SYMPOSIUM ON EFFECT OF WATER-REDUCING ADMIXTURES AND SET-RETARDING ADMIXTURES ON PROPERTIES OF CONCRETE

INTRODUCTION

By Bruce Foster

Admixtures for portland cement concrete are those ingredients which are added to the primary constituents (portland cement, aggregates, and water) to (1) improve or modify the properties of the concrete, (2) compensate for some deficiency in a primary constituent, or (3) effect a reduction in cost. Some materials which we class as admixtures, such as pozzolan and blood, were concrete ingredients used by the Romans.

Because the addition of another ingredient is very likely to require additional control and technical skill on the part of the concrete producer and inspection agency, and extra facilities for handling and proportioning, and because admixtures in general were originally frowned upon by the cement and concrete industries, these materials were for many years slow in gaining general acceptance. However, the recognition of the role of entrained air in imparting frost resistance to concrete has led to almost universal acceptance of the value of air-entraining admixtures and to departure from the previously widely-held concept that all admixtures were of doubtful value.

Appreciation of the advantages in the use of another group of admixtures, the pozzolans, was evidenced by the "Symposium on Use of Pozzolanic Materials in Mortars and Concrete" which formed an important part of the program of the First Pacific Area National Meeting of the ASTM held in San Francisco in 1949.

Further evidence of the new stature of admixtures is found in the activities of Subcommittee III-h on Methods of Testing and Specifications for Admixtures of ASTM Committee C-9 on Concrete and Concrete Aggregates which prepared specifications and test procedures for air-entraining agents in 1950, for fly ash in 1954, for natural pozzolans in 1957, and which is now preparing specifications for accelerators, for set retarders, and for water-reducing admixtures.

The last two mentioned, water-reducing and set-retarding admixtures, are the subject of this symposium. As its name implies, a water-reducing admixture, when added to a concrete, permits a reduction in mixing water with no loss in slump, or, if the water content is maintained constant, produces an increase in slump. The name is not wholly descriptive, however, because as will be brought out during the symposium, the benefit in strength at constant slump are normally greater than would be expected from the resulting reduction in water-cement ratio.

A set-retarding admixture reduces the

1 National Bureau of Standards, Washington, D. C.

2 Am. Soc. Testing Mats. (1950). (Published as separate publication ASTM STP No. 99.)
early rate of hardening and so permits the concrete to be handled and vibrated for an additional period after mixing.

The principal agents now in use fall in one of two classes: (1) lignosulfonic acids and their salts and (2) hydroxylated carboxylic acids and their salts. Both classes of materials, when added to concrete, reduce the water requirement and also retard the set. Modifications and derivatives of these materials may retain the water-reducing property of the admixture without modifying the hardening rate, or may even accelerate the set.

The Symposium Committee representing Committees C-1 on Cement and C-9 on Concrete and Concrete Aggregates, planned to bring together information on admixtures as follows: (1) the mechanisms by which these materials modify concrete properties; (2) the effects of the admixtures on the properties of plastic and hardened concrete and the variation of these effects depending upon the other materials involved, the type of concrete, and the existing temperature; (3) the types of construction and the conditions under which their use is particularly advantageous; (4) the problems in control and application brought about by their use; (5) the problems of preparing adequate purchase specifications; and, (6) research under way to produce even better and more reliable admixtures and thereby better and more economical concretes.

To accomplish this, contributions were sought from a variety of sources including universities and government agencies, as well as the producers of portland cement, ready-mixed concrete, and admixtures. A great amount of laboratory and field data are presented as well as descriptions of field experience with the use of the various products in a wide range of applications. Of necessity, there is some overlapping in the treatment of the subject matter, but this will be found to have more advantages than disadvantages.