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BY

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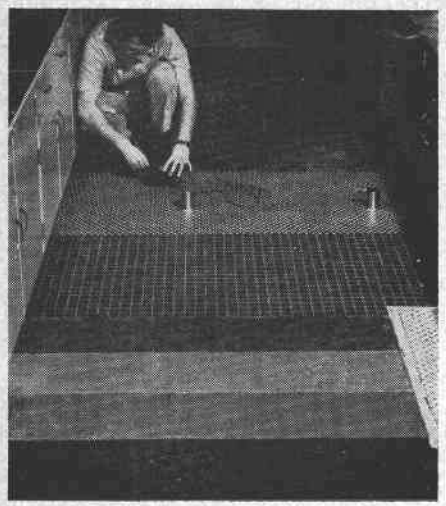

How to make conductive terrazzo flooring*

THERE are three general kinds of floorings moderately conductive to electricity: (1) floor coverings, (2) floor coatings and (3) cast-in-situ flooring. The present report covers the results of work on the properties of conductive terrazzo flooring.

The U. S. Bureau of Standards pioneered in the development of conductive terrazzo flooring. It was found that terrazzo flooring containing acetylene black in the amount of 3% by weight of the cement in the mortar underbed and 2% by weight of the cement in the 5/8" terrazzo topping, was a satisfactory conductive flooring. Since then a number of conductive terrazzo floors have been installed both in the U. S. and in Canada.

Reports have been received, however, that some have not met conductivity requirements. Work was undertaken to examine the possible factors responsible for the bad service record of some conductive terrazzo.

It was certain that the conductivity would have been satisfactory had the proper proportion of black been achieved throughout these floors. It is known that acetylene carbon black does not wet by water and is of extremely low density. For these reasons it is hard to get a uniform dispersion of the black in the cement mix. This was the obvious factor which might have been responsible for the failures. To overcome this difficulty, the National Terrazzo and Mosaic Association proposed the use of isopropyl alcohol as a wetting agent to disperse the black more readily.

A series of samples of conductive terrazzo was prepared to test this method. Isopropyl alcohol in concentration of 1½% in water was found suitable as a wetting agent for acetylene carbon black. This wetting agent did require more water to be used in the mix resulting in a decrease in the compressive strength of the sample in proportion to the increase in the water-cement ratio. There was no other undesirable effect on the hardened cement.

Successive batches of terrazzo with acetylene black in the amount of 2% by weight of cement showed remarkable reproducibility of electrical resistance as measured by the N.F.P.A. method. The resistance of these samples remained below one megohm even after drying in the oven at 220° F.

A number of terrazzo sealers of the penetrating type were applied on the samples of conductive terrazzo flooring. These sealers did not change the resistance of the flooring samples.

The reproducibility and uniformity of the resistance of these samples is attributed to the uniform dispersion of the desired proportions of acetylene carbon in the terrazzo mix.

This was achieved by the use of isopropyl alcohol as a wetting agent for the black and by careful proportioning of all the ingredients including the water. The mix contained just enough water to allow trowelling of the topping into place.

It is believed that the usual field practice of using excess water in the terrazzo mix to allow rolling of additional marble chips into the surface results in the removal of black with the excess water.

Conductive terrazzo flooring properly proportioned and laid will exhibit a matrix of uniform hardness almost as hard as most of the marble chips. This property of the matrix can be evaluated by means of the scratch hardness test using the Taber apparatus. Micrographs of a scratch test of a sample of good terrazzo as well as one not satisfactory from the

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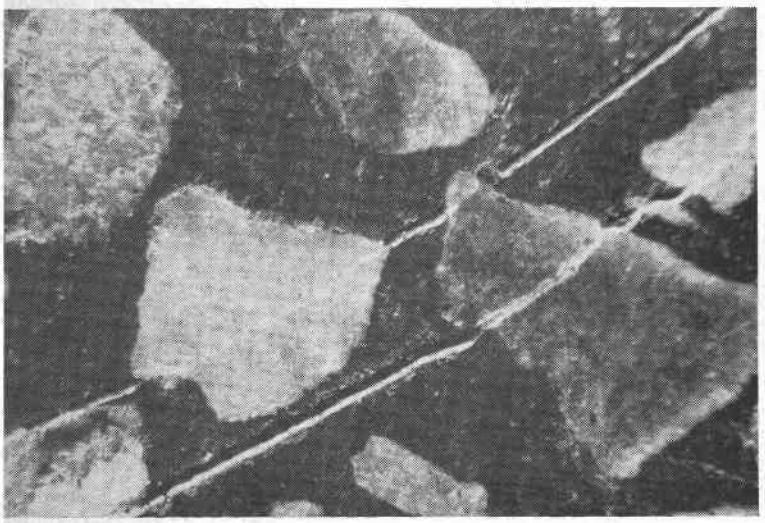
standpoint of durability are shown in the accompanying illustrations. (Figures I and II).

To assist the architect in specifying and the contractors in laying conductive terrazzo flooring, the following method is suggested. By following this specification a satisfactory conductive operating room floor was constructed recently in a Canadian Veterans' Hospital.

Underbed for all acetylene carbon black terrazzo should consist of one part portland cement, four parts coarse screened sand, and contain acetylene carbon black in the amount of 3% by weight of cement (2 lb. 10 oz. per 87.5 lb. Canadian bag of cement).

All sand and cement should be mixed with one half of the required mixing water. Isopropyl alcohol in the amount of 1½% (three fluid ounces per imperial gallon, or 87 cubic centimeters per imperial gallon of water) should be added to the remaining half of the required mixing water. Then the required amount of acetylene black should be added and the mixture stirred to make a paste. This paste should then be added to the mix of sand, cement, and half of the mixing water and mixed for three minutes. The resulting mix must be workable for trowelling. This mortar should be spread evenly, compacted on the slab, and brought level no less than ¾" below finished floor. All morter spread each

Figure I



day should be covered by terrazzo not later than the following day.

Dividing strips no less than 1¼" deep of plastic or similar non-metallic top and having proper anchoring features should divide the terrazzo into squares of suitable size for such work. The dividing strips should be set into the underbed when the mortar is in a semi-plastic state so that the top edges will be flush with the finished floor surface.

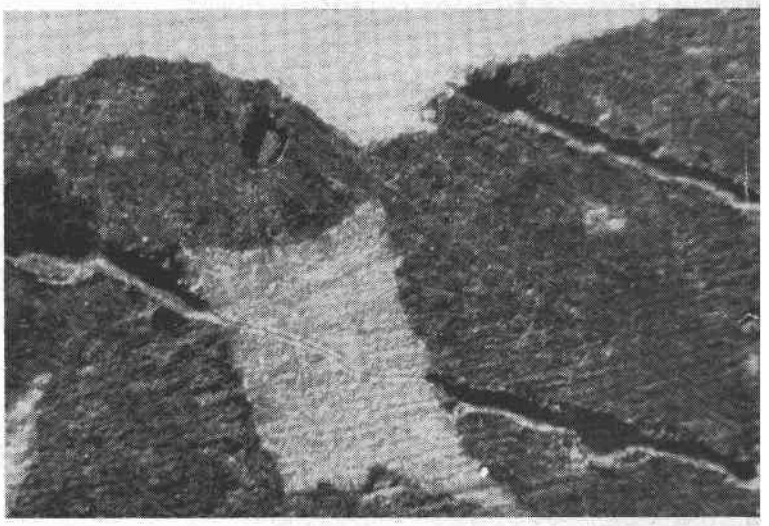
A wire mesh or screen of 1", 1½" or 2" opening made from galvanized iron or copper (such as poultry netting) should be installed between the underbed and the terrazzo topping and should cover all the surfaces of the underbed lying between the dividing strips. If more than one piece is used, joints in the mesh should be made by overlapping the two pieces at least 5". At least one wire connection should be made between adjacent strips of mesh by passing the wire through a hole in the metal base of the dividing strips and making good electrical contact with the mesh. The wire, mesh, and dividing strip should be made of metals or alloys which are compatible from the standpoint of corrosion.

Terrazzo topping should consist of one part portland cement and two parts marble granules by weight, and contain acetylene carbon black in the amount of 2% by weight of cement (one lb. 12 oz. per Canadian bag of cement). The marble granules should be a mixture of one part no. 1 granules and one part no. 2 granules. Only enough water to permit trowelling should be used in the mix (usually five imperial gallons per Canadian bag of cement).

All granules and cement should be mixed with one half of the required water. Isopropyl alcohol in the amount of 1.5% by weight of the water (three fluid ounces per imperial gallon of water or 87 cubic centimeters per imperial gallon of water) should be added to the remaining half of the required mixing water to which the required amount of acetylene carbon black should then be added and mixed into a paste Care should be taken to ensure that no lumps of carbon remain in the paste. If necessary, the paste should be passed through a screen of no more than ⅛" openings. The paste should then be added to the mix of cement, marble granules and one half of the mixing water and mixed together in a mechanical mixer for about three minutes.

The topping mix should be trowelled into place and to the required level. Rolling and sprinkling of granules on the surface of the wet mix should not be permitted.

Figure II



Conductive terrazzo should be allowed to cure for at least 14 days while maintaining the surface moist by means of a bed of sand frequently sprinkled with water or by covering the surface with a vapor barrier membrane such as polyethylene film.

The surface of the terrazzo should be wet ground to a smooth, even surface. Voids should be grouted with neat cement coloured to match the matrix and then refinished after curing for no less than 72 hours.

The floor should be left for a period of at least a month to condition before the resistance is measured by the N.F.P.A. method. If the resistance of the floor is in the desired range, the floor should then be sealed with a penetrating type of terrazzo sealer. It is recommended that the resistance be measured before sealing because if the resistance is very low the floor may be very wet and sealer will not penetrate into the surface. On the other hand, if the resistance is near or above the upper limit it would indicate that an error was made in proportioning the mix and sealing such a floor may increase the resistance. ◀