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Zertifizierungsstelle

**Summary concerning the second study
„Fire behavior of green facades
in large-scale tests“**

carried out by

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(Municipal Department 39)

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on behalf of

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Summary concerning the second study

„Fire behavior of green facades in large-scale tests“

Initial situation

Nowadays in Central Europe and especially in Vienna there is some kind of social consensus that greening measures are one possibility to confront urban heat islands caused by climate change. Façade greening is one way to create more green infrastructure.

Fire behaviour was and is often cited as one of the "stumbling blocks" for the construction of façade greening. Therefore, the Research Centre, Laboratory and Certification Services of the City of Vienna (Municipal Department 39) on behalf of Housing Promotion and Arbitration Board for Legal Housing Matters (Municipal Department 50) did a number of large-scale fire test on façade greening in 2018, to better understand the behavior of greenery in the event of fire. The report of this study is freely downloadable at <https://www.wohnbauforschung.at/index.php?id=480>. It has been a milestone in the consideration of the fire protection of façade greening and some kind of scale for a lot of cities in Central Europe (Zurich, Hamburg, Munich) for planning façade greening. In Vienna, the results were included in the new façade greening guidelines of the Department of Environmental Protection (Municipal Department 22). So it was possible to overcome the alleged stumbling block and to force façade greening.

Nevertheless, the time after the publication of the study has showed that there are still questions to be answered. So MA 39 launched this second study on the subject in 2020, thankfully again on behalf of MA 50.

Objective

The aim of this study is therefore to expose further façade greening constructions to large-scale fire tests within three work packages and to observe their behavior in order to be able to formulate further simple fire protection rules for these constructions. The three work packages can be defined as:

1. Technical verification of the function of a fire barrier defined in the façade greening guidelines as being evidence-free
2. First attempts with façade-bound metallic trough systems using fire barriers of different projection depth
3. Experiments on greenery on climbing aids in front of a building with variation of the distance between the façade surface and the climbing frame

Methodology

As in the first study, a fire scenario based on ÖNORM B 3800-5 (Fire Behavior of Building Materials and Components, Part 5: Fire Behavior of Façades - Requirements, Tests and Evaluations) was chosen. The assumed scenario is a complete fire in a room that breaks out of a window and attacks the adjoining façade. For the assessment, the contribution to the spread of flame, which the present façade design (form, building materials, assembly systems, etc.) offers, in addition to the ever-present spread, is used. The fire load is a 25 kg spruce wood crib.

Assessment criteria are including

- the fire propagation along the façade greening and
- the falling off of large and / or burning parts of the façade.

A total of seven large-scale fire tests were carried out, whereby the fire load was doubled for those with the greenery in front of the façade in order to take into account the fact that such greening constructions are also attached in front of loggias with possibly deposited combustible materials, which represent an additional fire load.

Results

All tests confirmed the most important result interpretation from the first study: ignition of the wood and the leaf mass of the greenery is to be expected from temperatures of approx. 500 °C. So every fire protection measure must be assessed to determine whether it ensures that façade greening is not exposed to these temperatures in the event of a real fire. If the greening begins to burn, a vertical fire propagation that is impermissible according to ÖNORM B 3800-5 is observed. Again it was shown that basically any plant can be ignited, regardless of which botanical genus it belongs to.

In the tests carried out, avoiding the above-mentioned 500 °C on the greenery was always successful when a correspondingly cantilevered fire barrier made of sheet steel with a thickness of 1.0 to 2.0 mm was installed above the fire chamber - regardless of what construction is mounted above the fire barrier. This fire barrier deflects the flames flowing out of the fire chamber and thus prevents a direct flame attack on the façade structure. As far as the cantilever depth of the fire barrier is concerned, a dimension of 20 cm beyond the outermost point of the greenery is definitely on the safe side, a lower cantilever of 10 cm has now been proven by testing for metallic trough systems. The fire test of an aluminum trough construction without fire sealing was negative, so the purely metallic and therefore basically non-combustible construction of a trough construction is not sufficient; the melting point of the material must be considered.

As far as the greenery construction in front of the façade is concerned, it is possible to prevent the "critical" temperature from being reached, with a certain distance from the façade surface. A distance of the greening on a metallic trellis of at least 40 cm to the façade surface appears to be adequate. The test with a smaller distance of 20 cm between the trellis and the façade surface had a negative result; in accordance with ÖNORM B 3800-5, an inadmissible fire spread over the entire greenery was observed.

Also, as already found in the first study, no falling of large or burning parts was observed in any of the tests, and the horizontal spread of fire did not play a significant role - even in the negative tests.

Further steps

As conclusions from the results of the tests, MA 39 may highlight the following points:

- The non-evidence variant of greening in building classes 4 and 5 defined in the façade greening guidelines, a partition using a 20 cm cantilevered, continuous sheet steel profile (thickness at least 1.0 mm) is confirmed and can be retained (barrier has to be mounted in every storey). Any solutions with lower cantilever depths still require technical verification.
- Façade-bound metallic trough systems on a metallic substructure with stainless steel fastening on the façade correspond to the fire protection protection goals on façades in building classes 4 and 5, if they are also equipped with fire barrier made of a 10 cm cantilevered, continuous profile made of sheet steel (thickness at least 2.0 mm).
- Forms of greenery placed in front of the façade in connection with non-combustible (e.g. metallic) climbing aids have to have a minimum distance to the façade surface or a balcony or similar. of 40 cm so that there is no fire spread through the greenery.
- The results of this study have no effects on the fire protection requirements for green facades for buildings with an escape level of more than 22 m.
- Furthermore, the following applies: Façade greening must be maintained and kept in a vital, functional condition (building book, clear regulation of responsibility for the care and maintenance of the greening). Necessary maintenance measures must already be taken into account in the planning and, if necessary, recorded in the building log.

These conclusions from the have to be discussed with the experts on the topic in order to then, in the best case scenario, record further simple and clear regulations for the constructions described in the façade greening guidelines of Municipal Department 22. This will give a new opportunity to plan and build an even wider range of greening constructions in terms of fire protection in order to improve the climate of a smart city - for the benefit of everyone who lives in it.

