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Contribution of Site Orientation to the Seasonal Fluctuations of Wood Moisture Content in Wooden Windows

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COST FP1303 Meeting

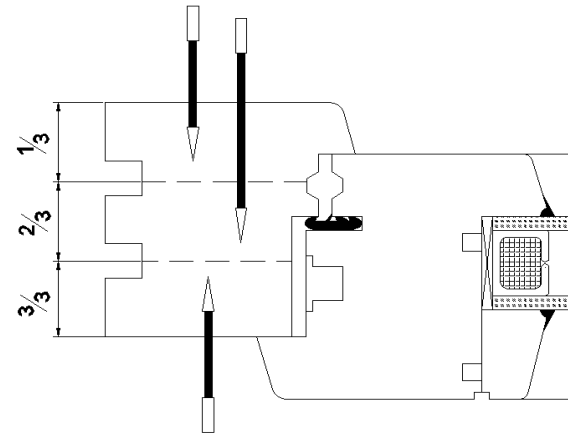
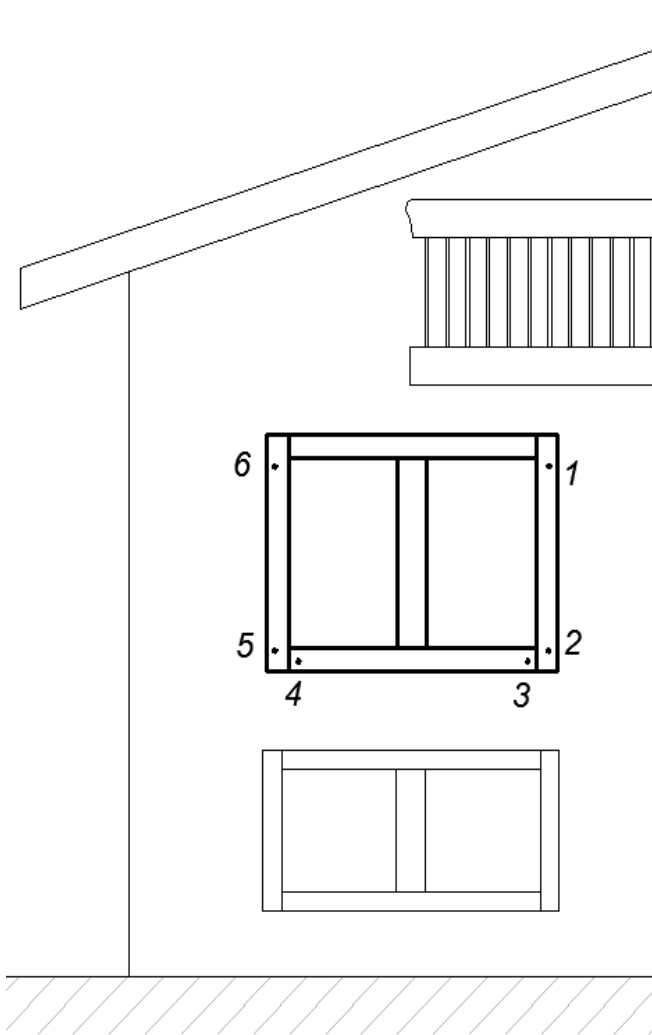
Design, Application and Aesthetics of biobased building materials

Sofia, 28 February – 1 March 2017

Introduction

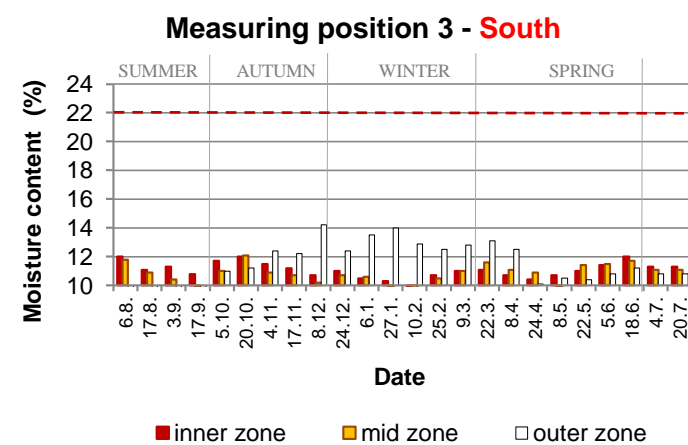
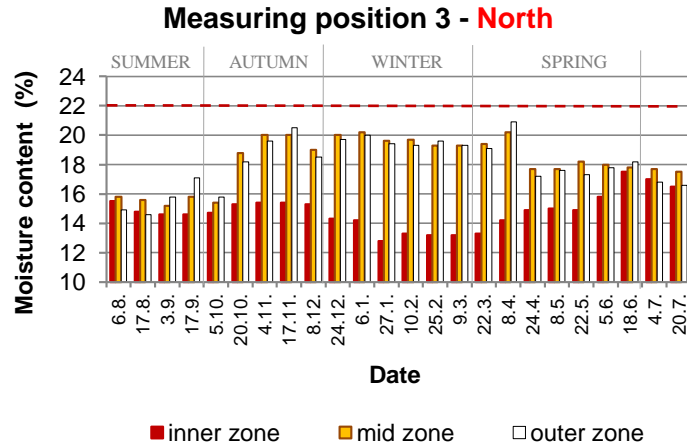
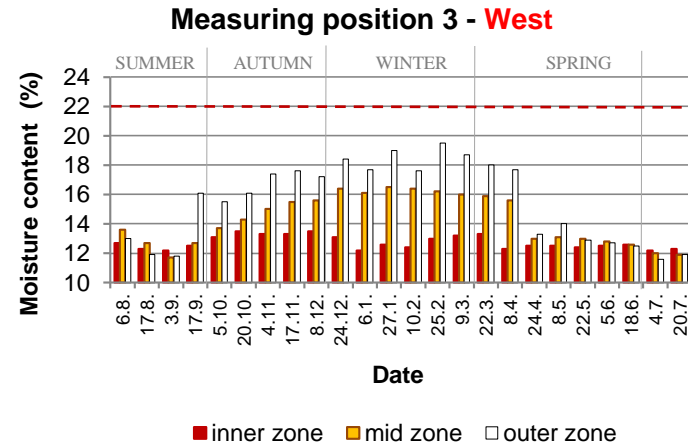
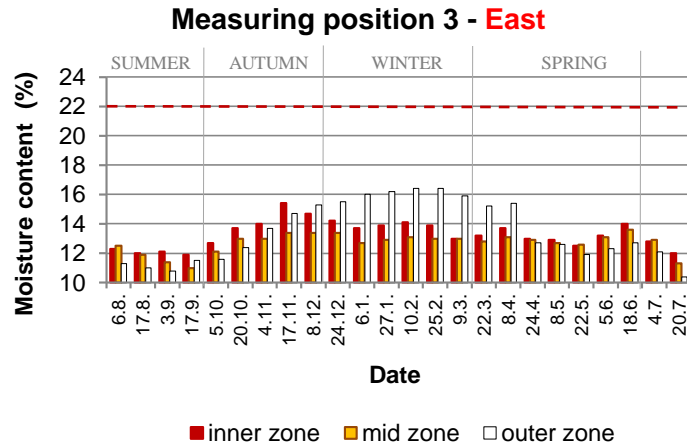
- *Wood windows durability*
 - material
 - protection and detailing
 - surface protection
 - installation
 - maintenance
- *Water upatke*
 - deformations
 - cracks
 - slow drying
 - degradation

Materials and methods



- 5 windows / 12 years after installation / maintained after 6 y / oriented E, W, N, S
- Electric resistance MC measurements every 2 weeks on 6 positions / 3 zones

Results: 4 windows at different expositions





Contribution of Site Orientation to the Seasonal Fluctuations of Wood Moisture Content in Wooden Windows

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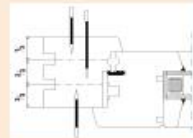


Thank you

INTRODUCTION

Durability of wood windows is especially important issue in times when energy efficiency, natural resources management and carbon cycle of products have great value. It greatly depends on several important factors: material selection, physical protection and detailing, surface protection, installation and regular maintenance. Moisture content and its distribution over the cross section of window frames directly influences dimensional (in)stability, particularly bowing and distortion. Therefore, the scope of this work was to monitor the distribution of moisture content of wood windows during one year period in order to get detailed insight into the influence of site orientation to the risk of degradation of wood.

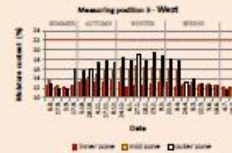
EXPERIMENTAL



Four different windows of the family house in continental Croatia were taken as a material for this research. Measurements were taken on several different windows placed on comparable positions of the family house facing east, west, north and south during one year period. All the windows were partially protected with the roof overhang, leaving their lower parts exposed to weathering. In order to get the insight into the moisture content distribution over the cross section of the frame, three pairs of electrodes with insulated shafts were used at each measuring position. MC was measured using electric resistance moisture meter, and exterior weather conditions data (air temperature, relative humidity, precipitation) were taken from the local meteorological station. Interior conditions (temperature, relative humidity) were also regularly monitored.

RESULTS

Outer zone of the frame indicates that, during one year period, the lowest maximum moisture content was detected on the window facing south (14.5%), east (16.5%), west (19.5%) and the highest maximum was measured on the window facing north (21%).



Windows facing north have MC over 15% already from early September until the first half of August, windows facing west have higher MC from mid September until late April, windows facing east reach 15% in December, and maintain such values until early April, whereas windows facing south never reach 15% MC at this position. At the same time, windows facing north attained MC close to 20% from late autumn until spring.



Minimum MC values also differ significantly, depending on the side of exposure. The lowest minimum MC was detected on the window facing south (9%), east (10.5%), west (11.5%) and the highest minimum was measured on the window facing north (15%). The minimum MC of wood materials in external windows as defined in EN 14220 should not be below 11%. Only windows fully exposed to south exceeded that limit during late summer period.



MC values in inner zone are in narrower range compared to the outer zone. The lowest and the most uniform MC values are measured in south position (10 - 12%), and the highest and widest MC range was detected in north (13 - 17%). Distribution of MC between the outer, mid and inner zone also depends on the exposure site.

CONCLUSIONS

Provided that windows are installed and maintained properly, east, west and south exposition will always attain significantly lower moisture content compared to north side. This is mostly due to absence of direct sun in the north exposition which would facilitate the reduction of wood moisture content to the acceptable range.

Conclusions

- east, west and south exposition will always attain significantly lower moisture content compared to north side
- Absence of wider roof overhangs directly influence seasonal fluctuations MC
- Gradient over the cross-section is low in summer (up to 2 %), increased in winter (up to 8 %)