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Investigation of Plastic Caulking Materials
for Low-Cost Housing Construction

The general program of the National Bureau of Standards in relation to its studies of materials for use in low-cost housing construction is outlined in Letter Circular No. 502. Each separate project is described in detail in additional letter circulars. While the research as a whole deals mainly with studies of structural elements, it includes consideration of special problems such as durability, thermal insulation, ventilation, and standardization.

The plastic caulking materials, which consist mainly of oils and finely divided inert materials (pigments) mixed to a plastic consistency similar to that of putty, are intended mainly for sealing joints between structural units. They have been used quite extensively in connection with brick and stone masonry, particularly between the masonry and wood or metal, as in door or window frames. They have also been used to some extent in the vertical joints between coping stones, or the different units of cornices and base courses. Numerous firms are producing such materials, many of which are made as a side line in conjunction with the production of paint. It seems probable that waste materials such as oxidized paint films and residues are incorporated in the plastics and

the control over the final product is insufficient to insure uniformity in the performance of the caulking material under service conditions. For several years this Bureau has been making tests to determine the quality of samples submitted by various Government departments in connection with the construction and maintenance of public buildings. Formerly chemical tests were relied upon to give the desired information, but later it was found that physical tests gave a better criterion for judging the quality; hence, for some time samples have been tested only for their physical behavior under conditions simulating, as far as practicable, the actual conditions to which they are exposed in buildings.

Present Information

About ten years ago some studies were conducted at this Bureau which were sponsored by the Indiana Limestone Quarrymen's Association, through a research associate. Numerous exposure tests were started with about fifty trade brands of caulking used in conjunction with limestone masonry. In this connection a paper was published outlining in a general way the findings of the investigation.¹ Additional studies have

¹"Tests of Elastic Caulking Compounds," Proc. Amer. Soc. for Test. Mats., Vol. 29, part II, page 954, 1929.

been made at this Bureau during the past eight years and a test

procedure² has been developed which is now in use for deter-

²"A Test Procedure for Plastic Caulking Materials," Proc. Amer. Soc. for Test. Mats., Vol. 35, part II, page 581, 1935.

mining whether the materials comply with a specification used by the Treasury Department.³ Funds made available during the

³"Pointing compound shall be light colored, elastic and waterproof. It shall not stain the stone nor corrode copper nor be affected by long exposure to extremes of outside temperatures. It shall gradually form a thin, tough "skin" on the exposed surfaces, but underneath the surface it shall remain soft and plastic indefinitely. It shall be mixed to the proper consistency at the factory and shall be used according to the manufacturer's printed directions."

latter part of 1935 by the Federal Emergency Administration of Public Works made possible an additional study of the performance of the plastic caulking materials when used with various other types of masonry materials. In this investigation numerous exposure tests were started and these are still under observation. Inspections of the materials in service were made on 34 important buildings located in seven different states and the District of Columbia. These inspections gave some information of value in regard to the behavior of caulking materials when placed in contact with a considerable variety of structural materials. Apparently it is more difficult to secure good results when the caulking adjoins mortar or concrete. It also seems that the caulking materials are more likely to separate from metal than from natural stone or brick. A report has been prepared covering this investigation and will be available for distribution at an early date.

Study of Acceptance Tests

The present investigation will be concerned partly with a study of the physical tests now in use in relation to the performance of the materials as shown by exposure tests referred to above. There is a need for more simple tests which can be applied on the job by construction superintendents, since in many cases the cost of the caulking materials for any particular job may represent such a small amount that complete laboratory tests may not be justified. One phase of the study will, therefore, be along the line of developing simple field tests and determining their reliability. Most of the present information in regard to the caulking materials has been obtained by tests on masonry which might not be used in low-cost housing. Since our studies have indicated that the performance of the plastics is influenced to a large extent by the capillary properties of the building material with which they form a contact, it will be necessary to give particular attention to their behavior when used in conjunction with lower cost products, such as various types of fabricated wall boards, concrete, stucco, etc.

Durability

Previous studies have indicated that the durability of the caulking materials cannot be expected to compare favorably with materials ordinarily used in the exterior of buildings. Where the original composition is not greatly changed by excessive evaporation of the volatile matter, or by removal of

the plasticizing oils from the body of the compound by capillary suction, a service of six years or even more may be expected. It is hoped that the study of the present exposure tests in conjunction with the results of the usual laboratory tests made on the materials will give information of value in writing a specification which will secure products of more uniform and durable qualities. Little attention has been given heretofore to the effect of different ingredients in the caulking materials on the length of service that may be expected. Various oils and combinations of oils are used in the preparation of such plastics and in many cases a heating or oxidizing process is applied. A great variety of fillers (pigments) is used and probably some of these constituents have a bearing on durability. In the present study an attempt will be made to determine more definitely what compositions are most durable and what ingredients should be avoided.

Our studies have quite consistently indicated that the main factor causing an early failure of the plastics is the action of capillary forces in the masonry materials which tend to draw an appreciable amount of oil from the plastic mass, causing excessive shrinkage. Studies in this connection will be concerned with measuring the capillary forces of different porous materials used in building construction and methods of sealing the pores to overcome the capillary action.

Installation Methods

Inspections of the materials in service, as well as reports from various sources, indicate that a frequent cause of trouble with the caulking materials is not always the poor quality of the original material but, to a large extent, an unsatisfactory means of application. In most cases, the joints are caulked with a thin grade of material applied with a caulking gun. By such methods the joints frequently are not filled to the intended depth and in some cases the caulking merely forms a bead, bridging the joint. It seems desirable, therefore, to give some attention to methods of applying the materials and also to certain conditions which may affect the behavior of the materials. We understand that where joints are primed it is the practice to follow immediately with the caulking material before the priming treatment becomes dry. Evidently this practice would not only defeat the purpose of the priming material but probably also exert an injurious effect on the joint filler. Other points in connection with the installation which merit attention in the investigation are as follows: effect of cleaning the joints of dirt; effect of moisture in the masonry; effect of temperature at time of filling the joint.