

Chapter 15

The Compatibility of Thermal and Acoustic Insulation in the Façades External Renovation in Residential Buildings

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ABSTRACT

In recent years, a significant economic effort has been made in the refurbishment and energy improvement of buildings, which should be used to improve their acoustics performance. It is necessary to avoid energy improvement from deteriorating the pre-existing acoustic performance prior to the refurbishment. In this work, an analysis of the acoustic insulation of the façades of enclosures in residential buildings is carried out in which the thermal insulation of the blind part of the façade is improved on the outside without mullions and battens. The most important factor for the improvement of the airborne sound insulation of the blind side of the façade is that the dynamic stiffness of the external thermal cladding is as low as possible, and that the openings are solved with a double asymmetrical glazing and its air cavity is as thick as possible. The obtained results may be useful for all professionals involved in the construction process of building renovation: architects, engineers, developers, manufacturers, etc.

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INTRODUCTION

In recent decades there has been a drive in Europe towards increasing the energy efficiency of buildings and this trend is likely to continue in the future due to increased environmental awareness and the possibility of changes in legislation (Council Directive 93/76/EEC & Directive 2002/91/EC). The need to thermally insulate a building is justified for the following main reasons: to save energy by reducing thermal losses in the building envelope; to improve thermal comfort by reducing the temperature difference between the inside surfaces of the building and the indoor environment; to eliminate condensation phenomena; and to improve the environment by reducing the emission of pollutants associated with energy generation (European Union. Council Regulation 2022/1369). In southern European countries, there are millions of dwellings built before the application of building regulations with higher demands on their habitability conditions, as is the case of Spain (Daumal, 2018), where most residential buildings were built before the application of the current building regulations (Código Técnico de la Edificación, 2006). Nowadays, the growth of the urban population, the increase in energy demand together with the technological development promoted over the last twenty years have led to a study and rethinking of the construction systems used. As a result, new regulatory frameworks have been established, setting new comfort and energy demand targets. In addition to the environmental impact, the thermal rehabilitation of existing buildings also has significant economic and social implications. Firstly, energy-inefficient buildings entail higher operating costs for their owners and occupants due to increased energy consumption. According to the World Bank report “Accelerating Energy Efficiency in Buildings,” improving energy efficiency in buildings could generate annual savings of up to \$280 billion for consumers worldwide by 2030.

The façade of a building is where the greatest technical and artistic efforts have been concentrated in construction, being the architectural enclosure par excellence. From a design point of view, the façade presents the design aspect, its adaptation to the surroundings and its expressiveness. The materials chosen, the relationship between the blind parts and the openings and the constructive relationship with the structure define the external appearance of the building. This must guarantee thermal, acoustic, lighting, airtightness, fire resistance and stability protection to achieve optimal habitability conditions for its use.

From the perspective of the airborne sound insulation of the enclosure façades, the transition from traditional façades to ventilated façades, when properly calculated and carried out, should not significantly affect the overall airborne sound insulation. This is because in general, the enclosure of the façade opening is the construction part that has the lowest acoustic reduction index, and consequently has the greatest influence on the airborne sound insulation of the enclosure façade.

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