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R.592. Permeability study on bricks

An investigation into the permeability of brickwork has indicated that irrespective of the fired state of the brick, penetration of water through a wall will be primarily through the mortar joints rather than through the bricks.

Over the past few years concern has been expressed over the presence of semi-porous bricks in external walls. Such bricks have been regarded as a potential source for water ingress and as such detrimental to the wall.

The initial rate of water absorption on the bed face of a brick is a standard test included in A.S.A. 140-1964. By using the actual face of the brick for this test it was hoped to relate permeability performance to a simple test.

PROCEDURE

Bricks with a high water absorption rate were selected, and each brick individually marked and tested for 'face' initial rate of absorption and cold water absorption. In addition a series of green bricks were obtained from one brickworks, and these bricks were laboratory fired in batches of twenty at a range of temperatures.

These fired bricks were individually tested for 'face' initial rate of absorption and marked for identification. They were subsequently checked for cold water absorption to aid correlation.

Each set of bricks was built into a small wall using a standard mortar mix to which was added an amount of Nonporite as specified by the manufacturers to waterproof the mortar. All the walls were made within four hours and left for fourteen days to dry.

The walls were then sprayed with water at a fixed rate over a circle of 18 inches diameter.

RESULTS

The laboratory fired bricks gave the following results:

Temperature of firing	I.R.A. (face) g/in²	% C.W.A.
850° C	14	14.2
900°	15	14.6
950°	19	12.8
1000°	17	11.5
1050°	14	7.6

The high water absorption brick selected had I.R.A. values in the 40 to 50 range, and cold water absorption values of about 17%.

From the laboratory firings it is evident that considerable internal change in pore structure takes place over a range of temperatures, but the surface pores are only slightly affected. This would seem to indicate that the measure of surface absorption bears very little relationship to the internal structure of the brick, and that a simple surface test is not likely to be informative about the true nature of the brick. On spraying each of the walls with water, the only penetration occurred through the mortar joints and never through the brick face. In some cases the penetration occurred within an hour, in others six hours were required before water penetration occurred.

The mortar joint must be a function of (*a*) the operator and (*b*) the initial rate of absorption of the bricks, and the subsequent bond formed with the bricks. The operator variable is a near constant for a single wall with near identical bricks, and this was confirmed to some extent as differing sections of the wall were tested. However, there appears to be no correlation between any test figures and time of penetration, which leads to the tentative conclusion that the mortar bond is a variable which cannot be simply resolved.

CONCLUSION

It would appear that bricks with a range of surface absorption form a satisfactory barrier to water ingress, and that it is the internal state of the brick which contributes most to limiting water penetration.

Additionally, there appears to be no significant difference in performance between bricks of high and low cold water absorption in terms of external water penetration.

These tests indicate that a study of the mortar/brick bond, with respect to water penetration, would be of benefit.