

3.3 SURFACE PROTECTION

INTRODUCTION

The waterproofing of a flat roof, by its very nature, is exposed to ultra-violet light and solar heat gain during the day. At night there is heat loss by radiation. When the roof covering is of a dark and non-reflective material such as a self-finished bitumen felt, a large amount of solar radiant heat can be absorbed which can raise the temperature of the surface considerably above that of the surrounding air. Conversely, radiation heat loss to a clear sky at night can cause the temperature of the surface to be about 5°C lower than the air temperature. It is not, therefore, unusual for a roof to be subjected to a temperature range from -10°C to + 80°C.

The effects of solar heat gain and radiation heat loss are to increase the thermal movements in the roof structure and to subject the waterproofing material itself to stress and cycles of softening and hardening. These effects can be reduced by applying a suitable reflective surface finish to the roof.

In addition to its influence on the temperature stability of the roof construction and waterproof covering, a surface protection layer is required to reduce the ageing effects that ultra-violet radiation and weathering have on most materials used in built-up roofing.

Oxidised bitumen and SBS modified bitumen on glass or polyester base roofing will deteriorate when exposed to UV light and need to be protected from

direct UV radiation. APP modified bitumen is rather more stable when exposed but even APP modified coatings will have a significantly increased life expectancy if protected from UV.

A surfacing may also be required to protect the waterproof covering from damage by pedestrian traffic and provide an aesthetically pleasing finish to a roof that will be overlooked.

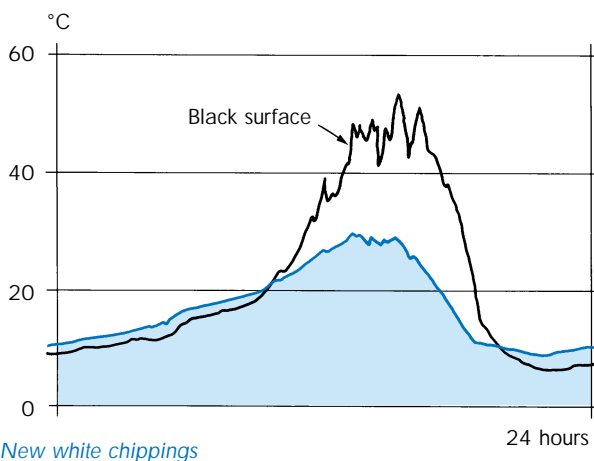
MINERAL SURFACED ROOFING

A satisfactory protection for bitumen felts is a factory applied surfacing of mineral granules, usually crushed slate or granite. These effectively block out UV radiation, but have little reflective quality and do not help to reduce surface temperatures in summer.

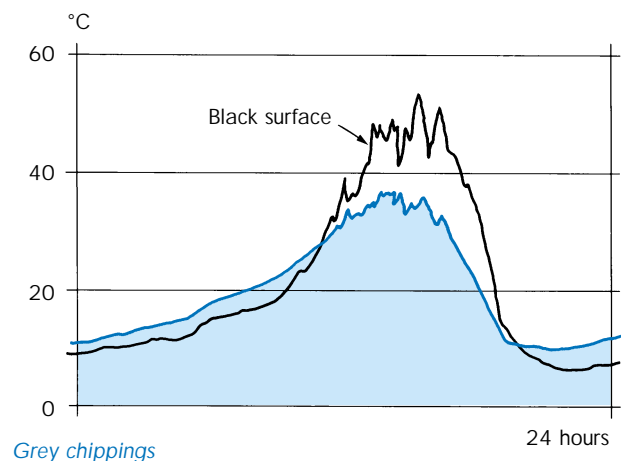
Mineral surfaced felt is suitable for the main areas of flat and sloping roofs and is widely used for all detail work including skirtings, gutters and edge details.

STONE CHIPPINGS

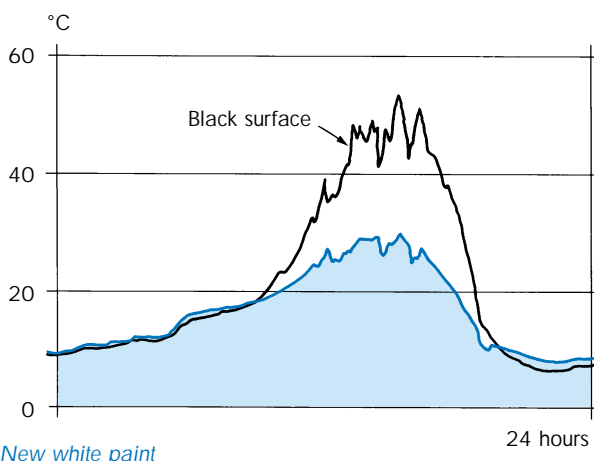
The more efficient surfacing is a layer of 10mm or 14mm stone chippings bonded in hot bitumen or a cold bitumen solution. This surfacing gives excellent protection from ultra-violet light due to the density of the stones. The chippings also act as a heat sink to slow the process of temperature change and reduce the extremes of temperature. Most stone chippings have reflective properties which significantly reduce the surface temperature in summer.



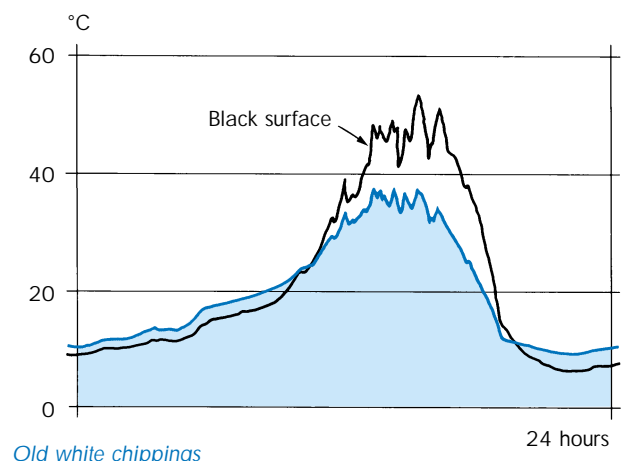
New white chippings



Grey chippings



New white paint



Old white chippings

The lightest coloured chippings can have the same order of reflective efficiency as white reflective paint, but after some years they may become dirty and the efficiency of the reflection is reduced to that of medium grey chippings.

The weight of 10mm chippings coupled with the temperature control which they provide is sufficient to prevent blistering in the majority of cases and the weight alone helps to provide security against wind forces.

It is best to key chippings into place with a thin application of cold bitumen adhesive rather than aim for a fully efficient bond.

Chippings should not block the outlets provided that a satisfactory grating is positioned before the chippings are applied. It is sensible practice to set the chippings back from the outlets or form a firm bond in the immediate vicinity. For roofs subject to wind scour, a thorough bond of the chippings overall may be required.

Designers are sometimes concerned about the possibility of the chippings penetrating a built-up roofing membrane as a result of foot traffic. In practice this is very rare after the surfacing is completed as the load is spread onto a large number of chippings. Hammer tests to represent heavy impact from traffic will demonstrate that the chippings do not penetrate the membrane.

PROMENADE SURFACING

Where pedestrian traffic is anticipated, a surfacing of tiles or paving slabs can be used. All tiled or paved roofs should drain efficiently with falls and cross falls as necessary. Small amounts of standing water or dampness will lead to mould growth and ice formation in cold weather, both of which make extremely dangerous conditions for pedestrians and can lead to the break up of the paving in severe weather. Falls of at least 1 in 80 are necessary to ensure adequate drainage. However, tiles can creep or slip when bonded in bitumen and a maximum fall of 1 in 40 is advisable.

Glass reinforced concrete tiles provide a lightweight promenade surfacing. They are applied in a thick coating of hot bitumen and the back of the tiles should be bituminised before placing to ensure a continuous bitumen bonded contact. It will also be necessary to treat the backs of the tiles with a bitumen primer. Intermediate expansion gaps across the roof are not normally required as the tiles will be installed with a gap of a few millimetres at each joint to allow a tolerance for inaccuracies. They form a stable surface on two layer Polyester 180 roofing as the laps of this specification do not stand proud. Thicker high performance materials should be avoided under tiles as they form laps which stand proud causing tiles to rock over the lap.

Concrete pavings, 25mm minimum thickness, provide a heavier and more stable promenade surface. They may be bedded in a thick layer of bitumen, but it is not possible to obtain a standard of flush finish to compare with that achieved when paving is bedded in sand or sand and cement. When concrete tiles or paving slabs are bedded in sand and cement, it will first be necessary to overlay the waterproofing with a building paper to allow differential movement between

the waterproofing and surfacing. Polythene sheeting is sometimes applied to act as a slip layer but this tends to cling tightly to the waterproofing and does not provide such a satisfactory separation. An allowance for expansion is necessary and it will usually be sufficient to set the tiles or slabs back 25mm from the vertical at the roof perimeter, and around major details, with intermediate joints at 3m centres.

Concrete paving slabs may be bedded on proprietary plastic corner supports or felt shims. Irregularities of level can be made up by extra bitumen felt pads forming shims. The great advantages of these systems are the effective separation of the promenade surface from the waterproofing, the rapid drainage of surface water and the easy access to the waterproof covering should inspection and repair prove necessary. The ease of removal can however be a disadvantage on buildings where vandalism is likely.

REFLECTIVE COATINGS

Reflective coatings are sometimes advocated as a replacement for mineral surfaced roofing or stone chippings. The coating can give a measure of protection to the built-up roofing membrane while it remains in good condition but is not likely to have a long life and significant bare patches may occur even after one or two years. Because most built-up roofing depends on a permanent protection, designers should be sure that if reflective coatings are to be specified, the building owner clearly understands the need to inspect the coating annually and renew or make good the surface as soon as significant bare patches appear. The permanent protection of stone chippings, paving, or factory applied finishes are much to be preferred. It is recommended that reflective coatings are applied to mineral surfaced cap sheets rather than self-finished felts.

It should be remembered that surface coatings may alter the external spread of flame rating to BS 476, and this should be checked with the manufacturer to ensure that the coating does not reduce the rating to unacceptable levels.

Although certain coatings achieve an excellent rating for spread of flame it is recommended that no dependency is placed on the coating to improve the fire characteristics of the membrane. It can never be certain that the coating will be replaced with a coating of similar fire performance at a future date as the implications of the provision of fire protection are not likely to be appreciated or remembered by maintenance staff.

ROOF GARDENS AND TERRACING

The waterproofing under a roof garden or immovable terracing should be regarded as a buried membrane which is inaccessible for inspection and repair. Faults are extremely difficult to trace and expensive to repair. Flat roofs should only be used as a base for roof gardens or terraces when the roof design can comply with all requirements of good practice without compromise. A number of proprietary high performance specifications are available and the advice of the manufacturers should be followed.