

# **Asphalt-Rubber Binder Stress Absorbing Membrane Interlayer**

Final Report  
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16. Abstract  This is the final report of an evaluation of an Asphalt-Rubber Binder Stress Absorbing Membrane Interlayer (SAMI) to control transverse, alligator and longitudinal cracking in the asphalt concrete overlay.  A control section consisting of a tack coat of CSS-1 applied to the existing pavement was used to compare against the Asphalt-Rubber SAMI and a paving grade asphalt SAMI.  Crack mapping for a period of 9 years disclosed the Asphalt-Rubber SAMI to perform slightly better than the paving grade asphalt and much better than the control.					
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ASPHALT-RUBBER BINDER  
STRESS ABSORBING MEMBRANE INTERLAYER

Wheeler I/C to Adams Co. Line, I-90

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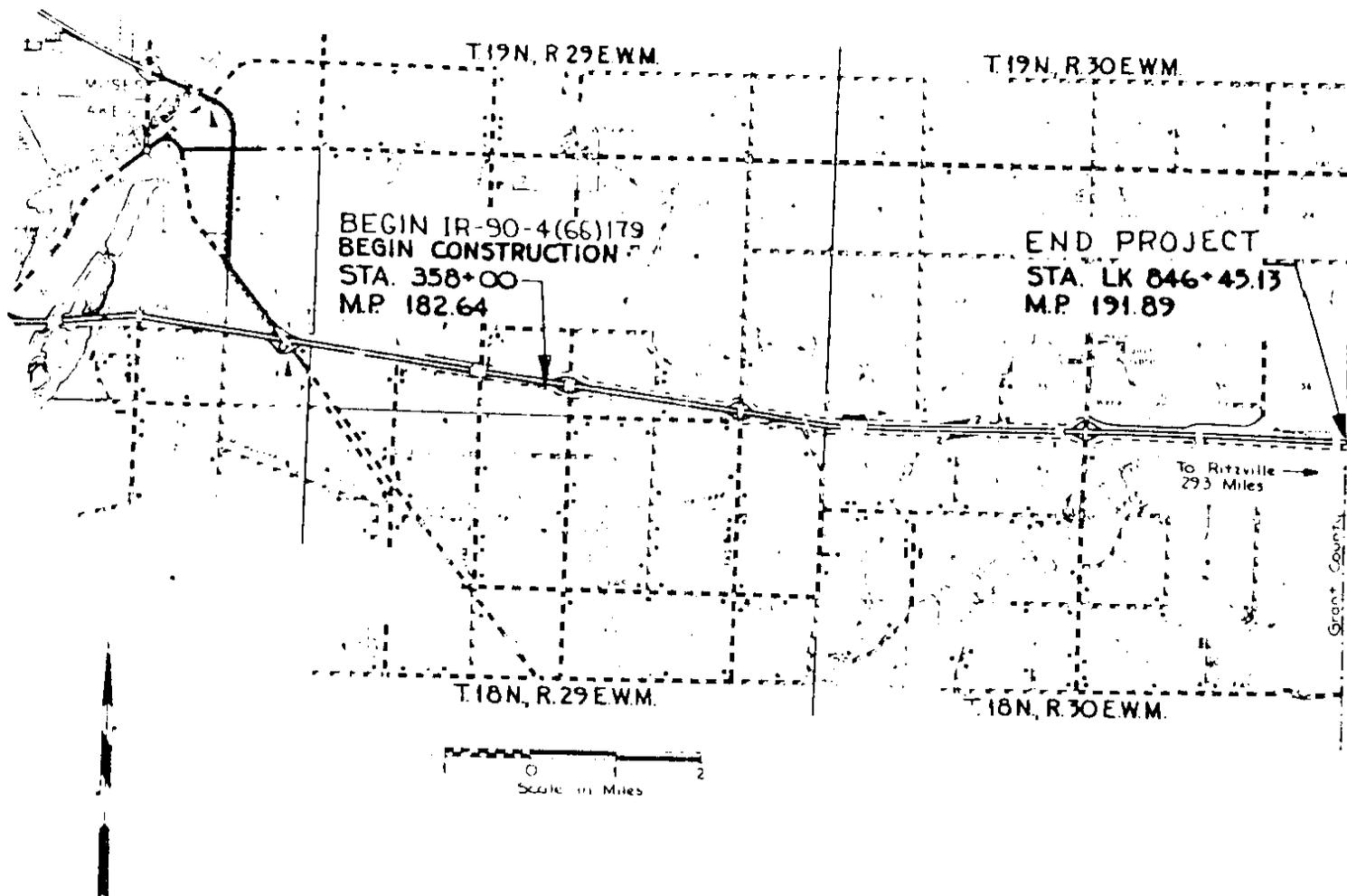
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## DISCLAIMER

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### VICINITY MAP

SR 90 MP 176.15 TO MP 191.89  
WAPATO DRIVE 1/C AND  
WHEELER 1/C TO ADAMS CO. LINE  
GRANT COUNTY

ASPHALT-RUBBER BINDER  
STRESS-ABSORBING MEMBRANE INTERLAYER

Introduction

A demonstration installation of asphalt-rubber was placed as a Stress Absorbing Membrane Interlayer (SAMI) on 9.17 miles of SR-90 east of Moses Lake in Grant County. The existing pavement was exhibiting distress in the form of longitudinal and alligator cracking in the wheel paths along with the reflection of the transverse shrinkage cracks in the underlying cement treated base. The objective of the demonstration project was the prevention, or at least the reduction, of the reflection of these cracks.

Project Description

The section of SR-90 involved in the project was originally constructed between 1964 and 1966. The existing pavement consisted of Asphalt Concrete (ACP) over either Cement Treated Base (CTB) and ballast or over Asphalt Concrete Base (ACB) and ballast. Either pavement design was more than adequate to satisfy both frost and "R" value design requirements, but continuous transverse cracking occurred throughout the project. This transverse cracking was attributed to either normal shrinkage in the CTB or thermal cracking in the ACP or ACB. Longitudinal and alligator cracking was also present in the ACP wearing course due apparently to aging and oxidation of the asphalt.

The pavement design rehabilitation proposal called for a 0.35-ft crushed rock cushion course over the existing pavement followed with a total of 0.35 feet of ACP. This design has been used successfully for many years to prevent reflective cracking, but inadequate clearances from overhead structures and side slope geometry made this

design unacceptable. The asphalt-rubber SAMI and ACP overlay saved a total of .40 ft in clearances and more in side slopes. The asphalt-rubber SAMI was chosen as an alternative means of preventing or reducing the reflective cracking.

The asphalt-rubber SAMI was to be applied to the existing pavement throughout the project with the exception of six specific test sections where a paving grade asphalt with chips was used in lieu of the asphalt-rubber SAMI to provide a means of determining the relative benefits of the asphalt-rubber interlayer.

#### Study Site

The six sites constructed with the heavy paving-grade asphalt SAMI are delineated below. This SAMI consisted of 0.35 gallons per square yard AR-4000W with 25 pounds per square yard crushed screenings, 3/8 in. to No. 10.

1. Sta. 373+50 to Sta. 375+50 Eastbound
2. Sta. 669+47 to Sta. 673+00 Eastbound
3. Sta. 840+00 to Sta. 842+00 Eastbound
4. Sta. 375+60 to Sta. 377+60 Westbound
5. Sta. 671+00 to Sta. 672+00 Westbound
6. Sta. 840+00 to Sta. 842+00 Westbound

A special control section was constructed between Sta. 358+00 and Sta. 373+50 in the eastbound lanes. Neither type of SAMI was used on this section. The existing pavement was tacked with a standard application of CSS-1 (.02 to .08 gal./sq yd) before constructing the overlay. This provides a standard for comparison of the SAMI sections with standard overlay procedures.

### Measurements and Observations

Low-level aerial infrared false-color photographs were taken of all of the study sites prior to construction. This provided a permanent record of the existing transverse cracking which could then be compared with the location of any cracks which would reflect through the overlay. The study sites were evaluated periodically over a period of nine years by mapping the number, length, and location of the cracks which developed.

### After Construction Summary

The asphalt-rubber SAMI was supplied and placed by Sahuaro Petroleum, an asphalt company of Phoenix, Arizona, as subcontractor for Associated Sand and Gravel Company, Inc., Everett, Washington, prime contractor on the project.

The construction sequence was quite simple. Asphalt-rubber was applied to the existing pavement at a rate of 0.50 gallons per square yard, followed immediately with a 25-pound per square yard application of 3/8 in. to No. 10 crushed screenings. Three rubber-tired rollers were used to seat the rock. A 0.25-ft ACP overlay was then placed over the SAMI. The construction began in May, 1978, and was completed by June of the same year.

### Crack Survey Results

The study sites were inspected four times following completion of the construction in June of 1978. The results of each inspection are shown in Table 1. The column labeled Maximum contains the total length of cracking before construction as measured from the infrared false-color photographs. Cracking lengths for the years 1980, 1981, 1983, and 1987 were derived from measurements made on the roadway with a measuring tape used for the cracking length and a mileage wheel used for location of the cracks.

The cracking observed in the study sites up to the 1987 survey was transverse and appeared to be reflection type cracks. The cracks were plotted on clear plastic overlays of the infrared photographs to determine if the cracking was reflecting through the overlay from the original pavement. In all cases the new cracks match-up with the original cracks.

The crack survey completed in 1987 discovered longitudinal and alligator cracking in addition to the transverse cracking previously noted. This was present in the study sites to the extent listed in Table 2. The original longitudinal and alligator cracking were not as well defined in the infrared false-color photographs as was the transverse cracking so there is no base data for comparing the longitudinal and alligator cracking.

#### Discussion of Results

A comparison of the transverse cracking from the infrared photographs with the transverse cracking now present indicates that most of the major transverse cracks have reflected through the overlay. The asphalt-rubber SAMI study sites are now showing 39 percent of the original cracking which compares with 41 percent for the paving grade asphalt SAMI and 80 percent for the control section without either type of SAMI. The comparison can be seen in Figure 1. The asphalt-rubber SAMI, which costs twice as much as the paving grade asphalt SAMI, is functioning only slightly better than the paving grade asphalt SAMI in preventing or reducing transverse reflection cracking. Both SAMI's are performing much better than the section with just CSS-1 tack coat and overlay, however this might be due totally or in part to the additional overlay thickness imparted by the SAMI's.

The data shown in Table 2 illustrates the longitudinal cracking present and the presence of alligator cracking. Since there was no base data for longitudinal cracking Table 2 shows the longitudinal cracking per foot of length along the roadway. This longitudinal cracking per length was averaged per section and is termed the average cracking index. The average cracking index is 1.58 ft/ft for the control section, 1.39 ft/ft for the paving grade asphalt SAMI sections and 1.77 ft/ft for the asphalt-rubber SAMI sections. Alligator cracking was present in the control section, present in four out of six of the paving grade asphalt SAMI sections and only two of the six asphalt-rubber SAMI sections.

The asphalt-rubber SAMI appears not to do as well as the paving grade asphalt SAMI in reducing the longitudinal cracking but the asphalt-rubber SAMI does much better than the paving grade asphalt SAMI in reducing alligator cracking.

#### Conclusions

The following conclusions can be drawn based on the observations of the study sites.

1. Infrared false-color photography provided the desired pre-construction data on transverse cracking for this particular section of pavement.
2. To date, both the paving grade asphalt and the asphalt-rubber SAMI have reduced the amount of transverse reflection cracking when compared to the control section. The asphalt-rubber SAMI is performing slightly better than the regular paving grade asphalt SAMI but at double the cost.

3. Although the asphalt-rubber SAMI does not appear to control longitudinal cracking as well as the straight paving grade SAMI, the asphalt-rubber SAMI appears to retard alligator cracking better than the paving-grade SAMI.

Table 1

## TRANSVERSE CRACKING SURVEY SUMMARY

	Section Limits	Max.	Cracking Length (ft)				SAMI Type
			1980	1981	1983	1987	
0	369+43 - 373+50 EB	449	190	214	219	358	No SAMI
1	373+50 - 375+50 EB	261	114	114	119	181	Paving Grade Asphalt SAMI
1A	375+50 - 377+50 EB	156	76	76	76	80	Asphalt-Rubber SAMI
2	669+47 - 673+00 EB	842	152	152	151	257	Paving Grade Asphalt SAMI
2A	673+00 - 676+00 EB	528	158	158	178	219	Asphalt-Rubber SAMI
3	840+00 - 842+00 EB	554	76	114	114	138	Paving Grade Asphalt SAMI
3A	842+00 - 844+00 EB	456	117	117	134	156	Asphalt-Rubber SAMI
4	375+60 - 377+60 WB	218	72	72	100	197	Paving Grade Asphalt SAMI
4A	377+60 - 379+60 WB	438	114	114	126	172	Asphalt-Rubber SAMI
5	671+00 - 672+00 WB	179	38	38	42	82	Paving Grade Asphalt SAMI
5A	672+00 - 673+00 WB	81	38	38	38	38	Asphalt-Rubber SAMI
6	840+00 - 842+00 WB	412	152	152	152	152	Paving Grade Asphalt SAMI
6A	842+00 - 844+00 WB	332	89	89	114	120	Asphalt-Rubber SAMI
Total Cracking		4906	1386	1448	1573	2150	
% Maximum		-	28	30	32	44	

Table 1

Table 2

## LONGITUDINAL AND ALLIGATOR CRACKING SUMMARY

	SAMI Type	Section Length	Longitudinal Cracking Length	Alligatoring Present	Longitudinal Cracking Index ft per ft
0	No SAMI	423	669	x	1.58
1	Paving Grade Asphalt SAMI	200	162	x	0.81
1A	Asphalt-Rubber SAMI	200	335		1.68
2	Paving Grade Asphalt SAMI	353	802	x	2.27
2A	Asphalt-Rubber SAMI	300	679	x	2.26
3	Paving Grade Asphalt SAMI	200	263		1.32
3A	Asphalt-Rubber SAMI	200	209		1.05
4	Paving Grade Asphalt SAMI	200	398		1.99
4A	Asphalt-Rubber SAMI	200	368		1.84
5	Paving Grade Asphalt SAMI	100	83	x	0.88
5A	Asphalt-Rubber SAMI	100	315	x	3.15
6	Paving Grade Asphalt SAMI	200	216	x	1.08
6A	Asphalt-Rubber SAMI	200	128		0.64

Control Section Avg. = 1.58 ft/ft  
Paving Grade Asphalt Section Avg. = 1.39 ft/ft  
Asphalt-Rubber Section = 1.77 ft/ft

Table 2

PERCENTAGE OF CRACK REFLECTION  
VERSUS TIME

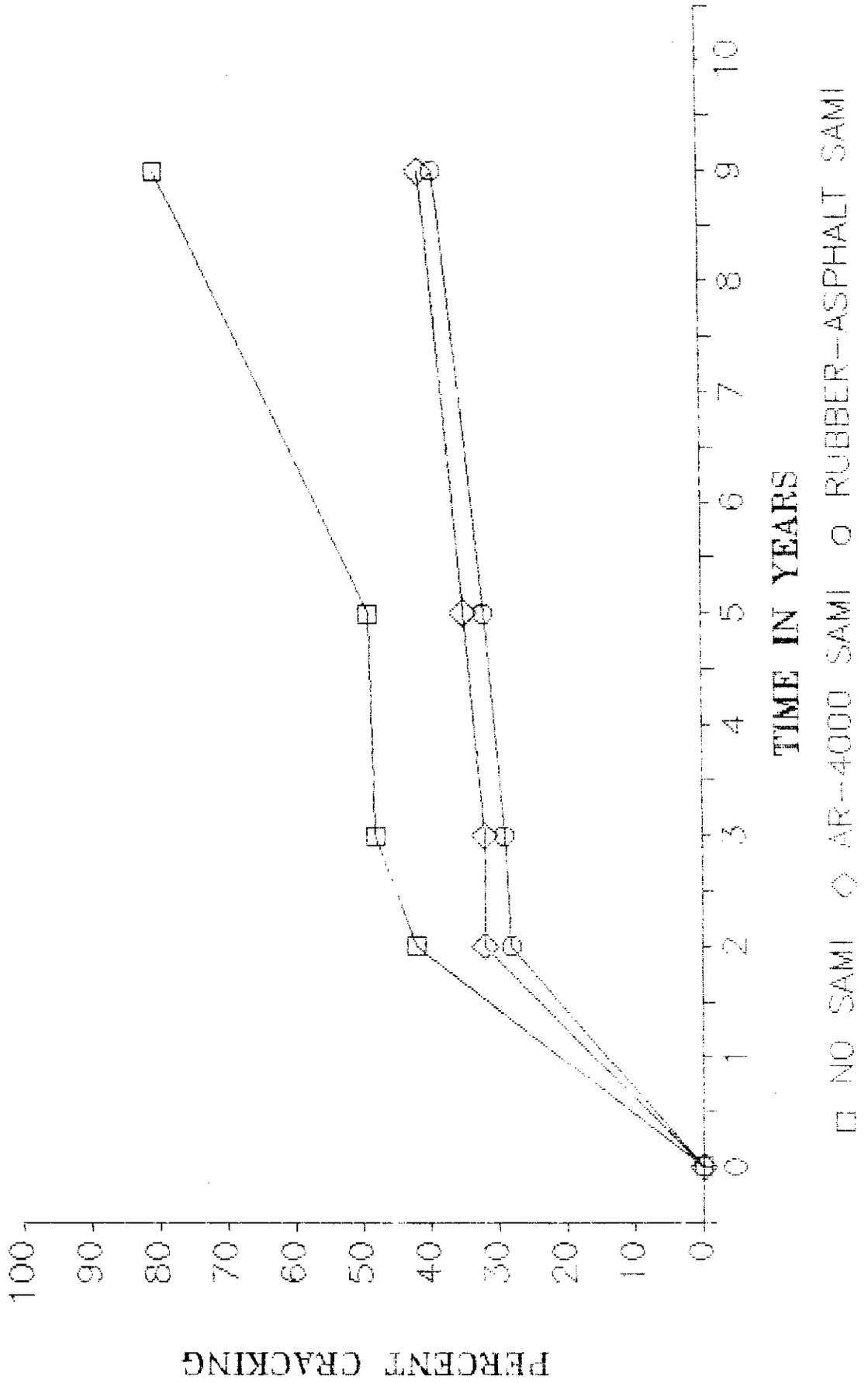
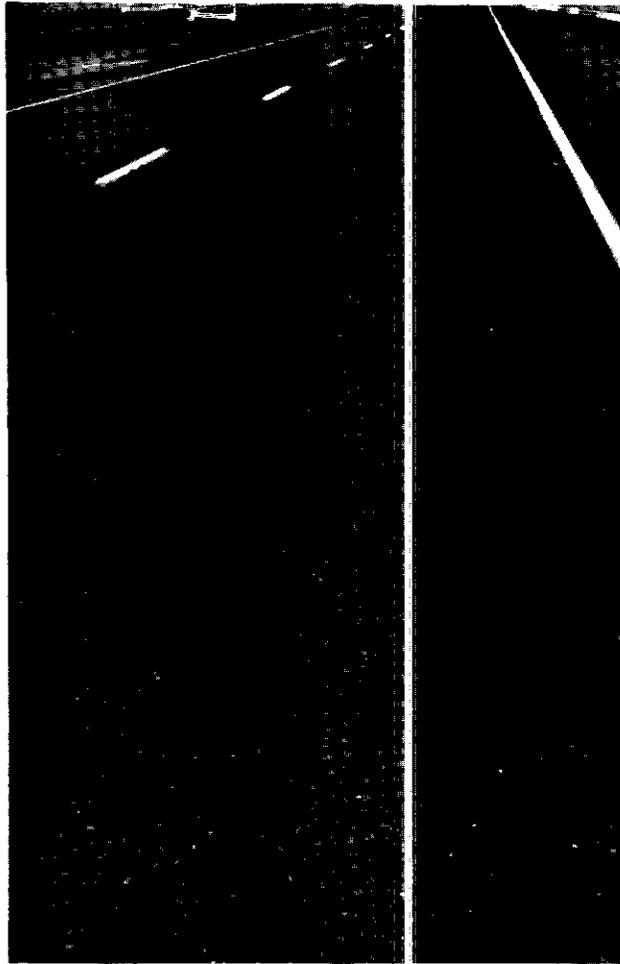


Figure 1

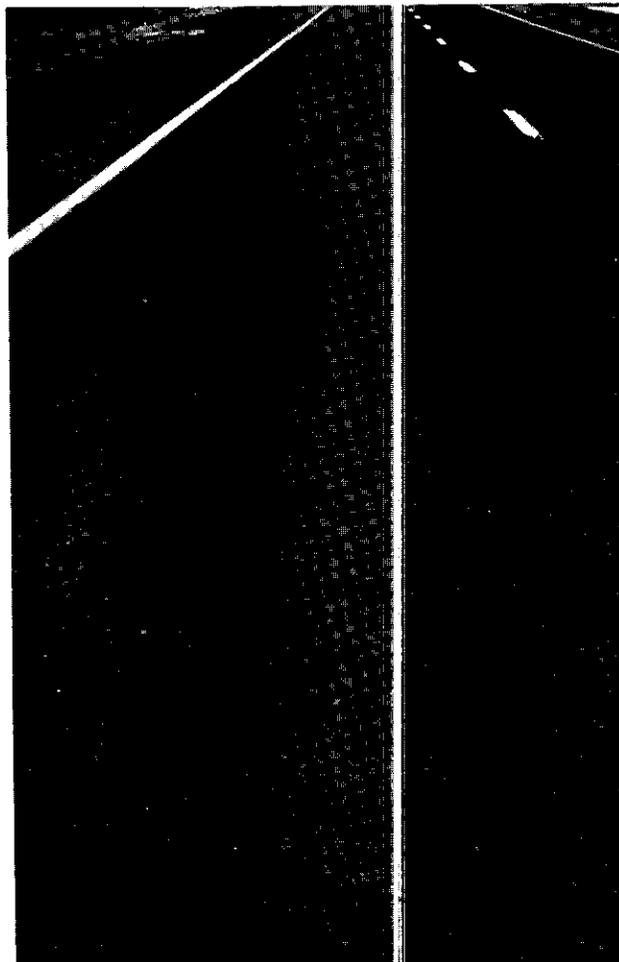
APPENDIX "A"



Wheeler I/C to Adams  
Co. Line SR-90  
3/19/87

Section 6A  
Paving Grade Asphalt SAMI  
Sta. 840+00 to 842+00

View looking west  
Travelled Lane  
Longitudinal cracking  
Sta. 840+70±



Wheeler I/C to Adams  
Co. Line SR-90  
3/19/87

Section 6A  
Paving Grade Asphalt SAMI

View looking west  
Passing Lane with alligator  
cracking  
Sta. 840+70±