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ASSESSING THE LONG-TERM PERFORMANCE OF APPLIED EXTERNAL THERMAL INSULATION COMPOSITE SYSTEMS (ETICS)

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Literature

- [1] Krus, M., Rösler, D.: *Aufdoppelung von WDVS – Hygrothermische Berechnung der Einsatzgrenzen unterschiedlicher Systeme. [Application of an additional insulation layer on ETICS – Hygrothermal calculations determining the limits of application for different systems]. Bauphysik vol. 33, June 2011 (issue 3, pp. 142–149).*
- [2] Künzel, H.: *Funktionssicherheit und Lebensdauer wärmedämmender Maßnahmen. [Functional reliability and lifespan of thermal insulation measures]. VDI Bericht no. 356, 1980.*
- [3] Lengsfeld, K.: *Beurteilung der Langzeitbewährung von ausgeführten Wärmedämmverbundsystemen. [Assessing the long-term performance of applied ETICS]. Valley: Fraunhofer IBP, 2015. (IBP-Bericht HTB 06/2015).*

BACKGROUND

External thermal insulation composite systems (ETICS) have been in use since the early 1960s. In the beginning, these insulation systems were only applied using polystyrene hard-foam boards and synthetic resin plasters. Later on, mineral systems were also used. As early as in the 1970s, the Holzkirchen branch of the Fraunhofer Institute for Building Physics IBP was commissioned at several times to examine completed buildings to determine the reliability of these systems under practical conditions. Investigation results on the durability of ETIC systems were published in IBP reports 192, 316, 382, 438 and 461.

ASSESSMENT

The present IBP publication reports on the condition of external thermal insulation composite systems (ETICS), which had been evaluated at regular intervals since 1975, the last examination dating back to the autumn of 2014 – a detailed account of the examination results is given in [3]. Based on a selected number of larger buildings, information regarding the long-term performance of ETICS can be obtained, including specific information on the type of renovations that have become necessary in the meantime.

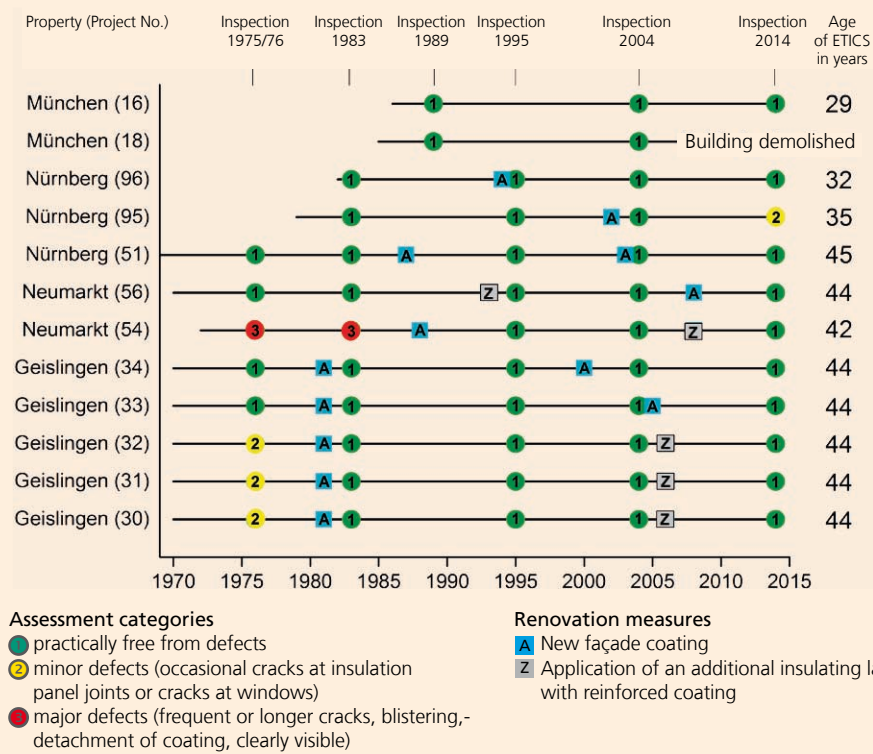
Just like in previous investigations, the condition of the examined façades was assessed according to three levels of quality. As merely visual flaws (caused by soiling or microbial infestation) are not classified as a technical defect, these are not included. The diagram on page 2 gives an overview of the examined properties and the time schedule regarding construction/installation, on-site inspection, and status assessment.

Thin layers of render and the use of soft insulating materials beneath the rigid render are often supposed to be possible causes for damage due to mechanical stress. However, no evidence for this theory could be found during repeated on-site inspections.

The age of the examined ETIC systems ranges from 29 to 45 years. Within the last ten years, five buildings did not undergo any renovation. Four buildings were renovated by the installation of an additional insulation layer on their ETICS, but for no other reason than for energy retrofit. Two buildings were repainted. Following the 2014 on-site inspection, the condition of the façades of ten out of eleven buildings can be classified in category 1 “practically free from defects”. Only one façade, which had been repainted, is locally affected by minor or major defects (category 2).



Diagram 1 Time schedule of application, on-site inspection and renovation of ETICS – including indication of the façade condition



CONCLUSIONS

The findings from repeated inspections of 12 residential buildings featuring different ETIC systems can be summarized as follows:

There are systems that did not receive any renovation coating during 14 up to 29 years, yet do not show any technical defects like cracks, blistering or larger areas of render detachment. A building in Munich (Fig. 1–3), which was not refurbished since the application of the mineral insulation system in the 1990s, can still be classified in category 1. However, significant grey discolorations due to soiling may occur (just like with conventionally rendered façades), and in most cases a certain extent of weathering of the paint coats can be determined. In addition, other typical phenomena may occur at ETIC systems: for instance, insulation fixings or individual panel joints can become apparent at the surface and at the building's

edge; also, increased susceptibility to microbial infestation may become evident.

As long as 21 years ago, the thermal insulation of one property was enhanced by adding another composite layer; another five properties had additional thermal insulation applied six or eight years ago – without any deficiencies. Only near the ground, some isolated cases of algae formation at the façade were noted. Grey discolorations are more common on surfaces exposed to weathering and next to busy roads. In [1] it is pointed out that the material of an additional insulation layer needs to be compatible or well matched to the existing ETICS with regard to their hygric properties.

In one system, several defects occurred due to an inappropriate paint coat that was applied twelve years ago. This façade is partially covered with blisters and net-like

Table 1 Maintenance and renewal of the external treatment of façades

Values estimated by building experts 1980 [2]		
Type of external treatments	Years until first renovation or renewal	
	Indicated areas	Mean values
Mineral exterior render	15 – 50	35
Paint	5 – 20	10
Synthetic resin render on masonry or insulating layers	10 – 25	18
Asbestos cement cladding	10 – 30	20
Determined at completed buildings 1970–2014 [3]		
ETICS	15 – 29	22

cracks, and discolorations are evident. This example proves the importance of carefully selecting system compatible materials.

The evaluation of ageing behavior and maintenance requirements is similar for façades provided with ETIC systems and for conventionally rendered external walls. In Table 1 estimated maintenance intervals are compiled for various external treatments of façades, based on the survey conducted among building experts in 1980 [2] and on the current assessment results. The new findings suggest that the average value for ETICS is slightly higher (22 years compared to 18 years).

Given these figures, the amount of maintenance required for the investigated ETICS is minimal. The durability of renewed paint coats can be rated as very good, mostly remaining free from defects over a longer period of time, which is comparable to the performance of rendered façades without thermal insulation.

1–3 West façade of property no. 16 in Munich, 4 years (left), 19 years (centre) and 29 years (right) after application of the ETIC system, no intermediate renovation of the façade.