WOOD PRESERVATION PAYS - SHAKES AND SHINGLES

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INTRODUCTION

Few of us have had the good fortune to view a first-growth Western Red Cedar, Thuja plicata D. Don., of the diameters 15-20 feet and heights up to 200 feet which were common on the West Coast 80-90 years ago. We are told that there are but a few remaining original stands on Northern Vancouver Island and in the Queen Charlotte Islands, B.C.. A century ago, photographs record the scenes of these enormous trees which have taken between 600 and 1000 years to grow, being hewn down by groups of lumberjacks within a matter of days. The trunks were then hauled out by teams of oxen, steam tractor or steam train. They were then hand-split into shakes for roofs which may last between 15 or 20 years in their natural state, depending upon pitch, overhanging vegetation and climate.

Nowadays mills concentrated on the river banks up and down the West Coast, B. C. take western red cedar logs floated down from source and with the aid of mechanical handling either split them into shakes or saw them into shingles, to be labelled certigrade or certisplit and exported to the U.S.A. - Texas and California mainly and to Europe.

The appeal of Western Red Cedar is irresistible to those who live with it, or have used it around their homes. It has exceptional properties: extremely fine and even grain, with high strength in proportion to its weight; high in permeability to liquids and low ratio of expansion and contraction with changes in moisture content; excellent thermal insulation properties and above all its aesthetically pleasing characteristics; its weathering to an attractive medium to dark silver gray in its natural state. These are good reasons for it to serve as an excellent roofing material.

DURABILITY AND ECONOMICS

Western Red Cedar is well known for its natural high decay resistance (1). Whilst the sapwood, like that of all wood species is perishable, the heartwood contains several fungicidal extractives which are responsible for this natural durability - mainly Beta and Gamma thujaplicins (2).

To study the effect of preservative treatment on the durability of red cedar shakes in service, Forintek Canada Corp. Western Forest Products Laboratory fabricated experimental roof panels and exposed them to the weather in 1973. As part of this study, samples from the roof panels made with untreated shakes were analysed for thujaplicins after 1, 3 and 5 years. 18 inch No.1 grade Barn Shakes were exposed at Maple Ridge, British Columbia. This test area experiences high rainfall (about 250 cm/yr) and relatively high sunshine (2000 hr/yr).

It was clear from these tests that weathering removes thujaplicins from western red cedar shakes in service. After 5 years the butts of the shakes no longer contained any, although they still appeared to be in good condition. In 1984, 11 year results from this test

site will be available.

It is unfortunate that the thujaplicins are water soluble like many man-made wood preservatives, and thus leach out. Today more and more shakes and shingles are being manufactured from juvenile trees, with less decay-resistant heartwood. It is in the heartwood that the thujaplicins start to be laid down, but generally not before the tree is at least 70-80 years old.

What then of the silver-graying process that is so appealing to architects and home-owners alike? If one takes a series of photographs weekly from the time the cedar roof is applied for a period up to 6 months and then a year, one realizes how quickly this graying process takes place. Within 3 months in Vancouver, B. C., they will have started to turn a silver gray and within 1 year they will be a graphite gray.

It is the ultraviolet rays of the sun which strip the wood of the lignin, leaving the silver cellulose behind. Microfungi then colonise the shakes and these are generally black pigmented. The shakes therefore start to turn a dark gray colour. As the pigmentation level rises so does the resistance to ultraviolet degradation and this gives protection for the wood rotting fungi to become established. Rhinocladiella mansonii and Phialophera hoffmannii (3) account for about 60% of fungi colonising shakes taken from Northern Washington and Vancouver, B. C. areas.

Recent research by Forintek Canada Corp. has shown that preservation does have a marked effect on the durability of the shake. In erosion tests carried out, the loss of wood due to erosion from the flat face of the shake untreated is about 1 mm in an 8 year period. This erosion-type decay is quite common too in Texas, (3) and in most cases is attributed to the decay fungi P. richardsiae. Erosion from a shake treated with a chromated copper arsenate wood preservative type C is 0.2 mm.

The average depth of penetration of a CCA preservative into a split shake laterally is 1 mm - into a shingle which is sawn it is much greater due to the cut fibres. By extrapolation therefore we could assume that it would take 5x8 years or 40 years for that 1 mm skin to be eroded away and decay to set in. The retention of the CCA preservative will affect the life. Commercially, 0.4 lbs/cu.ft. average dry oxide charge retention is considered satisfactory. The butt penetration is 2 - 3 cms and this is of course the area of highest decay hazard.

Tests on experimental roof panels consisting of 18" barn shakes treated with various preservatives were reported in 1976 (5) by A. J. Cserjesi. The preservatives tested were Timbor (Disodium octaborate tetrahydrate), Penta - LPG, Penta in oil, CCA-B, CCA-C, ACA, CAA. Conclusions from leaching tests carried out over an 8 month period showed that all shakes retained concentrations of the preservatives sufficient to prevent biological deterioration. However, CCA-C and PCP in oil proved most leach-resistant.

An Evaluation of preservatives was also carried out in Texas in 1981 again on 18" Barn Shakes. Tests compared the penetration, retention and durability of a variety of commercially available preservatives applied by either pressure impregnation, dip or brush application.

Table 1

Preservative	Treating Method		
	Pressure Impregnation	Dip Treatment	Brush Application
1. Pentachlorophenol (PCP)	X	X	X
2. Chromated Copper Arsenate-Type C (CCA-C)	X	N/A	N/A
*3. Copper-8-Quinolinolate	X	X	X
4. Tributyltin Oxide (TBTO)	N/A	N/A	X
5. Copper Naphthenate	N/A	N/A	X

The overall decay resistance of a preservative treated wood roof is directly related to the amount of preservative retained within the wood over time.

It was concluded that CCA, copper-8 or PCP will be the most cost effective treatments. It is highly unlikely that the pressure-treated shingles will require any further treatment over the life of the roof.

PCP has considerable opposition to its use by applicators due to the potential irritation to skin and mucous membranes of the nose and throat.

Copper 8 - Quinolinolate treated wood, although safe to handle, can be difficult to find due to treating companies not having the special corrosion-proof equipment necessary to apply it.

CCA-treated shakes are safe to handle once the chemical is 'fixed' - normally within a week of application - are relatively inexpensive and yet are durable.

Dip,spray and brush treatments proved to be only temporary expedients in deterring fungi, moss and lichen growth.

Let us now examine the economics of treating a red cedar roof with the most popular, most leach-resistant preservative - CCA type C. (See Table 2 - Next page).

The facts speak for themselves, which is why CCA Preservative treatment is recommended in CSA - 0118.1.1980(7).

Table 2

"WOOD PRESERVATION PAYS - SHAKES AND SHINGLES"

Average Home Roof - Vancouver, B.C.≡ 30 Squares

TYPE	COVERAGE/ SQ.	APPLIED COST/SQ. UP TO PITCH OF 6/12	COST OF ROOF	AVERAGE LIFE YRS.	COST TO STRIP/SQ.	TOTAL COST/SQ.	COST/ANNUM ON ROOF	COST/ANNUM ON TREATMENT
24" HEAVY RESAWS	90 SQ. FT.	UNTREATED $130	$3900	15	$30	$160	$320	$16
		CCA TREATED $146	$4380	30		$146	$146	
		Difference	$ 480					
18" BARN SHAKES	90 SQ. FT.	UNTREATED $107.50	$3225	15	$30	$137.50	$275	$15
		CCA TREATED $122.50	$3675	30		$122.50	$122.50	
		Difference	$ 450					
18" #1 SHINGLES	97 SQ. FT.	UNTREATED $135.00	$3780	12	$30	$165	$385	$10
		CCA TREATED$148.00	$4144	36		$148	$115	
		Difference	$ 364					

Factors Not Accounted For: Inconvenience Caused by Re-Roofing and Looks.

CONCLUSIONS

Does Wood Preservation pay, we ask? The pure economics of treating red cedar shakes and shingles to the homeowner, property manager and industrial owner leave no logical alternative but to say -'Yes'.

Consider also those prime growth red cedars of diameters of 10 feet and more. Old photographs show with pride, logs with inscriptions - "sufficient to cut 40,000 shingles". What dollar figure would that 'clear' timber make today as an interior panelling material where its inherent beauty can be admired year after year, without danger of deterioration. Consider the rapid depletion of "one of the World's largest and finest cedars - once called the Giant arbor vitae - the "tree of life" because of the everyday use made by the West Coast American Indians. They used its stringy roots, shreddy bark and fragrant timber. Council of Forest Industries, B.C., quote in their Handbook of Western Red Cedar (8) that it comprises almost 21% of the coastal forest. It is doubtful whether that is true today. In fact the Silverculture Department of B.C. Forestry confirm rapid depletion of Western Red Cedar from our forests. Their reafforestation programme is for 5 million trees of 30 million in the Vancouver and Kootenay regions annually from 1984 to 2000. Consider that having harvested an area of Red Cedar, Douglas Fir is generally planted followed by Hemlock. After some 250 - 300 years, red cedar then re-establishes itself. It does not become harvestable for poles for 40 - 50 years and for shakes/ shingles for 150 - 200 years.

If with CCA preservation we double the life of shakes and treble the life of shingles, then we are indeed helping to conserve the last of these beautiful trees. What is more, wood preservation puts back hard-earned dollars into the homeowner's and Government's pockets alike.

REFERENCES

1. Industrial Timber Preservation - J.G. Wilkinson - P.78.

2. FPJ Technical Note - Weathering Effect on Thujaplicin Concentration in Western Red Cedar Shakes. June 1980 Eric L. Johnson, A.J. Cserjesi.

3. Colonization and Degradation of Western Red Cedar Shingles and Shakes by Fungi - 1975 by Roger S. Smith, Garry W. Swann.

4. Evaluating Various Preservative Treatments and Treatment Methods for Western Red Cedar Shingles - Brian Buchanan - Texas Forest Products Laboratory Dec. 1981.

5. Permanence of Preservatives in Treated Experimental Shake Roofs - A.J. Cserjesi Dec. 1976.

6. Red Cedar Shingles Handsplit Shakes and Grooved Sidewall Shakes - COFI - June 1977.

7. CSA Standard - 0118.1 - 1980 Western Red Cedar Shingles, Handsplit Shakes and Machine Grooved Shakes.

8. Western Red Cedar Handbook - COFI - November 1981.