Zukunft Bau

SHORT REPORT – English version

Title

Waterproofing with pre-applied bonded membranes – basis for the creation of a standard for an innovative building technique

(*Bauwerksabdichtung mit Frischbetonverbundfolie - Grundlagen zur Erstellung eines Regelwerks für eine innovative Bauart)*

Motivation

Pre-applied bonded membranes have been used in Germany as an additional waterproofing layer on water impermeable concrete structures. However, for this form of preventive waterproofing there are still no regulations available, what lead to some ambiguities regarding the application. The aim of the project was to determine the basics for this building technique, which could be incorporated into the development the new standards.

Topic (of the research project)

In Germany, pre-applied bonded membranes are usually installed as an additional sealing layer on the water-side of the water-impermeable reinforced concrete structures. They are supposed to improve the reliability of basement structures with regards to their water impermeability, especially in the case of difficult building constraints or high interior usage requirements. In contrast to 'classic' below-grade waterproofing, pre-applied bonded membranes are installed before concrete is poured and form a tear-resistant and water-impermeable bond with the fresh concrete (cf. attached blindside membrane). This also prevents lateral water movements in the composite layer if the sealing layer is damaged.

This form of sealing has been used in Germany increasingly since 2012, but there are still no regulations that can be applied to it. These membranes are considered neither as independent waterproofing membranes regulated by DIN 18533, nor they are being dealt with in the DAfStb guideline "Water impermeable concrete structures". So far, the proof of usability has been provided through general appraisal certificates, which, however, are not based on uniform test principles and thus essential characteristics could hardly be compared between the products. In addition to these ambiguities regarding the comparability of products, there are also further questions concerning design and application of these sealings.

For these reasons, in 2017, the German Society of Concrete and Construction Technology (DBV) founded a working group HABA-FBV, who first wrote a progress report (DBV-Heft 44) and is currently working on a leaflet on the pre-applied bonded membranes. In order to be able to deal with this technology in a well-founded manner, fundamental questions regarding the membranes still had to be clarified. These fundamentals were partly dealt with in this research project. Among other things, the regulatory situation had to be analysed, essential product properties and associated test procedures had to be identified, characteristics of the technology to be determined in laboratory tests and practical recommendations had to be elaborated.

The research project included ten work packages, which are briefly presented below.

The aim of the first part of the project was to clarify the unclear regulatory situation for this technology. For this purpose, existing rules, regulations and legal foundations were analysed and the membranes were classified in terms of their use in Germany, with regard to the building regulations. This classification was integrated into the work of the DBV working group HABA-FBV and was published in the DBV-Heft 44 in 2018.

In order to be able to respond practically to the information requirements of the parties involved in the design and construction in the planned DBV-leaflet, the current practical experience was evaluated in a survey. Based on the survey results, the application recommendations and quality assurance measures were elaborated at the end of the project.

The third part of the project dealt with product properties and suitable test methods for the pre-applied bonded membranes. The aim was to define in the DBV leaflet the test methods that uniformly check the essential product characteristics of the FBVS and thus make them comparable across the board. First, product properties of German and foreign products were compiled, properties important for this building technology were identified and suitable test methods were identified. In some cases, test standards for other types of waterproofing could be adopted, in some cases existing tests were adapted or new tests formulated.

Furthermore, some essential properties of the FBVS were examined in laboratory tests. The selected properties of ten membrane types, which were provided by project industrial partners, were tested. The influences of various parameters on the water impermeable bond, the influence of the membrane on the adjacent hardened concrete properties, the coefficient of thermal expansion, the bond to the concrete as well as the shear strength and bond strength of different membrane seams were tested. The results of the tests also serve as a basis for the formulation of standardised test descriptions.

Conclusions

Within the project, the questions concerning the legal classification of the membranes, the evaluation of the practical experience and the laboratory tests were successfully implemented. Essential product characteristics of ten membranes on the market were

compared. The results are currently being used in the preparation of the DBV leaflet. Additionally, some essential test methods have already been evaluated for their suitability. However, the research project could not cover all currently pending test definitions. Although the goals of the research project were achieved, the project did not cover all current issues concerning the pre-applied membranes.

Key data

Short title: Waterproofing with pre-applied bonded membranes

Researchers / Project Manager:

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Overall costs: 197.656,80 €

Share of federal subsidy: 52.008,00 €

Project term: 27 (24+3) months

Figures

Figure 1: Application of a FBV mebrane on a blinding layer before reinforcing and concreting [source: DBV, Kiltz]

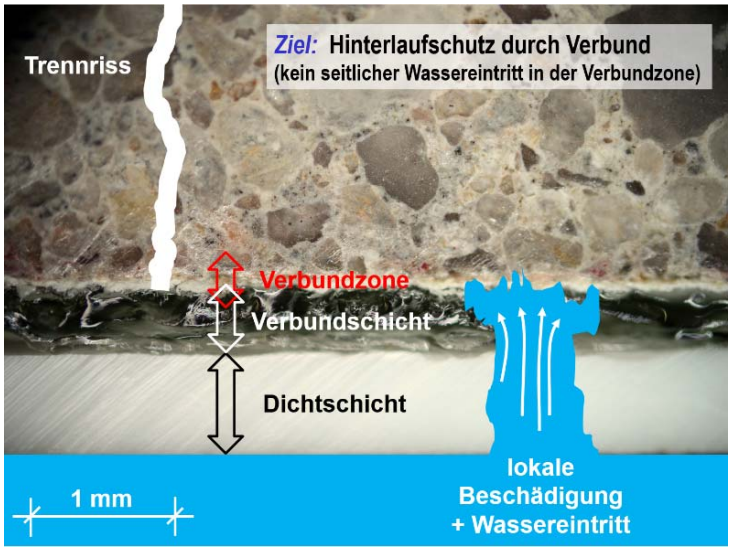

Figure 2: A schematic representation of the functional principle of a FBV system [source: DBV-Heft 44]

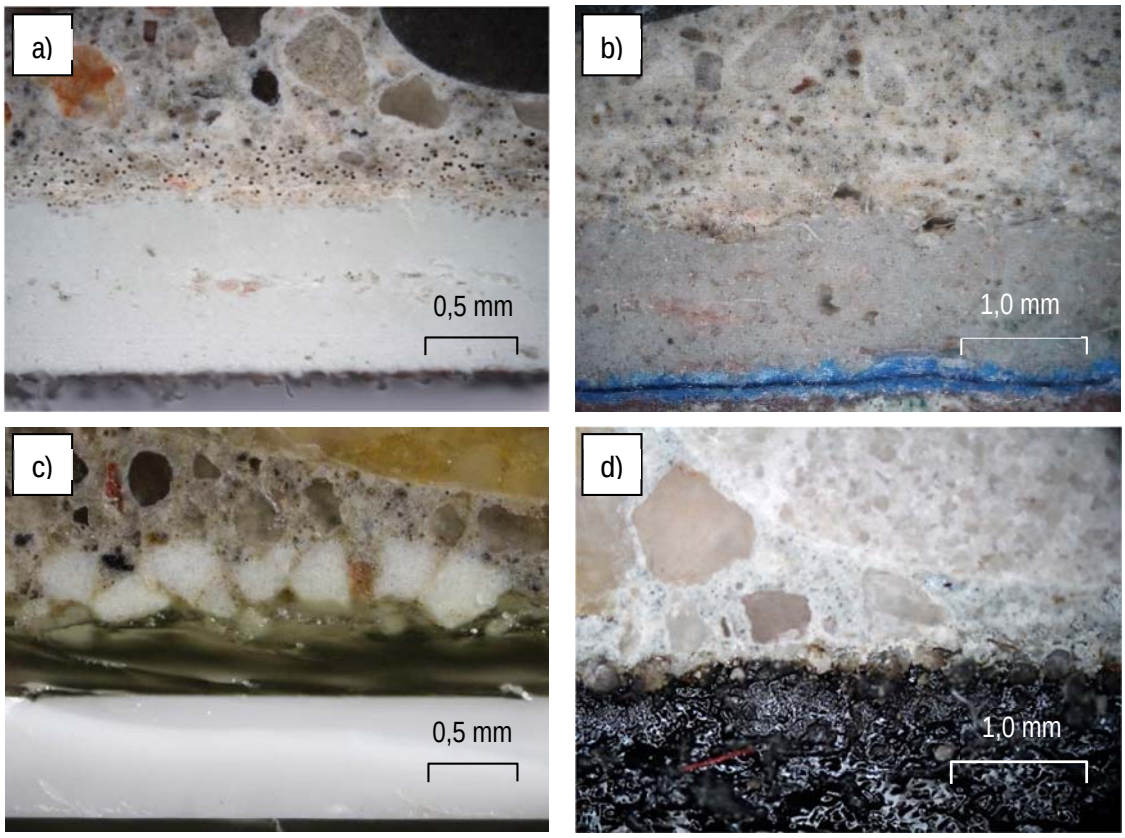

Figure 3: Cross-sections i.e. joint areas of different FBV systems on concrete.
a) mechanical-adhesive system (here fleece)
b) mechanically-adhesive system (fleece) with absorbing polymers integrated in the sealing layer
c) gluing-adhesive system with granular sanding
d) bituminous system (elastomer bitumen) with bituminous-adhesive composite layer

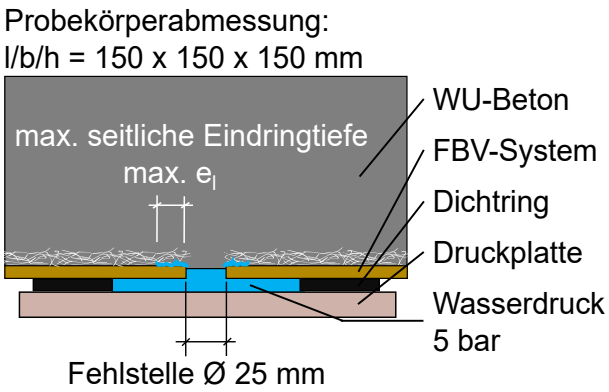

Figure 4: Infiltration test, test specimen at the WU test bench.

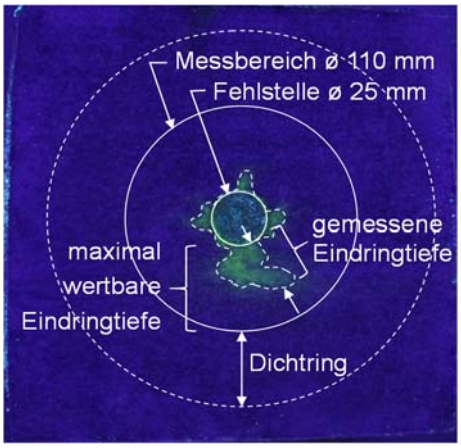

Figure 5: Infiltration test, visual assessment of the infiltration under UV light.

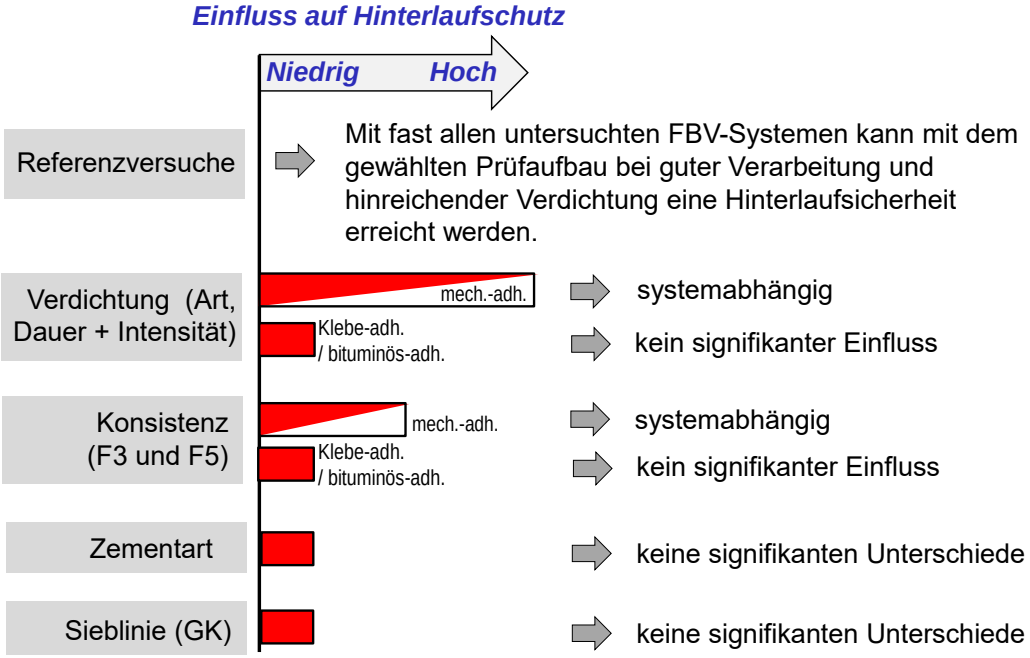

Figure 6: Infiltration test, summary of the test results (n = 292)

Figure 7: Test scheme for the adhesive tensile tests:

a) Specimens with marked drill locations
b) Core drilling
c) glued adhesive punches
d) adhesion tests