Trafficked Flat Roofs Waterproofed with Mastic Asphalt

The following guidance notes are written by G. J. Gillan, DiplArch, RIBA, Chartered Architect and Consultant Architect in the application of mastic asphalt

1.00 Essential Points

When specifying mastic asphalt to waterproof the structure the most essential points are:—

1. The roof's use should be clearly and realistically established.
2. The structure must be designed to support the various loads without deflection or any side or end movement.
3. The waterproof membrane must be continuous and monolithic.
4. The waterproof membrane should be separated both from the structure and the overlaying wearing or protective surfaces generally.
5. The falls designed to shed the water properly. (Not less than 1 in 60).
6. If insulant is placed under the waterproof membrane it must be of adequate compressive strength.
7. Maintenance and the practicalities of future repair and maintenance must be considered of both the waterproof membrane, if it gets damaged, and the overlaying surfaces.
8. Movement joint problems understood and catered for both in the structure, the waterproofing and wearing or protective surfaces.
9. The waterproofing is protected from contamination.

2.00 Generally

Mastic asphalt is made by mixing bitumen and flux oil to provide asphaltic cement and stone aggregate in the presence of heat.

This hot molten material from the mixer is poured into casts, where it cools.

The resulting blocks are then transported to site, broken, reheated and remixed on site usually in a portable heated mixer. The asphalt is poured from the mixer into lightly limestone dusted buckets, the hot asphalt is carried to where it is to be used, poured out on to the roof and spread by means of a wooden hand float.

The two types of mastic asphalt covered in this article are roofing asphalt and paving asphalt.

2.1 Roofing or waterproof mastic asphalt

Roofing mastic asphalt consists of about 12% asphaltic cement and 88% fine limestone aggregate. The limestone aggregate should be sufficiently fine enough to permit the heated soluble asphaltic cement to saturate the limestone and makes, for all intents and purposes, a waterproof membrane.

One coat of roofing asphalt can produce a waterproof membrane, but defects easily occur if any bay joints are poorly made or within the asphalt there is even the slightest defect, such as a single coke, will permit water to enter the building. It is usual to have two coats of roofing asphalt to act as the waterproofing membrane to overcome any minor defect in either one of the coats.

In certain situations it is recommended that three coats of roofing asphalt are laid, such as roof gardens.

2.2 Wearing surface or paving grade mastic asphalt

Mastic asphalt for these purposes is covered by two British Standards. Mastic asphalt for roads and footways BS 1446 natural rock and BS 1447 limestone fine aggregate.

Natural rock asphalt is dearer than limestone fine aggregate and there are no records to prove natural rock behaves differently or better than limestone fine aggregate.

During the remelting stage on site the coarse aggregate is added to the mix, to a given percentage. The percentage of coarse aggregate is related to the type of work the asphalt is to perform and to the thickness of the finished product.

Not all of the coarse aggregate can be saturated with the asphaltic cement, there is a tendency for the bay joints to open up in certain circumstances and the result is the paving grade asphalt is not waterproof.

There are a number of problems associated with the use of paving grade mastic asphalt, namely, the higher the percentage of coarse aggregate added the greater the degree of shrinkage, excessive cracking, openings and repetitive opening of bay joints. It is important that the coarse aggregate is mixed thoroughly in accordance with the requirements of the recent British Standard. The minimum thickness of paving should not be less or more than shown in the British Standard and to consider the design of the road in its own right, and not to consider the effect of combining the thickness of the wearing surface with the waterproofing membrane.

Coarse aggregate used in paving grade mastic asphalt which can be:—

(a) Crushed angular stone of igneous origin, for instance granite.
(b) Crushed angular stone of calcaereous origin, for instance limestone.
(c) Naturally occurring graded siliceous material, for example grit, reasonably rounded natural waterworn condition flint gravel or quartzite gravel.

The subject of selection of suitable aggregate is of a specialized nature and is beyond the scope of this paper.

Regarding the separation of paving grade from waterproofing layer: there are differing views on this subject, the view of the BRE and myself is that separating the paving grade from the waterproofing layer is essential, for reasons:—

(a) Future maintenance and repair should, when or if, the waterproof membrane fail.
(b) Differential rates of shrinkage between the two materials.
(c) The thickness of the paving grade if separated from the waterproofing needs to be designed to sustain the loads on its own account.

2.3 Ramps in paving asphalt

The waterproof asphalt should be laid in one coat of 13 mm to 15 mm thick directly on a keyed concrete structure, the paving asphalt laid directly on the waterproofed asphalt to a thickness of 25 mm to 35 mm dependant on anticipated loading. Difficulty will be encountered in applying asphalt to ramps in excess of 1 in 10.

2.4 Surface finish to paving asphalt

To improve skid resistance the crimping of the surface or the inclusion of precoated chippings will improve the surface tension. Synthetic resin bonded gritted surfaces and precoated chippings are also available.

To improve oil resistance in certain areas dressings of polyurethane or epoxy resin, or the use of pitch with grit surfacing will help to protect the asphalt from oil droppings and may also improve skid resistance. These treatments are expensive and require regular maintenance.

2.5 Maintenance

This subject is ignored in all of the publications I have read on the subject of maintaining and repairing trafficked roofs waterproofed with asphalt. Should there be a failure in the waterproofing membrane it is essential that this membrane can be got to without breaking up the whole of the waterproofing membrane for obvious reasons.

Time and again waterproof asphalt is overlaid with concrete paving set in hard mortar, or paving asphalt is laid directly on to waterproof asphalt. If there is a failure to discover the cause this creates further damage.

2.6 Expansion joints

The Mastic Asphalt Council, in October 1971, published a technical information sheet called Flush Expansion Joints TLS No 8.

The generally philosophy adopted here I agree with, namely that there is no need for expansion joints in the waterproof asphalt. There is a need, however, for contraction joints in paving asphalt. I recommend advice is sought when dealing with this from either myself or the BRE.