



OVERVIEW OF SOME NON- DESTRUCTIVE METHODS FOR IN SITU ASSESSMENT OF STRUCTURAL TIMBER

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The aim of this work

To investigate the possibilities of using ultrasound, Pilodyn and resistograph measurements to investigate the relationships to the physical-mechanical properties of timber.





Methodology

Non-destructive methods applied:

- Ultrasound velocity (TICO Ultrasound Instrument)
- Resistance drilling (Sibtech DmP)
- Penetration of a pin (Pilodyn)
- Visual grading into strength classes

Destructive methods applied:

- Bending and compression tests
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Methodology

- 37 logs and beams dated from buildings with various uses were gathered.
- Dimensions of specimen 50x50x1005...1100 mm
 - Ultrasound velocity, resistance drilling, Pilodyn, bending tests
- Dimensions of specimen 50x50x75 mm
 - Resistance drilling, compression tests

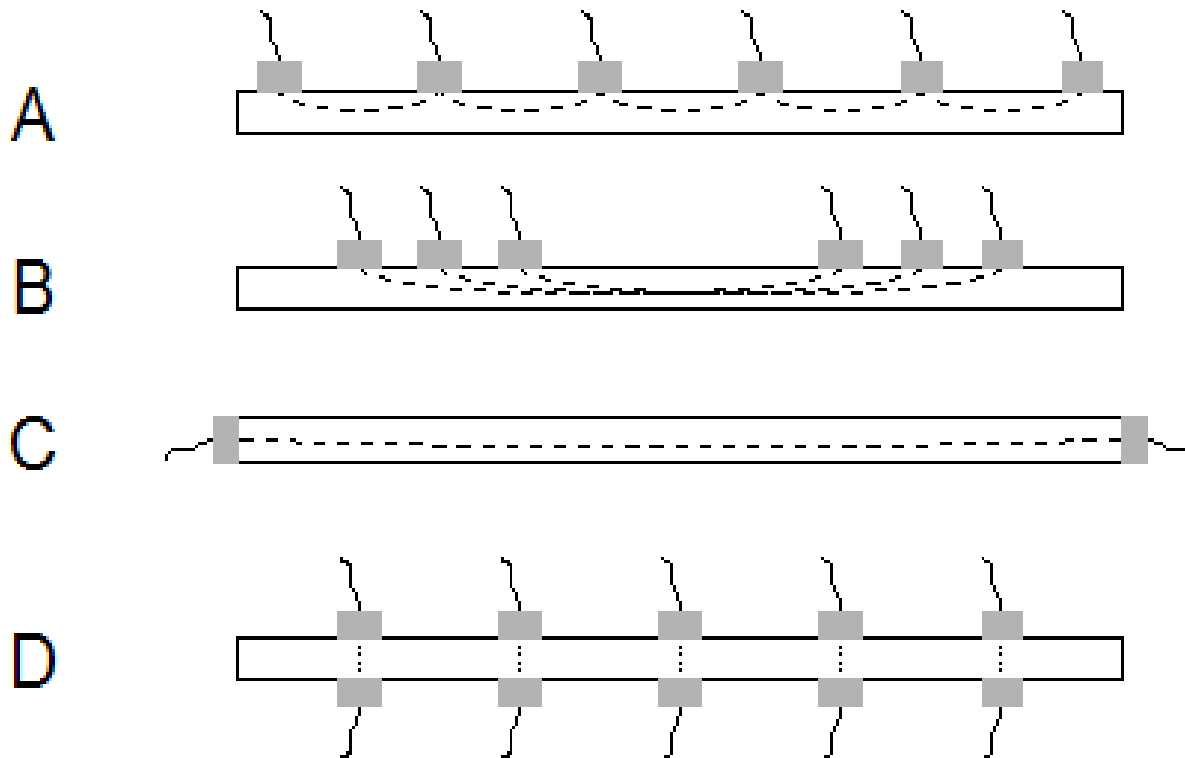
Methodology

Resistance drilling



Methodology

Ultrasound measurements



Methodology

Ultrasound measurements

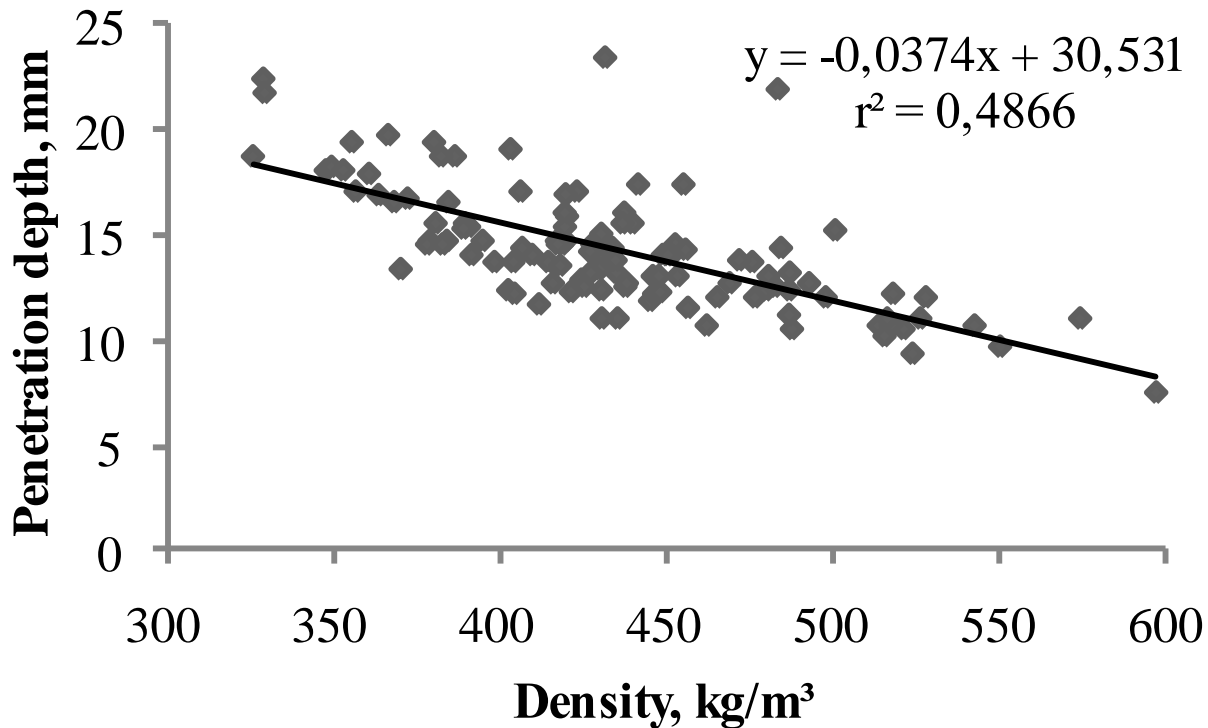
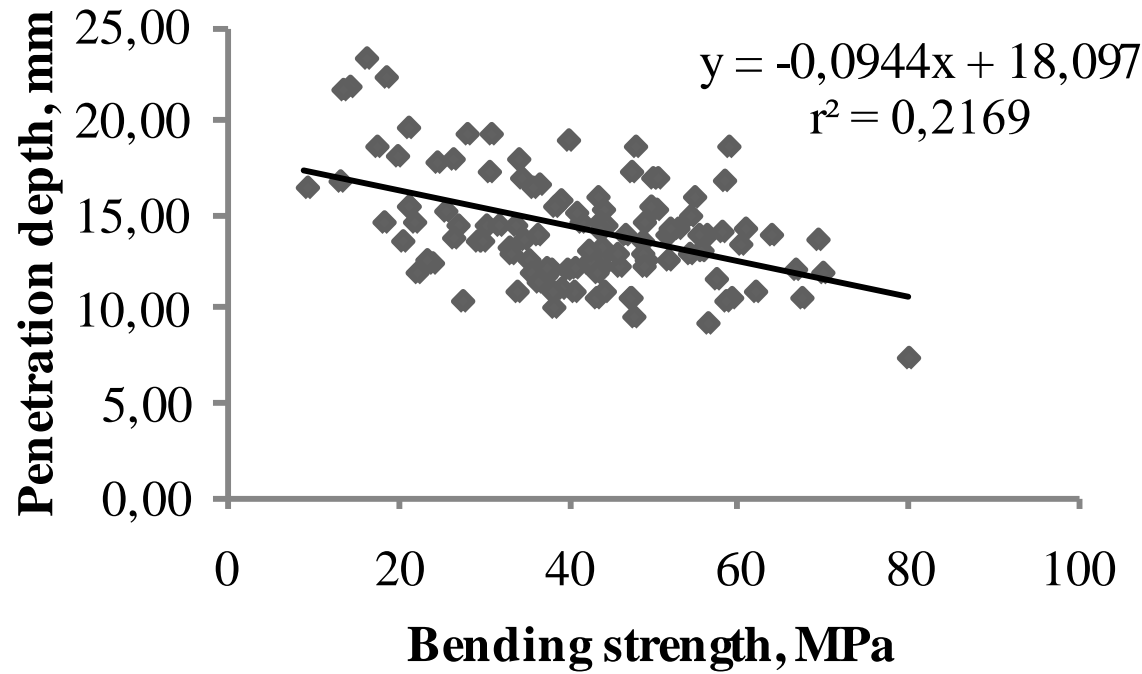


Characteristics	A, m/s	B, m/s	C, m/s	D, m/s	Max. force, N	Max. bending strength, MPa	MOE, MPa	MC, %	Density, kg/m ³
A, m/s	1								
B, m/s	0.63	1							
C, m/s	0.15	0.27	1						
D, m/s	0.32	0.05	-0.12	1					
Max. force, N	0.09	0.24	0.42	-0.29	1				
Max. bending strength, MPa	0.12	0.25	0.42	-0.25	1.00	1			
Modulus of elasticity, MPa	0.11	0.31	0.61	-0.38	0.72	0.72	1		
MC, %	-0.23	-0.04	0.09	-0.78	0.35	0.31	0.30	1	
Density, kg/m ³	-0.09	0.07	0.40	-0.31	0.50	0.51	0.80	0.16	1

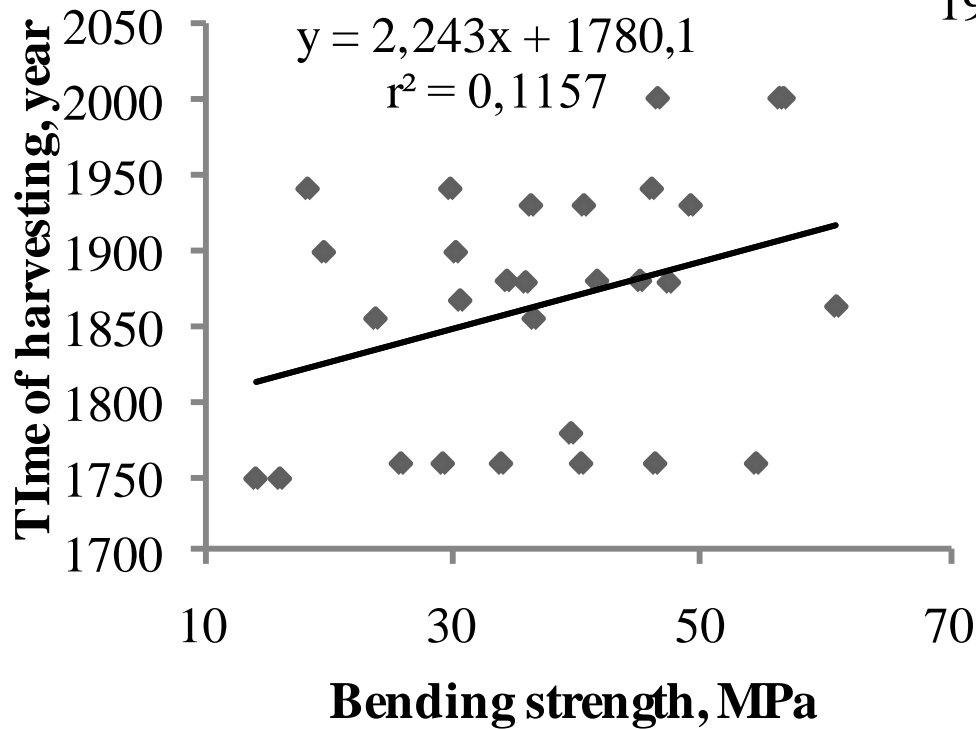
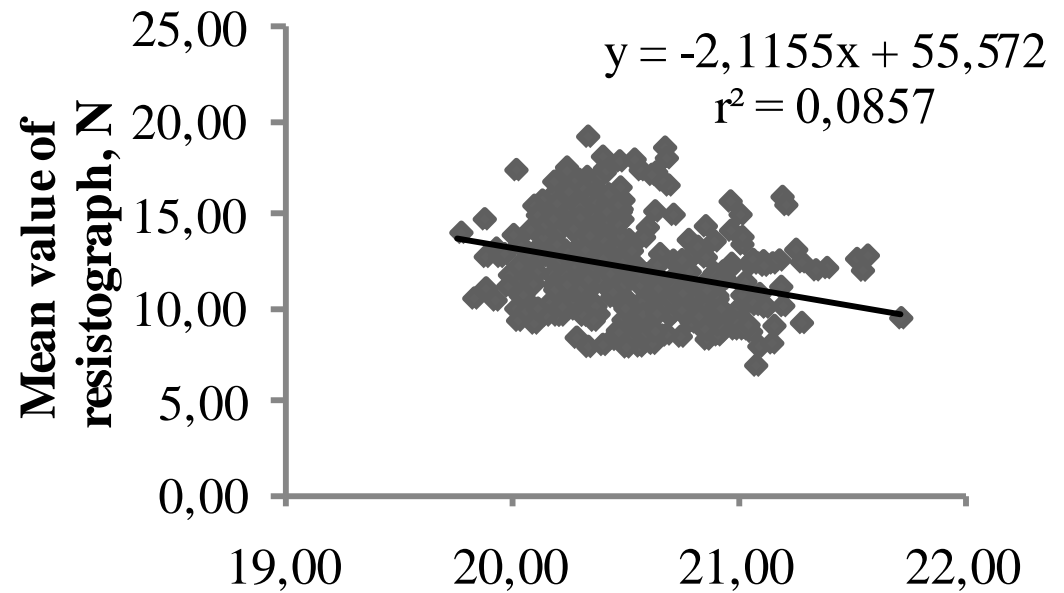
Results of regression analysis of resistograph and density

Groups of specimens	Coefficient of correlation r	Coefficient of determination r^2	p-value	The number of specimens
All specimens	0,665	0,442	<0,001	124
Specimens in strength class of C24	0,568	0,322	<0,001	46
Specimens with knots of <250mm ²	0,805	0,649	<0,001	18
Specimens with knots of <1/4 and knot clusters of <1/3	0,614	0,378	<0,001	77
Specimens without cracks and fungal damage	0,733	0,537	<0,001	61
Specimens with fungal and beetle damage	0,850	0,722	<0,001	28

Results



Results





Conclusions

- The best arguments in prediction of physical-mechanical properties with ultrasound were longitudinal (C) and the indirect measurement with a distance of 600 mm (B).
- The possibilities of using resistance drilling and needle penetration in prediction of density of wooden members are remarkable.
- The resistance of wood does not change significantly while loaded with longitudinal forces.



Thank You for Your attention



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