

1900

1050

Bituminous Waterproofing Treatment for Porous Lime Terracing

M. ASLAM and R. C. SATIYA
Central Building Research Institute, Roorkee, U.P.

Many a time lime terracing becomes porous by the passage of time, thus creating leakage problems in buildings. Sometimes even newly laid lime concrete roofs are found to be porous due to the use of substandard materials, poor mix design or inadequate supervision. Such porous roofs have to be given a waterproofing treatment to make them impermeable. Tarfelting is a costly operation and the application of bitumen as per C.P.W.D. schedule of work is not very effective. The Central Building Research Institute has developed a bitumen based treatment which is quite effective on such surfaces and is also economical.

Lime concrete is commonly used as decking material on flat roof for waterproofing as well as thermal insulation. Its surface may become porous by the passage of time or due to faulty raw materials or supervision. In such roofs there is a problem of water seepage and waterproofing treatment is required to check it. Replacing this lime terracing from the top is not only cumbersome and costly but sometimes may also adversely affect the overall structure of the building itself. An important method of waterproofing such roof is tarfelting which is quite costly. Bitumen when used in molten state as an alternative to tarfelt is not effective as it does not plug the pores to any appreciable extent. Water, which may get in through the cracks developed in the bitumen layer, will penetrate the roof thickness through the unplugged pores.

The Central Building Research Institute, Roorkee has developed a low cost bitumen based treatment, that can also be effectively used on new lime terracings which have been rendered porous due to the use of faulty raw materials, lean mix or poor workmanship or supervision. This treatment is effective for porous roof only.

MATERIALS AND TECHNIQUES

The main raw materials required in this process are specified grade

of blown bitumen and a mineral oil. This waterproofing treatment is a three coat system viz the primer, the under coat and the final coat. The method of preparation of all the three coats is very simple and does not require any technical expertise or special plants or equipment. It consists of slowly adding molten oil with continuous stirring. Different proportions of the two components are taken for preparing the three different coats. Overheating of bitumen should be avoided during material preparation. The prepared materials can be stored for any period in airtight containers in a dark and cool place away from fire.

SURFACE PREPARATION

The roof surface to be treated must be cleaned well with wire brush or any other mechanical device to remove dust and loose particles. Except for fine cracks, bigger cracks and pits should be repaired well before the treatment. Special care should be taken to clean the surface thoroughly if the roof top was given any type of bitumen treatment earlier. Failure to do so may result in trouble at a later stage. The entire roof should be fully dry and free from dust, algae or greasy matter before the application of the treatment is undertaken.

APPLICATION

After the surface is prepared as above the primer coat is applied with the help of a brush and well worked in so that it enters into the surface pores of the roofs. This coat should preferably be applied in the forenoon or not on a very hot sunny day. This is important because application of the primer coat on a very hot surface will adversely affect the efficacy of the treatment. The under coat is applied with the help of a brush next day when the primer coat has been fully absorbed and the surface is dry. The final coat is applied on the third day. This coating is very viscous and hence is applied with the help of wooden

trowel specially made for this purpose (Fig. 1). Finally, after a few days, the surface is dressed with coarse sand or gravel (Fig. 2). This dressing is necessary as it helps in increasing the durability of the treatment.

PERFORMANCE EVALUATION

(A) Water percolation Test

The test was carried out on the roof of a prototype room (3m x 4m) in the Institute. It was a newly built room with precast roofing units but had a porous roof deck which was leaking at many places. The porosity of the roof surface was probably due to the use of lean concrete mix. The roof surface was cleaned well and the treatment was given in the manner described above. After 7 days from the final treatment, the drain of the treated roof was plugged and water was filled on the roof to a height of 15 cm. A 15 cm. head of water was allowed to stand on the roof top for 7 days. No leakage was observed on the ceiling underneath after the expiry of this period.

(B) Natural weathering

The roof treatment described above was given in 1973. The effect of rains on the waterproofing of the treatment was observed during every monsoon in the following years. No leakage of water has been observed during the last 6 monsoons. The top surface of the treatment also looks intact and no deterioration of the treatment has taken (Fig. 3).

The treatment was also applied over the roof of airconditioning plant building (Fig. 4) of the Institute which was leaking very badly. The total roof area was approximately 36 sq. ms. The roof had a lime terracing which was damaged at places and had developed porosity with the passage of time. The top surface was cleaned well and the treatment was given as described above. The treatment has stopped the leakage of water and no leakage was observed during the current monsoon season.

The efficacy of the treatment is based on the fact that the com-

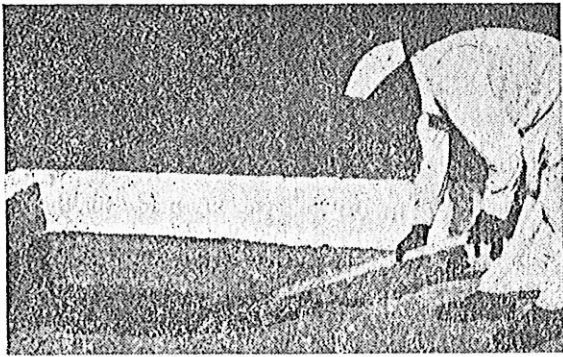


Fig. 1. Application of Bituminous Treatment

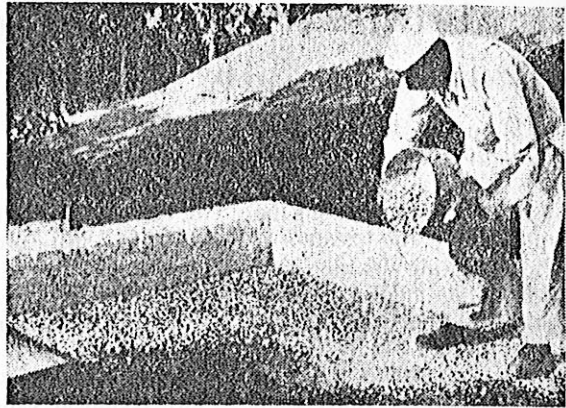


Fig. 2. Gravel Dressing on Treated Surface

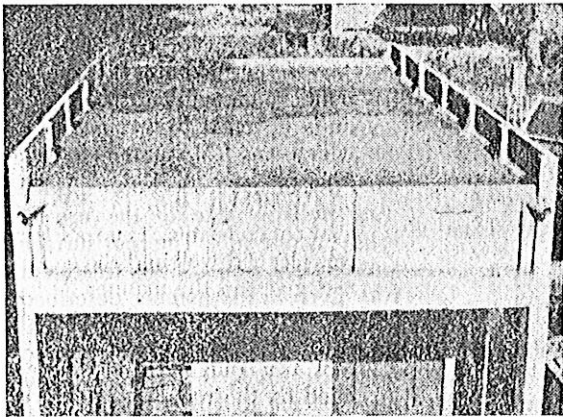


Fig. 3. Treated Roof of the Prototype Room after six years

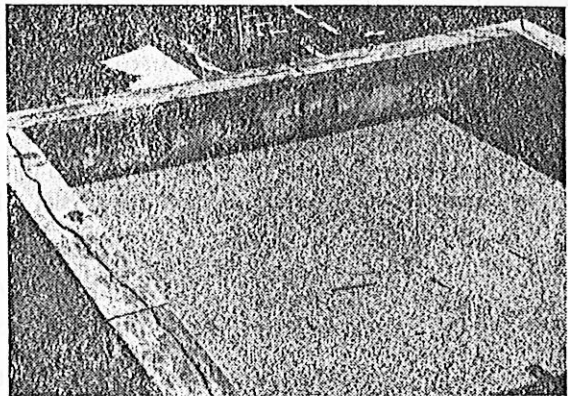


Fig. 4. Treated Roof of the Airconditioning Plant Building

position of the three coats have been so adjusted as to make the bitumen plug the pores as deep as possible. This ensures maximum waterproofing protection to the roof. The bitumen chosen possesses low thermal susceptibility and hence this treatment could withstand much higher temperature than the treatment proposed in C.P.W.D. schedule of work 1977.

It is important to note that a precondition for the success of this treatment is porous roof deck which should be otherwise strong and intact. It may, however, be noted that very compact and non porous roof surfaces do not require any such water-proofing treatment.

Even if there are some leakages in such roofs, efforts should be made to find out the actual fault to give an appropriate remedy rather than giving the bitumen treatment.

ECONOMICS

The overall cost of the treatment including materials and labour was calculated on the basis of actual

cost of treatment incurred over the roof of air-conditioned plant house of the Institute (Converted to latest market rates of September 1979) which is as follows: (Basis 100 sq. metres)

Bitumen	Rs. 260
Miner oil	Rs. 150
Fire wood	Rs. 10
Gravel	Rs. 20
Labour	Rs. 40
Total	Rs. 480

The overall cost of the treatment thus comes to Rs. 4.80 per square

metre. The comparative expenses of this C.B.R.I. process and other bitumen based waterproofing treatments as per 1977 C.P.W.D. schedule of works are given in Table I.

The C.P.W.D. rates of 1977 for (B) converted to Sept. 1970 figures are Rs. 4.10 per square metre. Thus it is seen that though the cost of the new treatment (C) is marginally higher than the cost of C.P.W.D. treatment (B), the former can be adopted in preference to the latter as it has been found to be more effective.

TABLE I

Waterproofing treatment	Schedule	Cost per sq. metre (Rs.)
A. Tar felt	C.P.W.D.	13.84
B. Bitumen treatment	C.P.W.D.	2.86
	Converted to fig. of Sept. 1979	4.10
C. Bitumen treatment	C.B.R.I. 1979	4.80

ACKNOWLEDGEMENT

The work reported here is a part of normal research programme of the Institute and is being published with the permission of the Director.

—Reprinted from *Indian Construction*, Vol. 13, No. 7, July 1980