Laboratory Testing of Wet-Processed Kyrock

Robert L. Florence
Kentucky Highway Materials Research Laboratory
MEMORANDUM

TO: A. O. Neiser
   Assistant State Highway Engineer

FROM: W. B. Drake
       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.

Enc. 1. Memo. from R. L. Florence, June 20
June 20, 1962

MEMORANDUM

TO: W. B. Drake
   Director of Research

FROM: R. L. Florence
       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

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 (CS₂) (centrifuge) ----- 5.4
Percent bitumen (benzene) (centrifuge) - 3.25

GRADATION OF EXTRACTED AGGREGATE

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<th>Sieve Size</th>
<th>Percent Passing</th>
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<td>No. 16</td>
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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 harden-
ing 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 CS₂; 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 deterrent 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.
Fig. 1
Fig. 2
COMPARATIVE MARSHALL TEST RESULTS

TEST DATA

<table>
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<th>Opt. % BH</th>
<th>Unit Wt.</th>
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<td>Stability No.</td>
<td>Flow</td>
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<td>% Voids Comp. Agg.</td>
<td>% Voids Comp. Mix.</td>
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<tr>
<td>% Voids Filled With Bit.</td>
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Chart B-3 February, 1955

HIGHWAY MATERIALS RESEARCH LABORATORY
LEXINGTON, KENTUCKY

MARSHALL STABILITY TEST
Mix No. Date 6/20/52
Project Wet-Processed Kyrock
Aggregate Rock Asphalt Sand
Bitumen

--- Asphalt Cement (66 Penetration)
--- Tar (RT-12)

Fig. 3
<table>
<thead>
<tr>
<th>Bitumen Content</th>
<th>Bitumen Content (% by Vol.)</th>
<th>Stability (lbs.)</th>
<th>Flow (0.01 in.)</th>
<th>Unit Weight (lbs/cu ft)</th>
<th>Mix. Percent Voids</th>
<th>Filled w/Bitumen</th>
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Kyrock with Added Asphalt Cement (86 pen.)

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<th>Bitumen Content</th>
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<th>Stability (lbs.)</th>
<th>Flow (0.01 in.)</th>
<th>Unit Weight (lbs/cu ft)</th>
<th>Mix. Percent Voids</th>
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