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Final Report (Appendix III)

A COLOR-CODED BAR GRAPH SHOWING CHANGE IN ASPHALT DUE TO EXPOSURE

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A DISCUSSION OF THE COLOR-CODED BAR GRAPH

The color-coded bar graph is employed to facilitate a rapid appraisal of the test data. Especially significant test results have been shown. Aggregate mixtures and exposures as included cover a considerable range of conditions. Each test asphalt is identified by a distinctive color, and its respective bar is placed in an appropriate column to facilitate comparison between the percent change of each asphalt.

The ability of an asphalt to resist change in composition or test properties is considered to reflect its internal stability. Throughout this investigation, the minimum variation from the properties of the original material has been accepted as evidence of a more favorable performance of the recovered asphalt after exposure. Such change, either an increase or decrease from the original test value, is reported as a percent of the original.

The results shown by the bar graph were derived from asphalts which were subjected to selected laboratory exposure and limited outdoor weathering. The data indicate the relative internal stability of the asphalts, which is important when probable service behavior is considered. Their relationship to actual paving performance has not, however, been established.

The percent change values resulting from exposure conditions for the several tests are related. Change in the fractional components, asphaltenes, oily constituents, and resins, are reflected in resultant test values and the magnitude of their percentage change. Previous testing of asphalt recovered from paving indicates that when the percent change in softening point and penetration, expressed as a softening point/penetration ratio, increases to values above 450 percent of the original material, the paving begins to develop a dry, lifeless appearance, map and shrinkage cracking is evident, cohesion and ductility decrease, and raveling is in the process of development. When the increase of percent change becomes 600 percent, the deterioration of the paving surface is accelerated and progressive.

The exposures (a) and (a_1) to (n) increase in severity. When no value is given for a particular asphalt, exposure tests were not made. In general, an increased percent change in the resin/asphaltene ratio is accompanied by a corresponding change in the other test properties. Difference in the magnitude of change between the three test asphalts is usually not great; Lion, Leonard, and Trumbull show favorable resistance in the order named.

The initial and supplemental test results after (n) exposure, indicate its severity. A comparison of the recovered asphalt from defective paving as reported in Progress Report 1,[4] ERI Project 2249, Field Inspection and Laboratory Tests on Asphalt and Asphalt Pavements, indicates that the (n) exposure produces test results similar to those for asphalts recovered from defective paving.

As to the spot-test characteristics of recovered asphalt, the results using Skelly "S" and xylene-heptane solvent indicate that (n) exposure tended to change an intially negative Leonard and Trumbull to partially or completely positive. It is also apparent that changes in the fractional components sufficient to produce an unbalance in the structure of the original asphalt result in heterogeneity, and that such a condition is manifest by the positive spot characteristics of the affected material.

PERCENTAGE CHANGE IN RECOVERED ASPHALTS FROM MIXTURES WITH VARIOUS AGGREGATE UNDER DIFFERENT CONDITIONS OF EXPOSURE

Identification of Symbols Used in Graph

Exposure	Mat'l Heating		Mix Time	Mixture Heating			Test Conditions
	Agg °F	Asphalt °F	Hobart, min	Time, min	Temp, °F	Type of Oven	
a_1	350	300	1	30	325	F. Draft	Cool 45 min, extract and recover.
h	350	300	1	90	325	F. Draft	Cool 45 min, extract and recover.
k	350	300	1	30	325	F. Draft	Loose spread in shallow pan, expose 60 days outdoors. Dry at 150°F to remove moisture. Cool, extract, and recover.
l	350	300	1	30	325	F. Draft	Compact mixture to 4" diameter x 4-1/2" cylinders, expose 60 days outdoors, dry at 150°F to remove moisture. Cool, extract, and recover.
n	350	300	1	180	325	F. Draft	Loose spread in shallow pan, heat to 325°F in force draft oven. Cool, extract, and recover.

Note: Numbers in spot bars on graph show number of samples for a specific spot condition. Test results on asphalt recovered from Michigan and Minnesota aggregate mixtures are combined in the columns headed penetration, softening point, and softening point/penetration ratio.

Numbers shown near the top of any bar graph column represent total percent change which exceeded the percentage scale. Such numbers are color-coded to indicate the asphalt to which they are applicable.

Aggregate 1 — Ottawa Sand
Aggregate 2 — Local Sand
Aggregate 3 — Michigan Material
Aggregate 4 — Minnesota Material

Leonard Asphalt — Red
Lion Asphalt — Blue
Trumbull Asphalt — Green