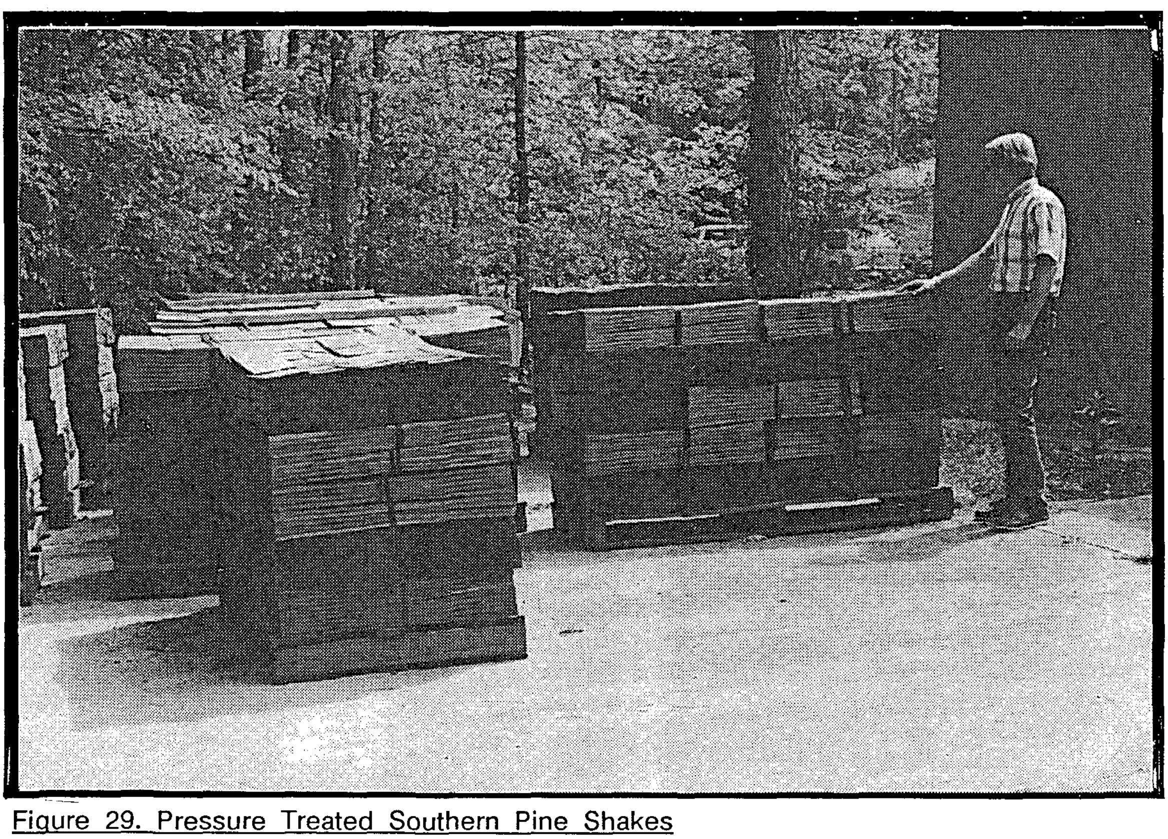


Figure 29. Pressure Treated Southern Pine Shakes

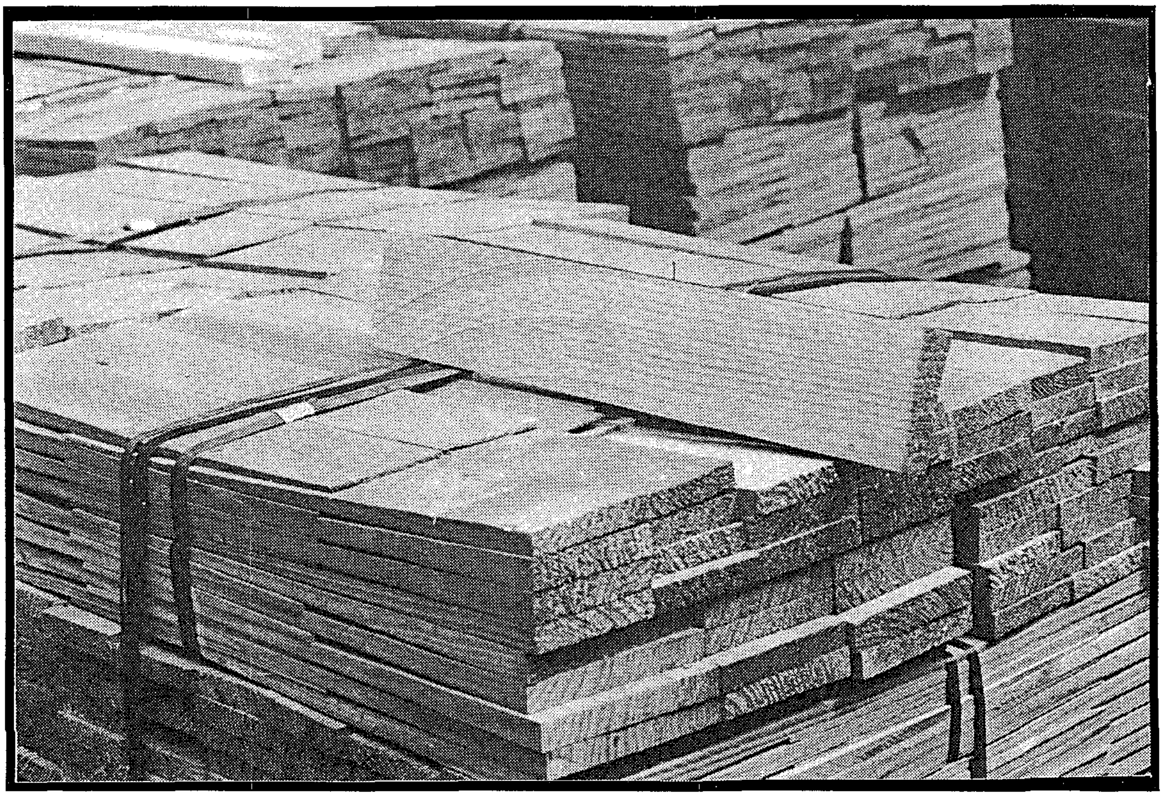


Figure 30. Pressure Treated Southern Pine Shakes

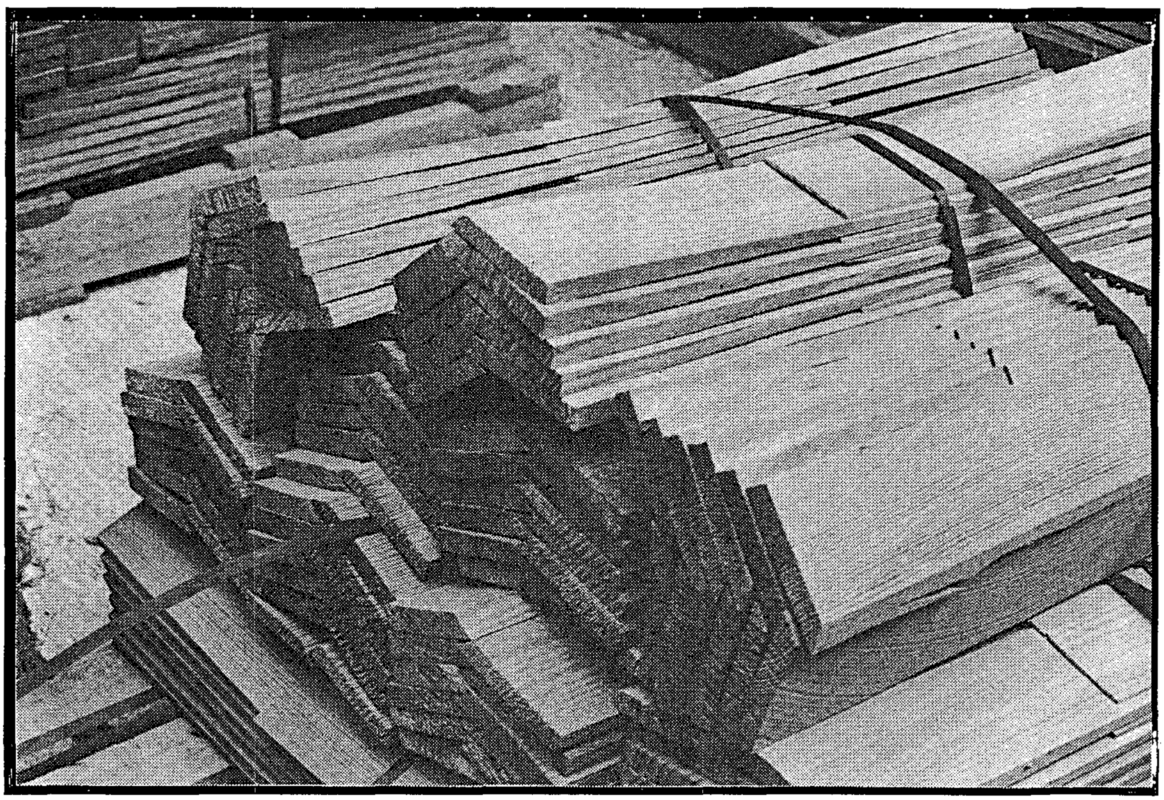


Figure 31. Pressure Treated Southern Pine Hip and Ridge Units

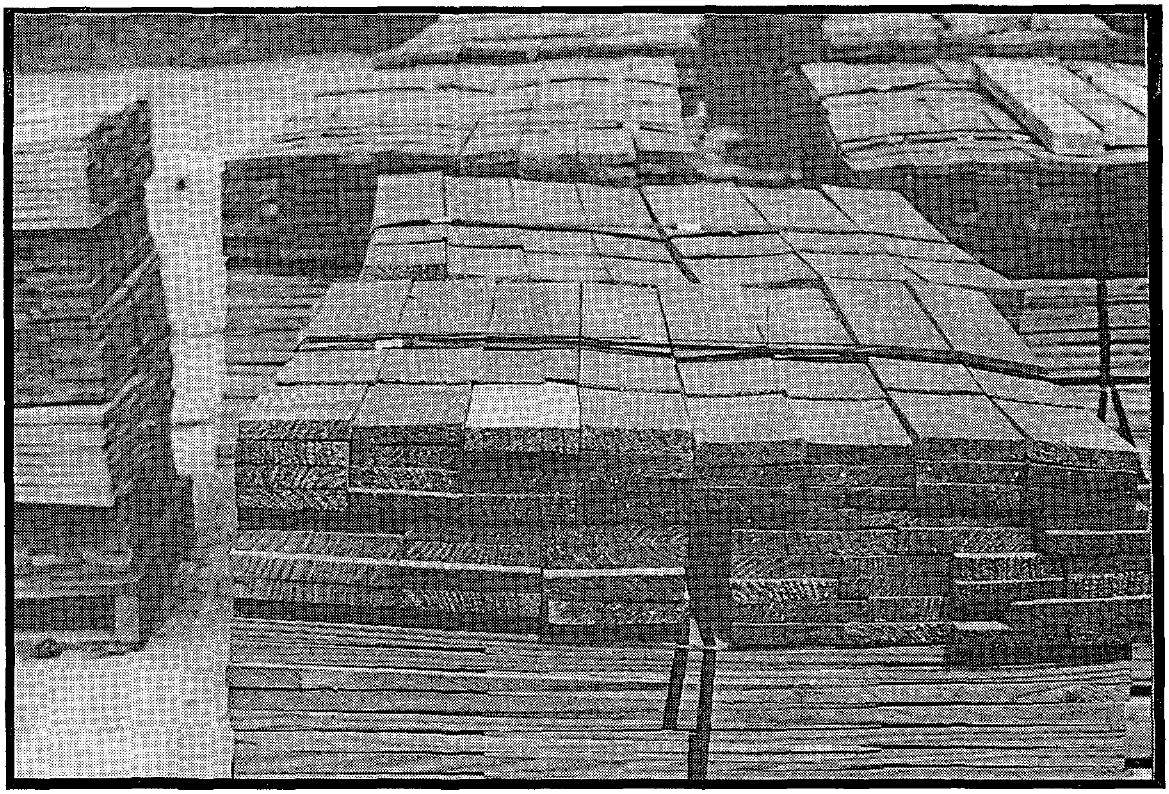


Figure 32. Pressure Treated Southern Pine Shakes

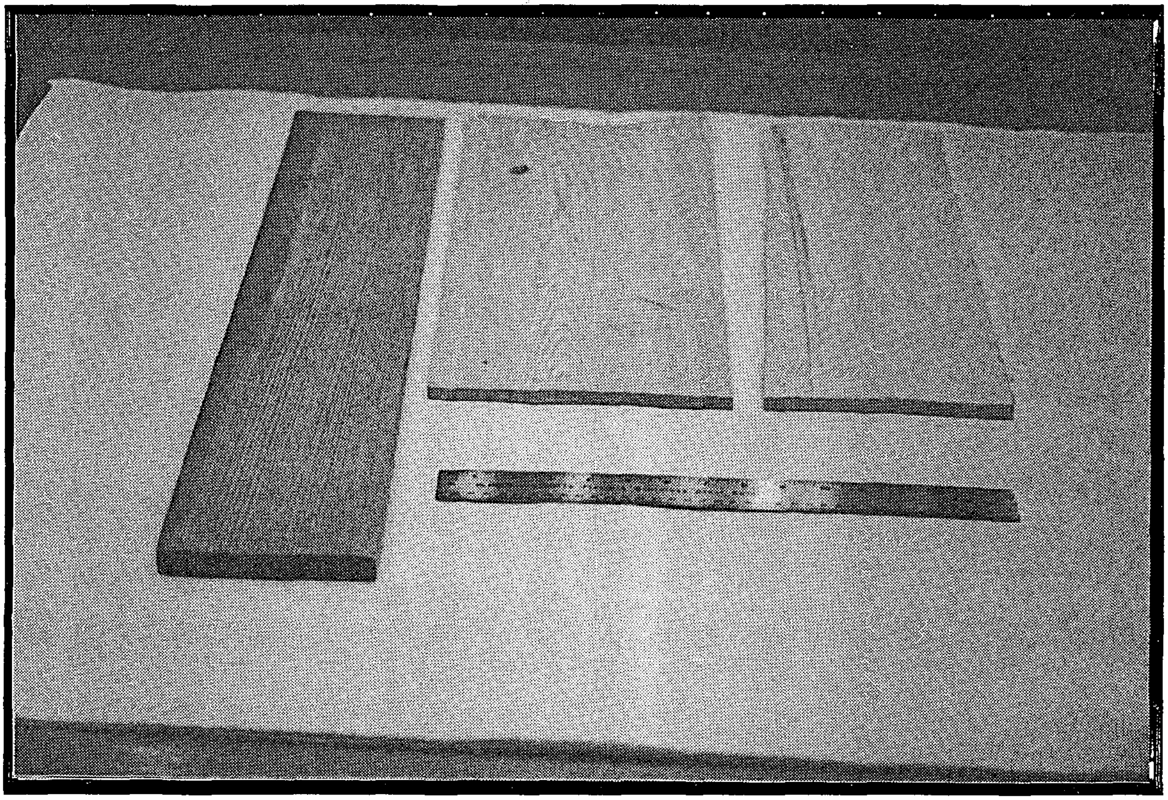


Figure 33. Southern Pine Shake (left); Alberta Prototype Pine (left), Aspen (right)

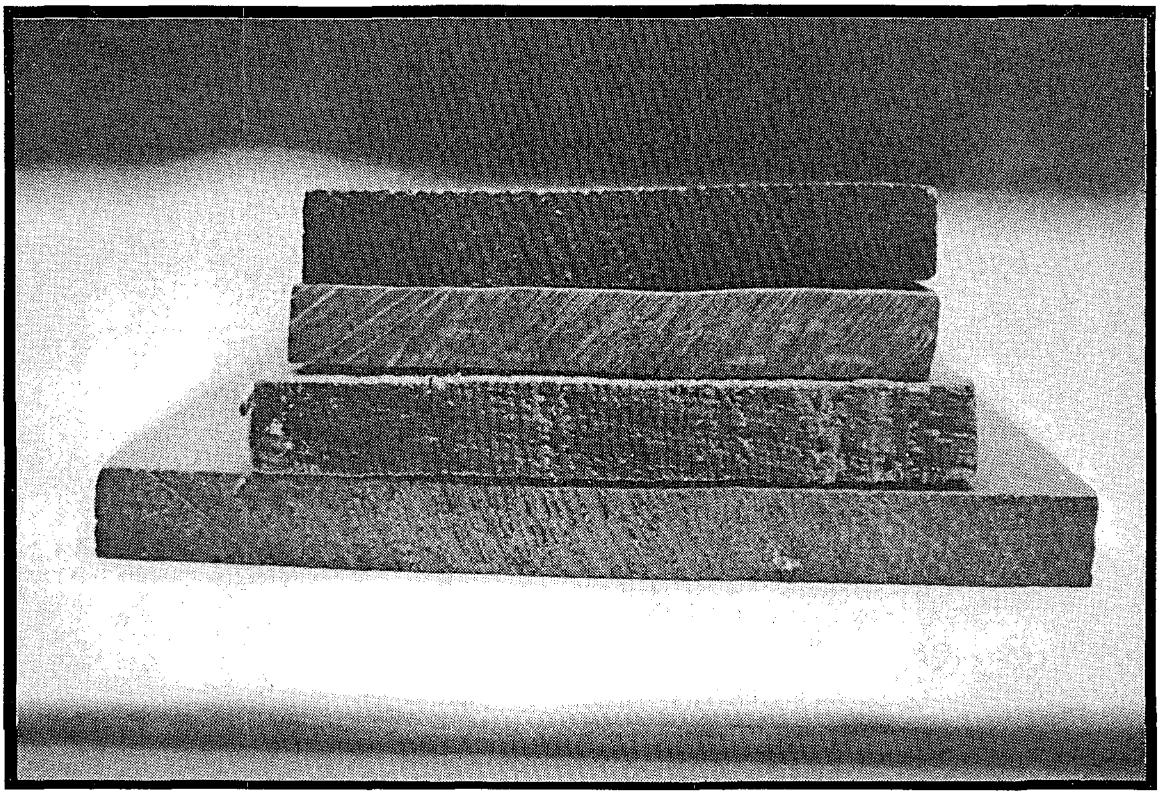


Figure 34. S. Pine; Black Gum; Silver Fir; Western Hemlock Shakes (top to bottom)

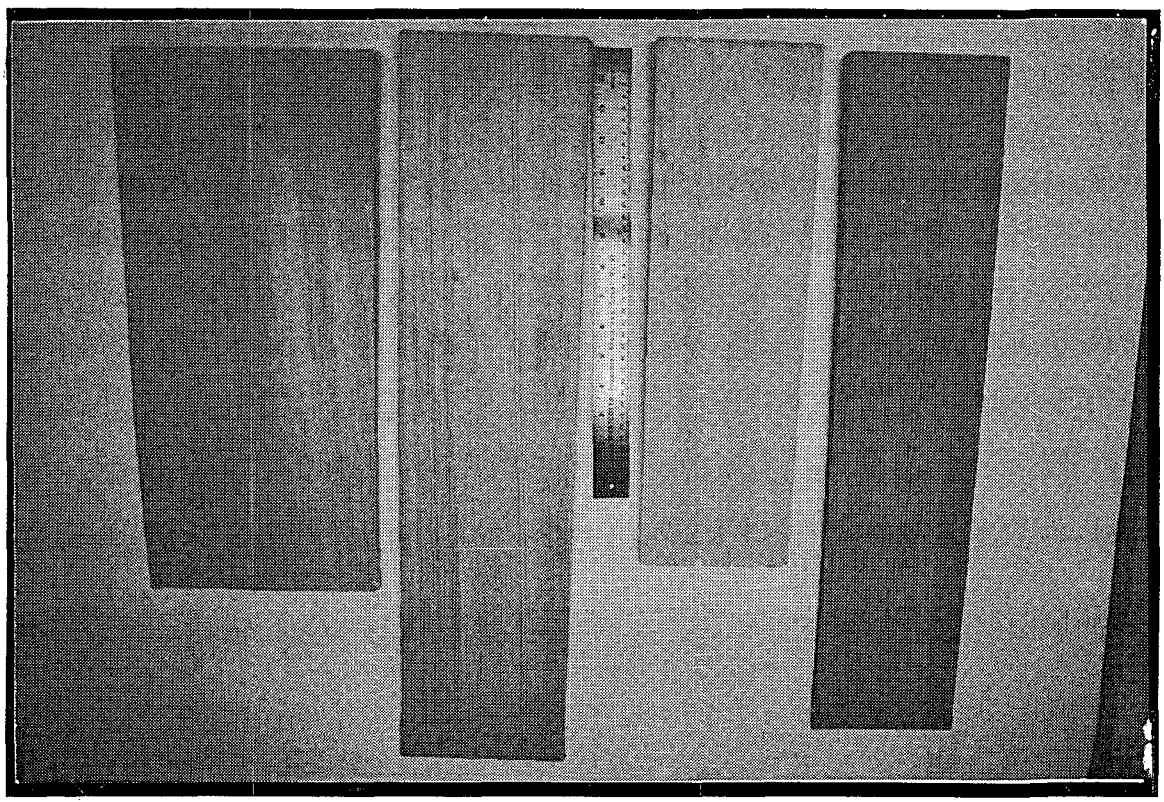


Figure 35. S. Pine; Black Gum; Silver Fir; Western Hemlock Shakes (L to R)

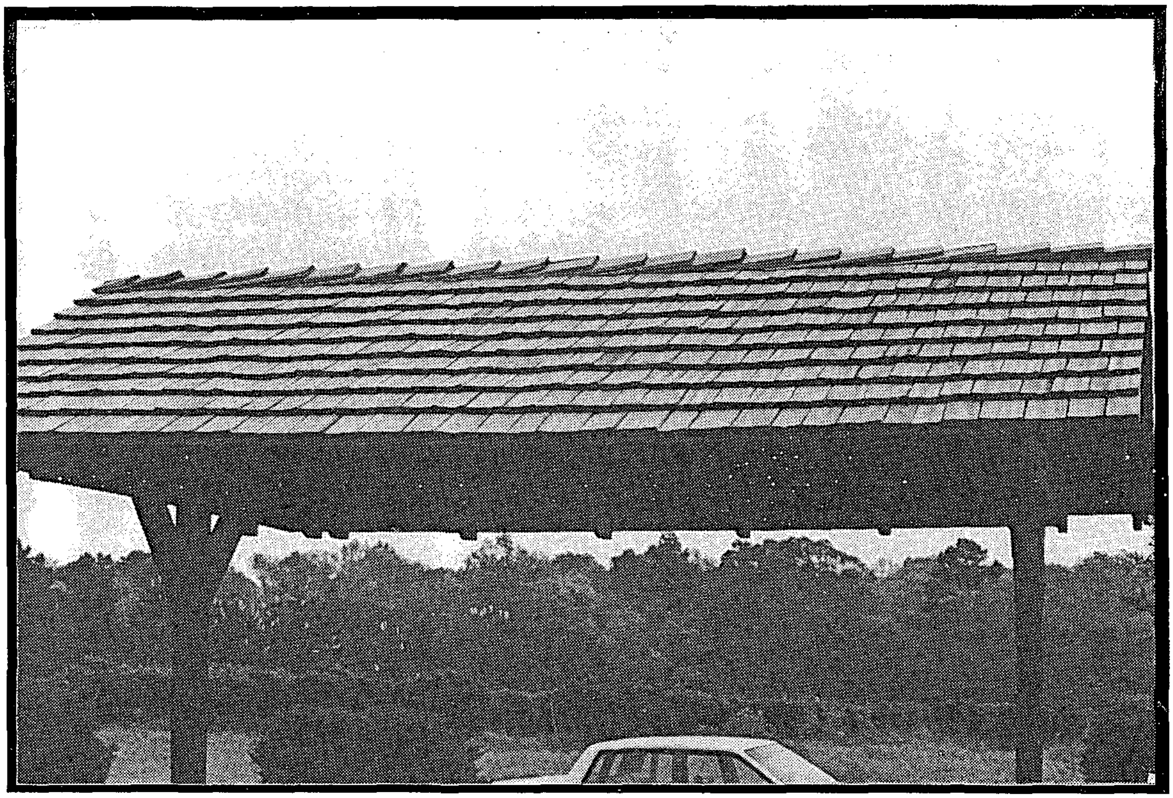


Figure 36. Black Gum Test Roof: 4 Years old; East Texas

Figure 37. Black Gum Test Roof; Close-up

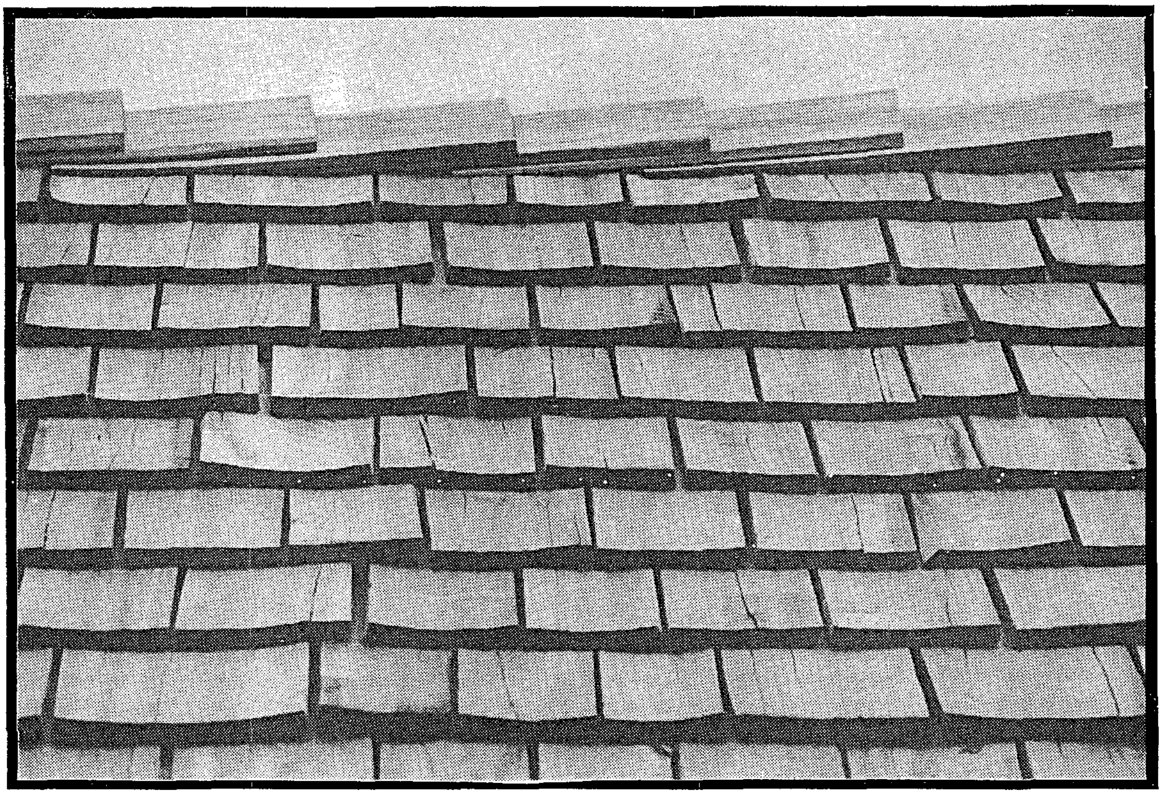


Figure 38. Yellow Poplar Test Roof; 4 Years old; East Texas

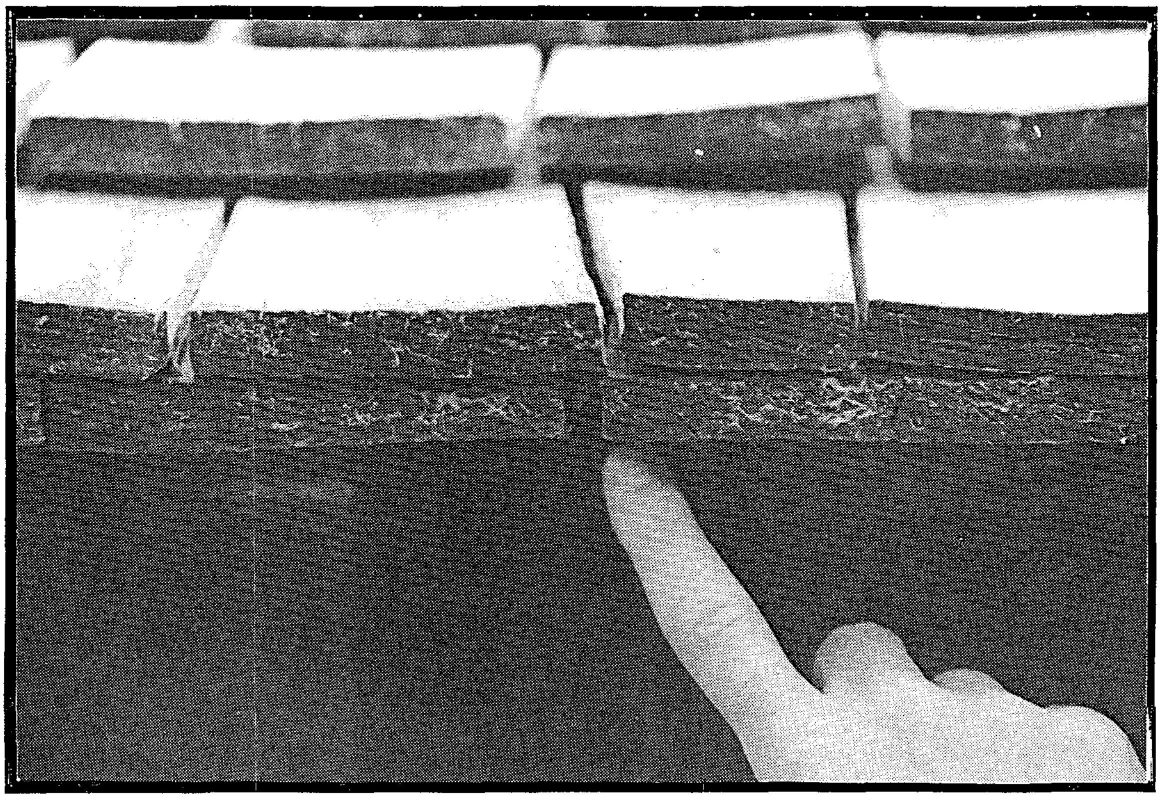


Figure 39. Yellow Poplar Test Roof; Close-up

6.0 CONCLUSIONS

The overall objective of this project was to answer the question "DO WE HAVE A PRODUCT?" We conclude that we do, indeed, have a product, but it is not the prototype shingle worked with in this project. We conclude that a taper sawn shake, with much better quality control and greater thickness, is the product to develop (see 6.1 Physical Suitability, and 7.0 Recommendations). This chapter presents our conclusions in three parts; 6.1 Physical Suitability; 6.2 Economic Potential; and 6.3 Building Code Acceptance. The prototype shingle which was used in this project, as well as our recommended taper sawn shake configuration, are discussed in each section.

6.1 Physical Suitability

The pine and aspen shingle prototypes produced for this project are not suitable for use in roofing applications. Excessive flat sawn portions, knots, excess width, and insufficient thickness all contribute to an inferior product which, in our opinion, will not perform well. The ARC test roofs illustrate this fact dramatically. This shingle could be improved into a moderate quality product by improving quality control (knots, bug holes, flat sawn, etc.), making smaller widths (no wider than 8"), and eliminating flat sawn portions (or moving away from the center of the shingle). The best approach, however, would be to incorporate all of these quality improvements, and to also re-design the shingle profile completely, moving to a taper sawn shake with the following dimensions:

- minimum 3/4" butt diameter (compared to 3/8" to 1/2" currently)
- 18" or 24" length (compared to 16" currently).
- 4" (min.) to 8" (max.) width

Treatment with a chemical preservative may not be required for sales within Manitoba, Saskatchewan and Alberta, however, marketing the taper sawn shakes outside of the three "dry" prairie provinces will almost certainly require preservative treatment. The jack pine treats moderately well with CCA (pressure application), while the aspen showed very poor results. A dip treatment with a different preservative may provide equivalent results with much lower cost. This would create an "encasement" of preservative on the outside of the shake, which is same result as was obtained with the pressure treatment. The lack of total penetration of preservative will be a hindrance (both in terms of performance as well as building code acceptance) if exporting to humid, warm areas (eg. southern U.S.).

The pine shake will be the easiest to develop into a marketable product. Building code acceptance will be much easier to obtain than for aspen (see 6.3 Building Code Acceptance), and the shingles on the ARC test roofs indicate that performance of the pine will be superior to the aspen.

6.2 Economic Potential

A full economic analysis is beyond the scope of this project. We have, however, undertaken a brief analysis in order to determine whether a shake with good performance characteristics (which, we have previously stated, is possible to make) can be manufactured and sold at a profit.

Consider the following example from the Southern U.S. (all figures have been converted into $CDN using an exchange rate of 0.81 $CDN./$U.S.):

COST ESTIMATE FOR SOUTHERN TAPER SAWN PINE SHAKES

ASSUMPTIONS:	130.56 bd.ft./square
	$310/MBF delivered log costs
	$110/MBF drying cost
	$93/MBF treating cost
	$123/MBF manufacturing and labour cost
	1 - Shinglemaster saw
	2 - clipper saws
	1 - cut-off saw
	2 - banders
	45 squares/day

COST ESTIMATE:

$	40.30	wood cost
	16.11	labour-manufacturing cost
$	56.41	cost at shake mill
	8.46	15% profit
$	64.87	F.O.B. mill price
	3.11	freight to treatment plant (100 miles)
	14.51	drying cost
	12.09	CCA treatment cost
	1.23	freight to wholesaler
$	95.81	cost to wholesaler
	5.75	6% wholesaler profit
$	101.56	COST TO BUILDER/GENERAL PUBLIC

PROFIT POTENTIAL:

45 squares/day x 5 days/week x 50 weeks/year = 11,250 squares/year
11,250 squares/year x $8.46 profit/square = $95,175 profit/year

CAPITAL COST:

Capital required to produce 45 squares/day is probably well under $100,000 (CDN).

Cedar shakes currently sell in the Houston market for a minimum of $110($CDN)/square. Pine shake producers in the south feel that they can command the same price as cedar due to superior quality and a 25 year warranty. Several mills are currently manufacturing pine shakes in the Houston area, and many more are planned. Texas Forest Service personnel estimate that as many as 40 to 50 southern pine shake mills could easily be operating in Texas in the near future.

The only significant cost differences which we can identify between the Southern Pine shake producer, and the Alberta jack pine producer are wood cost, and transportation to markets. Wood costs in the south are presently $310 - $370/MBF ($CDN), delivered to the mill. This works out to about $60 -

$71/cubic meter ($CDN; assumes 193 board feet/cubic meter solid wood, based on Scribner Log Scale to Alberta Log Rule conversion). Delivered wood costs in Alberta for large consumers of coniferous species typically fall in the $18 - $32/cu.m. range, less than half the southern U.S. cost. We do not have proper grade and yield studies to determine conversion rates (round wood to shakes) for jack pine shakes. The southern pine conversion number is 130.56 bd.ft./square (.68 cu.m./square). Previous work undertaken for the REDC by FOAL ENTERPRISES (1986) indicated that a shake production facility should anticipate .76 cu.m./square for ASPEN. A conversion number for jack pine and aspen could fall anywhere in the range between .68 and .80 cu.m./square, still resulting in wood costs/square substantially lower than the southern U.S. We think that the conversion factor for local species will be higher than the southern pine conversion factor because of the greater defect, and smaller log size, present in Alberta's jack pine and aspen wood supply. This will vary, however, with local conditions. Certainly, there appears to be room to pay higher delivered wood costs for a higher quality log which results in higher yield and grade. A direct relationship exists between log size and quality, and shake yield and grade.

The second major cost difference is likely to be transportation costs. If Alberta shake producers seek to develop markets far away from the mill, shipping costs will become significant. In Texas, few pine shakes will be shipped more than a few hundred miles. The competition, however, for Alberta pine (or aspen) shake producers is the west coast cedar shake producer. When shipping east, or south, Alberta producers will be facing equal or lower costs compared to the B.C. producer. If Alberta shake producers can compete with cedar successfully in Edmonton and Calgary, they should also be able to compete successfully in cities further east and south.

The selling price for cedar shakes in the Edmonton area is about $90 - $100/square (based on recent telephone survey to wholesaler yards). Unlike the southern U.S., consumers here are not frustrated with the short life of cedar. Typically, consumers can expect up to 40 (or more) years of service from cedar shakes in the dry prairie climate. Producers of pine shakes will likely have to buy market share from cedar through the use of discounting, and by offering warranties (not available with cedar shakes). The discount level required tobuy market share is unknown, however, with a 25 year warranty, we feel that a high quality pine shake should command at least 80% of the cedar shake price, and could sell for the same amount as cedar if good marketing tactics are used. In our opinion, a wholesaler price of $72/square should be readily achievable in the Edmonton/Calgary market. $90/square (the cedar price) is the upper end. Can a Lac La Biche producer make money at these price levels? We think he can! The southern pine figures presented earlier indicate a healthy profit with a final wholesaler price of just over

$100 (CDN) per square. Our wood cost could lower manufacturer's costs by as much as $20/square. Less stringent decay resistance requirements due to our much drier and less demanding climate could allow the marketing of an untreated, or dip treated, shake. In either case, substantial savings are possible. If untreated, shakes could be air dried, resulting in $26.60/square total savings. Dip treatment with certain preservatives does not require pre-drying ($14.51/square savings), and is cheaper than pressure treating with CCA. Total savings in this scenario are likely in the $20/square range (drying and treating savings). Thus, a Lac La Biche producer could produce a dip treated pine shake and make a reasonable profit with wholesaler prices as low as $60/square (FOB Edmonton). Of course, these numbers are preliminary estimates only. Producers should definitely undertake their own economic analysis using real production costs in order to determine profitability.

Recently, we have become aware of two Saskatchewan producers of pine shakes and shingles. One producer does not appear to be very active in the shake business, while the other producer does appear to enjoy significant sales, especially in the Calgary area. Little else is known about these businesses. Further investigation into the relative success (or lack of it) of these two ventures is warranted.

6.3 Building Code Acceptance

The National Building Code of Canada (NBC) forms the basis for almost all local building codes in Canada. Currently, the only wood roofing products recognized by the NBC are cedar shingles and shakes. Obtaining changes to the NBC to allow for pine or aspen shakes would be very expensive and very time consuming. Most local building authorities will accept a CMHC Building Material Evaluation Report as a proxy for actual NBC approval. The CMHC reports evaluate a specific product, and present an opinion to the effect that the product being evaluated will perform in an equivalent fashion to the material actually mentioned in the NBC. This is certainly a more desirable route for Lac La Biche producers of shakes.

In our opinion, a local producer could procure a CMHC evaluation report for almost any configuration of pine shingle or shake, regardless of the product's quality or performance. We certainly do not recommend this approach! The CMHC reports examined by Silvacom Ltd. under the current project all refer to the same 10 pine roofs still in service across northern Alberta. No testing or physical evaluation of the proponent's shakes were undertaken. A CMHC report number could likely be obtained for the prototype shakes used in this project, even though it can be proven that this product is not acceptable. Obtaining approval for an aspen roof will be more difficult because there are fewer aspen roofs still in service when compared to pine. In our opinion, a good quality, well configured shake, whether aspen or pine, could be successfully submitted to CMHC for a building material evaluation report. The aspen proposal would require more back up documentation and testing.

7.0 RECOMMENDATIONS

Our recommendations are summarized into point form, and cover technical aspects such as shingle/shake configuration, as well as strategic aspects for the REDC, or prospective manufacturers.

7.1 Technical Recommendations

1. Do not produce, or sell, any shingles using the prototype configuration described in this report. Both shingle quality and dimension will have to be improved.

2. Work towards the development of a taper sawn shake. Pine shakes should be developed first. Aspen can follow.

3. Restrict, or limit, the use of logs with large knots or insect infestation.

4. Maximize log quality. Better logs make better shakes.

5. Limit log diameters to greater than 9 inches to maximize vertical grain and maintain good productivity.

6. Manufacture taper-sawn shakes with minimum 3/4" butt thickness and 1/8-1/4" thickness at the taper.

7. Maintain shake widths between 4 and 8 inches. No shakes wider than 8".

8. Maximize the percentage of vertical grain. Minimize the amount of flat-grain. Flat grain is acceptable, but should always be kept away from the center of the exposed shake face.

9. Minimize knots. Tight knots up to 1" total area on exposed face is allowed. Up to 2 inches of total knot area on unexposed portion of shakes is allowed.

10. Manufacture 18" and 24" shakes with a maximum allowable exposure of 7.5 and 10 inches respectively.

7.2 Strategic Recommendations

We recommend that the REDC initiate an Alberta Shake Development Program. Shake production has the potential to be a high value added, good employment sector of the Lac La Biche regional economy. A Shake Development Program would assist in the establishment of a shake industry by addressing the issues outlined below. Pine shakes should be developed first, aspen shakes second. Benefits from the Alberta shake development program would flow to all Alberta forested regions, but development would likely be experienced first, and to a greater degree, by companies in the Lac La Biche region. The Shake Development Program would look at the following topics:

1. Investigate preservative treatments in greater detail. Jack pine appears to treat well enough using CCA pressure process (minimum .25 pcf retention). Aspen does not treat well with CCA. Investigate dip treatment, or diffusion treatment, of shakes as an alternative to pressure impregnation.

2. Investigate what stabilizing and preserving effect can be achieved using an oil-borne copper or zinc napthenate preservative as opposed to the water-borne systems such as CCA.

3. Investigate the need (or lack of need) for preservative treatments in the prairies. Currently it appears that shakes could perform well without preservative treatment, but this aspect should be investigated both from a technical and from a marketing perspective. Do likewise for fire retardant treatment.

4. Initiate an ongoing testing program which will incorporate both accelerated weathering as well as field exposure tests.

5. Examine the best means of establishing a shake inspection and certification program. In order to ensure the long run survival of a shake industry, quality control must be monitored by a third party inspection service.

6. Assist producers in obtaining CMHC approvals. A technical information library related to CMHC approvals should be maintained at REDC offices. Financial assistance, or help in applying for funds from other sources, should be made available.

7. Develop the local marketplace first, and spread out from there. Develop sufficient inventory of prototype shakes to roof (free of charge) as many test sites as possible in Lac La Biche area. Suitable buildings include park and campground fish cleaning houses, picnic shelters, etc.

8. Assist in the development of a marketing strategy (including brochures, etc.) for all producers. A common marketing approach is essential to long term survival. This must include a proper market analysis to determine opportunities and limitations.

9. Conduct an inventory to determine the best areas within the Lac La Biche region for shake wood supply. Pockets of high quality, large diameter pine and aspen should be catalogued, and efforts made to ensure that these trees go to a high value added product such as shake production (in contrast to low value added rough lumber, etc.).

10. Investigate different shake production methods - make all technological options known to potential manufacturers. Undertake proper yield and grade studies on the different equipment configurations.

APPENDIX A. PRESERVATIVE TREATMENT REPORT - SOUTHWESTERN LABORATORIES

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

WOOD PRESERVING INSPECTION DIVISION - P.O. Box 8768 - HOUSTON, TEXAS 77249

File No. ____________

Report No. ____________

Report Date 3-28-88

nt: Texas Forest Service
Forest Products Laboratory
P.O. Box 310
Lufkin, Texas 75901
Attention: Mr. Brian Buchanan
Wood Technologist

ect: Preservative Penetration and Retention Tests on CCA-C Treated Jack Pine Shingles

NTIFICATION
RKS: Samples received in our laboratory on March 24, 1988.
Two (2) bundles received, fifteen (15) shingles in each bundle,
Samples identified as follows:
Sample No. 1 - 15 Jack Pine Shingles - 0.25 PCF CCA-C
Sample No. 2 - 15 Jack Pine Shingles - 0.40 PCF CCA-C

[redacted]EST RESULTS

SAMPLE NO. 1: 15[redacted]hingles -[redacted]

	Retention (Lbs. Per cu. Ft.)	Percent of Total
Chromium (C_rO_3)	0.083	46.1
Copper (CuO)	0.034	18.9
Arsenic (As_2O_5)	0.063	35.0
Total	[redacted]	100.0

[redacted] TEST RESULTS

SAMPLE No. 1: 15 [redacted] Shingles - 0.25 PCF CCA-C

Number Pieces Showing Preservative Penetration	Percentage of Cross-Section Penetrated
4	1 to 25
4	26 to 50
1	51 to 75
5	76 to 99
[redacted]	[redacted]

SOUTHWESTERN LABORATORIES

Client: Texas Forest Service

File No. 162

Project: Preservative Penetration and Retention Tests on CCA-C Treated Jack Pine Shingles

Report No.

Report Date 3-28-

RETENTION TEST RESULTS

SAMPLE NO. 2: [redacted]

	Retention (Lbs. Per. Cu. Ft.)	Percent of Total
Chromium (C_rO_3)	0.121	42.7
Copper (CuO)	0.052	18.4
Arsenic (As_2O_5)	0.110	38.9
Total	[redacted]	100.0

[redacted] TEST RESULTS

SAMPLE NO. 2: 15 Jack Pine Shingles - 0.40 PCF CCA-C

Number Pieces Showing Preservative Penetration	Percentage of Cross-Section Penetrated
4	1 to 25
1	25 to 50
2	76 to 99
[redacted]	[redacted]

REMARKS:

An increment borer core was obtained from each shingle in each bundle, at a point one (1) inch from the butt end on a centerline of the wide face, to form a composite sample for retention determination. Each composite sample was analyzed in accordance with American Wood Preservers' Association Standard A9-86.

The penetration data shown indicates the percentage of the cross-section penetrated at the point where increment borer cores were obtained for the retention determination test.

SOUTHWESTERN LABORATORIES

Technician:

Copies:

Mr. Brian Buchanan
2--Texas Forest Service
Forest Products Laboratory

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

WOOD PRESERVING INSPECTION DIVISION - P.O. BOX 8768 - HOUSTON, TEXAS 77249

File No.

Report No.

Report Date 3-28-88

ent: Texas Forest Service
Forest Products Laboratory
P.O. Box 310
Lufkin, Texas 75901
Attention: Mr. Brian Buchanan
Wood Technologist

ject: Preservative Penetration and Retention Tests on CCA-C Treated Aspen Shingles

ENTIFICATION
RKS: Samples received in our laboratory on March 24, 1988.
Two (2) bundles received, fifteen (15) shingles in each bundle.
Samples identified as follows:
Sample No. 3 - 15 Aspen Shingles - 0.25 PCF CCA-C
Sample No. 4 - 15 Aspen Shingles - 0.40 PCF CCA-C

[redacted] TEST RESULTS

SAMPLE No. 3: 1[redacted]

	Retention (Lbs. Per Cu. Ft.)	Percent of Total
Chromium (C_rO_3)	0.077	44.5
Copper (CuO)	0.031	17.9
Arsenic (As_2O_5)	0.065	27.6
Total	[redacted]	100.0

PENETRATION TEST RESULTS

SAMPLE No. 3: 15 Aspen Shingles - 0.25 PCF CCA-C

Number Pieces Showing Preservative Penetration	Percentage of Cross-Section Penetrated
9	1 to 25
3	26 to 50
1	51 to 75
2	100

SOUTHWESTERN LABORATORIES

Client:	Texas Forest Service	File No.	1
Project:	Preservative Penetration and Retention Tests on CCA-C Treated Aspen Shingles	Report No.	
Page 2 of 2		Report Date	3-

RETENTION TEST RESULTS

SAMPLE NO. 4: [redacted] - [redacted]

	Retention (Lbs. Per Cu. Ft.)	Percent of Total
Chromium (C_rO_3)	0.170	46.7
Copper (CuO)	0.065	17.9
Arsenic (As_2O_5)	0.129	35.4
Total	[redacted]	100.0

[redacted]EST RESULTS

SAMPLE NO. 4: 15[redacted]- [redacted]

Number Pieces Showing Preservative Penetration	Percentage of Cross-Section Penetrated
4	1 to 25
1	26 to 50
2	76 to 99
[redacted]	100

REMARKS:

An increment borer core was obtained from each shingle in each bundle, at a point one (1) inch from the butt end on a certerline of the wide face, to form a composite sample for retention determination, Each composite sample was analyzed in accordance with American Wood Preservers' Association Standard A9-86.

The penetration data shown indicates the percentage of the cross-section penetrated at the point where increment borer cores were obtained for the retention determination test.

Technician:

Copies:
Mr. Brian Buchanan
2--Texas Forest Service
Forest Products Laboratory

SOUTHWESTERN LABORATORIES

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

WOOD PRESERVING INSPECTION DIVISION

222 Cavalcade St. • P.O. Box 8768, Houston, Texas 77249 • 713/692-9151

File No. 162

Report No.

Report Date 3-28-88

nt: Texas Forest SErvice
Forest Products Laboratory
P.O. Box 310
Lufkin, Texas 75901
Attention: Mr. Brian Buchanan
Wood Technologist

ect: Analysis of CCA Treating Solution Samples

:NTIFICATION
RKS: Samples received in our laboratory on March 24, 1988.
One (1) sample identified as: Solution G-1.35 CCA, Type C.
One (1) sample identified as: Solution H-0.85 CCA, Type C.

TEST RESULTS

SOLUTION G -[redacted], Type C

	Concentration (Percent)	Percent of total
Chromium (C_rO_3)	0.705	48.1
Copper (CuO)	0.255	17.4
Arsenic (As_2O_5)	0.506	34.5
Total	[redacted]	100.0

SOLUTION H -[redacted] Type C

	Concentration (Percent)	Percent of Total
Chromium (C_rO_3)	0.461	49.2
Copper (CuO)	0.155	16.6
Arsenic (As_2O_5)	0.320	34.2
Total	[redacted]	100.0

MARKS: The above CCA treating solution samples were analyzed in accordance with American Wood Preservers' Association Standard A9-86.

SOUTHWESTERN LABORATORIES

es: 2--Texas Forest Service
Forest Products Laboratory

APPENDIX B. SAMPLE CMHC EVALUATION REPORT FOR TAPER SAWN PINE SHAKES

Canada Mortgage and Housing Corporation
Société canadienne d'hypothèques et de logement

National Office
Bureau National

Ottawa
K1A 0P7

DIVISION 07313

BUILDING MATERIAL EVALUATION REPORT

EVALUATION REPORT NO.: 11644
ISSUE DATE: 87-11-26

NUMBER OF PAGES: 5

"WHITE PINE SHINGLE"

1.0 PRODUCT

Taper-sawn pine wood shingle.

2.0 PROPONENT

Trirak Industries Corporation, Box 38, Nipawin, Saskatchewan, SOE 1E0.

3.0 MANUFACTURED AT

Nipawin, Saskatchewan.

4.0 DESCRIPTION

White pine machine taper sawn roof shingle measuring 152.4 mm wide by 609.6 mm long by 3.175 mm to 19.05 mm thick. Material is high grade, with quality controlled machining, in a early green stage. Shakes have vertical edge grain and uniform yellow colour. All are free of heart wood and sap stain and any knots are sound and tight. No wane is present on the shakes.

5.0 USAGE AND LIMITATIONS

This product is permitted for use in construction financed or insured under the National Housing Act subject to the following conditions:

(1) "White Pine Shingles" may be used as roofing, decorative siding or as interior decorating in areas where combustible materials are permitted by the National Building Code of Canada 1985.

(2) "White Pine Shingles" must mot be used on roofs with slope less than 1 in 3.

(3) Only corrosion resistant nails conforming to CSA Standard B111, "Wire, Nails, Spikes, and Staples", should be used in fastening "White Pine Shingles".

6.0 ASSESSMENT

6.1 Compliance to Building Codes and Standards

In the opinion of the Materials Evaluation Department, "White Pine Shingles" comply with the intent of:

(1) National Building Code of Canada 1985, "Subsections 9.27.9, 9.27.10 and 9.28.7;
(2) CSA 0118.1-M1980, "Western Red Cedar Shingles, Hand Split Western Red Shakes and Machine Grooved Shakes; and
(3) CSA 0118.2-M1981, "Eastern White Cedar Shingles".

6.2 Performance

Inspections were performed by CMHC Technical Staff on ten (10) buildings built before 1954. Samples were obtained from the roofs of these buildings and, apart from being stained and showing signs of wear on the exposed portion, there was no decay to the point of having roof failure. The samples were about 7.5 mm at the thickest end compared to the "White Pine Shakes" that are 19.0 mm thick. The roof decks underneath the shingles were still in good condition showing that the shingles performed well.

6.3 Warranty

Trirak Industries Corporation guarantees the workmanship in its pine shingles for a period of twenty-five (25) years. The company will replace without charge, except installation and shipping, any shake that proves defective for a period of twenty-five (25) years from the date of manufacture.

The guarantee is limited to the replacement of defective shakes only and it does not cover damage due to unreasonable wear, improper installation, or other damage beyond the control of the proponent.

This guarantee applies only to natural unpainted shingles.

7.0 INSTALLATION

"White Pine Shingles" shall be applied in accordance with Subsections 9.27.9 and 9.28.7 of the National Building Code of Canada 1985.

Recommendations for installation are:

(1) Shingles by installed over a dry substructure.

(2) A 6 mm gap be left between shingle.

(3) Shingle joints must be staggered a minimum of 40 mm.

(4) Shingles must be fastened with at least 2 nails or staples located approximately 19 mm from the sides of the shingles and 38 mm above the exposure line.

(5) For a 1 in 3 roof slope, the maximum shingle exposure must be 204 mm.

(6) For roof slopes greater than 1 in 3, the maximum shingle exposure must be 254 mm.

(7) Flashing must conform to Subsection 9.27.4 of the National Building Code of Canada 1985.

(8) Eave protection must conform to Subsection 9.27.5 of the National Building Code of Canada 1985.

8.0 IDENTIFICATION

Bundles of shingles are identified with a label containing the following information:

(1) Name of manufacturer;
(2) Product name; and
(3) The phrase "See CMHC Evaluation Report Number 11644".

NOTES

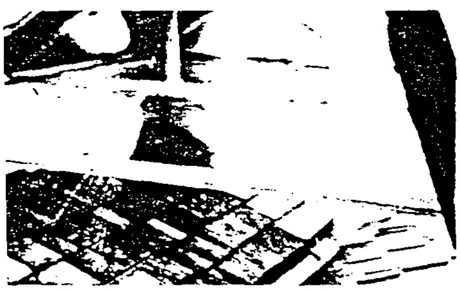
Readers are advised to confirm that this report has not been withdrawn or superseded by a later issue by contacting the Materials Evaluation Department at (613) 748-2280 or any CMHC local office.

Readers are asked to refer to limitations imposed by CMHC on the interpretation and use of this report. These limitations are included in the introduction to the "Manual of Building Materials Evaluation Reports" of which this report is part.

APPENDIX C. TEXAS TAPER SAWN SHAKE SAMPLE BROCHURE

THE ALTERNATIVE WOOD ROOFING MATERIAL

)urable, Energy Efficient, and Affordable



AFFORDABLE

ade from the highest quality southern pine timber, preser-:ive treated taper-sawn shakes cost competitive with cedar akes and shingles.

southern pine taper-sawn shakes more uniform so installation re-res less time, thus lower labor costs. iste is less than 5% compared to dar shakes and shingles which be as high as 30%. Taper-sawn ikes can be installed directly over sting cedar or composition ngles eliminating the cost and ss of removing and disposing of old roof. In addition the in-ative value is multiplied.

The Forest Products Laboratory of the Texas Forest Service has completed ten years of extensive research into the suitability of Southern Yellow Pine as an alternative to Western Redcedar for shake and shingle production. These studies show Southern Pine shakes to be stronger, more durable and affordable. Recent studies in the Houston area have shown that "twelve to fifteen years of dependable service is about all that we can expect" out of untreated cedar.

ENERGY EFFICIENT

The extraordinary beauty of wood matched with the energy-saving insulative value of Southern Yellow Pine can reduce attic temperature 20 degrees during the summer.

R-value *ratings* of Southern Yellow Pine are:

300% better than asphalt shingles

400% better than built-up roofing.

DURABLE

Service Life

35-50 years for preservative treated southern pine taper-sawn shakes

8-15 years for Western Redcedar shingles

Warranty

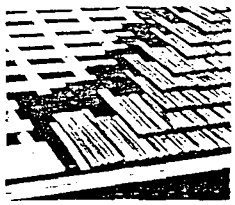
The treated pine shakes can carry a 30 year limited warranty against insects and decay. Cedar Roofing carries no warranty.

Application Recommendations
Southern Pine Taper-Sawn Shakes

ROOF PITCH AND EXPOSURE: Taper-Sawn shakes should be used on roofs where the slope or pitch is sufficient to insure good drainage. Minimum recommended pitch is 1/6th or 4-in-12 (4" vertical rise for each 12" horizontal run). Maximum recommended weather exposure is 10" for 24" shakes on roofs.

ROOF APPLICATION: Along the eave line, a 36" wide strip of 15 lb. (minimum) roofing felt is laid over the sheathing. The beginning or starter course at the eave line should be doubled. After each course of shakes is applied, an 18" wide strip of 15 lb. (minimum) roofing felt is laid over the top portion of the shakes and extending onto the sheathing, with the bottom edge of the felt positioned at a distance above the butt equal to twice the weather exposure.

NAILING: Use two hot-dipped zinc-coated nails for each shake, placing them approximately one inch from each edge, and high enough to be covered an inch or two by the succeeding course. Nails should be long enough to penetrate at least ½" into sheathing.



Individual shakes should be spaced apart about ¼" - ⅜ to allow for possible expansion. These joints or "spaces-between-shakes" should be broken or offset at least 1 ½ inches in adjacent courses.

LITERATURE: Complete details of taper-sawn shake application methods and grades are available from the Texas Forest Products Laboratory, Texas Forest Service, P.O. Box 310, Lufkin, Texas 75901.

UBC-SBCCI-CABO APPROVED

TAPER-SAWN
SOUTHERN PINE SHAKES

NUMBER 1 GRADE

These shakes meet all quality requirements for Taper-Sawn Southern Pine Shakes as established by the Forest Products Laboratory of the Texas Forest Service.

24"x3/4" Heavy Taper-Sawn Shakes

Preservative Treatment Conforms With UBC Standard No. 25-12

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TAPER-SAWN
SOUTHERN PINE SHAKES

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HIP & RIDGE UNITS

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FOREST PRODUCTS LABORATORY

The Texas Forest Products Laboratory is located in the Cudlipp Forestry Center in Lufkin, Texas. This department operates one of the few state-administered forest products laboratories in the nation. The department conducts a long-range program of applied research; assists wood using industries with technical and production problems by testing materials and wood utilization techniques; collects and provides technical information to timberland owners, manufacturers, and users of forest products; and lectures to university students on the proper use of wood and wood products.

TEXAS FOREST SERVICE

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