Temperature-Viscosity Relation of Asphalts Used in the United States

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● THIS REPORT presents information on the viscosity of asphalt cements produced in the United States for use in highway construction. The viscosity data used here are part of a comprehensive study of the properties of asphalt initiated by the Bureau's Division of Physical Research in 1954. It was undertaken to provide information on a national scope to show the properties of asphalts produced from various crude sources and by methods of refining in current use.

Through the cooperation of the regional offices of the Bureau of Public Roads and the states within each region, 323 samples of asphalt cement representing 105 refineries were obtained. Asphalt cements of a number of penetration grades were included. However, the best coverage of all the refineries was in the 85 to 100 penetration grade. A total of 146 asphalts of the 85 to 100 grade were received, including a number of duplicate samples submitted by different states within a region. After eliminating these duplications 119 samples were used for an evaluation of the properties of the asphalts.

The asphalts collected for this study were tested to determine those characteristics in general use as specification requirements and those that are being used by some agencies to provide more information on the asphalts or to obtain better materials.

Some state specifications have requirements for Furol viscosity at 275 F. Other states also require that the temperatures used for plant mixing of asphaltic mixtures and for application by spraying be based on the viscosity of the asphalt. Thus, to determine the range in viscosity of present day asphalts, Furol viscosity tests were made on the asphalts of this study. Although determinations are being made over a wide range of temperature, only Furol viscosity at 275 F of the 85 to 100 penetration asphalts are presented in this discussion. Because of the large number of samples tested the viscosity data are given by a grouped frequency distribution chart in the form of a frequency polygon. The results of each viscosity result on the 119 samples of asphalt were grouped into cells or intervals and the total number of values in each cell were then plotted and their mid-points connected to form the polygon. The frequency distribution for Furol viscosity at 275 F is shown in Figure 1.

The Furol viscosity of the 119 asphalts ranges from 85 to 318 seconds. Four asphalts have viscosity values less than 100 seconds; two asphalts, more than 300 seconds. The viscosity of 80 asphalts is within the range of 150 to 250 seconds.

It is evident from the results of this survey on properties of asphalts used in the United States that the viscosity varies greatly and that this property should be recognized in plant mixing of asphaltic mixtures, spreading and compacting of the mixtures on the road, and application of asphalts by spraying. It is believed that a thorough study of the effect of viscosity on these operations should be initiated, as it could ultimately lead to higher quality and more durable bituminous surfaces.

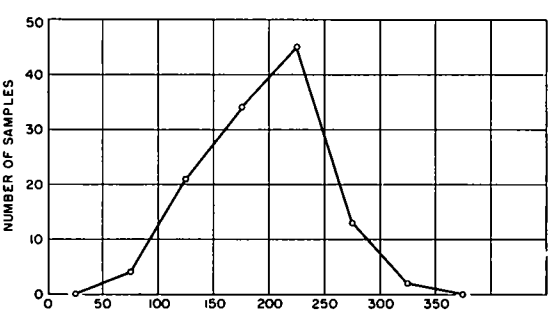

Figure 1. Distribution of Furol viscosity results.

Discussion

Mark Allen, Minneapolis, Minnesota.— Was the penetration range corrected?

Mr. Welborn.— These were all 85 to 100 penetration grade asphalts. Asphalt cements of penetration grades other than 85 to 100 would have different viscosities. A large number of asphalt cements of different grades are on hand and it is planned to test and report on them at a later date. Complete data will show the relation of viscosity to penetration.

Stuart Fergus, Ohio.— What viscosity, or range of viscosity, is best?

Mr. Welborn.— Others on the panel, specifically Messrs. Griffith and Halstead, plan to discuss that point later on. I would like to reserve the answer for them.

Clark Mitchell, Allied Chemicals.— There has been considerable difficulty with asphalt, particularly in a couple of my company's Midwestern plants, where the material refuses to set up in any reasonable length of time; that is, within a period of weeks. Is there any tie-up between this and the low viscosity encountered in the spray—somewhere in the range of 160?

Mr. Welborn.— I know of one instance where the asphalt mixture was "tender," or did not "set-up," that was attributed to the use of a low viscosity asphalt cement. It seems reasonable that this could be the contributing factor, especially during hot weather. It also is possible that aggregate gradation and small amounts of moisture retained in the aggregate after drying would have similar effects.