THE TEN-YEAR EXPERIENCE IN EUROPE WITH ONE AND TWO PLY SYSTEMS WITH BITUMINOUS AND PLASTIC ROOFING MEMBRANES

Werner Andernach
A. W. Andernach KG, Bonn-Beuel, West Germany

For more than a century we have been making roofs watertight with roofing felt. During that time, developments in roofing have been continuous, but the essential material – bitumen – still plays an important, in fact, the most important, role.

The original membrane – organic felt – got competition. Jute, glass and plastic fabrics were introduced, and one day – at least in Europe – organic felt was replaced by glass felt. This has become the trend in Germany as well. Today approximately 70% of all bituminous roofing in Germany consists of glass felt. However, the extensive use of base materials made of glass fabrics – about 10% of all bituminous roofing – also deserves attention.

Developments in roofing in the United States can profit from our European experience, and we have the positive result that greater thickness is being used in changing to glass felt for bituminous roll roofing and asphalt shingles, so that our unfavorable first experiences with very thin glass felt are being avoided.

While this change has been taking place, bitumen has remained, but not without developing considerably itself. The so-called unblown asphalt followed tar, and then came the oxydized, steep level asphalt. Most recently, several types of plasticized asphalts have been developed. The essential characteristics of this material are its improved flexibility, its stronger resistance to cold and hot temperatures, and its enormous aging durability.

In our country also, roofs were made with three or four plies of bituminous felt covered with aggregate in order to achieve a stronger weather protection. The layers of insulation, which kept getting thicker, "boiled" the bituminous roofing felt more and more, which caused the paper-felt to rot. This experience led to the more frequent use of inorganic base materials. The first stage brought glass felt, then glass fabrics were added, and now the newest development: PES mats made of polyester fibers.

At the same time, there has been another development during the past 20 years: heavy bituminous roll roofing with thick bituminous coating, the so-called torching felt. This roofing is applied by gas burner by melting the thick bottom coating to create adhesion. This saves using asphalt kettles and additional bitumen, but it does lengthen the time needed for application. For this reason the majority of the so-called torching felts are applied by the hot pouring method. The additional layer of bitumen makes the roofing membranes thicker and therefore naturally more watertight and more durable. Granules are embedded like fishscales in the upper coating during production or later embedded in the asphalt by hand or spread on loosely in a thickness of 5 to 8 cm.

Since roofing construction and roofing surfaces are continually becoming lighter and more unstable, the roofing membranes are being loosely laid more and more often. The first layer of roll roofing is spot-torched, or mopped with hot asphalt, or secured mechanically inside the laps, so that the membranes are not connected to the deck. This prevents vibrations and movements on the roof from affecting the roofing membranes. The loosely laid system is also used more and more often when old roofing is to be re-roofed. This method saves removing the old roofing, and the new roofing membrane is independent of the old roofing.

Both of these developments have caused a significant change in the use of built-up roofing, namely the application of built-up roofing in only two layers. The high quality and long durability of this new bituminous roll roofing allows this reduction of layers, which has become a necessity in view of the constant increase in roofing labor costs.

The new roll roofing reinforced PES mats and plasticized asphalt even allow and justify one-layer roofings. In a few European countries, modified bituminous roll roofing is already being applied in only one layer.

However, in Germany particularly, and in some neighboring countries, two-layer roofing has been retained for safety purposes, since the adhesion of two layers with hot asphalt – whether by the pouring or torching method – makes the laps and seams especially watertight, and guarantees additional thickness and better protection from perforation during rough construction work.

Elastomeric asphalt can be stretched like rubber. The base material made of needle-punched PES fiber mats is reversible by 25% and doesn't tear until stretched by 50%, whereby plasticized asphalt retains its elasticity. Apart

from the high elasticity these elastomeric asphalt and PES fiber mat combinations have totally new characteristics with regard to weather resistance and aging durability. This combination offers many new and different possibilities of application in hot and especially in cold climates. Whether hot mopped or torched on with a hot air gun or gas burner, this new elastomeric bituminous roll roofing offers totally new possibilities for use on flat and steep roofs, as well as for the sealing of water basins, canals, dumps, tunnels, bridges, and for underground construction.

These characteristics can be easily understood and will lose the impressions of being mere hocus-pocus when I tell you that the asphalt used is unblown asphalt. Unlike oxydized bitumen, the elastomeric parts of the unblown asphalt have been completely retained. Stability has been reached by adding plastic elastomeric materials instead of adding filler - that is, mineral powder. The roofing contractor is confronted with a new kind of material, which can be applied with all conventional machinery and tools and with the usual asphalt.

In the discussion of bituminous roll roofing and plasticized asphalt roll roofing, one very important advantage must be emphasized when comparing these types to other roll roofing systems, namely:

I. Bitumen felt
II. Torching felt, and
III. Plasticized asphalt roll roofing

can be renewed when the top layer has become old, looks bad, or has been damaged in some mechanical way or by bad weather conditions. Without removing the old roofing, a new one or two layer roofing can be applied by the various methods: loosely laid, hot mopped, or torched on. This is an advantage that **only** bituminous roll roofing offers. Today in Germany there are three main types of bituminous and plasticized asphalt roll roofings.

Group I

Normal coated mopping felt, about 2-3 mm thick, 2-3 kg per m^2, that is, approximately 10-15 lbs. per 100 sq. ft. It is used in a minimum of three layers on a dead level roof and a minimum of two layers on a steep level roof with a minimum pitch of 5% = 3°.

Group II

Torching felt, approximately 4-5 mm thick, approximately 5-6 kg per m^2, about 25-30 lbs.per 100 sq. ft. Torching felt is applied in 2 layers on all kinds or roofs.

Group III

Plasticized asphalt felt, about 3.5-6 mm thick per 1 m^2, approximately 17-30 lbs. per 100 sq. ft. One or more layers can be applied on all kinds of roofs.

Especially during the past ten years various roll roofing, made entirely of plastic membranes in thicknesses of 0.7 - 0.8 mm to 1.2 - 1.5 mm and 2 mm to make the roof watertight, has been introduced in Europe, which - besides bituminous roofing - is used 8-10% of the time. This type of roofing is usually loosely laid in one layer. This is mainly due to the fact that these plastic membranes cannot be connected to concrete, metal, wooden or insulation surfaces or connected or combined with a second plastic membrane. The reasons behind this are economical and technical. These plastic membranes are not suitable for rough construction work: the minimum thickness of a two layer bituminous roofing is 6-8-10 mm, whereas the maximum thickness of plastic roofing membranes is 1.2 - 1.5 - 2.0 mm. Since this kind of roofing is easily damaged, especially PVC and PIB plastic membranes, it is used less and less on roofs in Europe, especially in Germany. The damage occurs particularly when these plastic membranes are used with bitumen, so that it may be said today that this combination or mixture must definitely be avoided. The future of plastic roofs will depend on improved material, no damage through shrinkage and expansion, improved and simplified methods of application, and the possibility of multi-layer combinations and reliable seam protection.