LABORATORY EVALUATION

of

BITUMINOUS PAVEMENT SEALERS

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VERMONT DEPARTMENT OF HIGHWAYS

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Introduction

Current Department practice calls for the application of a single coat of tar emulsion over a two-foot wide strip along the curb lines of bridge decks. The tar emulsion is applied by squeegee at the rate of 0.2 gallon per square yard. The purpose of the application is to reduce the penetration of water and de-icing chemicals through the bituminous mix and to seal the joint between the pavement and the curb face. Based on field observations, the effectiveness of the tar emulsion has varied widely among projects and within different areas on the same bridge deck. The unsatisfactory conditions have included the formation of cracks, both in the coating and at the curb face. The cracks in the coating normally occur with heavy applications and are probably due to the high percentage of water in the material, while the cracks at the curb face often are the result of the lack of flexibility of the material at cold temperatures. In some cases, the effectiveness of the tar emulsion is directly related to the compaction or finish of the bituminous pavement, and the age of the mix when the sealer is applied.

The performance of an RC-800 asphalt, RS-1 asphalt emulsion, and a gilsonite based asphalt sealer, has been noted on limited field applications. Problems noted with RS-1 included cracks up to 1/2 inch in width and the existance of water beneath some areas covered with a heavy coating. Numerous bubbles and pinholes were noted in the other two sealers at scattered locations.

Scope

The purpose of this laboratory study was to determine if any of the commercially available pavement sealers are more effective than tar emulsion in sealing the surface of a bituminous pavement.

Materials

The materials included in the evaluation program were as follows:

1) Tar emulsion
2) RS-1, asphalt emulsion
3) Cationic emulsion
4) Polytok membrane, a 2 component asphalt modified polyurethane.
5) Perma-bind, a commercially available pavement sealer, containing Gilsonite asphalt.
6) Gilsabind, a commercially available pavement sealer, containing Gilsonite asphalt.
7) Barrier, Type A, a commercially available pavement sealer, consisting of 36 percent polyester resin solids in an alcohol solvent.

Test Procedure

The electrical resistance test was selected as the primary method of evaluation, since resistance to electrical current and moisture-flow through a di-electric material is directly related to the voids in the material. Consequently, the permeability or sealing ability of a coating can be related to the gross electrical resistance of the coating.

Bituminous concrete brickettes were constructed of material meeting Vermont Specification 406.02, Type IV Bridge Mix. Materials included 3/8" maximum aggregate size and 7 percent AC 5 viscosity asphalt. After the brickettes had cured for a satisfactory period, each sealer was applied on four brickettes, with all applications made at recommended application rates. After additional curing, initial resistance readings were taken on each sample. This was followed by a test series which included the following:

a) Freeze-thaw cycling
b) Submersion in water
c) Exposure to winter weather
d) Abrasive wear

Resistance readings were taken on each group of sealers, after a specific number of cycles or days exposure.

Analysis of Test Data

The results of the testing are shown in Table I. Electrical resistance readings on untreated bituminous brickettes averaged 7,000 ohms. Readings on the sealers, prior to cycling, ranged from 30,000 ohms to infinity. In nearly all cases, the highest readings occurred prior to cycling the samples. The exception occurred in the abrasion test, where the wearing action of an abrasive stone improved the seal on the bituminous concrete surface after one hundred strokes.

Samples of cationic emulsion were received after the test program was underway, and were not subjected to the same number of test cycles.

Summary

Based on the test results, the sealing property of the polyurethane membrane is superior to the other products evaluated. It could also be presumed that a polyurethane would effectively seal off the joint between the pavement and the curb face, if properly applied, since the material remains flexible at low temperatures and developes good adhesion to bituminous concrete, portland cement concrete, and granite.

Factors which could adversely effect a polyurethane seal include potential damage from snowplows, and the aging characteristics of the material when exposed to weather and sunlight over an extended period of time.

With the exception of the polyurethane, little, if any, improvement in sealing properties could be expected by substituting one of the other materials for the standard treatment of tar emulsion.

Recommendation

An experimental application of a polyurethane membrane is recommended, in order that a field evaluation can be made.

TABLE I

PRODUCT EVALUATION SUMMARY

Tests or Observations	POLY-URETHANE MEMBRANE	TAR EMULSION	PERMA-BIND	RS-1	GILSABIND	CATIONIC EMULSION	BARRIER
Surface Preparation Required	Sweep Clean	Sweep Clean	Sweep Clean	Sweep Clean	Sweep Clean	Sweep Clean	Sweep Clean
Moisture Sensitive	Yes	No	Yes	No	Yes	No	Yes
Curing Time	24 hrs.	5 hrs.	3 hrs.	5 hrs.	3 hrs.	5 hrs.	1 hr.
Ease of Application	Premixing Necessary	Easy	Easy	Easy	Easy	Easy	Easy
Application Rates	Approx. 50 Mill	0.2 gal/sy	0.10 gal/sy	0.2 gal/sy	0.10 gal/sy	0.15 gal/sy	Approx. 0.2 gal/sy
Cost/Gal.	$10.00 - $12.00/Gal.	.35¢/gal	$1.25/gal	.35¢/gal	$1.25/gal	.35¢/gal	$10.00-$12.50/gal
Block A Electrical Resistance	∞	20,000,000	∞	∞	∞	45,000	130,000
Six Freeze Thaw Cycles	∞	6,000,000	∞	1,600,000	∞	45,000	60,000
Fifteen Freeze Thaw Cycles	∞	140,000	∞	1,100,000	600,000	No Test	120,000
Fifty Freeze Thaw Cycles	∞	90,000	∞	300,000	200,000	No Test	7,000
Block B Electrical Resistance	∞	∞	∞	∞	∞	30,000	14,000
Submerged Eleven Days	∞	50,000,000	200,000	600,000	400,000	20,000	20,000
Submerged Twenty-Five Days	800,000	600,000	200,000	400,000	70,000	No Test	30,000
Submerged Eighty-Five Days	700,000	110,000	35,000	100,000	30,000	No Test	12,000
Block C Electrical Resistance	No Test	No Test	450,000	No Test	70,000	No Test	70,000
Twenty-Five Abrasive Strokes	No Test	No Test	200,000	No Test	45,000	No Test	30,000
Fifty Abrasive Strokes	No Test	No Test	110,000	No Test	25,000	No Test	20,000
One-Hundred Abrasive Strokes	No Test	No Test	300,000	No Test	1,000,000	No Test	50,000,000
Block D Electrical Resistance	∞	∞	∞	∞	120,000	400,000	200,000
Seventy-Five Days of Winter Exposure	∞	∞	200,000	1,500,000	80,000	15 Day Exposure 400,000	50,000
Recommendations	1	2	3	4	5	6	7
Comments	PRODUCTS	LISTED IN	ORDER OF	PERFORMANCE			