Acoustic behaviour of CLT slabs

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ABSTRACT

Among the different types of wooden slabs, the CLT one is a solution increasingly used worldwide for both new buildings and restoration, mainly due to its structural, thermal and seismic resistance, and also for its low energy and environmental impact. In this paper the results of the laboratory acoustic characterization of CLT slabs are presented with the application of different possible performance enhancement techniques, according to the ISO 10140 series standards.This specific type of construction element has thicknesses comparable to solid concrete slabs, but it is characterized by modest acoustic performance, mainly due to the low structural mass that distinguishes it. However, significant increases in performance can be achieved both for level of impact and airborne sound insulation with adequate intervention techniques. In this paper the results of the acoustic characterization in laboratory of CLT slabs are presented with the application of different possible techniques of performance increase, according to the standards of the ISO 10140 series.

1 INTRODUCTION

Starting from the bare floor in CLT of 140 mm a total of 8 configurations were analyzed. Various top and bottom stratigraphy have been used with a floating floor and a false ceiling solutions. The CLT base slab was placed in the perimeter on a 20 mm thick rubber panel. Stratigraphy are shown in table 1.

Table 1 – Configuration of the analyzed wooden floors

Configuration	Assembly scheme
A	CLT slab with a thickness of 140 mm
B	Configuration A with the addition of lightweight concrete 60 mm, acoustic insulation rolls sp. 8 mm and floating screed sp. 50 mm
C	Configuration B with the addition of a false ceiling with a 27 mm metal structure and a gypsum fiber board sp. 12.5 mm
D	Configuration A with the addition of sand sp. 60mm, acoustic insulation panels sp. 20 mm, gypsum fiber board sp. 25 mm
E	Replacement of the acoustic insulation panels sp. 20 mm used in configuration D with an acoustic insulation rolls sp. 8 mm
F	Configuration E with the addition of glass wool in the false ceiling
G	Configuration F with the insertion of a second acoustic insulation rolls sp. 8 mm between the CLT slab and the sand
H	Alternative to solution D, with acoustic insulation panels sp. 30 mm and sand-cement screed sp. 50 mm

2 LABORATORY MEASUREMENT OF IMPACT AND AIRBORNE SOUND INSULATION

The measurements were made at the ECAMRICERT S.r.l. laboratory. All the tests have been performed accordingly with the series standards ISO 10140 in order to evaluate sound reduction indices in conformity with the ISO 717-1 and ISO 717-2.

3 ANALYSIS OF THE RESULTS

The following graphs show the frequency trends of the impact sound attenuation with a comparisons between similar solutions, in which the curve of base slab is re-proposed against the floor compositions. The graph shown in figure 1 shows the behavior of the three solutions with traditional italian floating floor system also with adding a false ceiling (configurations B, C, H).

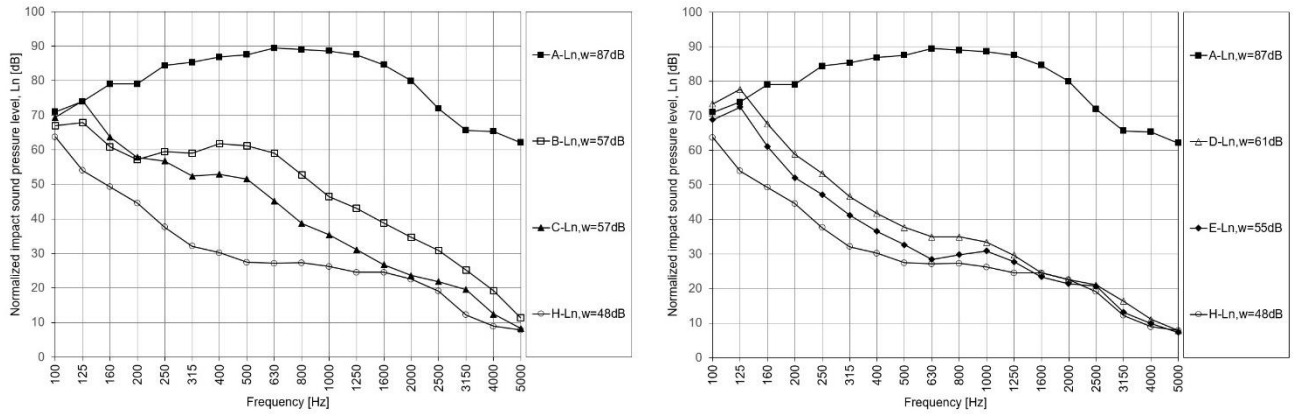

Figure 1: Normalized impact sound pressure level for A,B,C,H and A,D,E,H configurations

In the previous figure is also presented the comparison of the behavior of impact sound insulation between dry screeds, granular underlay and empty false ceiling (configurations D, E, H).
Regarding the airborne sound insulation, the research was focused on understanding of Transmission Loss value tipical final floor compositions, three conditions with greater variability of acoustic insulation panels and false ceilings, with air cavity or filled with glass wool, were analysed.

4 CONCLUSIONS

In this work the study on the analysis of the acoustic behavior of CLT slabs carried out was presented. The output data was partly used for the construction of a preliminary model for the evaluation of the acoustic performance of engineering timber floors, starting from the performance of acoustic insulation panels on concrete reference slabs.The analysis shows that it is possible to achieve significant improvements in the acoustic performance indexes of such floors, in which the performance of the acoustic insolation mat maintains a key role. The configurations presented are made up of "wet" solutions, which therefore involve the use of traditional italian screeds and concretes, and "dry" solutions, with sand anche gypsum board. However, the typical trend of CLT floors , even of the isolated ones, remains to radiate in a marked way in the frequencies between 100 Hz and 160 Hz. Only the final configuration (H) is able to reduce these frequencies to fall below 50 dB compared to the 'weighted normalized impact sound pressure level'.The overall laboratory study has led to good acoustic results for application to the current construction technologies of CLT buildings, which have already been confirmed by in situ measures.

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