

Department of Scientific and Industrial Research

REPORT OF THE BUILDING RESEARCH BOARD FOR THE YEAR 1939*

DESCRIBING the functions of the Research Station in war time the Chairman of the Board (Mr. G. Mowlem Burt) mentions that it is (1) supplying data relative to a particular problem, (2) investigating new materials and methods of construction, and (3) investigating the use of alternative materials. The Director (Dr. Stradling) was asked during the year to undertake the duties of Chief Adviser on Research and Experiment to the A.R.P. Department.

In his Report on General Research and Investigation the Director gives an outline of further work on various problems.

CLEANING OF BUILDINGS.—The method of continuous spraying has been successfully applied to more buildings, including parts of Trinity College and other Cambridge colleges. It has also been successfully used on concrete buildings in London. The stains that developed on the Admiralty Screen, Whitehall, after it had been cleaned have faded appreciably during the year.

EFFECT OF LIME IN FIRED CLAY PRODUCTS.—The defect known as "lime-blowing" is caused by the expansion of nodules of lime or calcium sulphate as they become hydrated. It is usually prevented by grinding the clay very finely or by "docking," *i.e.* soaking the bricks or tiles in water when they are taken from the kiln. Local conditions must determine which method is the more suitable. In one works, "lime-blowing" could not be induced even by prolonged steaming of bricks after the method of fine grinding had been adopted.

SAND-LIME BRICKS.—It has been found that the properties of the bricks are considerably affected by the state of the silicate bonding material formed during the autoclave process. The silicate may be either wholly crystalline or entirely amorphous. A study of the factors influencing crystallisation should make it possible to control more closely the properties of those bricks.

PROPERTIES OF POROUS BODIES.—This investigation has proceeded along three main lines: (1) *Crystallisation of Salts within the Pores.*—The "crystalline test" (in which the material is immersed in sodium sulphate solution and then dried to induce crystallisation in the pores, the process being repeated several times) has enabled the weathering qualities of natural building stones to be assessed and has provided a means of distinguishing good limestones or bricks from those of inferior quality.

- (a) *Effect of the Temperature of the Sodium Sulphate Solution.*—It has been found that at temperatures above 30° C. no disintegration of natural stones occurs in the crystallisation test. This is due to the fact that 30° C. is higher than the transition temperature of sodium sulphate decahydrate, the formation of which within the pores can set up stresses greater than the tensile strength of natural stones.
- (b) *Rate of Accumulation of Salt in the Pores.*—When samples of the stones were tested with the sodium sulphate solution above 30° C. there was for each specimen an initial increase in the salt content, but finally a limiting constant value was reached.
- (c) *Diffusion of Salt from the Stone.*—When a specimen of stone containing salt was placed in water, the rate of diffusion of the salt varied not only with its concentration, but also with the type of stone.

(2) *Relation between Frost-resistance and Pore Structure.*—An apparatus has been devised for measuring the changes in linear dimensions of a material when the crystals are formed within the pores. It has been found that the formation of ice within the pores of clay bricks results in an increase in linear dimensions. The nature of the change varies with the type of brick.

ARTIFICIAL WEATHERING OF ASPHALT.—By removing the normal surface finish obtained by sanding the ultimate degree of whiteness was more rapidly obtained. The removal of the surface was effected by cutting and grinding with carborundum.

FINESS OF PORTLAND CEMENTS.—An air permeability method for measuring the surface area of cements has been found to afford a rapid means of estimating the specific surface of fine powders (*cf.* Lea and Nurse, *J. Soc. Chem. Ind.*, 1939, 58, 278).

RESISTANCE OF CONCRETE AND MORTAR TO ATTACK BY CHEMICAL AGENTS.—Waste waters from the milk industry were found to cause softening of Portland cement mortars, whereas high alumina cement was entirely unaffected (Lea and Bessey, *Concr. Constr. Eng.*, 1939, 34, 610).

"CRAZING" OF CAST CONCRETE PRODUCTS.—A quick laboratory method of testing the liability of cast concrete to "craze" has been devised, the samples being alternately wetted and dried in a cycle of treatments under standard conditions; it has given promising results.

UTILISATION OF BLAST FURNACE SLAG.—Slag has been used for many purposes as an aggregate of concrete. The only trouble so far reported appears to be due to the presence of small amounts of sulphate producing expansion in the concrete. A maximum of 0.5 per cent. of sulphate, expressed as SO₃, in the aggregate of sand size is apparently a safe permissible limit.

PATTERN-STAINING OF CEILINGS.—Aitken's investigations (*Proc. Roy. Soc. Edinb.*, 1884, 12, 440) proved that dust tends to move from hot surfaces and to attach itself to cold ones. They

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afford a satisfactory explanation of the stains on plaster ceilings, in which the pattern of the construction behind the plaster is revealed. Experiments described dispose of the fallacy that the patterns are due to dust passing through the plaster. Recently there have been numerous instances of pattern-staining on hollow-tile ceilings. To prevent this, sufficient thermal insulation must be provided to reduce the heat flow through them to the level of the flow through the hollow tiles.

THE TESTING OF AIR FILTERS.—Two sets of apparatus for testing the efficiency of air filters have been devised. One of these is portable and is primarily designed for filters in commercial use; the other is a laboratory plant capable of accommodating single filter-units, which are usually 20 in. square.
