

Performance of a noise barrier with different wood materials – results from a service trial after 20 years' exposure

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Introduction

In connection with the construction of the Arlanda line, a railway connection between Arlanda airport and Stockholm, an 11-km long noise barrier made of untreated larch was built along the track.

This construction provided an opportunity to implement a full scale test study comparing different outdoor exposed wood species and preservative treatments.

Thus, Royal Institute of Technology (KTH) and SP Technical Research Institute of Sweden contacted the Swedish National Rail Administration (Banverket; now Trafikverket) in order to investigate the possibilities to install an extra number of sections made of preservative-treated wood and other untreated wood species.

Following a positive response, nine test sections made of treated and untreated wood were built and installed in March 1996.



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Aim of the study

The over all aim of this study, that initially started as a KTH diploma work, was to find the most appropriate wood material for a specific construction, in this case a noise barrier, with respect to durability and by extension to find the most ecological and economic wood material.

This presentation will focus on the durability properties of the different materials used in the test sections. A study on leaching of wood preservatives into the soil near the barrier was reported in 2005.



Description of test sections

Each test section is approximately 4 meters long and 3.1 meters high. Water shedding features (wedge shaped strips) were incorporated to help keep moisture out of susceptible joints. The three boards nearest ground are called “waste boards”. They are more or less in direct contact with the ground.



Materials in test:

Section	Wood species	Chemical treatment	Active ingredients	Preservation class
A	Pine	CCA Type C	Cu, Cr, As	AB
B	Pine	Tanalith MCB	Cu, B, tebuconazole	AB
C	Pine	Wolmanit CX-S	Cu, B, HDO	AB
D	Pine	CCA Type C	Cu, Cr, As	AB
E**	Pine	CCA Type C	Cu, Cr, As	A
F	Pine	Scanimp KF*	Propiconazole	AB
G***	Pine	Untreated		-
H	Spruce	Untreated		-
I	Larch	Untreated		-
J	Pine	Royal treatment#	Cu, BAC	AB

*includes a 3-layer coating of alkyd-type paint

#The Royal treatment consists of a pressure treatment with Kemwood ACQ 1900 followed by a drying step in pigmented linseed oil.

** below ground portion inadvertently exchanged for untreated wood when barrier collapsed in 1998

*** below ground portion inadvertently exchanged for CCA class A treated wood when barrier collapsed in 1998

Inspections

- The test barriers have been inspected a number of times since 1996.
- The most recent inspection was carried out in June 2016.
- All inspections have been carried out visually. At the base, soil was removed and the wood mechanically probed with a knife.
- For obvious reasons, only the back side (facing away from the railway tracks) could be inspected.



Well-known profiles in Nordic wood preservation at study visit in September 2001.

Results after 8 and 20 years' exposure

Panel	Treatment	Location	Condition 8 yrs	Condition 20 yrs
A	CCA Class AB	Above Below	Sound Slight decay	Sound Severe decay/Failure
B	Tanalith MCB	Above Below	Sound Mod. decay	Spots only with slight decay Severe decay/Failure
C	Wolmanit CX-S	Above Below	Sound Sound	Sound Slight/moderate decay
D	CCA Class AB	Above Below	Sound Slight decay	Sound Slight decay
E*	CCA Class A	Above Below	Sound Severe decay	Sound Failure
F	Scanimp KF	Above Below	Sound Sound	Spots only with slight decay Severe decay
G**	Untreated pine	Above Below	Sound Sound	Spots only with slight decay Slight decay
H	Untreated spruce	Above Below	Sound Severe decay	Spots only with slight decay Failure
I	Untreated larch	Above Below	Sound Severe decay	Spots only with slight decay Failure
J	Royal treatment	Above Below	Sound Slight decay	Spots only with slight decay Failure

Assessment of visual inspection



A: CCA Class AB



B: Tanalith MCB



C: Wolmanit CX-S



D: CCA Class AB

Assessment of visual inspection



E: CCA Class A



F: Scanimp KF



G: Scots pine



H: Norway spruce

Assessment of visual inspection



I: European larch



J: Royal treatment



March 1996



June 2016

Assessment of visual inspection



Example: Spot of slight decay



Example: Failure

Compliance with WoodExter results on service life prediction

Question:

Will the noise barrier **for the above ground** part last 30 years without onset of decay? Based on spruce, the material with the lowest durability ranking.

By using an [Excel tool](#) developed within the framework of the WoodExter project, we came to the conclusion:

YES!

Not exactly true!



Summary and conclusions

Based on the results from this study one can conclude:

- All sections (above ground) inspected were in good condition, also the sections of untreated wood for which evidence of decay was observed only in smaller spots, mostly in the triangular wedges.
- Sections of preservative-treated wood had in general performed somewhat better, but two sections had minor spots of decay. None of the preservatives are available on the market today.
- All untreated and treated sections, except for the CCA class A treated, had advanced decay in the board in ground contact. Treated sections with decay consisted, as far as could be observed, of heartwood with insignificant penetration. Already after 8 years all untreated “waste boards” were severely decayed whereas most AB class treated boards showed slight to moderate decay. Another evidence that class AB shall not be used in ground!



Summary and conclusions, cont'd

- The outcome of the WoodExter calculation was that no decay would appear (above ground) within the first 30 years' exposure. Not exactly true, but on the other hand it will be difficult to expect decay will cause any serious damage to the test sections of the noise barrier the next couple of years.
- No other sections of the 11 km noise barrier have been inspected and nothing can therefore be concluded concerning the over all performance of the larch. Other exposure situations, e.g. where vegetation grows close to the barrier, means a higher risk and probability for decay compared to the exposure conditions for the test sections.
- All sections were heavily subject to graffiti and it was not easy to evaluate any colour changes. However, the CCA-treated and Royal-treated seem to have kept their original colours best. The larch has become dark black and its colour is far from the pleasant original light reddish colour.





Thank you for your attention!



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