Effect of Crushed-Gravel Fine Aggregate on the Strength of Asphaltic Surfacing Mixtures

R. P. Lottman
Graduate Fellow

and

W. H. Goetz,
Research Engineer
Joint Highway Research Project, Purdue University

SYNOPSIS*

A laboratory study was made of the effects of crushed-gravel fine aggregate on the strength characteristics of bituminous-aggregate mixtures. The scope of this investigation included a comparison of strength test results from the Marshall test, the "open system" triaxial test and the ASTM compression test on ASTM and Modified ASTM test specimens. The strength properties of each mixture containing various percentages of crushed-gravel fine aggregate were evaluated from these standard tests.

The main variable used in this investigation was the percentage of crushed-gravel fine aggregate, locally called "crusher dust," in the fine-aggregate portions of three types of bituminous surface mixtures: namely, a dense-graded bituminous-concrete mixture, a dense-graded sand-asphalt mixture, and bituminous-concrete mixtures consisting of crusher dust-natural aggregate blends within ASTM specifications for ¾-inch maximum size aggregate. Round natural sand and the crusher dust provided the contrast in fine-aggregate characteristics, and in order to accentuate the effects of the fine aggregate, a uniform-type quartzite gravel was used as the coarse aggregate in the bituminous-concrete mix-

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tures. All of the bituminous-aggregate mixtures tested were hot mixtures in which an asphalt cement (85-100 penetration) was used. The asphalt content of each mixture was that determined by the Corps of Engineers' design procedure. Each mixture was tested at its respective design asphalt content.

The results of this investigation indicated appreciable increases in mixture strength as the percentage of crusher dust in the fine aggregate was increased. This was found to be true for all the types of mixtures investigated and for all the types of laboratory tests used in this investigation. In general, percentages of crusher dust in the fine aggregate of 25 to 75 percent provided the greatest improvement in mixture strength.

Additional investigation indicated that distribution of asphalt between the coarse-aggregate and fine-aggregate fractions of the bituminous-concrete mixtures had an influence on the triaxial strength characteristics of these mixtures. This distribution of asphalt within these mixtures was influenced by the amount of asphalt in the mixture, which in turn was influenced by the amount of crushed-gravel fine aggregate.

It was demonstrated that the addition of crushed-gravel fine aggregate to round natural sand materially increased the strength of bituminous-concrete mixtures and sand-asphalt mixtures prepared with all round natural sand in the fine aggregate.

In evaluating the results and conclusions, it must be remembered that this investigation was a laboratory study, using the triaxial compression test, the Marshall test, and the ASTM compression test for obtaining the strength data. The results have not been checked by other tests nor correlated with field performance of these mixtures.