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VENTILATION PROBLEMS
(INCLUDING AIR INFILTRATION OF WINDOWS AND DOORS)
AS RELATED TO LOW-COST HOUSING

The objectives, procedures, and scope of the Bureau research program on building materials with respect to their use in low-cost housing are outlined in Letter Circular 502. Each separate project is described in detail in an additional letter circular such as this. 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.

In low-cost housing, reliance for ventilation must be placed on such simple means as opening windows or doors. Even when windows and doors are fully closed, some air change takes place through the process of infiltration through crevices around windows and doors, and in some types of construction through the wall itself. If in winter this infiltration is greater than that required for ventilation, there is an unnecessary loss of heat, the heat being carried out of the house by the air. Since efforts to decrease the cost may lead to the use of windows and doors permitting large infiltration losses, a study of these losses is necessary before the economy of using a particular window or door can be determined. It is also necessary to consider the direct loss of heat through windows and doors. Such study forms a part of the program on thermal insulation.

I.- Purpose

The purpose of this part of the program is to obtain data on the air infiltration of windows and doors of recent type applicable in low-cost housing design. The construction of equipment for field testing of complete window and door installations, as well as laboratory tests on these elements is planned because of the uncertainties involved in accurate laboratory simulation of representative workmanship, aging and weathering effects. The immediate data are to consist of rates of infiltration at specified nominal wind speeds.

II.- Method of Test

The simplified static-pressure method described by D. O. Rusk, et al (Heating Piping & Air-Conditioning 4, 696-700, 1932) for direct measurement of infiltration rates gives

consistent and accurate result . The sample is mounted in a frame which is sealed against the flange of an airtight chamber with its inner face exposed to any excess air pressure up to several inches of water and its outer face at atmospheric pressure. A flow-meter is inserted in the tubing connecting the source of compressed air with the pressure chamber, and suitable valves and manometers are provided for control. Equipment for field testing is to be on the same principle. Routine laboratory tests will consist of noting infiltration rates for the selected test windows and doors at pressures corresponding to one or two typical wind velocities for each. Specimens are not, in general, to be mounted in actual exterior-wall panels for laboratory testing, since previous work indicates that infiltration effects due to windows and doors themselves are completely independent and separable from those due to walls and frame-to-wall seals.

III.- Cooperation with Industry

Industrial groups are invited to cooperate in this project by supplying specimens for laboratory test and making available installations for field test of air infiltration, as well as by the exchange of information. Advice offered and special problems suggested by interested groups will be given careful attention.

IV.- Types of Specimens

1. In general, only windows and doors for residential (including apartment building) use will be tested. Present equipment limits sample size to maximum overall rectangular dimensions of 96" x 70". Specimens supplied for test by cooperating groups should be, in so far as possible, completely assembled, with hardware, glazing, mounting frames and painted as recommended by the manufacturer for a finished job. Accessories, such as removable screen and storm sash, should be furnished. A description of the intended method of mounting in the wall opening and complete shop drawings should be supplied. Parts not supplied should be described in detail.

2. Wood windows. At present conventional-design double-hung wood windows will not be included in the routine laboratory tests, since adequate infiltration data on them under various laboratory conditions are available. New designs other than intrinsically high-cost ones will be tested. Field tests covering a range of depreciation conditions will include representative window types within the scope of the program.

3. Metal windows submitted for laboratory test should be intended for sale at a price not substantially greater than the uniform price currently specified by the Metal Window

Institute for "Light Casement Housing" type elements of comparable style, size and function, and should conform to the U. S. Treasury Department Procurement Division's maximum clearance requirement (Specification for Steel Windows, September 1936): "The metal to metal contacts between ventilators and their supporting frames and between double ventilators shall be such that, when they are closed and locked, it will not be possible to insert at any point a steel feeler gauge 1 inch wide and .031 inch thick without springing the ventilator."

4. Doors. Because of incomplete existing data, conventional as well as new forms will be tested. Only doors intended for residential use in exterior walls will be tested. It is essential that doors supplied for test be complete with frame and hardware and assembled.

5. Other types of elements. Weather-excluding elements of allied types, such as transoms, skylights, and special elements for natural ventilation, will be tested as available if they conform to the scope and aims of this project.

V.- Future Projects

The problem of natural ventilation brings up other questions beside infiltration which we hope to investigate later in the course of this program.

