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Revitalisation of external walls in listed buildings in the context of fire protection

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Abstract

The paper presents principles to select thermal insulation and contact insulating system in the context of fire safety requirements. It deals with the system solution of thermal insulation in original façades without the possibility of external interventions and pays attention to the impact of ETICS solutions on elimination of surface condensation on thermal bridges within allowable hygienic limits in dependence on the operation of protected spaces. It introduces case studies of ETICS solutions used in listed buildings, concerning thermal protection in the context of fire safety requirements and operating schedule of a building.

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Keywords: thermal protection; historic buildings; hygienic discomfort; thermal insulation system; fire protection

1. Introduction

The original thermal protection of historic buildings is, from the hygiene, static, and energy viewpoint, pretty inadequate for current conditions. If such buildings are subjected to renovation, their thermal protection is designed in such a way that it would eliminate construction defects and hygienic discomfort in protected spaces.

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In the early stages of building destruction, minor defects in roof drainage system are ignored. Defects of gutters cause rainwater attacks masonry near wall plates. Defects in drainpipes cause water penetration to peripheral walls and rising damp. Building moisture significantly worsens thermo-insulating properties of masonry, which brings about ideal conditions for moisture to be transferred on a wall surface and subsequently evaporated into the air in protected spaces. [9]

Surface condensation and mould growing occurs in joints of vertical and horizontal structures due to a combination of higher air humidity and poor thermal insulation of original structures. Indoor relative humidity rises due to increased surface evaporation. The air is usually saturated with fungal spores and fungi that parasitize on damp wall surfaces on the critical thermal bridges. The consequence of such a situation is considerable temperature and hygienic discomfort in the indoor environment and microclimate which puts occupants´ health at risk. From the hygienic point of view, such spaces are unsuitable for permanent stay of people.

In renovation of historic buildings, like in newer buildings that have similar thermo-insulating deficiencies, it would be ideal to increase their thermal protection up to the level of primary energy consumption which is limited for low-energy buildings. It would strongly reduce operating costs associated with heating, as well as improve health and thermal comfort of the occupants [1]. However, given extent of thermal protection in the renovation of most historic buildings is not possible because of the monument preservation.

2. Legislative requirements for thermal protection of listed buildings in Slovakia

Priorities affecting the renovation of historic buildings depend on all-society requirements to preserve their originality, appearance, and material solutions. Legislation valid for monument preservation in Slovakia is Act No. 49/2002 on monument protection which is follow-up to the implementary regulations. Details to carry out monument surveys are specified in Regulation 253/2010. It determines requirements for extent and techniques used in renovation of existing structures. The survey results are one of the documents needed for the design and method of their thermal protection. The historic buildings, protected because of their architectural and historical significance, wherein to comply with the requirements for the energy performance would unacceptably alter their character or appearance, are not subjects of mandatory certification within § 2 article 2a of Act No. 555/2005 and subsequently 300/2012, amending and supplementing Act No. 555/2005 Coll. on energy performance of buildings and amendments to certain laws, which amends and supplements Act No. 50/1976 Coll. on urban planning and building code. Since historic buildings are not subject of mandatory certification according to the section of Act No. 555/2005 including its amendments, the extent of their thermal protection is dealt with within allowable limits of monument preservation to optimize thermal and hygienic stability of protected spaces.

3. Principle to design thermal protection of a building envelope in listed buildings

Depending on the level of monument protection of the original historic façade in renovated buildings, conclusions of monument preservation are crucial for choosing the type and position of insulating system. If the external façade intervention is not possible, thermal protection is designed as internal. The effectiveness of thermal protection is limited as a result of its breakage on thermal bridges in joints of walls and horizontal structures. It is primarily designed in order to optimize the hygienic quality of the indoor environment [2].

The requirements valid are those of the Health Ministry of the Slovak Republic specified in Act No. 259/2008 on detailed requirements for indoor climate environment and minimal requirements for low-standard apartments and accommodation facilities following the criteria of STN 73 0540 : 2012 and its changes in 2016.

3.1. Criteria to design thermal insulation

When designing thermal protection of historic buildings, the choice of thermal insulation depends on its position in relation to the protected spaces. In the case of listed buildings´ façades without the possibility of external interventions, internal thermal insulation is chosen to meet the limitations of monument preservation. Criteria to choose adequate insulation are very important.