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Residential Building Facade Retrofit

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Abstract : The need to retrofit old buildings lies in the fact that buildings are responsible for the main energy use and CO_2 emission. Existing old structures are more dominant in their effect than new energy-efficient buildings. Nevertheless not every case of urban renewal that aims to replace old buildings with new neighbourhoods necessarily has a financial or sustainable justification. Façade design plays a vital role in the building's energy performance and the unit's comfort conditions. A retrofit façade residential methodology and feasibility applicative study has been carried out for the past four years, with two projects already fully renovated. The intention of this study is to serve as a case study for limited budget façade retrofit in Mediterranean climate urban areas. The two case study buildings are set in Israel. However, they are set in different local climatic conditions. One is in 'Sderot' in the south of the country, and one is in' Migdal Hahemek' in the north of the country. The building typology is similar. The budget of the projects is around $14,000 per unit and includes interventions at the buildings' envelope while tenants are living in. Extensive research and analysis of the existing conditions have been done. The building's components, materials and envelope sections were mapped, examined and compared to relevant updated standards. Solar radiation simulations for the buildings in their surroundings during winter and summer days were done. The energy rate of each unit, as well as the building as a whole, was calculated according to the Israeli Energy Code. The buildings' facades were documented with the use of a thermal camera during different hours of the day. This information was superimposed with data about the electricity use and the thermal comfort that was collected from the residential units. Later in the process, similar tools were further used in order to compare the effectiveness of different design options and to evaluate the chosen solutions. Both projects showed that the most problematic units were the ones below the roof and the ones on top of the elevated entrance floor (pilotis). Old buildings tend to have poor insulation on those two horizontal surfaces which require treatment. Different radiation levels and wall sections in the two projects influenced the design strategies: In the southern project, there was an extreme difference in solar radiations levels between the main façade and the back elevation. Eventually, it was decided to invest in insulating the main south-west façade and the side façades, leaving the back north-east façade almost untouched. Lower levels of radiation in the northern project led to a different tactic: a combination of basic insulation on all façades, together with intense treatment on areas with problematic thermal behavior. While poor execution of construction details and bad installation of windows in the northern project required replacing them all, in the southern project it was found that it is more essential to shade the windows than replace them. Although the buildings and the construction typology was chosen for this study are similar, the research shows that there are large differences due to the location in different climatic zones and variation in local conditions. Therefore, in order to reach a systematic and cost-effective method of work, a more extensive catalogue database is needed. Such a catalogue will enable public housing companies in the Mediterranean climate to promote massive projects of renovating existing old buildings, drawing on minimal analysis and planning processes.

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