CCA-TREATED BOOMSTICKS

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Summary

A shortage of boomsticks used for log transportation has been an ongoing issue due to losses from marine borer infestation, mechanical wear and tear, and reduced supply. Forestry companies approached FPInnovations looking for a solution to the diminishing supply. While considering many alternative products, CCA treated boomsticks emerged as an achievable option due to the infrastructure already in place to manufacture them. FPInnovations facilitated a field study and trial production of CCA treated boomsticks. This report will outline the setup and preliminary results of the field study and full scale treatment trial.

1. Introduction

Booming is a log transportation method that was once widely used, but has more recently been limited to operations in coastal and central interior BC. This is because it still has the lowest costs for transportation. With this mode of transportation, two types of boomsticks are employed: tow sticks used to enclose bundles of logs that are actively transported and standing sticks that are used to contain logs in booming grounds in preparation for dewatering and use, or sorting for transportation. Since boomsticks are normally kept in brackish or salt water for extended periods of time, the two main deterioration modes are from biological damage in the form of marine borers and mechanical damage due to physical wear and tear. Mechanical damage usually occurs around the ends and drilled holes where steel chains cause abrasion.

An urgent need to extend the service life has occurred due to a reduction in the supply of suitable logs for use as boom sticks as the industry transitions from old growth harvesting to second growth. Preservative treatment can be a way to retain the traditional use of logs as boomsticks but extend their useful service life. CCA treatment has been shown to protect against marine borers and if treated properly can achieve service life of 20+ years in piling (Morris & Barford, 1992; Morris & Ingram, 2003). The protection of the ends is hypothesized to be achieved by physical protection by a polymer coating or steel sleeve. This work outlines the initiation of two field tests. One of full length boomsticks treated with CCA for biological protection and two types of mechanical end protection. A second test of shorter logs treated with CCA was set up to determine the optimum preservative retention required for this particular application.

2. Methods

2.1 Preparation of Full Scale 60' Logs

Forty five 60' logs were roughly debarked prior to treatment by the log suppliers, and then boomed to Stella Jones' treating facility in New Westminster BC. Of the forty five, twenty seven boomsticks were peeled and kiln dried to below 25% MC and processed for the application of either the metal sleeve or polyurethane coating. Boomsticks were treated targeting a medium retention (below the 24 kg/m^3 CSA marine piling standard) using a typical full cell process.

Eighteen treated sticks were coated on the ends with a proprietary polyurethane coating provided by Normac Adhesive Products Inc. and applied by Ceramiweld Technologies International (Figure 1). Nine treated sticks were fitted with a steel sleeve for towing applications (Figure 2). The remaining 18 untreated sticks were used as control boomsticks for comparing performance of treated sticks with untreated sticks. Table 1 summaries the sticks deployed in this study.

Figure 1. Application of polyurethane coating around sticks' end

Figure 2. Metal sleeves used in the study on top and bottom end of holes

Table 2. Summary of deployed boomsticks

Boomstick Modification Type	End Protection	Standing Sticks			Tow Sticks			
		Fd*	Hw	Ba	Fd	Hw	Ba	Total
Treated	With poly coating at the ends	3	3	3	3	3	3	18
	With steel liners at the ends				3	3	3	9
Control (Untreated)		3	3	3	3	3	3	18
Total		6	6	6	9	9	9	45

** Fd = Douglas-fir, Hw = Western hemlock, Ba = Amabilis fir*

2.2 Preparation of 8' Logs

The evaluation of performance of 8' lengths of CCA-treated boomstick with three different loadings (10, 15 and 24 kg/m^3) was performed at a location of high marine borer infestation to determine effect of preservative loading on service life and match borer resistance to mechanical life.

Seven hemlock, six Douglas-fir and five amablis fir 32" diameter logs were procured from coastal British Columbia and delivered to FPInnovations' Vancouver Lab. The logs were cut into 8ft long sections and labelled with unique identifiers. Samples had one hole at one end, drilled with a 3" borer. Samples for controls were set aside. Samples for pressure treatments were loaded into FPInnovations 8' kiln in 3 separate loads and kiln dried for 3 days to a target 20% MC at 2" depth.

Due to the presence of bark and the rough surface quality of the logs, samples that were to be treated were cleaned on the surface using a disk grinder and wire brush.

The prepared samples were then stacked indoors at ambient conditions until they were treated in FPInnovations' large stainless steel retort. Treatments used a typical full cell process with a 30 minute initial vacuum followed by a minimum 8hr press at 150-180psi and a final vacuum of 1hr. Solution strengths varied between 2% and 4% depending on the target and species treated. Samples were treated in groups of 4-5 depending on the diameters of the logs.

Treated samples were weighed before and after treatment for gauge uptakes. When removed from the retort samples were wrapped in lumber wrap to retain moisture before loading the samples into the kiln for fixation. Fixation occurred while still individually wrapped in the kiln for 48hrs.

2.3 Retention analysis

For the full size boomsticks, two 1/4" diameter 3 inch long cores were taken from a spot approximately 6 inches from the brass ID tag. Samples were put into labelled bags and kept in a cooler for transportation. The boomsticks were then plugged with softwood dowels treated with CCA at approximately the same solution concentration. Before being sent for analysis at ALS via Wood PLC (Amec Foster Wheeler), samples were prepared by cutting to 4cm lengths and chopping the sample into smaller pieces as recommended by ALS.

Figure 3. FPInnovations staff taking the sample cores from treated sticks for retention and environment performance analysis

For the 8' long boom sticks one 1" diameter 3 inch long core was taken from a spot approximately at the middle of the 8' length. Samples were halved and put into labelled bags and kept in a freezer. The boomsticks were plugged with softwood dowels treated with CCA at approximately the same solution concentration. Before being sent for analysis at ALS via Wood PLC (Amec Foster Wheeler), one of the halved samples were prepared by cutting to 4cm lengths and chopping the sample into smaller pieces as recommended by ALS. The other half of each sample was measured for preservative penetration, then dried and cut to 25mm, ground with 60 mesh in the Wiley mill zone then pelletized for XRF analysis at FPInnovations.

2.4 Deployment

Nine treated sticks with coated ends and nine controls sticks were deployed as standing sticks in booming grounds in three locations: Shoal Islands B.C., Port Mellon B.C. and Duke Point, B.C. Twenty seven tow sticks (9 treated with coated ends, 9 treated with metal sleeves and 9 control sticks) were deployed by to the participating forest companies (Figure 4) and used in normal towing applications. One low floating treated tow stick and one broken treated tow stick were transferred to a standing stick pile.

Figure 4. Deployment of sticks at Stella Jones' waterfront

Seventy two 8' sticks were strung together and deployed at the Port Mellon B.C. site (Figure 5).

Figure 5. Deployed 8' sticks

2.5 Performance Assessment

Samples were de-watered and laid out on top of the skid logs in a dryland sort for assessment. Fullscale boomsticks were assessed visually for attack and any attack if present were noted. Eight foot sticks were evaluated using a modified AWPA E5-13 rating scale slightly adjusted to account for the size of samples.

3. Results and Discussion

Assay retentions met the desired target ranges and full sapwood penetration was found in all full length boomsticks and in most of the 8' logs. Averages of penetration and assay retention for each group and species are summarized in Tables 2 and 3.

Table 3. Full length boomstick treatment summary

Species	Penetration mm	Assay Retention kg/m³
Western Hemlock	32	14.2
Amabalis Fir	22	17.3
Douglas Fir	22	13.5

Table 4. 8' boomstick treatment summary

Target Low	Solution %	Avg. Penetration mm	Assay Retention kg/m³
Western Hemlock	3.5	20	8.4
Amabalis Fir	3.2	27	7.3
Douglas Fir	3.3	23	10.0
Target Medium	**Solution %**	**Avg. Penetration mm**	**Assay Retention kg/m³**
Western Hemlock	3.5	24	12.2
Amabalis Fir	3.5	27	15.2
Douglas Fir	3.4	25	15.3
Target CSA Standard	**Solution %**	**Avg. Penetration mm**	**Assay Retention kg/m³**
Western Hemlock	3.2	24	23.9
Amabalis Fir	3.5	29	20.4
Douglas Fir	3.8	30	25.2

After 11 months exposure at the Port Mellon test site, all of the treated 8' boomsticks and controls were rated 10 showing no signs of marine borer attack. Treated full length boomsticks at all sites showed no visible signs of marine borer attack. Controls at Shoal Island showed signs of both gribble and marine borer attack. At the Duke Point Site only gribble attack was observed on controls. At Port Mellon, 60' length controls and treated sticks were sound and no sign of marine borer attack was observed.

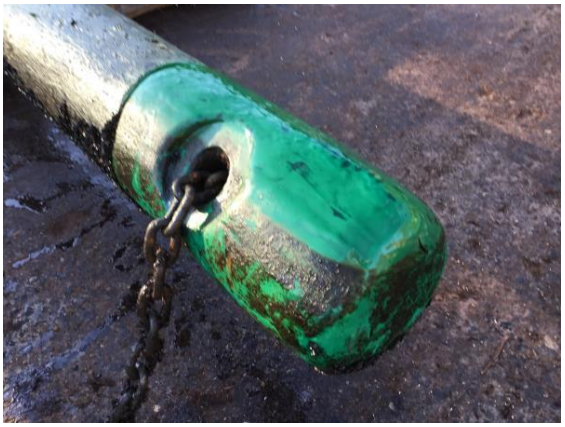
Figure 6. Attacks observed on control sticks

Mechanical damage was observed in all full length boomsticks. In some cases untreated wood was observed to be exposed by severe damage caused by chains in the tow applications. In standing boom applications damage was observed but not deep enough to expose untreated wood. Surfaces of treated boomsticks appeared cleaner than those of the untreated controls.

a) b)

Figure 7. Mechanical damage observed in control sticks (a) and treated sticks (b)

The polyurethane coating showed wear and tear and peeled off to varying degrees at the three test sites. The amount of damage to the coating could be due to the different handling practices of these test pieces by each of the participating companies. In one case, the stick with the coated end failed and the chain spliced the end as shown in left image of Figure 8. The metal teeth of the sidewinder boom boats pierced the coating where impacts occurred. This suggests that the application of the coating would mean that the way the sticks are normally handled would have to be adjusted. Sidewinder operators would need to make efforts to avoid hitting the coating when possible. Steel sleeves had corroded slightly but showed adequate protection to the holes while leaving the ends still vulnerable to damage.



Fasteners for the brass tags attached to the full sized boomsticks at installation had corroded and fallen off during exposure, so identifying individual sticks in some case was not possible.

4. Conclusions

- Treated boomsticks showed little marine borer damage and moderate mechanical damage at all test sites after 11 months exposure.
- Untreated boomsticks showed early signs of marine borer attack at all sites except Port Mellon
- Since no attack occurred on any 8' treated or untreated material there was no differentiating between the effectiveness at high or low retention levels after 11 months exposure
- Boomsticks will continue to be monitored and evaluated periodically

5. References

American Wood Protection Association 2015 Standard E5-13, Standard Field Test For Evaluation Of Wood Preservatives To Be Used In Marine Applications (UC5A, UC5B, UC5C); Panel And Block Tests, AWPA, Birmingham AL. 4p.

Canadian Standards Association 080.1 -08 Specification of Treated Wood section 9.8 Marine (salt water) Applications (UC5A), CSA 080, Toronto On, 5p

Morris, P. I., & Barford, G. (1992). Performance of five preservative treatments in marine piling. Report prepared for the CSA O80 Technical Committee on Wood Preservation. Vancouver, B.C: Forintek Canada Corp.

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