Palazzo San Giuliano

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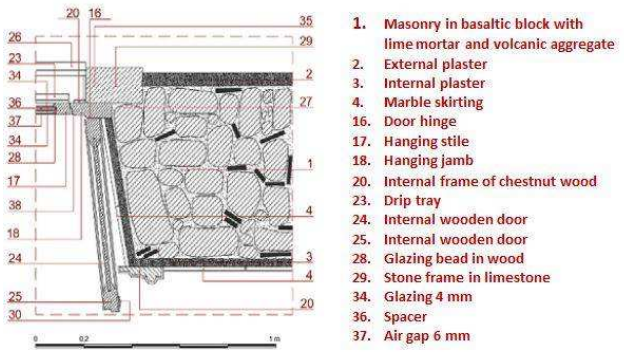
Nanoporous Aerogel insulating blanket

Walls

What is the solution?

The solution is a flexible 10 mm nanoporous Aerogel blanket in the “Palazzo San Guiliano". The blanket is applied at the internal side of an existing wall made of blocks of local lava stones mixed with lime mortar, situated in a historic building from the 1700s. The installation is finished by a 12.5 mm plasterboard sheet.

Cross section of the wall build-up, available pictures of the solution:



Cross section of the Wall, copyrgiht: Unict

Why does the solution work in terms of compatibility with conservation, moisture safety and energy improvement?

The solution is compatible with conservation issues, since the facades are not altered. Moreover, the small thickness of the boards (22.5 mm overall) does not significantly modify indoor volumes and net surfaces. Moisture safety is slightly worsened. However, according to numerical calculations, in warm climates like in Southern Italy the wall still does not experience moisture accumulation. The U-value is reduced by 33%, while the overall heat losses through the building envelope can be reduced by 21%, also thanks to the correction of the thermal bridges.

Description of the context:

The building is situated in the historical centre of Catania (Latitude 37°30'4"68 N, Longitude 15°4'27"12 E; 833 Heating Degree Days; Climatic zone B). The historical center of Catania is characterized by wide roads in the North / South and East / West direction interrupted by squares. The buildings that exist on these axes occupy entire blocks. Moving away from the roads, the size of the urban fabric becomes smaller and reflect the structure already existing in Catania before the earthquake of 1693, which destroyed the city. The construction of the “Palazzo San Giuliano” began in 1695 and finished in 1861. It arose as an aristocratic palace and now is used as an office location.

Pros and cons of the solution:

Pros: compatibility with the architectural and historical value of the facades, small insulation thickness thanks to the very low thermal conductivity of the nanoporous Aerogel insulating blanket, energy savings, reversible and dry solution, easy application. Cons: potential indoor summer overheating, high costs of the insulating boards, higher risk of moisture accumulation in the wall.

Type of data available (level of information, simulation):

The U–value of the existing wall has been measured through a heat-flux meter, based on the Standard EN ISO 6946 (U = 0,67 W/(m2 K)). Starting from this measured U-value, and adding the thermal resistance of both the 10 mm Aerogel blanket (λ = 0,014 W/(m K) and the plasterboard (12.5 mm, λ = 0.2 W/(m K), the expected final U-value of the insulated wall is U = 0,45 W/(m2 K). Then, numerical 2D steady-state simulations, performed with Therm 7.7, allowed quantifying the effect of thermal bridges before and after the proposed solution. According to the numerical simulations, the most significant thermal bridges are those at the intersection between the outer walls and the windows,

and those at the intersection with the outer walls and the balconies. Apart from the reduction of the U-value, the proposed solution reduces by 37.5% the heat losses through the thermal bridges.

Additional Information:

It is not easy to know exactly the composition of a thick wall built over three centuries ago. Based on surveys on other similar buildings from the same period and the knowledge of traditional techniques of the Etna territory, it is possible to guess the following approximate distribution: 67 % basaltic blocks, 16 % small mixed basaltic stones, 17 % lime mortar and basaltic aggregate (so called azolo). However, due to the random arrangement of the different materials, the presence of numerous small air cavities is highly probable, which justifies the relatively low U-value resulting from the experimental measurements. This suggests that the U-value might significantly change for different walls in the same building according to the different constructive technology.