



**Title:** Assessment of a *Eucalyptus cloeziana*-pole with regard to attack by shipworm

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## 1 Introduction

### 1.1 Assignment

On September 1<sup>st</sup>, 2006 Wood Solutions B.V. in The Hague, Netherlands commissioned SHR Timber Research to carry out an assessment of parts of a *Eucalyptus cloeziana*-pole with regard to attack by shipworm.

Wood Solutions is confident that *Eucalyptus cloeziana* has good properties to be used for constructions in salt water environments. One of these properties would be resistance against shipworm (*Teredo* sp.). A pole of this wood species from a harbour with known presence of shipworm was made available for the assessment.

### 1.2 Exposition of the samples

Wood Solutions has provided the following information regarding the exposition of the pole. This pole was placed in the salt water harbour of Herkingen in the province of Zeeland in May 2003 by the firm Kraaieveld from Barendrecht. Due to restructuring of this part of the harbour, the pole was taken out again by the same firm in May 2006 (see photos in Appendix).

The 10 m pole was driven into the harbour ground for about 5 m. This leaves 5 m in and above the water. Average water depth here is about 2,3 m, leaving 2,7 m on average above the water.

As the water level is regulated, there is no tidal effect.

Water temperature normally rises up to 22 °C in summer.

The presence of shipworm in the harbour is known from attack on other poles. Previous experiences have shown pine poles to be completely degraded within two years after placement.

## 2 Execution of the assessment

### 2.1 Identification and description of the samples

Samples of the pole were received at the laboratory of SHR on August 30<sup>th</sup>, 2006.

They consisted of seven consecutive parts of the pole, coded by the commissioner from A to G and marked with arrows in order to know which sides of the parts belonged together (see Photo 1).

The codes were also used for the assessment.

According to the commissioner the samples were taken from the extracted pole. They originate from the lower part of the upper half of the pole, i.e. the part under water but just above the mud line. According to the commissioner no attack (pinholes) has been observed in the other part of the upper half of the pole.



Photo 1 Marks / arrows on the samples E and F

## 2.2 Procedure of the assessment

The samples have been placed in conditioned surroundings with a normal climate of 20 °C and 65% RH and left there for three weeks. On September 22<sup>nd</sup>, 2006 the samples were measured and weighed and after that assessed for attack by shipworm. This was done visually by counting and measuring the apparent holes in the upper cross cut surfaces. Also on each upper cross cut surface the distance to the outside of the inner edge of the most inward shipworm gallery was measured and at that same spot the distance from the outside to the sapwood boundary, which was estimated using colour differences on the cross cut surfaces. All axial surfaces were furthermore examined for the small entry holes (pinholes).

## 3 Results

In all samples attack by shipworm was apparent from the presence of the galleries with calcium deposits. Table 1 shows the results for all samples.

**Table 1 Results of the assessment for all samples**

Sample			A	B	C	D	E	F	G
Item		Unit							
<u>General observations</u>									
Axial length		cm	8	23,5	26,5	27,5	5,5	30	30
Diameter	min	cm	*	16	16,5	16,5	16,5	17	17
	max	cm	17,5	19	18,5	18	17,5	18	18,5
Weight		g	1364	4988	5547	5533	1170	6683	6647
<u>Calculations</u>									
Avg diam		cm	*	17,5	17,5	17,25	17	17,5	17,75
Volume		cm <sup>3</sup>	*	5652	6374	6427	1248	7216	7423
Density		kg/m <sup>3</sup>	*	880	870	860	940	930	900
<u>Shipworm assessment</u>									
Pinholes		count	3	5	3	3	1	2	1
Galleries	3 mm	count	5	2					
	4 mm	count	1	1			1		1
	5 mm	count	4	5				1	
	6 mm	count	7	2			2	1	1
	7 mm	count		2		2		1	
	8 mm	count		1	1	1		2	2
	total	count		17	13	1	3	3	5
Distance from outside	max	mm	24	21	24	24	20	22	22
Sapwood boundary		mm	28	24	30	28	25	28	25

\* Sample A was partly missing. Therefore the minimum diameter and the calculations are missing for this sample.

## 4 Discussion

In all seven samples attack by shipworm is apparent. Given the presence of shipworm in the harbour of Herkingen and the placement of the assessed part of the pole, this coincides with the findings of Barnacle (1990), who describes that the most likely point of severe attack for Teredinids (shipworm species) would be between the mud line and the low water level.

From Table 1 it can be seen, that all shipworm galleries are well inside the sapwood part of the pole. This is consistent with the findings in an earlier investigation (Creemers & Klaassen, 2004).

In that project a piece of *Eucalyptus cloeziana* wood was examined, that had been exposed for one year to shipworm in the same area. The following conclusions were drawn:

- based on wood anatomical features the wood really was *Eucalyptus cloeziana*;
- only slight superficial attack by shipworm was present, restricted to the sapwood;
- silica grains were present very regularly in the ray parenchyma of the heartwood, with a maximum in the outer (youngest) heartwood; no grains were found in the sapwood.

Silica grains can give wood resistance against shipworm, in that they dull its boring parts, making it impossible for the animal to further penetrate into the wood. The absence of such grains in the sapwood makes it the only part to be susceptible to shipworm attack, which coincides with the findings in the present research.

## 5 Conclusion

In all seven parts of the *Eucalyptus cloeziana* pole attack by shipworm is present, but although the pole has been exposed to shipworm for three years, the attack is completely limited to the sapwood part of the samples. This coincides with earlier findings, that silica grains are present in the heartwood of this wood species. The presence of silica grains is one of the factors associated with natural resistance of wood against shipworm, e.g. the wood species *basralocus* (*Dicorynia guianensis*).

## Literature

Barnacle JE. 1990. Marine borers and marine wood protection – Some answers and some outstanding questions – A comment. IRG Document Nr. IRG/WP/4163. International Research Group on Wood Preservation, Stockholm, Sweden

Creemers JGM & RKWM Klaassen. 2004. Paalwormbestendigheid van *Eucalyptus cloeziana* (Resistance to shipworm of *Eucalyptus cloeziana*). SHR Report 3.629. SHR Timber Research, Wageningen, Netherlands

## Appendix 1 Photographs



Cloeziana mooring pole in harbour of Herkingen



The investigated pole, after being taken out

(both photographs furnished by commissioner)