COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
FRANKFORT
July 17, 1962

HENRY WARD
COMMISSIONER OF HIGHWAYS

ADDRESS REPLY TO
DEPARTMENT OF HIGHWAYS
MATERIALS RESEARCH LABORATORY
132 GRAHAM AVENUE
LEXINGTON 29, KENTUCKY

B.2.2.10

MEMORANDUM

TO: A. O. Neiser
Assistant State Highway Engineer

FROM: W. B. Drake WBD
Director of Research

SUBJECT: Processed Kentucky Rock Asphalt
Submitted for Consideration by
Mr. Holman R. Wilson

Following the April 27th meeting in Commissioner Ward's office, attended by:

1. Commissioner Henry Ward,
2. Mr. Holman R. Wilson, The Kentucky Company,
3. Mr. C. H. McKinney, an associate of Mr. Wilson's,
4. Mr. H. V. Wheelock, Turnbull Engineers,
5. Mr. Sam J. Johnson, Jr., Consultant,
6. Mr. Damon Surgener, Kentucky Asphalt Sales,
7. Mr. P. F. Phelan, Koppers Company,
8. Mr. A. O. Neiser, Assistant State Highway Engineer,
9. Mr. J. H. Havens, Assistant Director of Research,
10. Dean D. V. Terrell, Consultant, and
11. Myself,

the Research Division has devoted considerable time and effort to the evaluation of the processed rock asphalt. I feel that we have been quite fortunate to have available the services of Dean D. V. Terrell, who has a

long time knowledge of rock asphalts and of Mr. J. H. Havens, who has worked with rock asphalts for the past 12 years and has been directly responsible for major research projects conducted on these materials in both Kentucky and Indiana.

This memorandum has been prepared following numerous discussions with Messrs. Terrell, Havens and R. L. Florence, Research Engineer Associate, Head of the Bituminous Section of this Division. I believe that it represents the best conclusion that we can develop under the time and material limitations.

Mr. Florence reported the laboratory test results on a 50-lb. sample of processed rock asphalt on June 20, 1962. A copy of his memo is attached. This material was brought to the laboratory by Messrs. C. H. McKinney and L. W. Huntington and was reported by Mr. McKinney as having been processed from material taken from the Highway Department's stockpile of bituminous rock asphalt near Sweeden in Edmonson County. This material had been crushed and stockpiled for a period of over five years.

Mr. Wilson has submitted various samples of rock asphalt to the laboratory of Koppers Company, Inc. for analyses. By letter of July 10, to Mr. Wilson from Mr. P. F. Phelan, two reports dated June 18 and June 22, were made on a companion 50-lb. sample of processed rock asphalt received in the Kopper's laboratory on June 6, 1962. A copy of this letter and the reports noted are attached.

An effort was made to compare the processed rock asphalt with the natural rock asphalt and so far as we can determine the material is still rock asphalt with some of the light oil removed. The remaining asphalt appears to have a penetration of 51 which is somewhat harder than the asphalt normally used in surface courses. The process also separated the

grains of sand each apparently coated with asphalt sufficiently hard to resist sticking together at room temperatures.

Based upon the tests that we performed on the materials as submitted, and from our previous experience with non-skid, sand-asphalt, wearing surfaces, and our knowledge of rock asphalt gained by several years of experience and considerable extended research, we can see no promise from an economic standpoint or from what we believe would be a service record in the use of this so-called processed rock asphalt.

We know very little about the proposed processing and can not judge the expected product from the widely varying existing rock asphalt deposits. We do not believe that the material as submitted can be used in high-type, hot-mix-plant bituminous surfaces. No rational proposal for incorporating the processed material into a high-type pavement has been submitted.

We are of the opinion that the processed rock asphalt as submitted by Mr. Wilson is not worthy of further experimentation or road testing and do not recommend its consideration as a material for high-type bituminous pavements.

WBD:dl
Enc. 1. Memo. from R. L. Florence, June 20
2. Letter from P. F. Phelan to H. R. Wilson, W/attachments, dated July 10.

June 20, 1962

MEMORANDUM B.2.2.10

TO: W. B. Drake
Director of Research

FROM: R. L. Florence RLF
Research Engineer Associate

SUBJECT: Laboratory Testing of Wet-Processed Kyrock

REFERENCE: Memo from W. B. Drake, J. H. Havens, and D. V. Terrell, to Henry Ward Dated May 31, 1962.

The following laboratory test results were obtained on the 50-lb. sample of wet-processed Kyrock delivered to the laboratory on May 23, by Mr. Huntington.

Percent organic matter (ignition) ------ 5.5
Percent bitumen (CS_2) (centrifuge) ----- 5.4
Percent bitumen (benzene) (centrifuge) - 5.25

GRADATION OF EXTRACTED AGGREGATE

Sieve Size	Percent Passing
No. 16	100
No. 30	98.9
No. 50	73.2
No. 80	18.5
No. 100	11.9
No. 200	5.5

Tests on Recovered Bitumen (benzene extraction)
Softening Point (ring and ball) ------- 156°F.
Penetration at 77°F., 100 g., 5 sec. -- 51.0

The Marshall method of test was performed on the material as received and with added quantities of PAC-5 and RT-12. The results of this testing are shown graphically in Figures 1, 2, and 3 (attached). These data are also shown in Table 1 (attached). In order to use the sample sparingly, Marshall specimens were prepared by re-using the same material throughout each test series. This, of course, may have caused some hardening of the binders due to re-heating the specimens several times.

It is of interest to compare this material with a 20-lb.

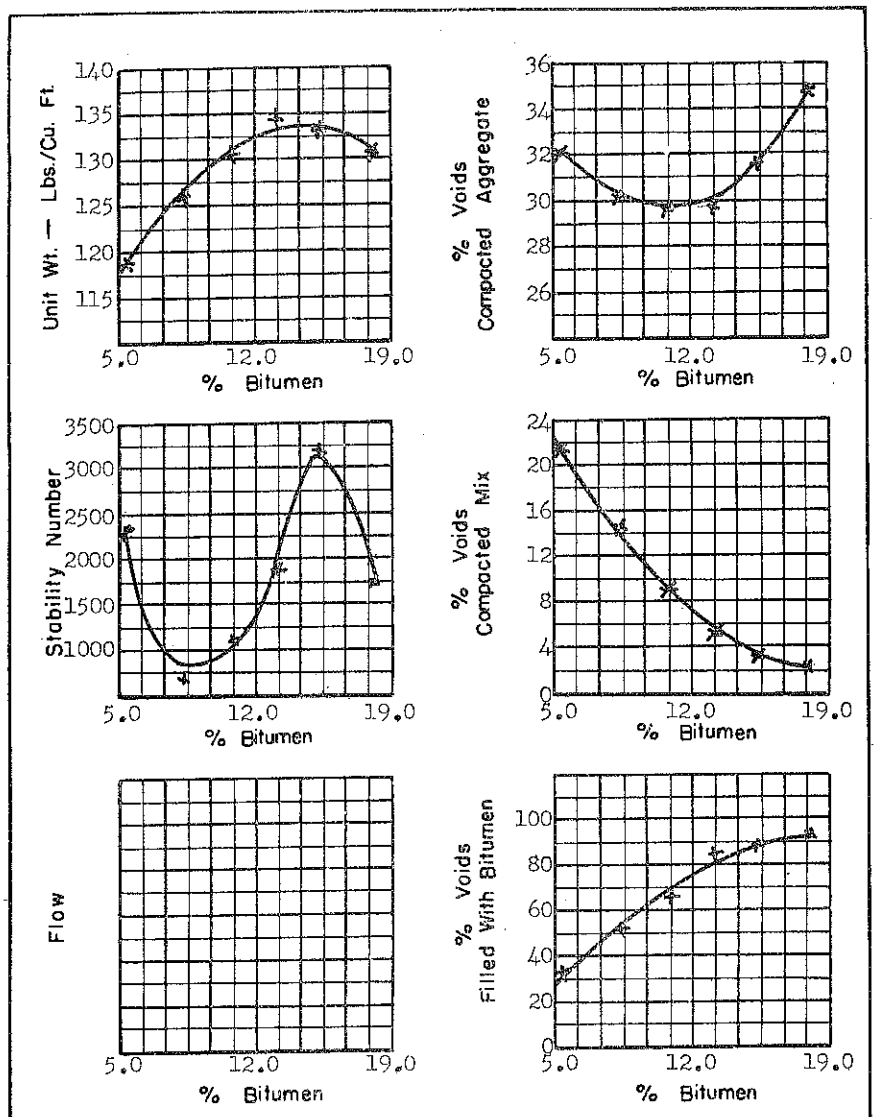
sample of processed rock asphalt submitted by Mr. C. H. McKinney in September, 1959 (Ref: Res. Lab. File B.2.2.10, Memo dated 9-23-61). The sample submitted then had a bitumen content of 6.0% by weight. The gradation of the extracted aggregate was nearly identical to that of the present sample. The sand grains were well coated with bitumen but the material was not sticky. Due to the size of the sample, the bitumen was not recovered for determination of penetration. High void contents in Marshall specimens prepared from the material with added asphalt cement indicated the bitumen performed more-or-less as an aggregate rather than as a typical binder material. However, the bitumen was largely soluble in CS_2; but evidently it was not dissolved by or did not blend with the added asphalt cements. In other words the amount of asphalt cement needed to achieve the maximum strength was about equal to that needed by the same sand without the existing bitumen.

Whereas the earlier efforts toward processing the material (above) left the bitumen on the sand in a totally ineffective condition, the present sample appears to be much improved in this respect. At least the bitumen in the sample presently under study softens sufficiently, by heating, to permit compaction and, thereupon, to provide some cemented strength. The existing bitumen is not present in a sufficient quantity (from the standpoint of good design practices) and would therefore have to be supplemented with a significant quantity of other bitumen. Additions of soft bitumens would naturally result in a decrease of strength; whereas, additions of bitumen in the 50-pen. class would enhance the strength greatly.

In order to be able to blend the additional bitumen into this material and in order to otherwise prepare it for spreading on the road, the material would have to be heated to approximately 300°F. This fact alone presents a real determent and perhaps precludes any actual use of the material -- this may prove to be so because of economic considerations as well as the practical limitations on heating and mixing equipment. As you know, there would be no real interest in this material if the cost of such processing and the product therefrom exceeded the cost of ordinary sand-asphalt materials.

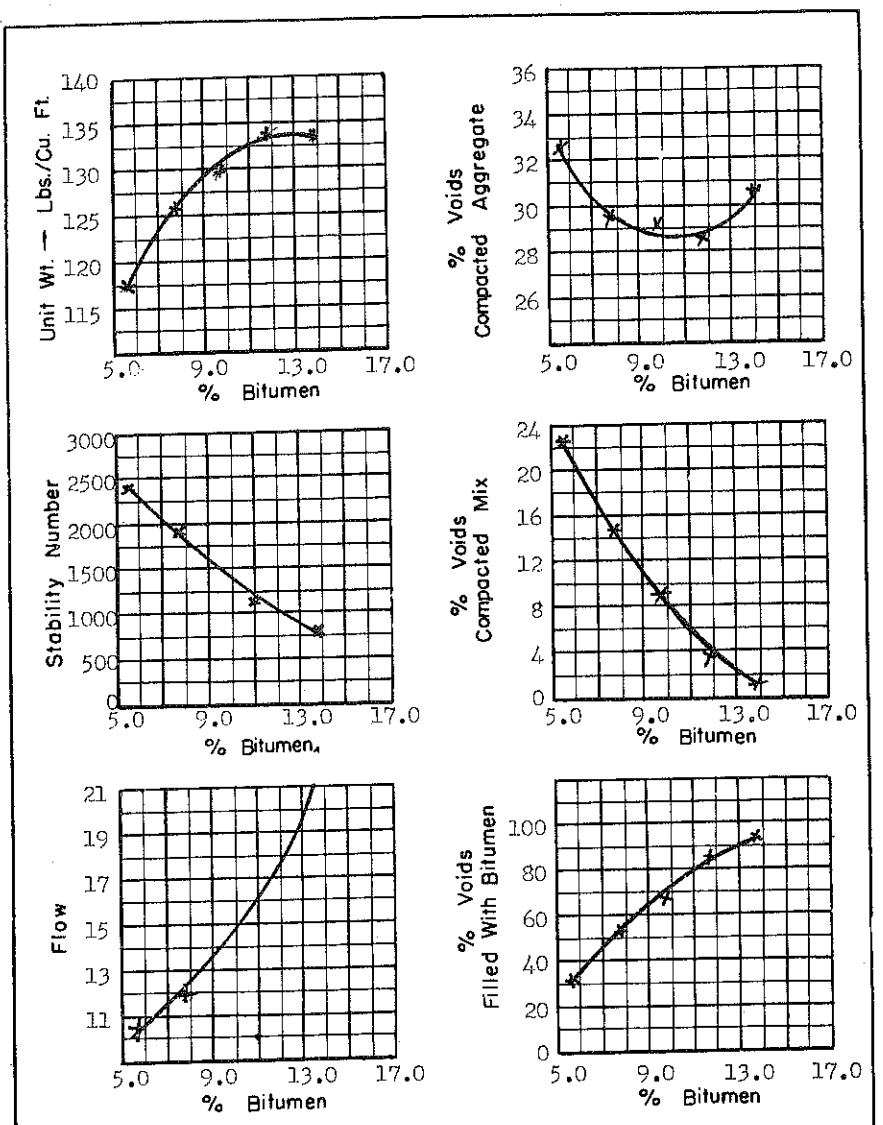
RLF:mkb

Attachments: Figs. 1, 2, and 3
Table 1



TEST DATA	HIGHWAY MATERIALS RESEARCH LABORATORY LEXINGTON, KENTUCKY
Opt. % Bit. _____ Unit Wt. _____	MARSHALL STABILITY TEST
Stability No. _____ Flow _____	Mix No. _____ Date 6/19/62
% Voids Comp. Agg. _____	Project Wet-Processed Kyrock
% Voids Comp. Mix. _____	Aggregate Rock Asphalt Sand
% Voids Filled With Bit. _____	Bitumen Tar (RT-12)
Chart B-3 February, 1955	

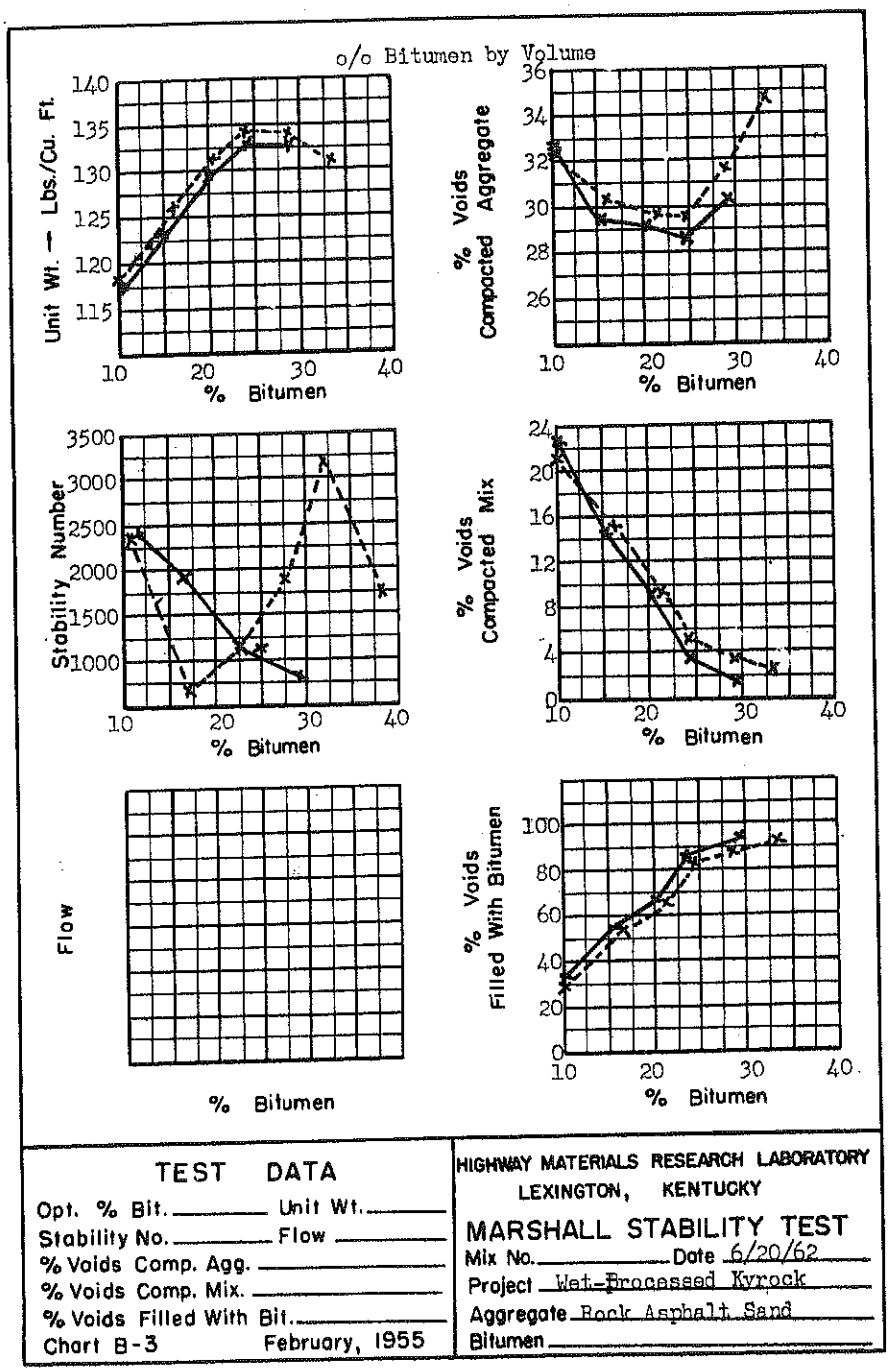
Fig. 1



TEST DATA	HIGHWAY MATERIALS RESEARCH LABORATORY LEXINGTON, KENTUCKY
Opt. % Bit. _____ Unit Wt. _____	MARSHALL STABILITY TEST
Stability No. _____ Flow _____	Mix No. _____ Date 6/19/62
% Voids Comp. Agg. _____	Project Wet-Processed Kyrock
% Voids Comp. Mix. _____	Aggregate Rock Asphalt Sand
% Voids Filled With Bit. _____	Bitumen Asphalt Cement
Chart B-3 February, 1955	

Fig. 2

COMPARATIVE MARSHALL TEST RESULTS



——— Asphalt Cement (86 Penetration)
– – – – Tar (RT-12)

Fig. 3

TABLE 1. MARSHALL TEST RESULTS WET-PROCESSED KYROCK

Kyrock with Added Tar (RT-12)

Bitumen Content	Bitumen Content (% by Vol.)	Stability (lbs.)	Flow (0.01 in.)	Unit Weight (lb/cu ft)	Percent Voids		
					Mix.	Filled w/Bitumen	Aggregate
5.5 NAC	10.4	2299	10.3	118.4	21.8	32.3	32.2
+2.9	15.6	724	8.0	126.0	14.6	51.7	30.2
+5.3	20.2	1071	6.3	130.3	9.6	67.8	29.8
+7.7	24.7	1814	6.5	134.0	4.8	83.7	29.5
+9.7	27.9	3245	11.3	133.9	3.7	88.3	31.6
+12.7	32.6	1755	18.3	131.7	2.3	93.4	34.9

Kyrock with Added Asphalt Cement (86 pen.)

5.5 NAC	10.4	2450	10.7	117.5	22.4	31.7	32.8
+2.2	15.4	1960	12.0	126.0	14.3	51.9	29.7
+4.2	19.9	----	----	129.6	9.2	68.4	29.1
+5.5	22.3	1105	10.0	128.4	8.7	71.9	31.0
+6.2	24.7	----	----	133.8	3.9	86.4	28.6
+8.2	28.7	764	23.0	133.0	1.7	94.4	30.4