Effect of Mix Temperature

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● HOT MIX asphaltic concrete should be laid at the lowest mix temperature which will enable securing the specified or desired result in the completed pavement. For asphalts from different sources, this temperature will vary over a considerable range. For asphalts from the same source of different penetration ranges, the minimum satisfactory laying temperature is usually higher for the more viscous asphalts.

Because of its thermoplastic nature, asphalt cement decreases in viscosity with increase in temperature. For asphalt cements of the same penetration range, the relationship between temperature and viscosity is more often not the same for asphalt cements from different sources. Because of this situation, mixing and laying temperatures in most specifications are set at broad ranges rather than narrow ranges. It appears there would be a great deal of advantage for the supplier or user to determine the temperature-viscosity relationship of asphalt cements so that optimum mix temperature can be set for a particular mix.

Coarse aggregate mixes can be mixed and laid at lower temperatures than fine aggregate mixes. This means that for both mixing and laying, the asphalt cement must be at a lower viscosity for the finer mixes.

Since proper placing of the mix in the course has a bearing on the compaction secured, with a given compactive effort, something should be said concerning this important operation. The components of a paver which come into contact with the asphalt mix should be pre-heated to and maintained at or near the mix temperature. This is also true for hand tools used to rake, shape and compact the mix, either in a hand operation or as a part of the regular paver operation. Failure to maintain the paver screed components at the mix temperature will result in scuffing of the surface and edges of the course. Scuffing is due to congealed mix adhering to the screed face and the screed skirts. Unless it is corrected, severe tearing of the surface of the course usually follows with the placing of a mat of widely varying density. A mat laid in this manner will cool more rapidly, making compaction more difficult.

Rolling or compaction of the course should be performed soon after it has been placed while the mix is at or near the optimum temperature for compaction. The timing of this operation depends upon the temperature of the supporting base and the atmosphere. In any event, the initial compaction or rolling of the mix is more properly performed as soon as possible after laying. Subsequent and finish rolling is then timed so this operation is completed before the mix has cooled to the point where the compactors are no longer effective. It has been found rubber-tired compactors enable more rapid finishing of courses with greater and more uniform density of the courses if the rubber-tired compactors have wheel loads and inflation pressures that enable securing contact pressures equal to or in excess of those exerted by the standard rollers.

In order to investigate the effect of mix temperature on compaction or field density, this study was made in Ohio some years ago in conjunction with other factors affecting field density. The test was made during July 1952, on a project where the nominal maximum particle size of the coarse aggregate is ¾ in. with a compacted course thickness of 1½ in. The aggregates were limestone and limestone sand and the asphalt cement 70-80 penetration range. At mid-day, mix temperatures were varied from 250 F to 325 F in increments of 25 F. Three loads of 10 tons each were prepared and placed at each temperature. The same compactive effort was used for all test sections, which was in excess of the minimum required by specifications using standard steel-wheeled rollers. The compacted weight per cubic yard of this mix in place at the time of construction varied from 3,618 lb at 250 F to 3,709 lb at 325 F. These test sections were again sampled in August 1952 and December 1953 to determine gain in density due to traffic. This mix was placed on a heavily traveled road and it was

found all test sections had the same density in August 1952, with a slight increase over the density secured at a mix temperature of 325 F. The December 1953 sampling showed all the test sections to have the same density, with an appreciable gain in density over the sampling in August 1952.

From the experimental work related above, it appears there is advantage in placing asphaltic concrete at optimum temperature. With standard rollers, greater density can be secured at the time of construction at an optimum temperature. It is desirable to secure greater density at the time of construction in order to minimize the increase in density due to traffic. Furthermore, it would be desirable to have a compactor that would enable securing ultimate traffic density at the time of construction.