EFFECT OF OVEN HEATING TIME OF ASPHALTIC CONCRETE ON MARSHALL STABILITY

BY JOHN ROLAND
PHYSICAL TESTS ENGINEER

JULY 1982

TESTING PERFORMED IN THE MATERIALS LABORATORY
OF THE
IOWA DEPARTMENT OF TRANSPORTATION

EFFECT OF OVEN HEATING TIME OF ASPHALTIC CONCRETE ON MARSHALL STABILITY

Objective

It has been observed in the Laboratory that an increase in oven heating time of relatively short duration between mixing and compaction of asphaltic concrete hot mixes can have an effect on the Marshall stability results obtained. The purpose of this short investigation is to determine the effect of oven heating time on the density and stability of hot mixes.

Materials

A total of seven hot mixes with various aggregates, gradations and asphalt contents were made and tested. All of the mixes were proportioned and mixed in the Laboratory from aggregates that were in excess of the trial mix requirements. The proportions, and consequently the gradations, were the same as those used in the trial mixes shown in the tabulation by their ABD numbers. Each mix was made from different aggregates and gradations, and each contained the recommended asphalt content. A variety of asphalt sources was used.

Apparatus

Standard mixing, compacting, density and stability apparatuses and procedures were used.

Procedure

1. Only one mix was made and tested each day.
2. The total weight of dried aggregate used in each batch (mix) was 14,000 grams.
3. Asphalt cement was added to result in the recommended

percentage of the mix.

4. After mixing, the asphaltic concrete was weighed into twelve equal portions and each portion was placed in an individual pan. Each pan contained enough mix for one Marshall specimen having the appropriate height.
5. All twelve pans of mix were then placed in the oven at one time.
6. When the mix was back up to compaction temperature, three Marshall specimens were compacted.
7. Every hour thereafter for three hours three more specimens were molded for a total of twelve specimens from each mix.
8. The specimens were tested for density and stability.
9. The same procedure was repeated for the other six mixes.
10. The densities and stabilities obtained at the different intervals of heating time were tabulated (tabulation attached). Each density and stability figure shown is an average of three specimens.
11. The tabulation also shows the increase in Marshall stability (in pounds and percent) at each heating interval as compared to the first set that was compacted.

Conclusions

Each mix tested showed an increase in Marshall stability as the heating time interval between mixing and compacting increased. For the specimens compacted three hours after the initial set was molded, the increase in stability ranged from 385 to 895 pounds (15.9 to 72.0 percent) with an average increase of 33.1 percent. Each one hour of additional heating time after the initial set

was molded resulted in a significant increase in stability for a given mix (up to the three hour limit of this investigation).

The changes in densities for the different time intervals of oven heating of the mixes are judged to be insignificant.

The effect that oven heating time would have on Marshall stabilities of mixes received from the field was not determined (only trial mixes). There could be a difference. Also heated material stored in a silo for various intervals of time would undoubtedly show different changes in stability than this investigation did, due to less oxidation of the larger mass involved. This could be the basis for an interesting future project.

The Bituminous mix section of the Laboratory has been making trial mixes in the mornings, and often it has been three hours or more before the specimens could be compacted. The specimens are kept in the oven until molding is accomplished. Since this procedure can result in variable stabilities dependent on the time delay between mixing and molding, the time interval will be kept to an absolute minimum. Also it is very important to know this source of variability when performing any Marshall stability research work.

This investigation presents the best evidence to date in favor of AASHTO's single specimen mix concept, which has not been proven practical in large volume operations.

EFFECT OF OVEN HEATING TIME OF ASPHALTIC CONCRETE ON MARSHALL STABILITY

Each Set Molded 1 Hour After Finishing Previous Set

Mix Same As	Type	Class	Asph. Cement	Den. & Stab. No. 1	Den. & Stab. No. 2	Den. & Stab. No. 3	Den. & Stab. No. 4	Added Stability Over No. 1			
								No. 2	No. 3	No. 4	
ABD1-118	B	II	5.50	2.306 1070	2.309 1433	2.313 1522	2.311 1840	363 33.9	452 42.2	770 72.0	Pounds Percent
ABD1-124	B	II	4.75	2.403 2637	2.398 2825	2.397 2973	2.391 3043	188 7.1	336 12.7	406 15.4	Pounds Percent
ABD1-125	B	I	5.50	2.329 1625	2.332 1917	2.326 2048	2.327 2237	292 18.0	423 26.0	612 37.7	Pounds Percent
ABD2-22	B	II	6.50	2.281 2048	2.281 2318	2.275 2450	2.279 2647	270 13.2	402 19.6	599 29.2	Pounds Percent
ABD1-119	A		5.00	2.360 2412	2.352 2775	2.353 2975	2.352 3307	363 15.0	563 23.3	895 37.1	Pounds Percent
60% Recyc 40% New	Recy.		1.90	2.381 2420	2.382 2483	2.385 2648	2.380 2805	63 2.6	228 9.4	385 15.9	Pounds Percent
ABD1-135	A		6.00	2.365 2475	2.359 2653	2.362 2847	2.363 3083	178 7.2	372 15.0	608 24.6	Pounds Percent