EXTENSIVE ROOF GREENERY QUESTIONED

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Problem statement. The green roofs are mostly seen as architectural components having a positive influence on quality of life, particularly in urban settlement structures. This positive effect is manifested at the macro level through improving air quality and also reducing effect called urban heat islands and at the very buildings by raising their interior comfort, especially floors directly under the roof. The precondition for effectiveness at macro level is particularly healthy green converting carbon dioxide to oxygen, casting a shadow on the flat roof and moisturizing surroundings in the summer. In the winter, it has particularly aesthetic and psychological importance. The care of greenery is of paramount importance, while in larger areas it may also be quite costly affair. The operation of green roofs may over time exceed possibilities of small investors, which is then reflected in a gradual decline of greenery and counterproductive change of the roof into a dusty surface with negative impacts in the environment (Fig. 1). A correct design of greenery reflecting the roof structure and location of the building is therefore very important.

Fig. 1. Failed extensive roof greenery

In terms of the quality of the internal environment the greenery itself is more or less non-significant factor, a more important role plays the substrate, which can contribute to the thermal protection of the internal environment in the summer and winter as well. In summer, it is especially its ability to accumulate solar radiation and thus prevent overheating of the under-roof space. In winter time period, the substrate is contributing to the improvement of thermal resistance of the roof structure, even though it has to be ignored within calculation of the roof's thermal resistance as it is not its integral part. From legal point of view, hence, an improved thermal protection of under-roof spaces is a secondary effect of the green roof and as such should not play a major role in the decision-making process during the green roof design (even though in case of wooden roofs it can be quite an important factor). More important is to consider

whether the cost of its construction and operation will return in the form of more attractive and healthier environment, but this is easier said than quantified.

Purpose of the study and main results. The essence of green roof is greenery and its positive health and aesthetic effects on humans. It can, however, only be achieved, if the greenery is truly functional. Under the climatic conditions of Central Europe with four approximately equal seasons, cold winters and relatively warm, and often dry, summers are the plants in artificial conditions, under which the green roof can be considered, subject to extreme temperature fluctuations. Even plants typical for the Central European area that thrive in this environment can be difficult to survive. In contrast to the plant roots in the normal ground, the temperature of which oscillates at one meter depth under the ground surface between 0° and approx. 16° of Celsius, i.e. in the range of approx. 16 Kelvin, the roots of greenery planted in roof's substrate are exposed to a much wider temperature range. Using an example of typical green roof with extensive greenery (substrate thickness between 6 and 12 cm [1]) the case study shows the course of temperatures in the substrate of green roof during the common winter and summer days and compares it with the temperature course at the same depth below the surface of the common ground.

The contribution introduces possible ways to address the above issue, starting with the selection of suitable plant species, through year-round care, for example by summer irrigation and winter protection, up to creation of a constant temperature of the substrate with heated / cooled ceilings under the roof layers. The last method is predominantly tested in overseas, in Central Europe would be likely to encounter administrative difficulties as this type of roofing does not contain thermal insulation and therefore would not reach the required level of thermal resistance without the use of a heating system. We refer to it for the sake of completeness of the topic (such roofs could be used above unheated spaces, e.g. garages). In order to demonstrate the performance differences among different roof compositions the results of dynamic simulation of compared roofs backed by some on-site measurements will be introduced in the accompanying presentation.

Conclusion. Even though extensive vegetated roofs are considered (and promoted) in Central Europe as maintenance- and irrigation-free they need both – a year round maintenance and regular irrigation during summer months. When creating details, special attention must be paid to fire safety, protection against the growth of roots, and the selection of suitable plants (not simply some kind of succulents). The design of green roofing is a complex matter, which requires highly professional attitude and strong cooperation between architect / planner on the one hand and garden designer on the other hand. Even though there is not too much standardization and legislation regarding the roof vegetation, the recommendations of specialized professional associations should be kept.

References

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