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## ROOFING MATERIALS FOR LOW-COST HOUSING CONSTRUCTION

I.- General

The general objectives, procedure, and scope of the National Bureau of Standards' research program on building materials for low-cost housing have been outlined in Letter Circular 102. The present circular describes a part of the general program relating to roofs and roofing materials. Plans for this work call for a comprehensive survey of the various types of commercial roofing materials used in this country, and observations on their weathering qualities on roofs of known history in locations typical of widely differing climatic conditions in the country.

The objectives are the determination of the types of roofing design, construction, and materials best adapted to low-cost housing construction. Present plans cover a two-year program, the initial work being confined to Washington and vicinity.

Note: The mechanical features of different roof designs and the fire-resistive properties of roofing materials and problems concerning the thermal insulation of roofs are included in other parts of the general research program.

II.- Scope

1. General. It is believed that an inspection of roofs in service will give information of more direct value than will the laboratory examination and testing of roofing materials. Laboratory accelerated weathering tests are of value principally in comparing materials of the same type. Laboratory tests are of no value whatsoever for comparing materials as unlike in nature as sheet copper and bituminous shingles, for example. Furthermore it is practically impossible to establish any definite relationship between accelerated tests and continuous outdoor service exposure except possibly for tests planned to simulate conditions obtaining in some specific location. With the wide variety of roofing materials and the extremes of climate in this country, the inspection of roofs under actual service conditions appears to be the only practicable method of determining the general serviceability of roofing materials and the causes of failure in defective roofs, and of correlating the serviceability of any specific roofing material with mode of installation. By this method, the establishing of an approximate year-cost per unit

area for each type of roofing studied may be realized. Materials for gutters, valleys, downspouts, and flashings are included as integral parts of a roof.

Since a material may be suitable for low-cost housing in one locality and not in another because of the variation in cost with geographical location, some consideration, preliminary at least, is necessary for all types of roofing materials.

The program embraces research to establish the characteristic and significant properties of roofing materials in general, the determination of the properties of those materials whose usage is well established to serve as a basis of comparison for newly-developed materials, and the study of methods of installing roofing materials to determine which methods are most conducive to long service life.

2. Details. (a) Preliminary work - This includes the assembling of existing information based on publications on the design and construction of roofs and the materials used in such construction; reports of surveys of a similar nature and of tests to determine the weathering qualities of roofing materials; specifications for materials and modes of construction; and statistics of production of the different roofing materials.

It is planned to make contacts with Government and private agencies wherever possible for the purpose of obtaining specifications, statistics of production, and recommendations as to typical roofs to be inspected.

(b) Types of roofing materials to be investigated - It is not practicable to list definitely all of the roofing materials that are to be investigated since it is planned to include practically all types of conventional and new materials. In general, however, these materials may be roughly classified as bituminous, metal, slate, tile and cement, and wood.

Bituminous roofs include all types and weights of prepared and built-up roofings; metal roofs, construction and protection of all types and gauges of sheet-metal and shingles; slate all colors and dimensions of the natural products known by that name, and tile and cement, all forms and compositions. Work on wood shingles will include only the collecting of some statistical information and the observations necessary for a comparison of them with other types of roofing materials, since they are properly part of a similar program being carried out by the Forest Service, Department of Agriculture.

(c) Flashings, valleys, gutters, and downspouts - These items, ordinarily considered as incidental by the average home

owner, since they represent but a small proportion of the total cost of a roof, are actually of major importance and are logically a part of any roofing investigation.

In general, flashings and valleys are the least accessible part of a roof in case replacement is necessary because of failure, and are vulnerable locations for leakage in many roofs. Gutters and downspouts may also be sources of early failure. Information concerning the relative merits of various types of gutters, downspouts, valleys, and flashings used, the difficulties encountered with each in service, the approximate cost of installation and maintenance should be of value to any one interested in housing.

(d) Inspection - This survey will be confined to Washington and vicinity, at least in the early stages of the investigation, it being extended afterwards to selected locations typical of the different climatic conditions of the country. General features to be included in the inspection of any roof are methods of design and construction; materials and how they are applied; general appearance and durability; initial and maintenance costs; and nature and condition of flashings, valleys, gutters and downspouts.

This type of investigation, of necessity, requires the cooperation of manufacturers, and large users of materials. The National Bureau of Standards will be pleased to receive comments or suggestions from interested organizations or individuals who have information concerning the behavior of conventional roofing materials and the possible adaptability of new materials, design, and construction. Manufacturers are invited to submit panels (approximately three feet square) showing the exact construction recommended by them for representative types of roofs.

3. Summary. The objectives of the investigation of roofs and roofing materials may be summarized concisely as follows:-

(a) A detailed description of the types of roofing materials listed on page 2, including existing classifications of the Underwriters' Laboratories.

(b) Description of weathering characteristics of each type of roof when exposed in different parts of the country, including, if possible, an approximate year-cost per unit area for each type of roof.

(c) Where particular types of roofs are not adapted to certain climates, it should be evidenced by the survey, and types that give good service recommended.

(d) Information and data largely obtained from production figures, which indicate trends in utilization, design, and construction of roofing material.

(e) A determination of the proportion of premature failures caused by faulty application of roofing materials and accessories.

(f) In general, the information made available by this investigation should be of value, not only to purchasers of large quantities of roofing materials under definite specifications, but also to the average home owner whose technical knowledge of materials is limited.