EXPERIMENTAL USE OF AN

ASPHALT RUBBER SURFACE TREATMENT

INTERIM REPORT 81-4

JUNE, 1981

(Follow-up To Initial Report 79-6)

Reporting On

Category III Work Plan 79-R-6

SPRINGFIELD-WEATHERSFIELD IR-F 91-1(4)

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

T. EVSLIN, SECRETARY OF TRANSPORTATION
S. J. GAGE, P.E., DIR. OF ENGINEERING & CONSTRUCTION
R. F. NICHOLSON, P.E., MATERIALS & RESEARCH ENGINEER

Prepared by
R. I. Frascoia
Research Specialist

Reviewed By:

R.F. Nicholson

R.F. Nicholson, P.E. Materials & Research Engineer

Date: 8/13/81

" The contents of this report reflects the views of the author who is responsible for the facts and the accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation. Anyone, other than the Agency using this report does so with awareness that the Agency does not guarantee the opinions, findings, or conclusions contained herein".

INTRODUCTION

This interim report discusses the condition and performance of highways treated in 1979 with experimental applications of OVER-FLEX asphalt rubber. The material was produced and applied by the Sahuaro Petroleum and Asphalt Company of Phoenix, Arizona at the following locations:

A. Interstate 91 SB between the Ascutney and Springfield interchanges
   1. As a surface treatment on 8.54 miles of roadway between milemarkers 51/24 and 42/70.
   2. As a membrane interlayer on 0.97 miles of roadway between milemarkers 42/70 and 41/73.

B. Interstate 89 NB in the Town of Richmond
   1. As a surface treatment on 0.95 miles of roadway between milemarkers 76/05 and 77/00.

For detailed information on the construction phase of the experimental treatment, refer to Initial Report 79-6 published in December, 1979.

WEATHER CONDITIONS DURING EVALUATION PERIOD

Climatological data for the Springfield area during the period October, 1979 - April, 1980, discloses a freezing index of 1119, 96 freeze-thaw cycles and 41 inches of snowfall, with the latter approximately 40 inches below the seasonal average. Temperature changes in excess of 30°F within 24 hours occured 32 times during the period while the maximum temperature extreme for the period July, 1979 - June, 1980 was 110°F. Data for the 1980 - 1981 winter season was not available at the time of this writing.

LOSS OF COVER STONE

Roadway inspections through April, 1980 revealed a significant loss of cover stone on all areas while additional inspections through June 12, 1981 disclosed that the problem had subsided. Comments documented at the time of inspection were as follows:

7/25/79	Experimental section opened to traffic on 7/24/79. Numerous loose stones noted on road surfaces.
8/7/79	Very few loose stones noted on road surface.
8/24/79	No change in surface condition since 8/7/79.
10/11/79	Significant amount of loose stones on road surface. Stone windrowed along centerline some areas and shoulders nearly covered with layer of stone at some locations. Loss of individual stones clearly visible although overall % of loss not alarming. Most significant loss noted over 6 inch wide by 150 foot long area on or adjacent to longitudinal joint between two passes. Up to 30% of stone is missing in this area.

1/80/80 Surface treatment still losing stone as evidenced by pickup on inspection vehicle undercarriage and by passing vehicles. Loss noted on painted centerline varies from 10 - 70%. Could assume a greater loss has occured in wheelpaths but difficult to determine. Noted (4) 14" - 29" wide strips nearly continuous in length for up to 650' which were nearly void of stones and also other smaller areas. Estimate overall loss of stone at 15 - 20%.

4/8/80 Loss of stone appears to be stabilizing. Very little loose stone on roadway or shoulders. Some areas reveal differences in stone loss between the 3 adjoining passes of from 10% to 75%. No areas of complete stone loss in the 1/2" aggregate section. No significant loss of cover stone along edge of cracks in surface treatment.

7/9/80 No noticeable change in surface condition or evidence of loose stones on roadway or shoulders. Only 2 stone chips missing from 13 square feet of centerline which had been painted 42 days earlier on May 27, 1980.

8/15/80 Loss of cover stone resulted in numerous verbal reports of damage to windshields, headlights and vehicle finishes and 25 wriffin claims for damage during the first 12 months of exposure to traffic. The last report of damage occured on this date.

12/9/80 Detailed inspections made at each mile and 1/2 mile point treated with 3/8" cover stone revealed an estimated 20% loss on the passing lane and 14% loss on the travel lane. Areas with 1/2" stone fared better with 9% loss on the passing lane and 8% estimated on the travel lane. The % stone loss does not include an average of one 3" wide strip per lane with up to

100% loss of cover stone.

6/12/81 Survey at mile and 1/2 mile intervals revealed no change in stone loss over that noted on 12/9/80.

REFLECTIVE CRACKING

Treatment	Original Crack Count	% Reflective Cracking 2/4/80	3/10/80	4/16/80	4/8/81
Asphalt Rubber Surface Treatment (4 test sections totaling 4240Lf)	181.0'/100Lf	52	62	69	89
*Asphalt Rubber Interlayer (2 test sections totaling 798Lf)	132.9'/100Lf	39	50	57	82
**Control Section (4 test sections totaling 2122Lf)	244.2'/100Lf	12	14	15	42

*(1) 1" bituminous surface course

**(2) 1" courses bituminous pavement

PAVEMENT RUTTING

Treatment	Location	Pre-construction	Post-construction	12/80	6/81
Asphalt Rubber Surface Treatment	Travel Lane	1/2" - 5/8"	Insignificant	2/32	3/32
	Passing Lane	3/8"	"	1/32	2/32
Asphalt Rubber Interlayer	Travel Lane	1/2" - 5/8"	Insignificant	(1)	(1)
	Passing Lane	3/8"	"	(1)	(1)
Control Section	Travel Lane	5/8"	Insignificant	(1)	(1)
	Passing Lane	3/8"	"	(1)	(1)

(1) No readings taken

RIDING QUALITY

Riding quality as measured in inches of roughness per mile with a Mays Ride Meter.

	Inches per Mile		
	1978	11/1979	11/1980
Asphalt Rubber Surface Treatment	139.6	29.8	47.0
Asphalt Rubber Interlayer		21.1	27.5
Control Section	193.4	15.6	31.1

FRICTION READINGS

Friction values obtained with a locked wheel friction trailer operating at 40 mph were as follows:

Treatment	Average Value 10/79	9/80
Asphalt Rubber Surface Treatment (3/8"stone)	45.8	50.4
Asphalt Rubber Surface Treatment (1/2"stone)	46.0	50.0
Asphalt Rubber Interlayer	-	45.4
Control Section (Vt. Type III Bit. Mix)	-	50.4

MAINTENANCE REQUIREMENTS

The accumulation of displaced cover stone on the roadway and shoulder areas necessitated sweeping operations by maintenance forces a total of seven times with the last one occuring on March 20, 1980. There have been no other maintenance requirements on the asphalt rubber surface treatment, interlayer, or northbound control section.

PROJECTED REQUIREMENTS

Since the problem with cover stone loss has stabilized, the Agency does not anticipate a need for any corrective changes or maintenance requirements in the near future.

SUMMARY TO DATE

Loss of Cover Stone - The surface treatment has stabilized following significant stone losses through the first eight months of exposure to traffic.

Reflective Cracking - The standard bituminous overlay placed on the control section had 42% reflective cracking while the asphalt rubber interlayer had 82% and the asphalt rubber surface treatment had 89% through two winter seasons.

Riding Quality - Mays Ride Meter readings averaged 47 inches per mile on the 15 month old surface treatment while the control pavement averaged 31. The section with the asphalt rubber placed as an interlayer produced a reading of 28 inches per mile.

Friction Readings - Friction values of 50.4 were obtained on both the surface treatment and control pavement approximately 14 months after placement.

Maintenance Requirements - Maintenance was limited to seven sweeping operations through March 20, 1980

Projected Requirements - No corrective changes or maintenance is anticipated in the near future.

Photographs of I91 SB in Springfield taken December 9, 1980.

Note loss of cover stone and cracks in Asphalt Rubber Surface Treatment.

INTERSTATE 89 - RICHMOND, VERMONT

WEATHER CONDITIONS DURING EVALUATION PERIOD

Climatological data for the Richmod area during the period October, 1979 - April, 1980 discloses a freezing index of 1186, 73 freeze-thaw cycles and 33 inches of snowfall with the latter 47 inches below the seasonal average. Temperature changes in excess of 30°F within 24 hours occured 20 times during the period while the maximum temperature extreme for the period October, 1979 - September, 1980 was 112°F. Data for the 1980 - 1981 winter season was not available at the time of this writing.

DETERIORATION OF UNDERLYING PAVEMENT

The asphalt rubber was not able to prevent further deterioration of the existing pavement which had been breaking up in random areas since it was placed in 1975. Prior to placing the asphalt rubber, the test section contained 31 bituminous patches encompassing an area of 794 square yards or 6% of the total pavement area. Following treatment, removal and patching was required at 61 additional locations totaling approximately 285 square yards through October 7, 1980. Deterioration through early June, 1981 continued at approximately the same rate.

LOSS OF COVER STONE

The loss of cover stone was a serious problem on the Interstate 89 test section.. The initial report documented stone loss within the first two weeks at 19 areas totaling 608 lineal feet of the travel lane. Additional inspections through December 11, revealed a nearly complete loss of stone over an area one to two feet wide adjacent to the centerline for 90% of the project length. Numerous other short bare strips in the travel lane and a single strip in the passing lane were noted plus up to 40% stone loss at other locations.

A detailed survey of the test section conducted on October 7, 1980 revealed a single 90 foot long section on the southerly end of the project which was free of significant stone loss. With the exception of that area, 100% stone loss occured along an area 1 to 5 feet wide in the area of the left wheel path of the travel lane. Up to 15 additional bare strips ranging from 1" to a foot or more in width were also noted across the 24' roadway. The area with 100% stone loss totaled approximately 25,000 square feet or 21% of the surface treatment. All other areas had varying amounts of stone loss. The loss of cover stone resulted in 5 written claims for damage with the last report of windshield damage occuring in November, 1979.

The reason for the loss of stone can not be clearly linked to any specific conditions or materials involved with the application. The Springfield and Richmond applications were similar with respect to personnel and equipment involved, use of an antistrip additive, gradation and temperature of stone, asphalt coating on stone, average rate of application, time lapse between asphalt rubber and stone application, time lapse between stone application and compaction, compaction effort and percent stone embedment. Conditions which varied included the viscosity of the asphalt, type of cover stone, ambient temperature, pavement surface temperature, surface width covered per pass, cure time prior to exposure to traffic and traffic volume on the roadway. The 85-100 penetration grade asphalt used in Richmond was a stiffer asphalt averaging about 350 poises higher than that used on the Springfield project. The crushed rock used in Richmond should have been better suited for the intended purpose due to more fractured faces than the crushed gravel used in Springfield. The ambient temperatures were higher in Springfield but were also acceptable in Richmond where they ranged from 67 - 70°F and 70 - 78°F. Overnight temperatures were significantly lower on the Richmond project.

Pavement surface temperatures averaged over 100°F in Springfield as compared to readings between 81°F and 87°F in Richmond. The width of the application made in Richmond may be a factor in the extensive loss of aggregate from the outer edge of the pass made in the travel lane. It is possible that the distributor lacked sufficient power to apply the required amount of asphalt rubber at the outer ends of the spray bar when the application was made over a 12 foot width. The lack of cure time prior to allowing traffic on the surface treatment may have been an important factor. Although a high volume of slow moving traffic would be beneficial in embeding the cover stone, the fast moving traffic actually experienced was probably detrimental to the treatment. The quicker overall loss of cover stone in Richmond may also be attributable to 50 percent higher traffic volume over that experienced in Springfield.

REFLECTIVE CRACKING

Initial crack surveys were made on three test sections totaling 1584 lineal feet of roadway. All cracks noted were transverse with an average of 43 Lf per 100 Lf of roadway. Approximately 60% of the cracks reflected through the surface treatment by December 11, 1979, while 100% reflection was noted in May, 1980. The absence of crack filling on I89 is believed to have caused the higher rate of reflective cracking over that which occured on I91 in Springfield.

RIDING QUALITY

Riding quality as measured in inches of roughness per mile with a Mays Ride Meter.

	Inches per Mile	
	11/79	11/80
Asphalt Rubber Surface Treatment	64.0	73.6
1975 Overlay	36.4	62.8

FRICTION READINGS

Friction values obtained in September, 1980, with a locked wheel friction trailer operating at 40 mph ranged from 17.5 to 31.9 with an average value of 24.4. The low values are the result of up to 100% stone loss in the left wheel path of the travel lane.

MAINTENANCE REQUIREMENTS

The accumulation of displaced cover stone on the roadway and shoulder areas necessitated sweeping operations by maintenance forces 5 times between September 17 and November 24, 1979.

Continued deterioration of the underlying pavement also necessitated removal of such material at 61 locations totaling approximately 285 square yards in area through October 7, 1980. Additional patching was carried out through April, 1981 at which time a project was let to remove the asphalt rubber surface treatment and the 1975 bituminous overlay.

SUMMARY TO DATE

Loss of Cover Stone - The loss of cover stone was a serious problem with 100% loss noted on over 20% of the treated area and varying amounts lost from the remaining sections.

Reflective Cracking - One hundred percent of the cracks in the underlaying pavement reflected through the surface treatment.

Friction Readings - The loss of cover stone resulted in friction values averaging under 25 on the surface treatment.

Maintenance Requirements - Maintenance requirements included 5 sweeping operations due to stone loss and continued removal and patching of the underlaying pavement at 61 locations covering approximately 285 square yards in area through October 7, 1980. Additional patching was carried out through April 1981 at which time a project was let to remove the asphalt rubber surface

treatment and the 1975 bituminous overlay from the test section and approximately 6.7 miles of adjacent roadway. Removal of the surface treatment was completed on June 11, 1981.

Photographs of I89 NB in Richmond taken August 27, 1980.

Note loss of cover stone, new pavement patches and pavement showing on Asphalt Rubber Surface Treatment.

CONCLUSIONS

The following preliminary conclusions can be drawn from the projects following 21 to 23 months of observations.

I91 Springfield - Weathersfield

(1) The OVER-FLEX asphalt rubber surface treatment is performing satisfactorily as a riding surface following a significant loss of cover stone during the first eight months of exposure to traffic.

(2) Neither the surface treatment or the asphalt rubber interlayer were successful in preventing reflective cracking.

(3) No corrective changes or maintenance is anticipated in the near future.

I89 Richmond

(1) The OVER-FLEX asphalt rubber surface treatment was not able to prevent further deterioration of the underlying bituminous pavement placed in 1975.

(2) The surface treatment experienced a severe loss of cover stone due to conditions or materials not clearly identified.

(3) The removal of the surface treatment in June 1981 precludes further study of the expermental application on Interstate 89.