

Long-term performance of plastic and rubber sheets used for flat roof waterproofing

Summary account

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Aims of the study/Current regulations

As reflected by recently published regulations, the number of materials and types of plastic and rubber sheets used for roof waterproofing has greatly increased. Part two of the revised regulations for roof waterproofing (DIN 18631), whose final version was published in November 2005, contains a considerably extended list of new materials and types of plastic and rubber sheets. It specifies eight materials in 31 different varieties, which are all grouped in the category of E1 and can therefore be utilized even under great mechanical and thermal stress. Their classification according to the different quality standards (categories of application) K1 and K2 (standard quality and high quality) merely depends on their minimum nominal thickness.

The newly published German regulations DIN EN 13956 (issue 2006-02) "*Flexible sheets for waterproofing – Plastic and rubber sheets of roof waterproofing – Definitions and characteristics*" name as many as 26 materials considered to be "common", which fall into three main categories (plastic, rubber and thermoplastic rubber) although their production and their properties may be very different. The regulations do not exclude other materials, they merely describe the specified 26 items as "some of the commonly used

materials". The intention explicitly stated is that the European standard should not obstruct any further development in this field.

In the new adaptation standard DIN V 20000-201: "*Use of building products in construction works – part 201: Adaptation standard for flexible sheets for waterproofing according to European standards for the use as waterproofing of roofs*", nine different materials are mentioned, and table 3 ("*a survey of plastic and rubber sheets*") includes 38 different types of sheets.

But so far, a product-independent survey of the practical performance of the various sheets or of their market share has not yet been carried out. So the manager of this project, who is a member of the standardization committee (DIN 18531) and represents the consumer council, initiated a research study to assess – independently of manufacturing firms – the performance and limitations of typical waterproofing sheets currently on the market.

The findings are based on the inspection of numerous roofs, on occasional sampling from waterproofing sheets and on the evaluation of the information provided by roofers, who were questioned in several surveys. Since the sample of a particular roof sheet is comparatively small, as is the number of roofers having utilized it, the findings of the research study do not claim to be representative of all (unused) flat roofs or all waterproofing sheets.

Nevertheless, the study can describe the practical performance and possible limitations of particular waterproofing roof sheets. It can provide criteria for the critical assessment of various products and can thus help users to make an informed choice.

Results of the study

As shown both by the inspection of practical examples and the survey among professionals, part of the sheet types listed in the regulations (DIN 18531-2) have been widely used and have functioned appropriately, so that they have proved to be reliable in the long term.

A considerable part of other sheet types mentioned in the regulations could not be assessed in the field because they were not suggested by roofers, who pointed out most of the buildings inspected. This may in part be accidental, but probably supports the conclusion that the market share and period of use of these sheet types is (as yet) rather small.

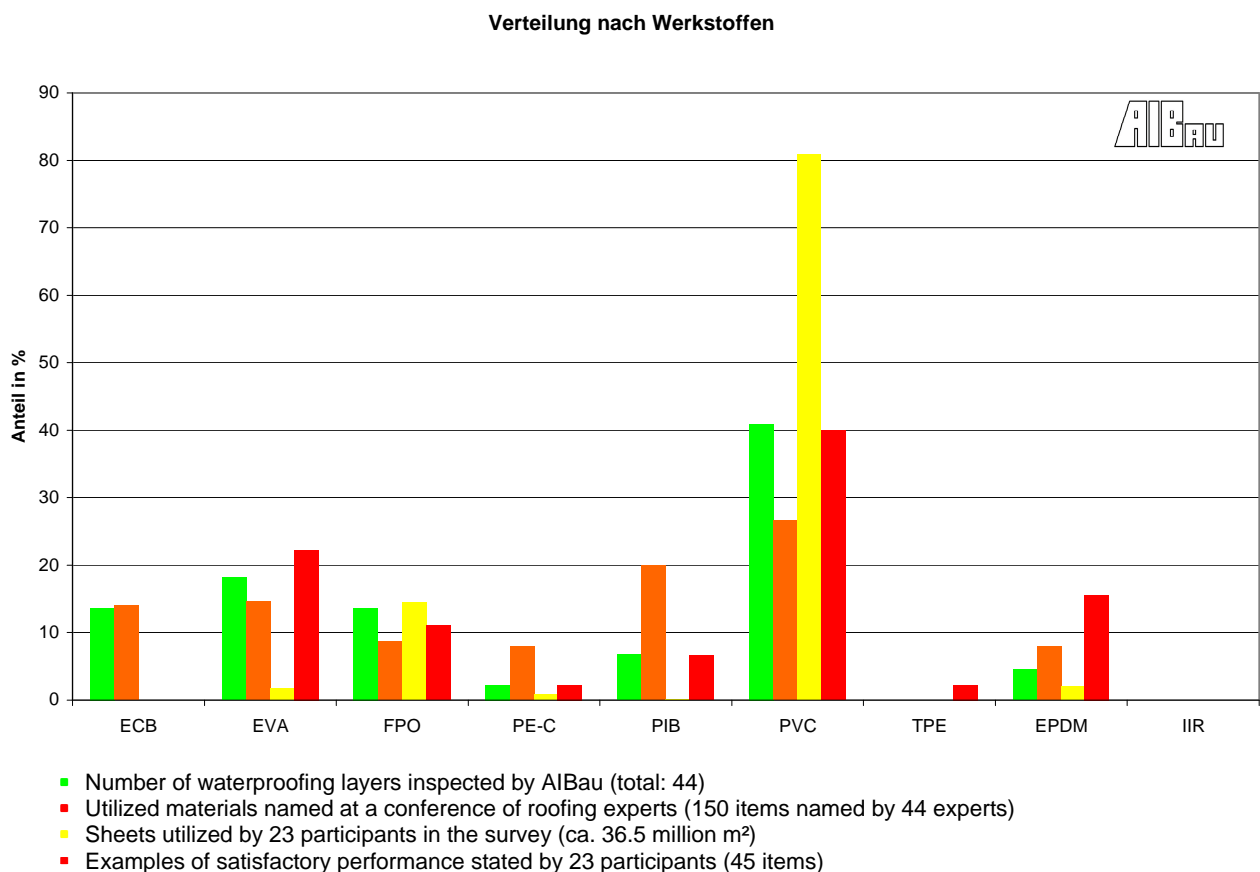
One of the aims of the study could not be achieved, namely to establish a link between certain types of sheets and specific areas of application. The recommendations given by manufacturers for specific applications can be accepted in principle. But, judging from the practical experience of those who contributed to this study, all users of these products – clients, designers and roofers – are advised to closely compare the intended function with the technical data of the product and the directives for installing it. This especially

applies to sheets secured with imposed loads and the necessary resistance to microbes, to the compatibility of the product with other materials of the roof system and to the directives for bonding.

As far as the life span of plastic and rubber sheets is concerned, both the information provided by professionals and the result of the inspections in the field point to the same conclusion. When questioned about the age of waterproofing sheets that had to be replaced because of material deterioration, roofers mainly stated a period of 10 to 20 years. Similarly, most of the roofs suggested for inspection, which were characterized by an insufficient strength value, had been utilized for about 15 years. But most likely deterioration in these cases is due to defects in the full bonding of the sheets or to a change of the material as a result of unsatisfactory resistance to microbes. Other sheets, though more than 20 or 25 years old, were only slightly defective in their function – if at all.

As most buildings were selected for inspection at the suggestion of roofers or experts in roofing work, the samples of sheets cannot be regarded as statistically significant. This also applies to the frequency of certain materials mentioned in the survey among roof waterproofing firms, since the number of participants was relatively small. The diagram below shows the comparative frequency of materials used for waterproofing. It becomes quite clear that the distribution of inspected roofs generally corresponds to the distribution of those materials that are predominantly used by roofers and that have proved to function satisfactorily.

Frequency of materials used for waterproofing



On the basis of this non-representative investigation, it is not possible, nor was it the intention of the study, to classify certain materials or types of sheets as basically suitable or not.

General conclusions concerning the selection of material

All types of sheets can be used for typical constructions; any predominant areas of application cannot be clearly identified. Consequently, the most important criterion for choosing a particular product will – quite rightly – be the cost factor.

It is essential that roofers should be familiar with the specific techniques of laying and joining a particular type of sheet. This requirement should be explicitly stated in the terms of bidding and contract, including some certification of competence.

The technical life span of sheets is estimated at a period of 10 to 20 years. Possibly there are longer periods of satisfactory performance, but they cannot be safely predicted, due to the numerous impacts on durability and to the lack of exact details of the composition of materials.

For long-term performance it is important that sheets should be easy to repair and to replace in parts, and for that purpose the product must be easy to identify. So only those sheets should be selected, whose composition is durably and clearly marked or specified. This requirement should also be included in the terms of bidding for the contract.

One of the characteristics that are apt to increase durability and to lower the cost of repair is the easy removal of sheets. Therefore loosely-laid sheets (secured by loads or fasteners) are preferable to bonded sheets.

Further development in the production of roof sheets should take account of the following conclusions from the research study:

It is important

- **to make sure that the type of sheet and the date of production are known.**

Today more than ever, the great number of sheet types makes it necessary that owners of a building and roofers doing maintenance or repair work should be able to clearly identify a particular product. This not only requires the producer's logo, but also the label of the product. As is the rule with car tyres, the information should include the name of the company, the specification of the material according to DIN EN 13956 and the date of its production. In this way it can be guaranteed that new sheets used to repair or convert a building are in fact compatible and can be bonded with existing sheets. If companies do not mark their products in this way, they possibly do not expect them to function satisfactorily in the long term.

- **to point out incompatibility and to specify any change in the composition of materials.**

When laying new sheets or repairing existing roof layers, both owners and roofers should be able to link the product label on the sheet with a list of specific compatibility standards. For instance, the German Institute for Building Technology (DIBt) or other producer-independent institutions could establish a data bank making the relevant information accessible to the public. It should make known which natural substances typically found on roofs (e.g. microbes) or which other building materials (e.g. bitumen, or PE layers) are not compatible with the particular sheets in question. This must also apply to sheets of the same material, if their composition has been changed, so that they can no longer be welded with older sheets.

The product data sheets required by DIN EN 13956 could serve as a suitable basis if the “information for clients” according to Chapter 7f or the “information for consumers” according to Supplement D were more comprehensively informative for all waterproofing sheets on the market.

- **to take special care if the sheet is directly bonded to the surface below.**

As quite a few of the roofs with bonded layers examined in the survey did not function appropriately, workers should take special care if the sheet is directly bonded to the surface below; when choosing a bonding agent, the directives of the manufacturer should be observed very strictly.

Especially before repair work, the producer should take part in testing the surface below and his agreement to bond his product with existing roof layers should be given in writing, including specifications for bonding the sheet. This also applies to bonding bitumen-proof sheets to bituminous surfaces.

- **to improve proper function by using separation membranes.**

If the parameters of bonding cannot be precisely assessed, it is safer to install a separating membrane and to secure the sheet by loads or by mechanical fasteners. This makes the sheet more easily recyclable and environmentally sustainable. It also increases the possibilities of renovation, because the clean bottom side of the sheet can also be used for bonding.

- **to secure sheets with loads only if they are resistant to microbes.**

Sheets that are laid and secured with loads must have proved to be resistant to microbes.

- **to seal the seams of sheets with inserts.**

Plastic sheets with inserts in the waterproofing layer run a greater risk of capillary moisture than sheets made of homogeneous material. Their seams must therefore be examined with great care and touched up,

if necessary. It should be obligatory, at least in areas where puddles are to be expected (concave mouldings, non-sloping surfaces), to additionally seal the seams.

- **to use a sufficient gradient of the surface.**

With plastic sheets, sloping the surface does not only serve to minimize the impact of possible defects, but also to prevent water absorption by the waterproofing sheet itself.

- **to give more detailed information about new developments of building materials.**

If problems of waterproofing are evidently due to the failure of materials, manufacturers are generally rather accommodating. But apart from that, the qualified public should be objectively informed about the causes of material-related damage (e.g. in the case of “shattering”) so that clients, designers and roofers may have greater confidence in the development of building materials.