

REPORT ON SURFACE TREATMENTS WITH MODIFIED BINDERS
prepared by Subcommittee MC-A3(7)
of HRB Committee MC-A3 on "Bituminous Surface Treatments"

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In the fall of 1963 Subcommittee MC-A3(7) consisting of Messrs. R.A. Crawford, B.M. Gallaway, J.W. Reppel, E. Zube, and J.M. Rice (Chairman) solicited information on current experience with "Surface Treatments with Modified Binders". Producers of elastomers and synthetic binders and other interested parties were requested to provide the following information: (1) new materials, processes, or applications of modified binders, (2) reports on recent installations or inspections of individual projects, and (3) tabulations of recent installations and older projects that are still of current interest. The response to the inquiry was not as complete as desired, because some of those contacted did not realize that the subject matter was intended to include premixed treatments as well as application types, and also thin surfacings with pigmented binders. The information which follows is essentially that developed and reported verbally at the 1964 meeting of Committee MC-A3, January 13, 1964.

California Division of Highways

E. Zube

By correspondence, Mr. Zube mentioned having laid a number of screening seal coat test sections involving the addition of synthetic latex to high viscosity anionic emulsions. However, no significant improvements in screening retention have been observed. Under normal conditions of climate and control, both control and modified binders produced satisfactory results, while in the north coastal area where fog and low temperatures prevail, almost total failure occurred with both control and rubberized emulsions.

He further commented that their main concern in this type of construction is retention of aggregate immediately after placement since it is necessary to open roadway to high speed traffic within a few hours of completion of rolling.

He noted that they have been unsuccessful in their attempts to interest producers in supplying for trials emulsions prepared from rubberized asphalts. At this point, Mr. Rice described briefly a trial of this nature which had been conducted in Canada with the cooperation of the Department of Highways of Ontario, the Flintkote Company, and the Natural Rubber Bureau.

Mr. Zube mentioned a few test sections with white pigmented binders used as overlays for bridge decks or approaches. No difficulties in handling were encountered but the projects are too recent to evaluate service life.

Consulting Bituminous Engineer

Jewell R. Benson

While Mr. Benson has not been recently active in the rubberized asphalt field, the Husky Oil Company, Cody, Wyoming, has been producing cutback asphalts containing neoprene for several years under his patents. In his written comments, Mr. Benson noted that this company has maintained a good market for these materials and that several states in the area have recently increased their use.

He described the condition of a project at Walsenburg, Colorado, placed in 1958, which contained sections with natural rubber styrene-butadiene, neoprene, and a normal asphalt. When last inspected, the overall appearance of these sections was good, but it was noted that close examination revealed distinct difference in the condition of the asphalt films with respect to durability or "life". In decreasing order, he rated the materials as NR, SBR, neoprene, and normal. However, on the basis of his extended experience with SBR and neoprene, it was his opinion the neoprene provided special value in reducing "throw-off" during the initial critical period - first 24-48 hours. In the discussion following, Mr. Benson emphasized the complex chemistry of asphalts and elastomers, and the need for careful study and experiment to develop the most suitable combination.

He concluded with the statement that "Where test projects using normal and rubberized asphalts are set and all work is performed under strict controls, little difference is noticeable between the two materials. Where normal, everyday methods are used, much difference exists, both initially and over a long period of time."

Idaho Department of Highways

Reported by J.M. Rice

Mr. Rice called attention to "A Report of Field Experiments in Seal Coats" which had recently come to his attention. This report, by Messrs. L.F. Erickson and H.L. Day, includes information on rapid-curing cutback asphalts containing neoprene, and concludes, in part, that these gave excellent performance in retaining cover aggregates even though the embedment of stone in several instances was low.

E.I. DuPont de Nemours and Co.

D.C. Thompson, R.M. Turner

Mr. Thompson reported (by letter) that he had little to offer in the way of new information on materials, processes, tabulations, or inspections of surface treatment projects. At the meeting, Mr. Turner mentioned two installations of bridge deck overlays on the New Jersey Turnpike. These were neoprene-asphalt-asbestos hot mix jobs, the first placed 3/4" thick on the Lincoln-Tunnel Complex about two years ago, and the second placed 1 1/2" thick on the Passaic River Bridge in 1963. This latter project is described in Constructioneer, January 13, 1964.

Pioneer Products Dir., Witco Chemical Co.
Naugatuck Chemical Dir., U.S. Rubber Co.

H.R. Bornscheur
S.P. Tauber

Mr. Bornscheur furnished a brochure on WITCOPAVE - an asphalt blended with a butadiene-styrene copolymer made by U.S. Rubber Co. The brochure emphasizes the retention of penetration with aging and includes a list of 21 paving projects in Massachusetts. Mr. Tauber, by letter, noted that these projects are hot plant-mixed thin layers, 3/8" to 3/4", rather than liquid surface treatments, and that additional projects have been placed in Connecticut and Pennsylvania.

Massachusetts Institute of Technology

Reported by J.M. Rice

The chairman cited an M.I.T. report (R 63-31) titled "Study of Road Surfaces by Photographic Method" by E. Tons and A. Lau. This report gives information on the performance of 16 road sections in Massachusetts which were placed in 1960. Each section contained both a polymer additive and a control as thin overlays over 15 old bituminous surfaces and one portland cement concrete pavement. The pavements were photographed prior to resurfacing and two years later in 1962. Deterioration was classified as ravelling and cracking, although there was no ravelling after two years. In the control sections 32% of cracks had reappeared and in the additive sections, 28%. The authors concluded that the reduction in cracking due to the polymer additive is not significant after two years of service.

Goodyear Tire and Rubber Co.

D.A. Kaliin

Mr. Kaliin provided a brochure on PLIOPAVE, a tabulation of 1963 Pliopave Modified Asphalt Projects, and other information by letter. Pliopave is available either as S-180 Powder with 80 percent synthetic rubber or L-170 Latex with 68 percent elastomer content. The tabulation of 1963 projects is summarized below in five categories.

	<u>Type</u>	<u>No. of Projects</u>	<u>Total Miles</u>	<u>Additive</u>
I	MC-5 Chip Seal	4	190	Latex or powder
II	Asphalt Cement Chip Seal	2	7	
III	Emulsion Chip Seal	8	71	Latex only
IV	Slurry Seal	6	21	Latex only
V	Hot Mix	9	10	Latex or powder

Mr. Kaliin noted that the slurry seals were a new application and cited advantages such as speed-up in drying time, improved adhesion, low cost, and expectation of longer wear. The use of rubberized RS-2 emulsion had shown the greatest growth in 1963 and the advantages appear to be a speed up of break or cure and greater immediate stone retention. Rubberized hot mix may be prepared either with the rubber premixed in the asphalt cement or by direct addition to the pugmill, although the premixing gives a more intimate blend and dispersion.

Xylos Rubber Co.

Division of Firestone Tire & Rubber Co.

H.V. Carlson

Mr. Carlson submitted information on Rub-R-Road R-504 for thin surfaces of rubberized sand-asphalt and noted its use by 19 highway agencies in Ohio, including the State Highway Department. R-504 is an aqueous latex containing 50 percent synthetic rubber, and for hot-mix paving the latex is added directly to the hot aggregate in the mixer - normally as 10 percent of the asphalt.

The advantages claimed for this application are better adhesion to smooth or polished surfaces, increased toughness and wear resistance, skid-resistance approximating that of Kentucky Rock Asphalts, and thinner resurfacing layers which can be advantageous for street paving. Included in the submission were several reprints of reports from trade magazines, one of which gave the cost per ton for the rubberized mix as \$20 compared to \$7.50 for the standard T-35 mix used in Ohio. One of the reprint reports describes the use of Rub-R-Road compound R-524, a non-aqueous latex for direct blending with cutback asphalts such as MC-5 - typically proportioned as 3.5 percent liquid rubber. Experience in Portage County has indicated cost reductions in the order of 10 to 18 percent over former surface treatment methods.

Also included were suggested specifications for "Rubberized Sand-Asphalt Wearing Course," "Rubberized Tack Coat for Rubberized Sand-Asphalt Wearing Course," and "Dispersible Rubber Compound for Use in Rubberized Sand-Asphalt Wearing Course." Other information submitted dealt with use of Rub-R-Road Sealant No. 526 which is rubber-resin for colored sealants for use on bridges, parking structures, and pavements.

U.S. Rubber Reclaiming Co.

R.J. Dzimian

Mr. Dzimian provided a data sheet on RAMFLEX V-17- a new asphalt-soluble, flaked rubber composition. This devulcanized rubber powder can be dispersed in asphalt by mixing at 350° F for a maximum of one hour, or the powder can be added directly to the hot aggregate in the pugmill. MC-2 cut-backs can be made from rubberized asphalts. Recommended uses are for bridge decking, hot and cold patching, and joint sealer modifier. Mr. Dzimian stated that RAMFLEX has been used in western New York beginning in 1952 and all installations were in good condition when inspected in 1963. Subsequent to the meeting a Bulletin T-100 on RAMFLEX was received. This includes a tabulation of installations in six states.

International Institute of Synthetic
Rubber Producers, Inc.

Roland Vokac, Consultant

Mr. Vokac had supplied a paper titled "Rubber in Roads" by J. MacLachlan and S.H. Morrel which had been prepared for the Rubber and Plastics Research Association of Great Britain. This consisted of a digest of the literature and since it was marked "Confidential", Mr. Rice asked Mr. Vokac to present appropriate comments verbally with emphasis on the practical investigations and foreign activity and interest in this area. In his presentation, Mr. Vokac noted that the report could be made available to interested persons. In his comments, he also elaborated on the potentiability of developing a synthetic elastomer which would be universally suitable for all asphalts.

Natural Rubber Bureau and
Road Research Laboratory, D.S.I.R.

Reported by J.M. Rice

The chairman reported on several items which had come to his attention through the courtesy of the Natural Rubber Bureau. The first of these was "A Review of the Results of Full-Scale Road Experiments Using Rubberized Asphalts: 1953-1962", by P.D. Thompson, Lab. Note No. LN/357/PDT, May 1963, Road Research Laboratory, D.S.I.R. It is understood that this note is now

published as Road Research Technical Paper No. 71. Information is given on the comparative performance of normal surfacing materials and similar materials rubberized with natural rubber. Several types of road surfacings were investigated and advantages have been obtained with mastic asphalt, rolled asphalt, bitumen macadam, and bitumen surface dressings. The results for the tar surfacings were less conclusive although graft-rubber may provide some advantages. The note contains a number of references to other Road Research Laboratory publications relating to rubberized surfacing materials.

The chairman cited another report by P.D. Thompson titled "The Rheological Properties of Bituminous Materials Containing Natural Rubber and their Relation to Road Performance," which is published in Proceedings of the First Conference, Australian Road Research Board, Vol. 1, 1962.

Subsequent to the meeting, the Road Research Laboratory, D.S.I.R., issued Road Note 36 which is a Specification for the Manufacture and Use of Rubberized Bituminous Road Materials and Binders. This includes an appendix describing the Determination of Rubber Content by Iodine Value and Specific Viscosity Measurements.

Neville Chemical Company

J. Walaschek, J.R. Patterson

Mr. Patterson supplied literature describing three types of PAVEBRITE synthetic binders for colored thin overlays. These are Pavabrite 90 and Pavabrite 65 in two penetration grades and available in bulk quantities, Pavabrite GR which is gasoline resistant and also supplied in bulk, and Pavabrite II - a two component system for small jobs. He provided a list of six highway installations in Ohio, New Jersey, Pennsylvania and New York, the oldest of which was then 15 months. The chairman noted that he had observed one of these on U.S. 422 east of Harrisburg in which several colors had been used experimentally. The color differentiation was excellent in daylight, although less impressive at night.

Mr. Walaschek provided some personal observations on color paving in general, somewhat as follows: (1) resin suppliers are continually changing processes to improve materials, (2) important results have been achieved with white aggregates although costs of \$10 to \$12 a ton (for aggregate) have met resistance, (3) a sheet asphalt grading with all material passing a No. 8 sieve is essential for retention of uniform color, (4) with proper prime coat color paving can be attached to either portland cement or bituminous concrete in very thin overlays, (5) the higher performance over asphalt indicated by laboratory tests has not necessarily come to pass, (6) initial tackiness may collect dirt but this wears off under traffic, and (7) an analysis of results of color paving with respect to traffic control, safety and lighting is hazy because of lack of sufficient data.

Humble Oil and Refining Company

D.S. Lewis

Subsequent to the meeting Mr. Lewis provided a written commentary on "Surface Treatments with Paving Mixes Using Synthetic Binders Derived from Petroleum". This includes descriptions of several field trials using VIADON and MIRADON by public agencies and by Humble's research affiliate, Esso Research and Engineering Company. On the Garden State Parkway in New Jersey

overlays with VIADON and MIRADON have been used in a 1/2" thick all-sand mix and a 1 - 1 1/4" stone/slag sand/native sand mix. Resistance to crack reflection has been observed to be good. The Port of New York Authority in 1962 placed test sites in the Lincoln Tunnel and its approaches using both materials in stone-filled silica sand mixes at a nominal 3/4" thickness. In Richmond, the Virginia Department of Highways is testing thin sand overlays using synthetic binders to evaluate serviceability and improvement in safety at intersections due to colors. The installation has been described in American Road Builder, December, 1963. On the New York State Thruway, experimental test sites have been placed on interchanges near Albany to evaluate off-white synthetic binders as overlays on portland cement concrete. VIADON was used in a fine-graded mix placed at 5/8" thickness. Another series of 15 test sections has been placed in Union County, New Jersey, using both binders in all-sand and fine bituminous concrete mixes. The commentary concludes with a comment on some difficulty experienced in machine-laying and the need for the same careful construction practices required in handling comparable asphalt paving mixes. (Note by chairman: The main difference between VIADON and MIRADON is that the latter is more resistant to solvent action.)

Vesicol Chemical Corporation

J.M. Gibbons

Mr. Gibbons described WYTON as a petroleum-derived, polymeric paving binder that handles in the same manner as conventional asphaltic cement but has superior properties - increased ductility to give more resistance to reflection and thermo cracking, and a chemical nature that resists de-icing salts and water deterioration. WYTON is available in three penetration grades - 5-15, 60-80, 75-90 - and also as a cutback liquid binder. Emulsions for seal coats and slurry seals are under development. A large number of installations have been placed since the first in 1959 and include a variety of uses other than for highway paving. A major highway installation is 14.5 miles of six-lane paving on the Kingery-Calumet expressway outside of Chicago. Subsequent to the meeting literature was received identifying WYTON as a "light asphalt" and citing its use for correcting depressions or other deterioration in portland cement concrete pavements.

Shell Oil Company

J.O. Izatt

Mr. Izatt reported by letter that Shell has an active program for developing sealants and seal coats for concrete surfaces using a cold-applied, oil-extended epoxy, and also has a hot-applied, epoxy asphalt for a tack coat on concrete which, in turn, is overlaid with an asphaltic pavement wearing surface. While this information was of interest, it is not strictly within the scope of "Surface treatments with modified binders."

South Dakota Department of Highways

R.A. Crawford

A study of the relative merits of rubberized RC-4 chip seals as compared with regular RC-4 chip seals was initiated in South Dakota in 1959. Between 1955 and 1959 approximately 1400 miles of highway were chip sealed in South Dakota. Of these 1400 miles about 825 miles were placed using a rubber additive in the asphalt. All of these 1400 miles, constituting 119 projects,

have been observed over the 7 year period of 1959 through 1965. One conclusion resulting from this study is that the addition of rubber to the asphalts used in these chip seal projects has not influenced the quality nor the longevity of the chip seals one way or the other. Because of this lack of evidence of improved performance with the addition of rubber the South Dakota Department of Highways does not feel that the added cost of the rubber is economically justifiable.

In August 1958 a chip seal test project was placed near Groton, South Dakota, using four different asphalt binder materials. The four asphalts used were on RC-4 with a no-strip additive, a natural rubber modified binder, an SBR modified binder and a neoprene modified binder. After seven years of service no significant differences are discernible in the four test sections. All four test sections are still giving satisfactory service. It has been noticed that the portion of the project not included in the test sections is not as satisfactory as any of the four test sections. This portion of the job used SBR modified binder. The reduction in quality of this portion is probably due to a relaxation of construction control after the test sections had been completed. After seven years of observation it appears that the addition of natural rubber, SBR, or neoprene to the asphalt binder does not noticeably affect the quality nor the length of life of a chip seal.