

BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE, INDIA



WATER-PROOFING OF PREFABRICATED ROOFING SCHEMES

Introduction

Several precast roofing/flooring schemes have been developed at the Institute which result in saving in cement, steel, cost and time of construction. Precast units such as cored units, channel units, waffle units and R.C. planks (C.B.R.I. Data sheet Nos. 3,5,6 and 7) have been used in a large number of buildings for floors and roofs. The width of these units have been kept small, so that they can be easily handled manually. As such, there are a number of joints between the units which are filled with insitu concrete and it is necessary to take proper care in their filling to make the roof structurally complete and leakproof. This digest describes the precautions to be taken in the construction to make the roof waterproof. For other details of precast floors/roofs including structural design, casting of the units and labour and material requirements, reference may be made to C.B.R.I. Date Sheets.

Cleaning of Precast Units

Care should be taken to see that the surfaces of the units are clean and that no paper, oil, grease or other foreign material is sticking on to it. It is also advisable to keep the surfaces of the units, except the ceiling, rough to provide good bond with insitu concrete. While casting the units, excessive use of mould oil is harmful as the surface of the units cast will have a coating of the mould oil. If the surface of the unit is oily, it will result in poor bond with the insitu concrete laid in the joint. The oily surface has to be brushed with washing soda solution. In case, paper has been used as a release agent, it should be removed by wetting the surface of the units and peeling off the paper preferably 48 hours after casting, as soon as the units are turned upside down at the casting yard.

Levelling of Bearing Surfaces

The top of the walls on which the units are to be placed should be levelled with 6 mm cement plaster 1:3 (1 cement : 3 fine sand) finished with a floating coat of neat cement and a thick coat of lime wash or kraft paper. Similarly, the bearing area of beams

should also be made level and smooth. This is necessary to allow free movement of the roof over the walls/beams. If free movement of the roof is restricted, the resulting thermal stresses may lead to cracks in the roof, resulting in leakage.

Alignment of the Precast Units

While placing the units care should be taken to see that they touch each other sideways as far as possible. Any protrusions formed on the edges, while casting the units due to leakage of slurry, should be removed before placing the units in position. The units should have straight edges. The maximum deviation at any point along the length should not exceed 5 mm.

Application of Cement Slurry

Before filling the joints between the units with concrete, the surface of the units should be wetted. At any location, if there are wide gaps due to chipping off of concrete at the edge of the unit, stiff cement : sand mortar 1:4 should be packed there to prevent the leakage of concrete while filling the joints. A coat of cement slurry with 0.5 kg of cement per square metre of area should be applied to the vertical sides of the units with a wide brush or cloth just before filling the joints with concrete. This is necessary to provide proper bond of the precast units with the insitu concrete laid in the joints.

Provision of Reinforcement in Joints at Supports

It is always advisable to design the roof slab as a continuous one with provision of negative reinforcement between adjacent units over intermediate supports. The negative reinforcement should be provided in the joint near the top such that it is having only the cover as per design. Care should be taken to see that the reinforcement is not pushed down, while compacting the concrete in the joint.

If the roof spans are designed as simply supported, there is chance of transverse cracks occurring over the intermediate supports which may lead to leak-

age. In such situations, tarfelt or fibre glass reinforced bitumen treatment should be provided over the roof treatment at the intermediate supports for at least a width of 60 cm. Alternatively, single thickness brick/block parapet walls 45 cm high may be provided over the precast roof at the intermediate supports. The junction between the parapet and the roof on either side should be treated as described in this digest later, after providing lime concrete/mud-pluska treatment over the precast roof.

Compaction and Curing of Concrete in Joints

After applying the cement slurry to the vertical sides of the units and placing negative reinforcement, the joints between the units should be filled with M-150 concrete with 10 mm coarse aggregate leaving a gap of 5 mm at top (Fig. 1). The joints between precast units of adjacent spans over intermediate supports should also be filled with M-150 concrete in a similar way. It has been often noticed that improper filling of these joints over walls/beams has led to leakage. The concrete should be well compacted using a needle vibrator or by rodding. The laying of insitu concrete should start from one end of the building and proceed forward. After the concrete is laid, the units should not be disturbed. As far as possible, for three days nobody should be allowed to walk over the units, where the joints have been filled. The insitu concrete should be cured for at least 7 days by ponding water over the roof. If leakage, other than dampness, is observed at any

spot, the same should be treated by applying cement slurry and by giving an extra coat of bitumen before doing bitumen painting, on entire surface.

Bitumen Painting

The surface to be painted should be even, smooth and bone dry; otherwise there will not be proper adhesion between the bitumen and the roof surface. In case the roof surface is moist, the same should be dried with blow lamp. The entire surface of the roof should be cleaned with wire brush and cotton and should be further cleaned with a piece of cloth lightly soaked in kerosene oil. The surface including the depressed portions over the joints should be coated by bitumen primer prepared by blending kerosene and hot bitumen of grade 85/25 in the ratio of 60:40 by weight. Hot bitumen of grade 85/25 should be applied on the depressed portion and the same should be sprinkled with clean coarse sand and further coated with hot bitumen so that the top of the filling is in level with the roof surface. The entire surface should then be painted with 85/25 grade bitumen @ 1.7 kg/sq m after heating it to the required temperature as per specifications of manufacturers. Care should be taken to see that no blank patches are left. Air bubbles formed during the application of bitumen should be punctured and the portion recoated with hot bitumen. Bitumen of grade 80/100 is not to be used as it is likely to flow out in extreme summer.

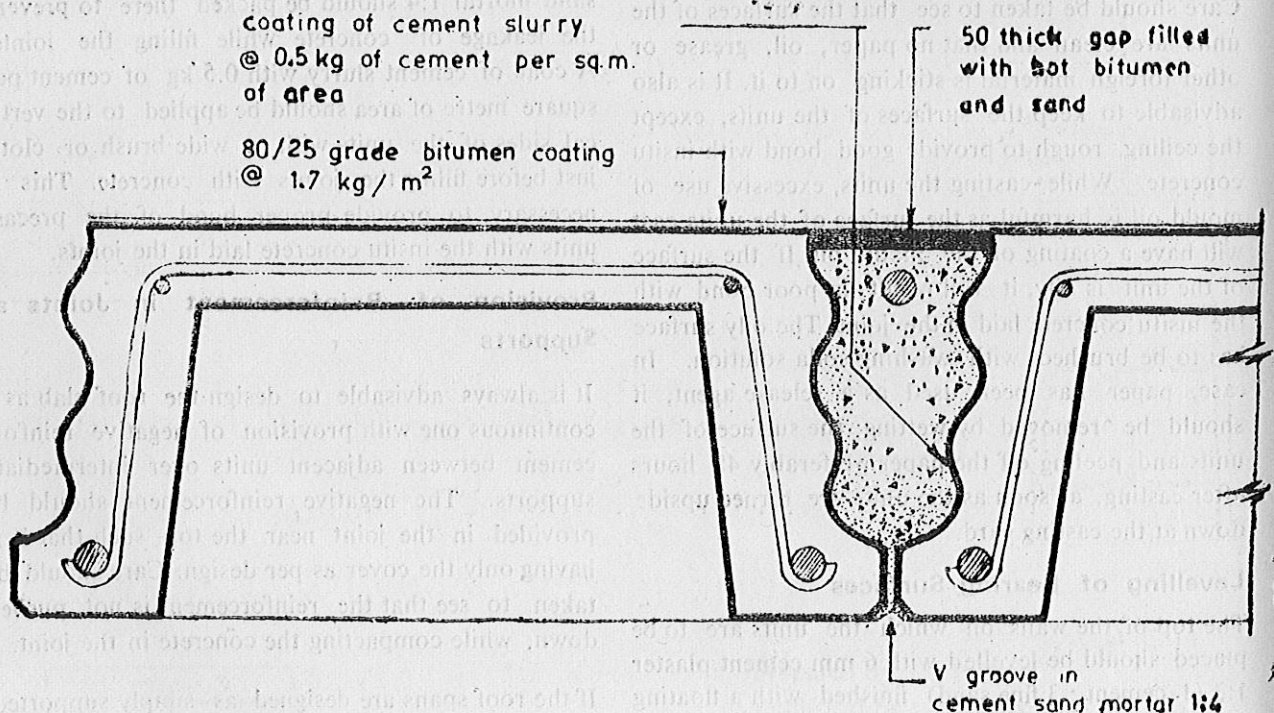


Fig. 1. Details of Joint Between Precast Units

Weathering Course

Lime concrete terracing or mudphuska treatment with the tiles above or any other proven treatment should be provided over the bitumen coating as per IS : 3036-1965 or IS : 2115-1967. Care should be taken to provide a slope of at least 1 in 40 and to see that there are no depressions left on the surface.

Special attention is needed to ensure the quality of lime used in case of lime concrete and the quality of soil used for mudphuska. The quality of lime should be tested as per IS : 1624-1974 before using the same for lime concrete. For effective compaction of lime concrete, the tamping machine developed at the Institute (C.B.R.I. Technical Note No. 29) may be used. The machines are being produced by M/s. M.S.J. (Engineers) & Co., Khanjarpur, Roorkee and M/s. Roorkee Engineering Works, Roorkee who

have taken the patent.

In situations where thermal insulation is not very important, lime concrete/mudphuska treatment can be avoided and the roof finished with tarfelt treatment as per IS : 1346-1976 or fibre-glass reinforced bitumen (Draft IS Code of Practice for Insitu Waterproofing and Damp-proofing Treatments with Glass Fibre Tissue Reinforced Bitumen) treatment topped with a layer of aluminium foil. In thin unprotected roof slabs, where thermal insulation is avoided expansion joints should be provided at an interval of 15 metres.

Treating the Junction Between Roof and Parapet

Parapet walls should be provided over the roof on the outer walls. The junction between the roof and the parapet wall should be made as per details given in Fig. 2 or 3. At the bearing of the units over walls

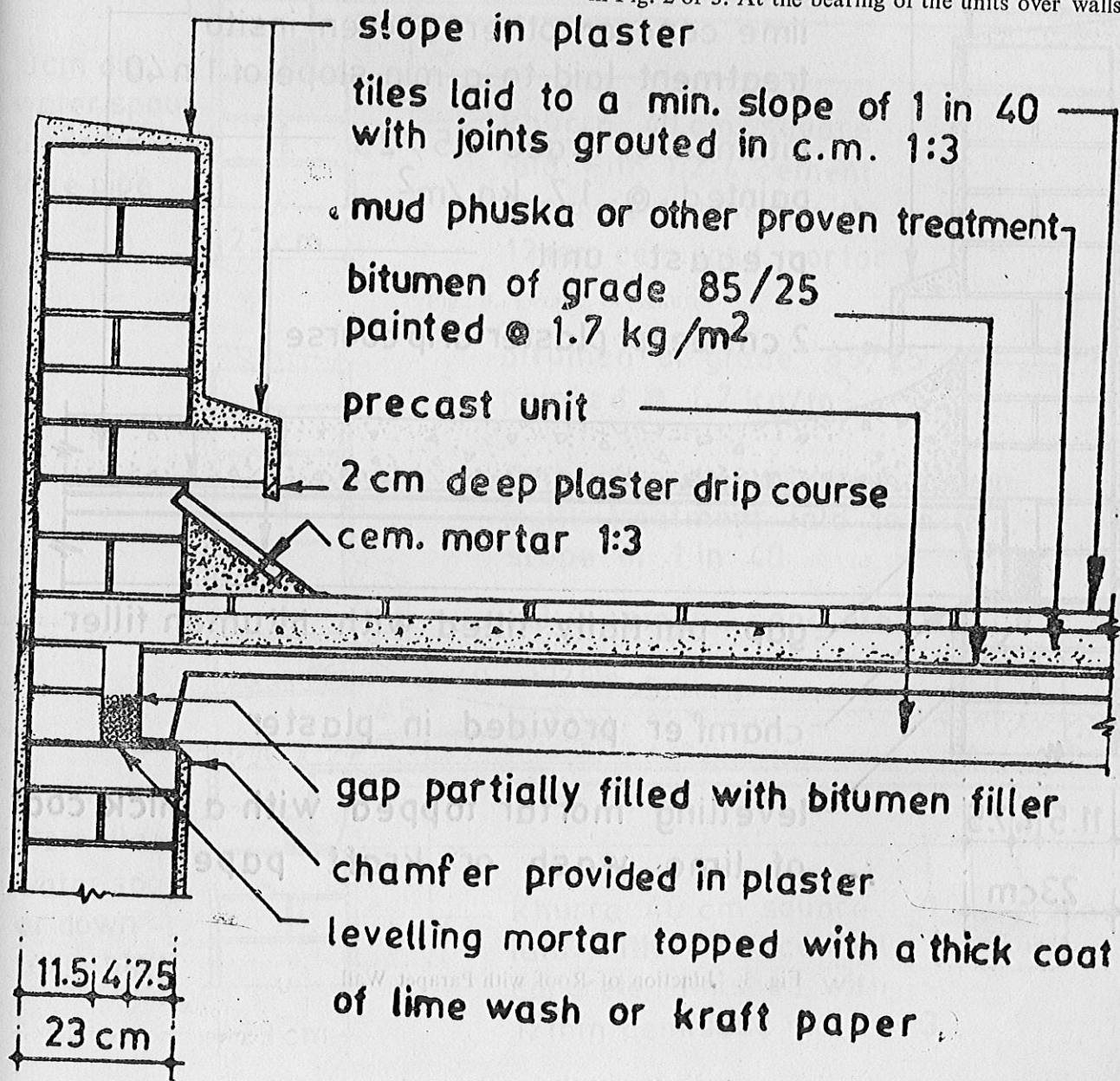


Fig. 2. Junction of Roof with Parapet Wall

a gap, at least 12 mm wide and to the full height of the units should be provided. The gap should be partially filled in height, with hot bitumen of grade 85/25 mixed with sand or saw dust or with bituminous compounds as per IS :1580-1969. Over the mudphuska or any other treatment with tiles above, one layer of tiles should be provided at slope at the junction of roof with parapet as shown in Fig. 2. In case of cast-in-situ treatments such as lime concrete treatment, a concave strip of same material should

be provided at the junction as shown in Fig. 3. In both cases a drip course should be provided by projecting bricks out and plastering the same as shown in the sketches. The top of the parapet wall and the projecting brick should be plastered with inside slope.

Provision of Rain Water Pipes

100 mm diameter rain water pipes should be provided for every 40 sq m of roof area to be drained.

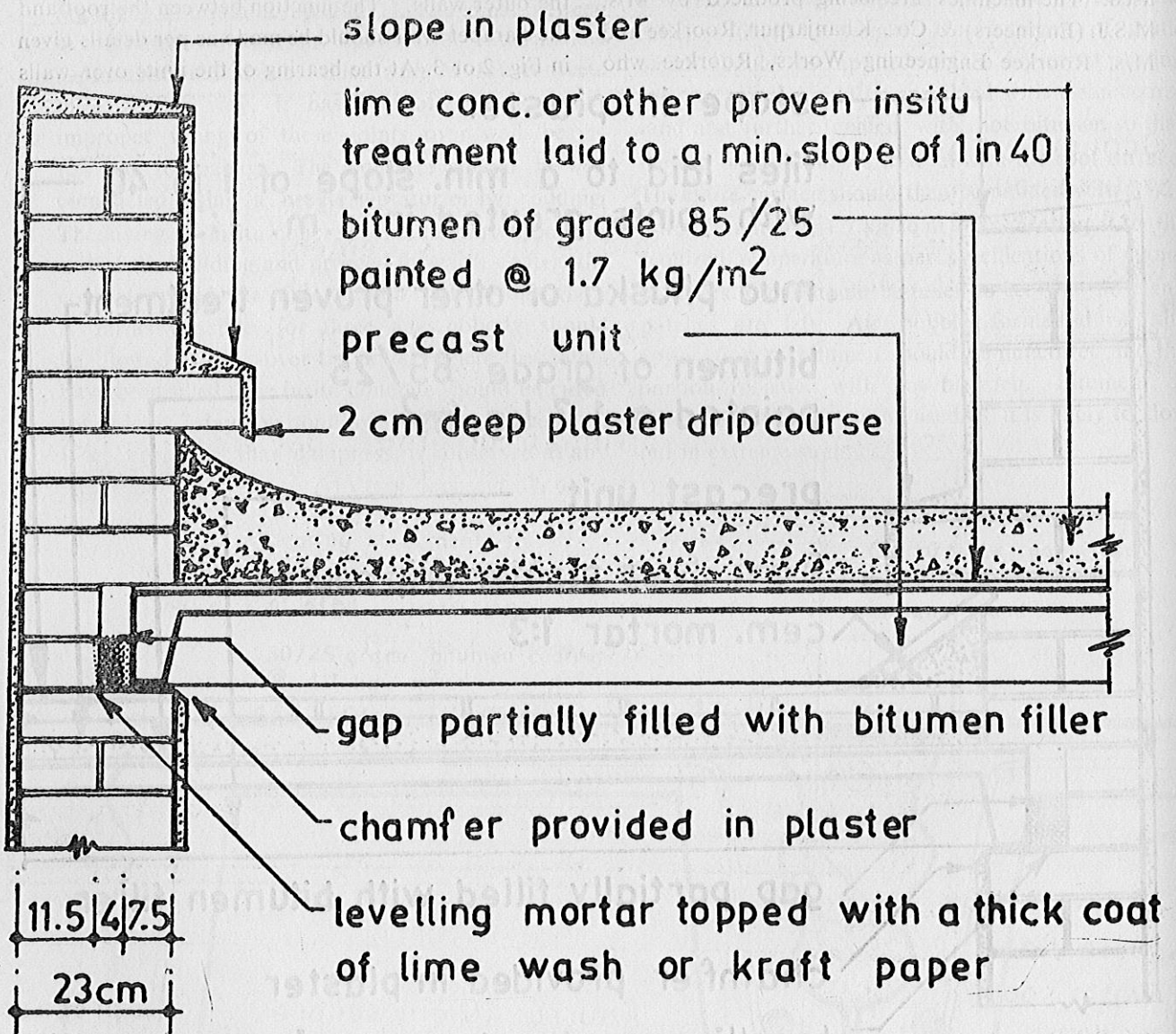


Fig. 3. Junction of Roof with Parapet Wall

40×40 cm size khurras should be provided where rain water pipes are to be taken out of the parapet walls. The khurras should be lined with 1:2:4

concrete with a minimum thickness of 40 mm, laid to slope. Details of the khurras are shown in Fig. 4 and 5.

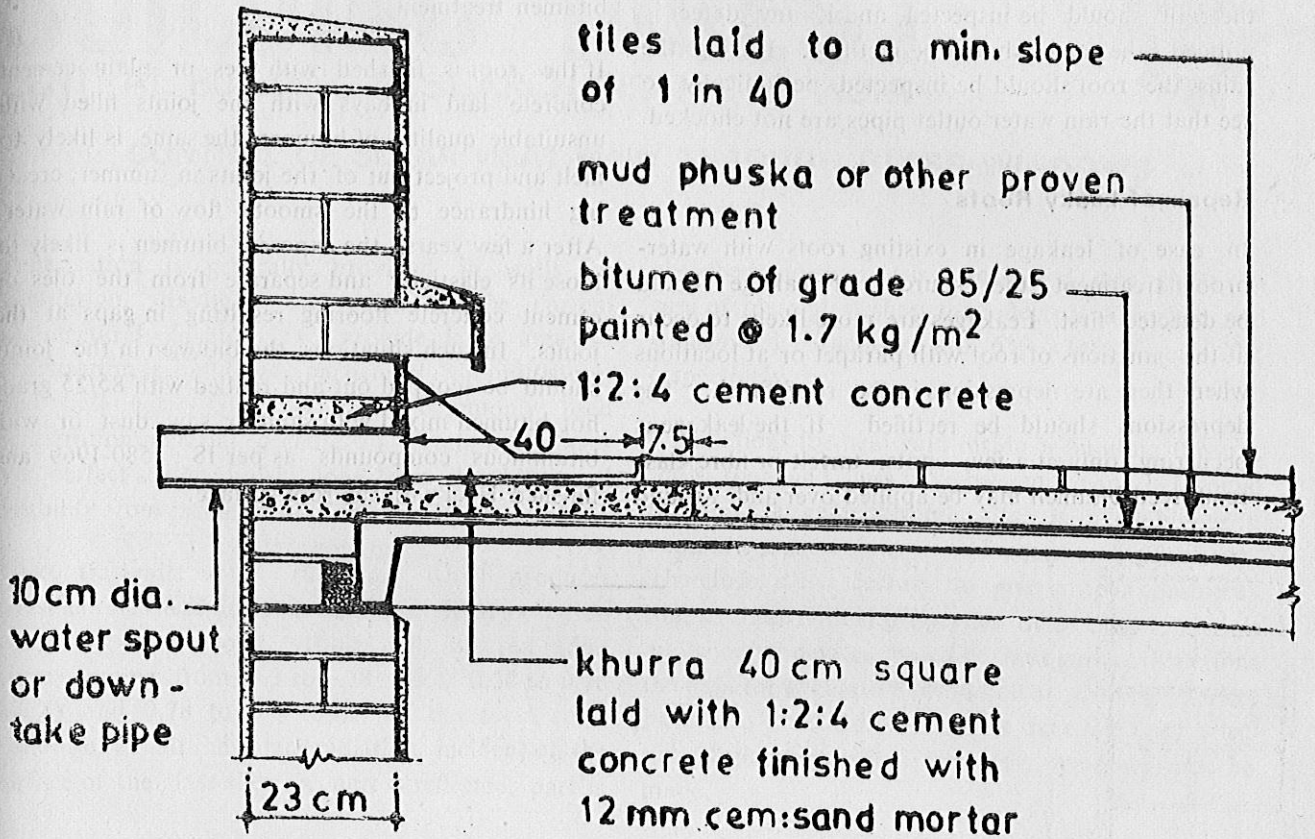


Fig. 4. Details of Khurra

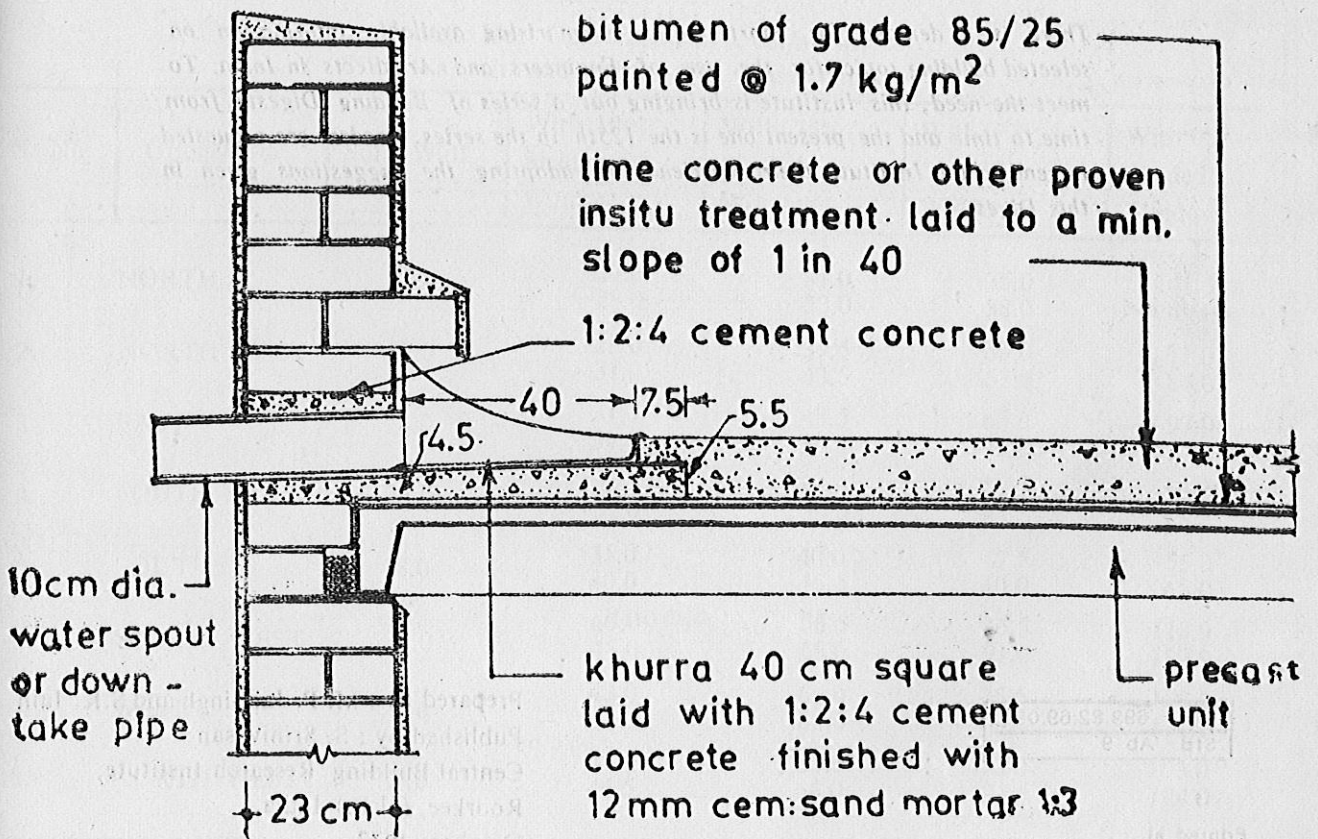


Fig. 5. Details of Khurra

Proper Maintenance

Proper maintenance of the roof is also equally important to prevent the leakage of roof, whether insitu or precast. Before the onset of rainy season, the roof should be inspected and if any defect is noticed, the same should be rectified. During the rains, the roof should be inspected periodically to see that the rain water outlet pipes are not choked.

Repair of Leaky Roofs

In case of leakage in existing roofs with waterproof treatment, the source of leakage should be detected first. Leakages are more likely to occur at the junctions of roof with parapet or at locations where there are depressions in the roof finish. The depressions should be rectified. If the leakage is occurring only at a few spots, tarfelt or fibre glass reinforced bitumen may be applied over and around

the area. In case the leakage is observed at several places the weathering course may have to be redone. Alternatively, the entire surface may have to be provided with tarfelt or fibre glass reinforced bitumen treatment.

If the roof is finished with tiles or plain cement concrete laid in bays with the joints filled with unsuitable quality of bitumen, the same is likely to melt and project out of the joints in summer, creating hindrance to the smooth flow of rain water. After a few years, the exposed bitumen is likely to loose its elasticity and separate from the tiles or cement concrete flooring resulting in gaps at the joints. In such situations, the bitumen in the joints should be scooped out and refilled with 85/25 grade hot bitumen mixed with sand or saw dust or with bituminous compounds as per IS : 1580-1969 and finished level with the roof surface.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need, this Institute is bringing out a series of Building Digests from time to time and the present one is the 125th in the series. Readers are requested to send to the Institute their experience of adopting the suggestions given in this Digest.

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