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Author: N. Granzotto F. Bettarello A. Ferluga L. Marsich C. Schmid P. Fausti M. Caniato



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## Energy and acoustic performances of windows and their correlation

N. Granzotto<sup>1</sup>, F. Bettarello<sup>2</sup>, A. Ferluga<sup>3</sup>, L. Marsich<sup>3</sup>, C. Schmid<sup>3</sup>, P. Fausti<sup>4</sup>, M. Caniato<sup>3,4\*</sup>

<sup>1</sup> Industrial Engineering Department, University of Padova, Via Gradenigo, 6/a - 35131 Padova, Italy

<sup>2</sup> AcusticaMente Designers Team, via Garibaldi 13/b, 31015 Conegliano (TV), Italy

<sup>3</sup> Engineering and Architecture Department, University of Trieste, via Valerio 6/a, 34127 Trieste, Italy

<sup>4</sup> Department of Engineering, University of Ferrara, via Saragat 1, 44122 Ferrara, Italy

\* corresponding author: mcaniato@units.it

### Abstract

Buildings are designed and constructed to use their external envelope to protect people during living, working and sleeping. Nevertheless, although there are several studies on opaque wall insulation, which could reach very good insulating performances, limited research has focused in detail on sound and thermal insulation correlation on transparent elements like windows.

This work analyses these aspects and investigates the effects of every single part of windows like frame, glazing thickness, overall transparent thickness, PVB presence, and so on. The relation between sound and thermal insulation is investigated too. Results show how single components won't influence global thermal insulation whereas acoustic performances are affected by unique constituent. No global relation between thermal and acoustic insulation values was established and finally a new prediction equation for single number sound insulation is proposed.

*Keywords: windows; sound insulation; thermal insulation; sound insulation prediction*

### 1 Introduction

High thermal and acoustic insulation as well as air tightness of buildings are needed in order to ensure good living conditions inside dwellings. Many studies have been carried out during recent years, because the performances of the envelope components of buildings are the basis of energy saving [1]-[5], indoor comfort [6] - [8] and possible building solutions [9].

Nevertheless, further in-depth studies are necessary because these vertical or horizontal elements are not homogenous and composed of many other large or small parts like opaque walls, windows and doors, air inlet systems, traditional or particular shapes and projections.

The performances of opaque vertical and horizontal parts are simple to analyse. The addition of thermal insulation or resilient layers [10], air and water insulations sheaths, aerogel-based finishing [11], [12] or paint [13] is used to improve or restore buildings technologies.

Thermal insulation of walls, floors and roofs has reached its best performances since the thermal insulation layers have become very thick [14]. However an increase in the thickness over 28-30 cm

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