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Developing of Ecological Internal Insulation Composite Boards for Innovative Retrofitting of Heritage Buildings

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Abstract : WHISCERS™ (Whole House In-Situ Carbon and Energy Reduction Solution) is an innovative process for Internal Wall Insulation (IWI) for energy-efficient retrofitting of heritage building, which uses laser measuring to determine the dimensions of a room, off-site insulation board cutting and rapid installation to complete the process. As part of a multinational investigation consortium the Austrian part adapted the WHISCERS system to local conditions of Vienna where most historical buildings have valuable stucco facades, precluding the application of an external insulation. The Austrian project contribution addresses the replacement of commonly used extruded polystyrene foam (XPS) with renewable materials such as wood and wood products to develop a more sustainable IWI system. As the timber industry is a major industry in Austria, a new innovative and more sustainable IWI solution could also open up new markets. The first approach of investigation was the Life Cycle Assessment (LCA) to define the performance of wood fibre board as insulation material in comparison to normally used XPS-boards. As one of the results the global-warming potential (GWP) of wood-fibre-board is 15 times less the equivalent to carbon dioxide while in the case of XPS it´s 72 times more. The hygrothermal simulation program WUFI was used to evaluate and simulate heat and moisture transport in multi-layer building components of the developed IWI solution. The results of the simulations prove in examined boundary conditions of selected representative brickwork constructions to be functional and usable without risk regarding vapour diffusion and liquid transport in proposed IWI. In a further stage three different solutions were developed and tested (1 - glued/mortared, 2 - with soft board, connected to wall with gypsum board as top layer, 3 - with soft board and clay board as top layer). All three solutions presents a flexible insulation layer out of wood fibre towards the existing wall, thus compensating irregularities of the wall surface. From first considerations at the beginning of the development phase, three different systems had been developed and optimized according to assembly technology and tested as small specimen in real object conditions. The built prototypes are monitored to detect performance and building physics problems and to validate the results of the computer simulation model. This paper illustrates the development and application of the Internal Wall Insulation system.

Keywords : internal insulation, wood fibre, hygrothermal simulations, monitoring, clay, condensate
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