

# **STATE OF THE ART WATERPROOFING MEMBRANE TECHNOLOGY**

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The subject of my presentation is 'State of the art waterproofing membrane technology'.

My subject deals with mastic asphalt waterproofing, which I understand has never been previously discussed at any I.W.A. congress. I now hope to redress that balance and change your perception of mastic asphalt, forever.

## **INTRODUCTION**

This paper addresses the successful technological breakthrough of combining a high-performance roll-type membrane with mastic asphalt to achieve the first fully bonded mastic asphalt roofing system.

## **RESUME**

Le document suivant est une étude sur les toitures inverties qui utilisent e'un des plus vieux matériaux du monde; une combinaison de mastic d'asphalté et d'une seconde couche imerméabilisante. Il en résulte une préparation adhérente et imperméabilisante à base de mastic d'asphalte qui peut être posée à plat et qui est capable de protéger un bâtiment pendant toute sa durée de vie.

## **ZUSAMMENFASSUNG**

Die folgenden Ausführungen beziehen sich auf "umgekehrte Dächer", bei denen eines der ältesten bekannten Materialien zur Herstellung von Wasserdichtheit verwendet wird Mastix in Kombination mit einer zweiten wasserdichten Membrane. Das Ergebnis ist ein perfekt verbundenes Mastixsystem, das völlig flach ausgelegt werden kann und das die Lebensdauer des Gebäudes besitzt, das es schützt.

When installed as part of an inverted roof, the system effectively prevents water tracking between the structure and waterproof membrane. As many of us know to our cost, if an inverted roof

begins to leak it is often impossible to trace the source without resorting to costly major investigations of the entire roof structure - that problem has now been effectively eliminated and it's a major step forward.

There is nothing particularly new about mastic asphalt in terms of its material benefits and qualities. Mastic asphalt is one of the oldest building products known to man. Noah's Ark was 'Caulked with pitch and sand', a contemporary version of mastic asphalt. Tutankhamun's tomb was encased in 'an asphalt compound' according to the reports of its discoverers. The tomb stayed watertight and preserved for over 2,000 years.

The Hanging Gardens of Babylon were reportedly waterproofed with a 'bituminous substance' according to legend and contemporary reports, as was the Temple of the Moon God, the birthplace of Abraham.

More recently, Sir Walter Raleigh originally discovered the famous Trinidad Lake of Asphalt in 1595. However, the real commercial use of Trinidad Lake Asphalt in building operations was not started until 1864 by the Previté Company.

The lake at the time was owned by Lord Dundonald but a lease to operate it was granted to Previté in 1862 and they started exporting the material two years later. To this day, the basic Trinidad Lake Asphalt 'épuré' is still used in certain countries but its use in the UK is now minimal.

But what exactly is mastic asphalt? The official definition is of a 'finely graded mineral matter together with asphaltic cement in such proportions as to form a coherent, voidless, impermeable mass, solid or semi-solid under normal temperature conditions but sufficiently fluid when brought to a suitable temperature, to be spread by means of a hand float'. A bit of a mouthful !

The easiest way to visualise mastic asphalt is to envisage concrete with the 'cement' being replaced by 'bitumen' as the binder. Like concrete, many variations on 'cement' content and aggregate sizes and composition are possible. These need to be designed for the specific purpose required, be it roofing, paving, flooring or tanking. Equally, like concrete, various 'additives' to the 'cement' can greatly enhance or alter the performance of the total product.

Mastic asphalt, like brickwork, elegant timber work and other traditional products, is experiencing a great resurgence against other synthetic materials. Architects and specifiers are returning in droves to good basic building construction after some of the 'adventures' in 'new' technology which proved disastrous. The Building Research Establishment in the UK claims that mastic asphalt should last 50-60 years, it's competitively priced, user-friendly, resistant to physical and site damage, is seamless, flexible and easily covers complex shapes. Notwithstanding its traditional benefits, mastic asphalt technology in manufacturing and in distribution and application has improved enormously in the last ten years or so. Like 'high-performance' felt membranes, modern polymer modified mastic asphalt greatly out-performs the basic material particularly in the critical zones of low temperature, flexibility and extensibility. This was the one area where traditional mastic asphalt sometimes had some problems. Modern polymer modified mastic asphalt can be truly called the 'Rolls Royce' of waterproofing membranes. Although it out-performs all other methods of waterproofing flat roofs, amazingly it is still very competitive in price to many of the 'thin' single ply or felt membranes. Another great advantage of mastic asphalt is its 'buildability'. It is 'user-friendly' to main contractors where complicated projects with multi-discipline finishes are required and protection is a nightmare.

Modern polymer modified mastic asphalt is durable and forgiving, very forgiving, compared to 'thin skin' waterproofing. It is a seamless and flexible product. It is hand floated and capable of following and mastering the most complex of shapes without lap joints. It is not temperature sensitive for laying conditions and can still be laid in very cold weather when single ply membranes could not be installed. A mastic asphalt roof should last 50-60 years and there are many examples well over 70 years old to prove it.

After more than 40 years in the mastic asphalt business it is perhaps not surprising that I am an ardent ambassador for the material - but even the best can get better - and it has, with the first fully bonded mastic asphalt roofing system for an inverted roof.

It has many advantages over other types of inverted roofs which use thin synthetic membranes. These have had a history of disasters in terms of puncturing and other physical site damage

- often created within a week or so of the roof being installed.

During this period a roof has to take large volumes of foot traffic from contractors and trades wanting to install essential services. Mastic asphalt can take this kind of harsh treatment - other types of membrane cannot.

In spite of mastic asphalt's durability, clients, architects and other specifiers have been more and more insistent on a fully bonded roof structure. Mastic asphalt was in danger of losing market share, unless it could evolve and adapt.

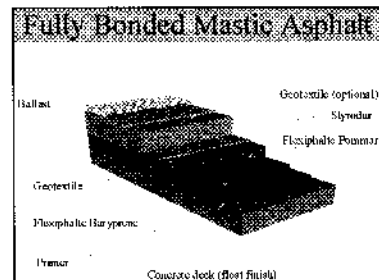
Mastic asphalt could not be laid directly on to concrete without 'blistering and blowing'. In such cases an isolating membrane is used to provide a base to take the waterproof layer, but this, in turn, means that asphalt cannot be fully bonded.

The answer was to find a compatible membrane that could offer the dual advantages of being able to be bonded to the roof deck and that could also cope with the very high temperatures, some 300°C, of molten mastic asphalt, during installation.

We found it with a polymer modified membrane, Baryprene, reinforced with barytes, a heavy earth, resistant to high temperature and which prevented volatile oils leaking into the mastic asphalt which would cause blistering during the installation process. Any other type of membrane would have disintegrated. In short, it was a perfect marriage.

All we needed was the "best man" for the wedding and we found that with a purpose-made insulation board supplied by one of Europe's largest manufacturers.

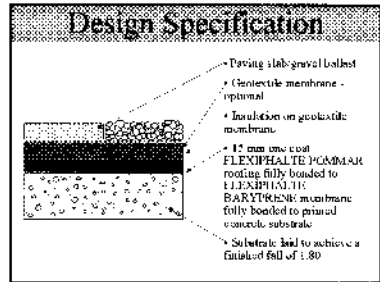
The top waterproof layer is a polymer modified mastic asphalt produced by mixing an asphaltic cement with limestone filler and coarse aggregate. It is then blended with polymers and other additives. The Baryprene is a polymer modified membrane reinforced with a 50gm<sup>2</sup> glass fibre mat, with talc on the upper surface



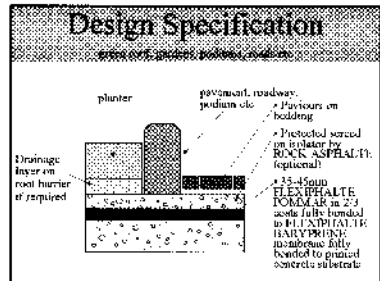
and a sanded finish on the underside.

The membrane is used as a higher specification alternative to a traditional underlay and is fully bonded using the traditional pour and roll method. The third part of the system is a CFC free extruded polystyrene which can be produced in any thickness according to the specification.

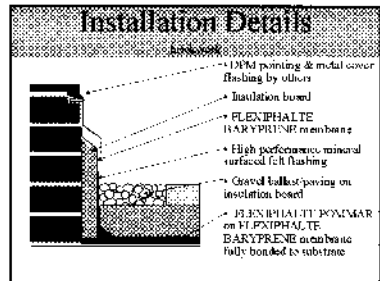
Typical design specifications and detailing are as illustrated.



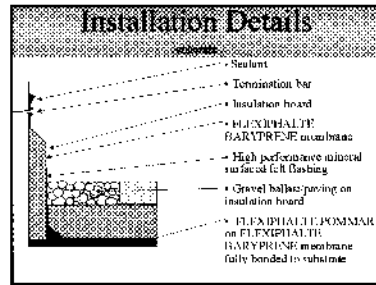
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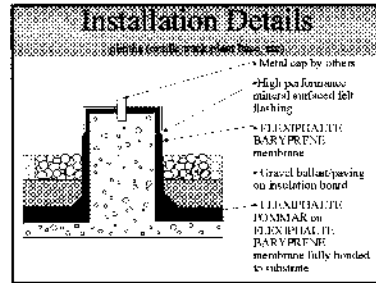
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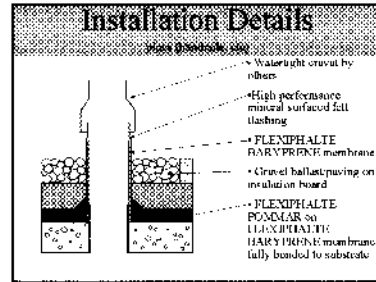
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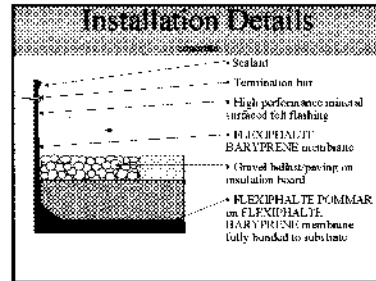
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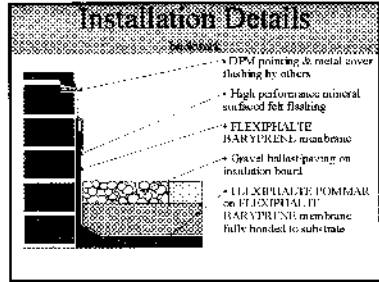
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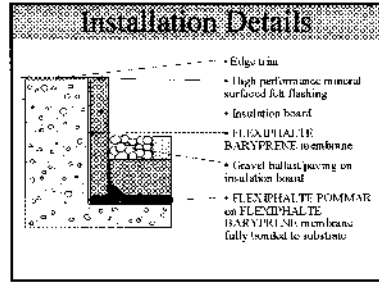
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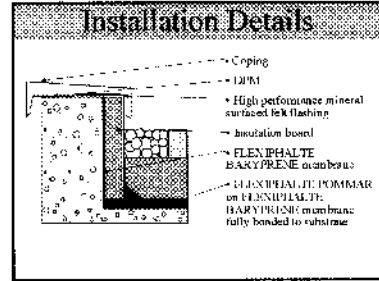
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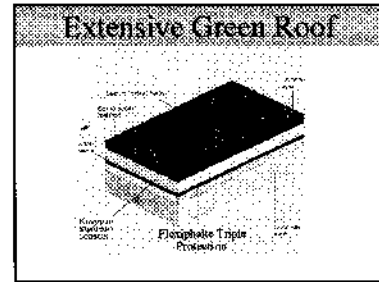
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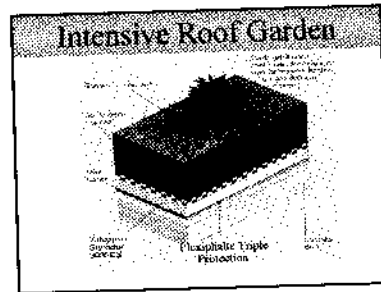


As you can see, the system also particularly lends itself to roof garden constructions. This, if you excuse the expression, is a growing market for us in the UK, although I understand that the 'Green Roof' concept is very popular throughout the rest of Europe.



The illustration is of an "extensive" garden roof which broadly means grasses and sedums are used as the vegetation.

An "intensive" roof garden would include shrubs and trees as the vegetation. Once installed, a fully bonded mastic asphalt system, as already discussed, should never leak. If damaged, there will be no major water tracking problems. Even better, if there is damage, any leaks can be quickly located and corrected.



The installation of the system is relatively simple using conventional roofing techniques and I will not take up the time of the congress with this detail.

Far more important are the opportunities that such a system offers to architects and designers. They can literally use their imagination to design a flat roof into a thing of beauty.

As already mentioned, the system is ideal for roof gardens, standard inverted roofs, lightweight decks, high-rise developments, retail, commercial and office projects - anywhere where aesthetic and distinctive good looks count.

*Installation examples: -*

Kensington Palace Gardens. Ground level waterproofing over basement leisure centre.

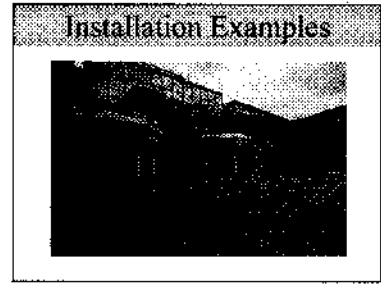


Pearl Assurance Corporate Headquarters. Ground level waterproofing over basement computer suite.



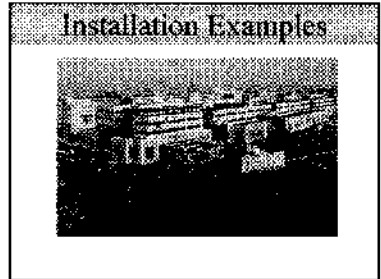


UK Public Records Office, Kew. Waterproofing of flat roofs and terrace areas over all the documented records of births, marriages and deaths throughout the country.



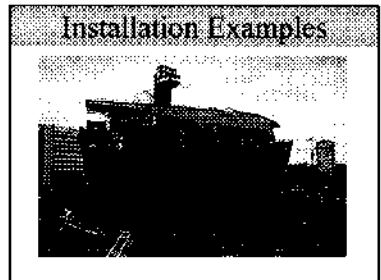
County Mall Shopping Centre, Crawley.

Flat roofing and terrace waterproofing to one of the largest and most prestigious shopping malls in the UK.

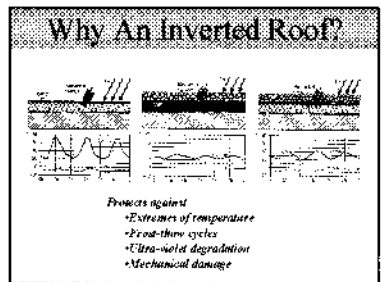


London Ark.

Refurbishment after the initially specified single ply membrane leaked extensively shortly after installation.



In case any of you are not convinced, there is more to support the unique qualities of this particularly roofing package. It is not just another inverted roof. The insulation, as in all such roofing design, offers protection from thermal shock - a major cause of stress for flat roofs.

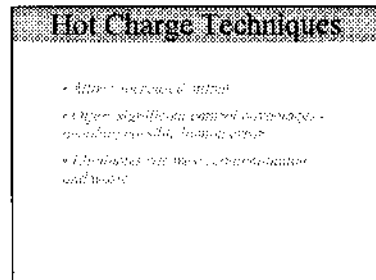


This is not just an inverted roof. Unlike much of the competition, it can be laid dead flat and is not reliant on falls. When properly designed, vapour checks and vapour release mechanisms are unnecessary - avoiding all problems of blistering or breakdown in the membrane.

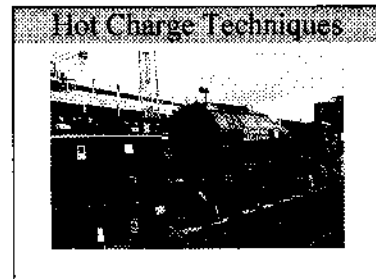
There is no doubt that this is a new type of flat roof system - good enough to have a European Agrément Certificate which says it will last the lifetime of the building.



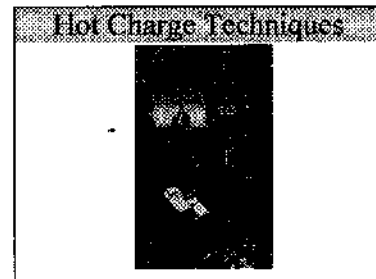
It is laid by licensed contractors often using what we call Hot Charge techniques.



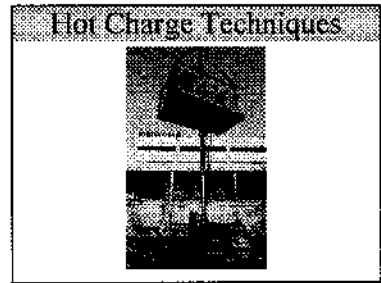
The mastic asphalt simply arrives in a tanker in molten form



It is then transferred to smaller containers called "spams" which is an acronym for "self-propelled asphalt mixers".

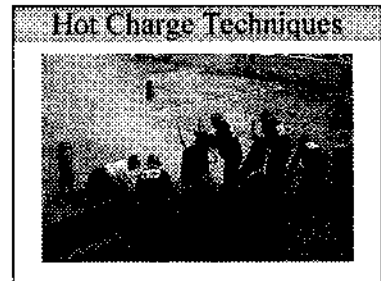


These are then hoisted to roof level in a specially designed lifting frame.



The material is then laid using traditional methods.

Every component in the roof is guaranteed by the individual manufacturer. It's quite a package - the owners of these buildings thought so and that includes Europe's largest shopping mall, Bluewater.

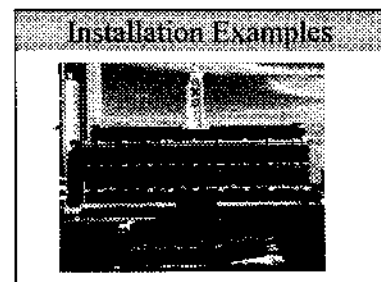


Bluewater Shopping Centre, Dartford, Kent.

Waterproofing of anchor store roofs and ancillary retail areas



Refurbishment roofing to the famous "Oxo" building which now includes one of the finest restaurants in London.



Roofing to Nokia Corporate Headquarters in Farnborough, Hampshire.



To summarise, I believe this is the most effective flat roof system ever devised. It combines the strength and durability of mastic asphalt with a second membrane to achieve a fully bonded roof.

At a stroke it eliminates the lateral transmission of moisture and according to its Agrément Certificate, will remain watertight while there is still a building to protect. I'm convinced it's the best.