



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

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## **Summary concerning the study**

### **„Fire behavior of green facades in large-scale tests”**

#### **Summary**

##### **Background and problem definition**

Greening measures, in particular facade greening, are becoming increasingly important, especially for large cities such as Vienna. Global climate change is particularly affecting metropolitan areas, as the heat accumulation in the urban area is high due to the sealing of the areas (this in turn is justified by the increasing population density and the associated area requirements).

The city of Vienna recognized this tendency early on. For almost 20 years, the Vienna Department of Environmental Protection (MA 22) has been dealing with the topic of heat in the city in the form of basic studies, strategic papers and active information work.

There is a broad consensus that more urban green infrastructure (such as parks) or blue infrastructure (such as open water, streams) will improve the situation. However, open spaces and green spaces in particular are under pressure due to the increasing demand for land, the maintenance costs and in part also the low acceptance of green infrastructure. This can largely be avoided if already existing as well as just newly created buildings are greened.

Fire protection is often cited as one of the inhibitors of façade greening since it is generally assumed that plants are burning and because fire cases involving façade greening are reported time and again, but the fire behavior of these in large-scale test arrangements is not described in any currently known literature.

##### **Objective**

The aim of this study is therefore to first investigate to what extent the fire behavior of façade greenery has been researched and subsequently to expose different, common facade green plants to large-scale fire tests and observe their behavior in order to be able to create a plant list with plants that can not be made to inflame with the assumed fire scenario and those in which this was the case. On the basis of this classification, the corresponding fire protection measures could subsequently be formulated in order to achieve the national Austrian goals for fire protection in facades.

From the beginning it was clear that this study had to limit itself to the fire behavior of ground-based façade greenery, as the façade-bound systems are so diverse that it is not possible to deduce the totality of the systems from a few fire tests.

## Methodology

As mentioned earlier, the work is based on a broad literature research on the topic, which - as will be seen later - was not very productive.

For the large-scale fire tests, a fire scenario based on ÖNORM B 3800-5 (Fire Behavior of Building Materials and Components, Part 5: Fire Behavior of Facades - 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 facade. 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.

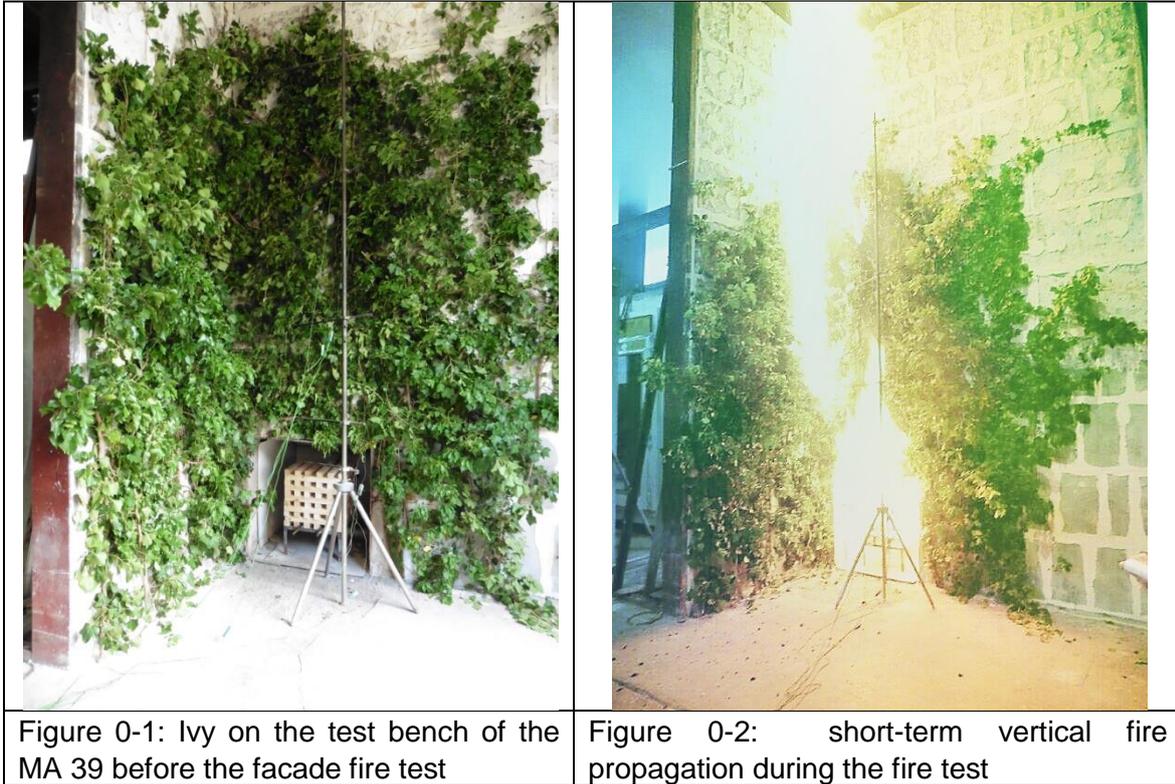
Assessment criteria are included

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

In total, four large-scale fire tests were carried out with different plants (*ivy*, *akebia*, *hydrangea*, *parthenocissus*, *wisteria*) typical for façade greenings in Vienna. In three of these experiments, the plants were mounted mechanically on a metallic climbing aid and in one of the tests mechanically directly on the test stand were.

## Results

It was found that basically all tested plants contribute to a vertical fire propagation in the large-scale fire test by burning away in a straw-like manner within a short time (a few seconds) and sometimes continuing to smolder (see the following figures 1-1 and 1-2).



In principle, a combustion of the leaves can be seen, a combustion of the lignified shoots is not or only to a very small extent in the vicinity of the fire chamber, ie in the range of the highest temperatures of about 850 °C to 900 °C, to recognize. The reason for this is assumed to be the content of essential oils in the leaves after no deadwood was present during the test.

If the plants are mounted at a distance of 60 cm above the fire chamber (= simulated window), the "straw fire effect" is already reduced, at a distance of 1.0 m, no combustion of the facade greening is observed, the critical temperature appears at approx. 500 °C to 550 °C - this is the temperature that was measured in the experiments at this exact height 10 cm in front of the facade greening. Vertical fire propagation was not observed in any of the experiments. The secondary fire hazard due to falling, burning parts was also not given. In any case, the metallic climbing aid does not contribute to the forwarding of fire, it can withstand the fire scenario without falling off.

These results in the following trendsetting insights for future applications of facade greening:

- For buildings up to building class 3 (see 3 storeys), no evidence with regard to fire propagation or special fire protection measures is required.
- For higher building classes, incombustible trellis aids (for example made of metal) should be used; depending on the type of crop used, additional fire protection measures (for example, firing barriers in every storey) may be necessary. Distance regulations for the installation of a facade greening must be formulated - a suggestion is at the end of the long version of the study.
- For higher building classes, a positive test report in accordance with ÖNORM B 3800-5 or other suitable proof must be provided for the façade-bound system used (excluding plants). The systems are then to be set up according to the positively tested details.
- Facade greenery must be maintained in a vital, functional condition (building book, clear regulation of the responsibility for the care and maintenance of the greenery). Necessary care measures must be taken into account in the planning and, if necessary, recorded in the building book.