ARIZONA
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BITUMINOUS PAVEMENT REJUVENATOR

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PRODUCT EVALUATION

84-01

BITUMINOUS PAVEMENT REJUVENATOR

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16. ABSTRACT

This report contains a product evaluation of K.A.E. Paving Consultant's Bituminous Pavement Rejuvenator (BPR). BPR is a coal tar product consisting of a low viscosity blend of aromatic oils designed to penetrate the asphalt, and rejuvenate and plasticize the binder.

Two test sections of BPR were placed in Arizona. At both sections the BPR was mixed, heated, and applied by manual methods. After placement a sand blotter was used to increase the friction characteristics.

Visual inspection and core samples were performed at both sections.

Both test sites had severe cracking prior to placement of the BPR. After placement a limited amount of crack sealing was observed; however, the test conditions were so extreme that it was difficult to adequately evaluate the test sections. After one year, no significant difference between the treated and untreated sections was apparent.

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I. INTRODUCTION

Bituminous pavement rejuvenators have been used to reconstitute Arizona roadways since the early 1960's. The process typically involves the application of special emulsified asphalts by distributor trucks at regular intervals of time. The rate of application and interval selection is determined by each of the local maintenance authorities at the time of treatment.

In retrospect, the results of these maintenance activities are varied. Many applications have been exceptionally successful while others have reduced the service life. Even today, after 30 years of experience and performance, considerable disagreement exists as to the value and effectiveness of this form of preventative maintenance.

During this time, Reclamite, an emulsion of petroleum oils and resin in water, has been utilized almost exclusively as the rejuvenating agent. Although other products have been tried, the preponderance of usage suggests that Reclamite has been preferred. Recently, a product known as Bituminous Pavement Rejuvenator (BPR) has been promoted as a substitute and superior product. BPR was developed by the Koppers Company in 1959 and paralleled the development of the Reclamite rejuvenator by Golden Bear. BPR, however, is not an asphalt product. It is a coal tar product consisting of a low viscosity blend of aromatic oils designed to penetrate the asphalt, and rejuvenate and plasticize the binder. The product was produced by the Koppers Company until about 1975 when it was discontinued. In 1983 K.A.E. Paving Consultants acquired the rights to distribute BPR, produced by

the Koppers Company, upon demand.

Historical experience with the product involves the results of experiments and usage by the U.S. Air Force and the Corps of Engineers. One four year study by the Air Force indicates that both BPR and Reclamite do rejuvenate the asphalt binder. Although reference to highway and commercial usage of BPR was made in the original brochures produced by the Koppers Company, few citations are available in the literature and only limited application is believed to have occurred. It is not known whether the limited highway usage resulted from lack of marketing or from a concern over reduced surface skid resistance.

II. ARIZONA EXPERIENCE WITH BPR

ADOT's first field exposure to the BPR product occurred in early April, 1984, when a private company placed two small (1 sq. yd.) test sections on a northwest Phoenix shopping center access road. The test sections were extensively cracked with typical crack widths of 1/4". After two weeks of traffic the cracks had narrowed to approximately 1/8" and less. The positive results indicated that field testing by ADOT may be warranted.

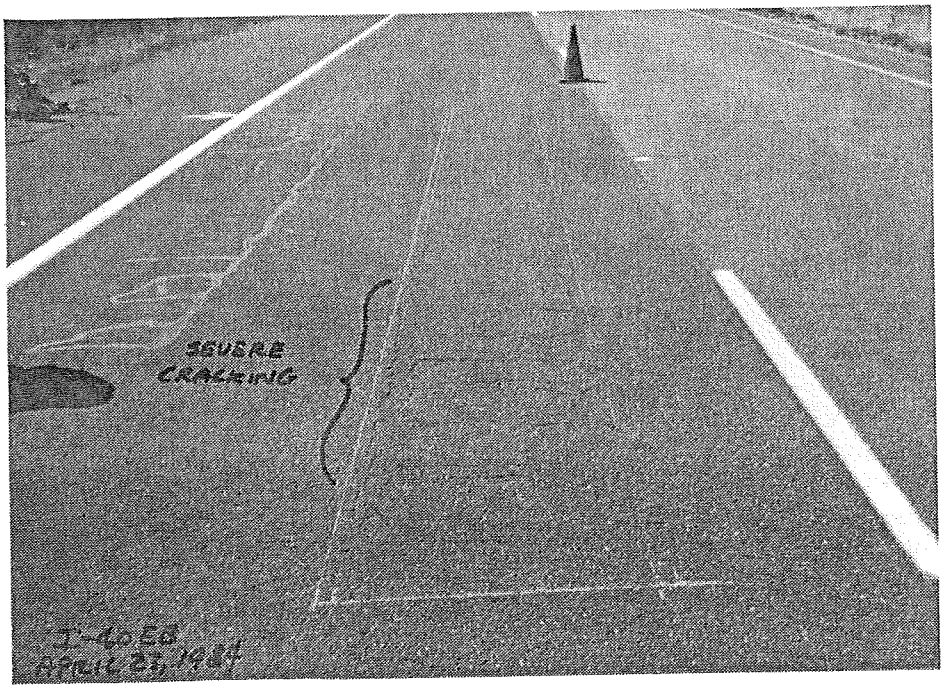
Subsequently, discussions between Research and District III indicated that a test section on I-40 near Crookton was appropriate and on April 23, 1984, small test sections (10 sq. yd.) were placed on the eastbound and westbound roadways (See Figures 1 and 2). After two months of performance, an evaluation of the test sections indicated that the treatment had been effective in healing the cracking and rejuvenating the asphalt. An apparent sealing of the surface was noted.

Based upon the I-40 test results, a more ambitious test section on a severely distressed pavement was attempted. Sheldon Street in Prescott was selected for two additional sites; one site in front of the District office and a second site two blocks away (Figures 3 and 4). Both sites were approximately 125-150 square yards in size. Sheldon Street in this area was badly distressed and scheduled for reconstruction in the near future. Crack widths of over 1 inch were evident with soil infilling present. After two months of performance, a visual reconnaissance was performed and pavement cores retrieved. Results indicated definite surface sealing and the possibility of some crack healing. The severe crack widths and filling with soil fines inhibited penetration into the cracks and rejuvenation of the asphalt. Rejuvenation of some cracks appeared to have occurred but this was difficult to substantiate.

In July of 1985, a visual inspection of I-40 and Sheldon Street test sections was performed. The conditions of all the test locations indicated no significant difference between the treated and untreated sections. Cores were subsequently retrieved from the Sheldon Street locations to determine the asphalt viscosity. The viscosity test results were inconclusive (See section IV for testing problems). However, during the coring operation it was noted that the treated cores held together upon removal while the untreated cores typically did not. This would suggest a significant reaction with the asphalt.

III. TEST SECTION PLACEMENT

At all the test site locations, the BPR was mixed, heated, and applied by manual methods. Three gallon hand-pump sprayers were utilized for application (Figure 5). After the BPR



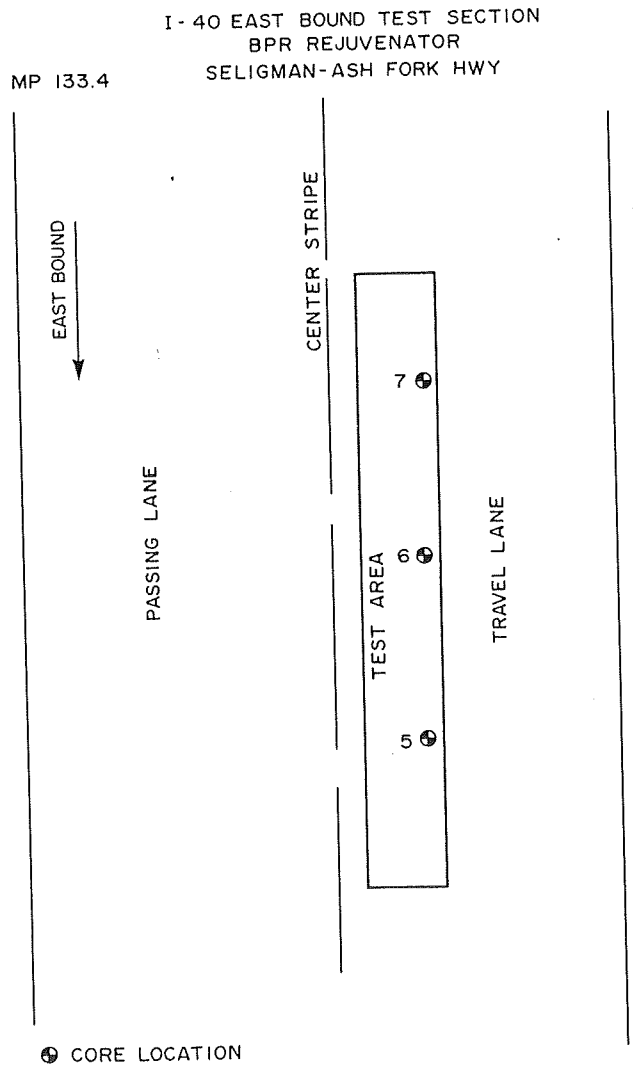


FIGURE 1 - LOCATION OF TEST SECTION, I-40 E.B

I-40 WEST BOUND TEST SECTION
BPR REJUVENATOR
MP 130.03 SELIGMAN-ASH FORK HWY

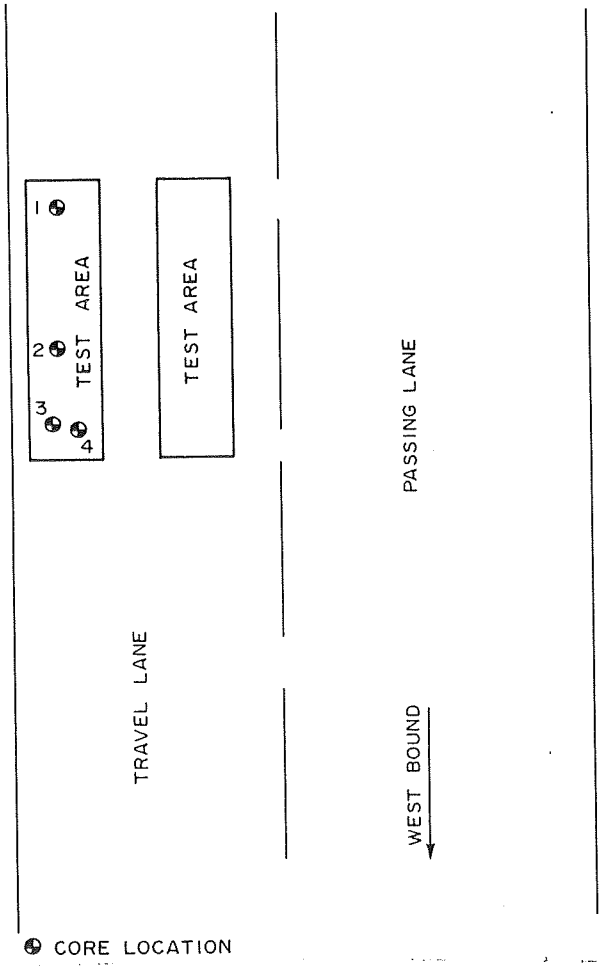
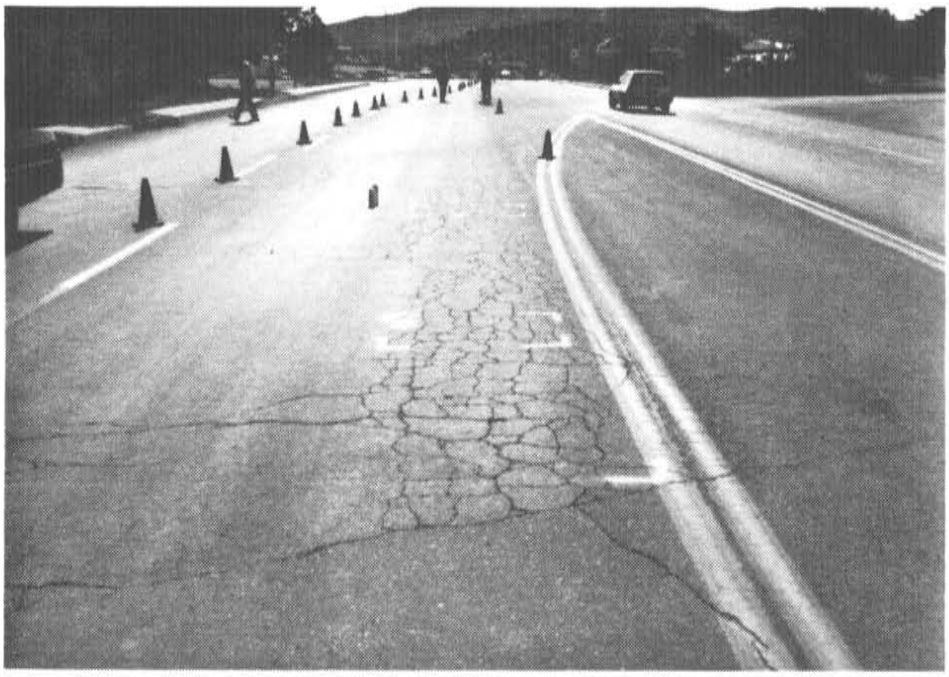


FIGURE 2 - LOCATION OF TEST SECTION, I-40 WB



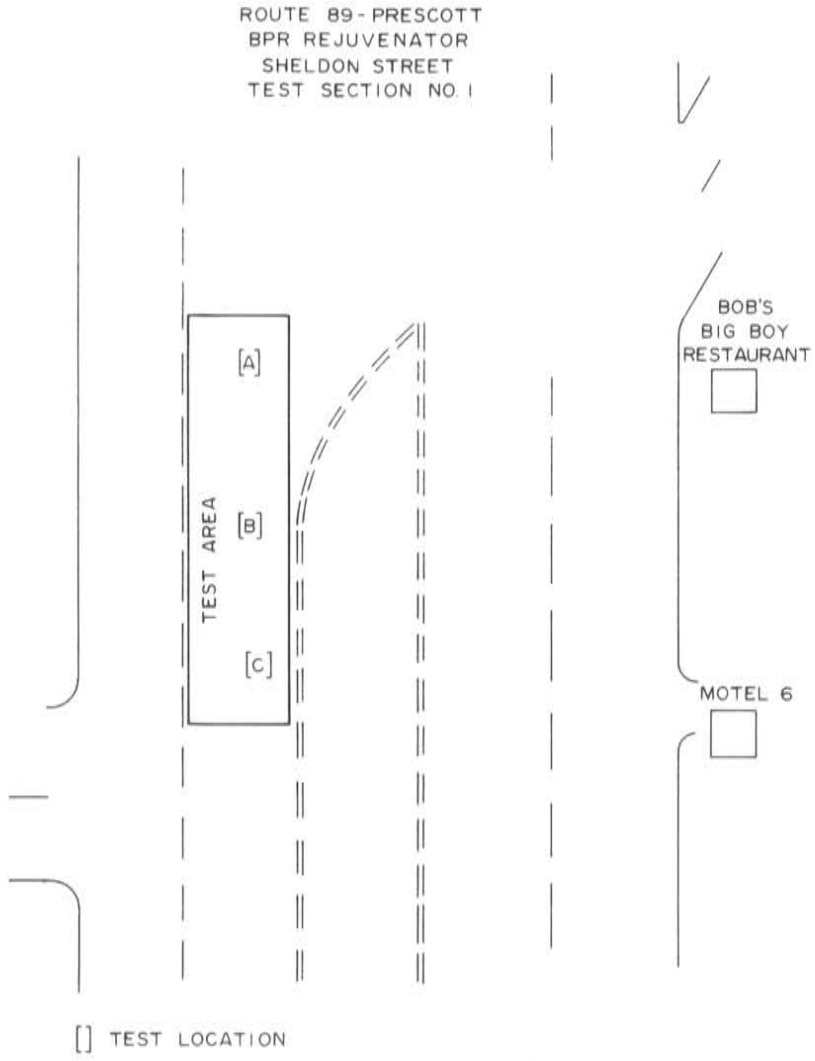


FIGURE 3 - LOCATION OF TEST SECTION, SHELDON STREET #1

ROUTE 89 - PRESCOTT
BPR REJUVENATOR
SHELDON STREET
TEST SECTION NO 2

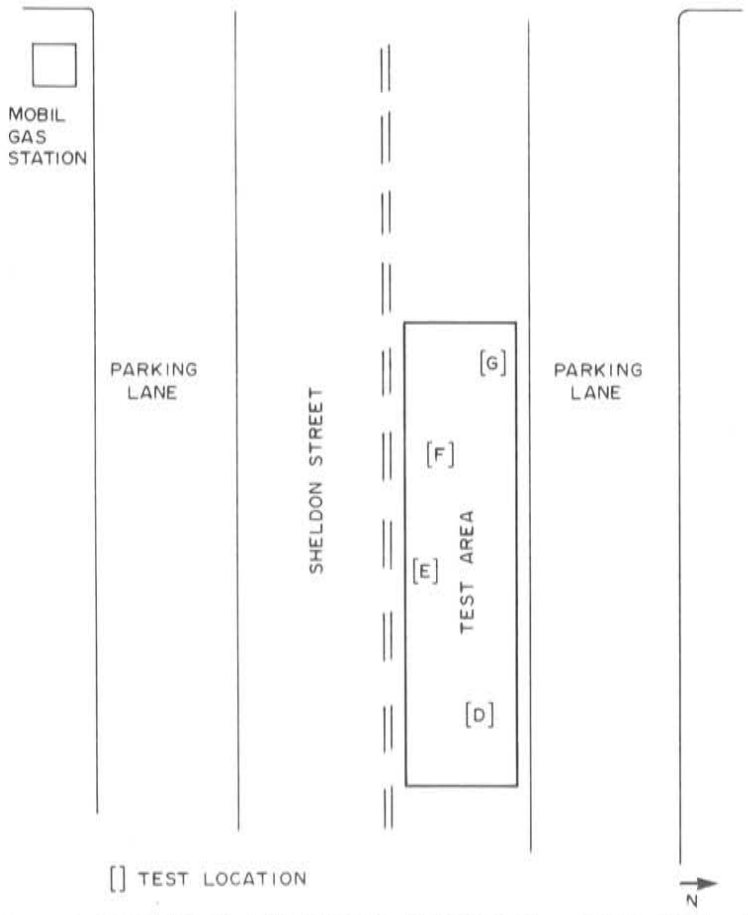


FIGURE 4 - LOCATION OF TEST SECTION, SHELDON STREET #2

penetrated into the pavement, sand blotter was applied by hand broadcasting at each site. The prevailing test conditions are shown in the appendix. The Sheldon Street sites were placed under inclement weather with rain occurring shortly after completion of the test sections.

IV. FIELD REVIEWS AND TESTING

Field evaluations consisted of visual examination of each test site before and after treatment, pavement core retrieval at selected locations at each site and limited rut depth determination at the Crookton site. Cores retrieved from the Sheldon Sections in July, 1985, were tested for viscosity. The top

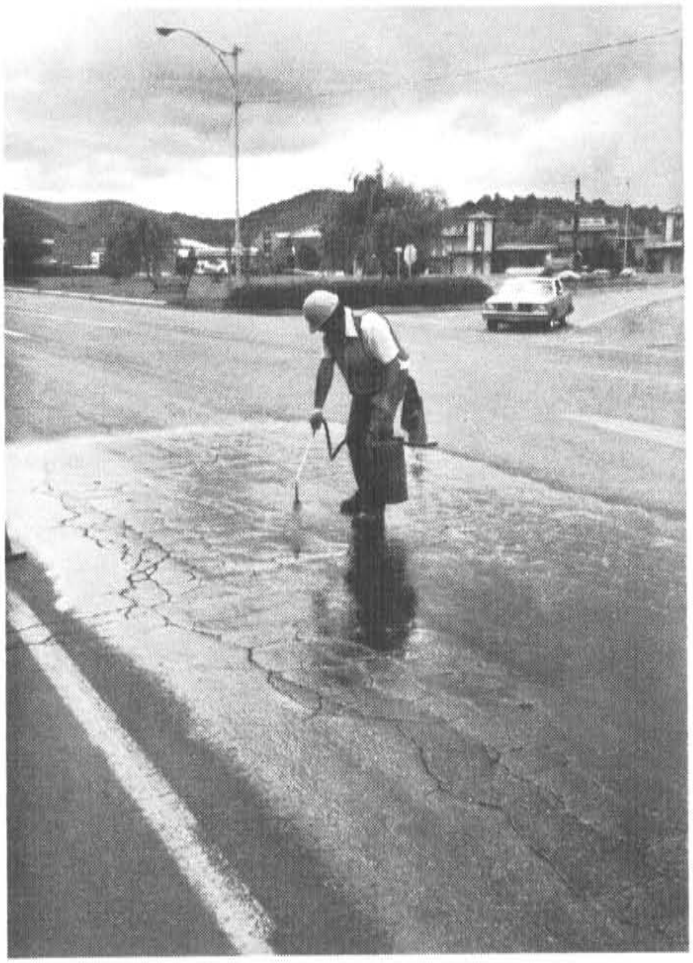


FIGURE 5 - APPLICATION OF BPR

one inch of material was removed from each core and tested. The asphalt was extracted by the soxhlet test (AZ413) and recovered with a rotary vacuum evaporator (AZ511). The recovered asphalt was tested for absolute viscosity using AASHTO T202. The results of this testing indicated no significant difference between the treated and untreated asphalt viscosities. However, the distribution of data suggested a potential problem with the test results. A second set of cores and chunks were retrieved from the Sheldon project. It was not possible to retrieve cores from all the areas because the street was being reconstructed. Portions of asphaltic concrete were obtained in areas where pavement was being removed. Upon completion of laboratory testing, it was again noted that test results were inconclusive.

Since the completion of the laboratory testing, it was learned that the test results may have been influenced by the quality of the technical grade methylene chloride utilized in the soxhlet test procedure. Unfortunately, this cannot be verified and therefore the test results are inconclusive.

V. ANALYSIS

Performance evaluations are based upon the subjective interpretation of the investigators with the principal instrument of measurement the human eye. The analysis is as follows:

- Surface sealing occurred at each test site and, possibly, reduced surface frictional qualities.
- Penetration of the BPR into the pavement occurred within 30 minutes or less but required application of sand blotter to improve the frictional characteristics

of the surface.

- Cores taken at the I-40 site indicate that crack sealing had occurred to depths of 4 inches. All surface cracking at this site had been healed by the BPR and sand blotter application within two months of placement. After one year of service the pavement displayed considerable cracking.
- No significant rutting was attributable to the application of BPR.
- Although limited sealing at the Sheldon Street site is believed to have occurred, the test conditions were so extreme that the effectiveness of the product was not adequately evaluated.
- The I-40 locations also did not prove to be an adequate evaluation of the product. The pre-existing condition of the pavements of both sites influenced the performance assessment.
- No skid testing was performed.
- The cost/gallon of BPR is anticipated to be twice the cost of conventional Reclamite. Inadequate information is available to reasonably estimate costs.
- The evaluation period was basically one year and, therefore, long term performance cannot be assessed.
- The product has a strong odor during placement and it is questionable whether it would be suitable for urban applications.

VI. CONCLUSIONS AND RECOMMENDATIONS

The results of the test sections of I-40 and Sheldon Street are inconclusive. BPR promoted healing of cracks at these sites

within two months of application. After one year, no significant difference between the treated and untreated sections was apparent. The pre-existing condition of the pavements at these sites made it difficult to properly evaluate the product.

Based on literature findings, BPR appears to have a potential as an alternate to the conventional Reclamite product. Evaluation of the skid properties of pavements treated with BPR is necessary before utilization as a substitute can be advocated. Additionally, the ecological acceptability of this agent should be reviewed in detail as well as any adverse affects on maintenance patches or slurry. The limited extent of this study, approximately one year, precludes the assessment of long term performance.

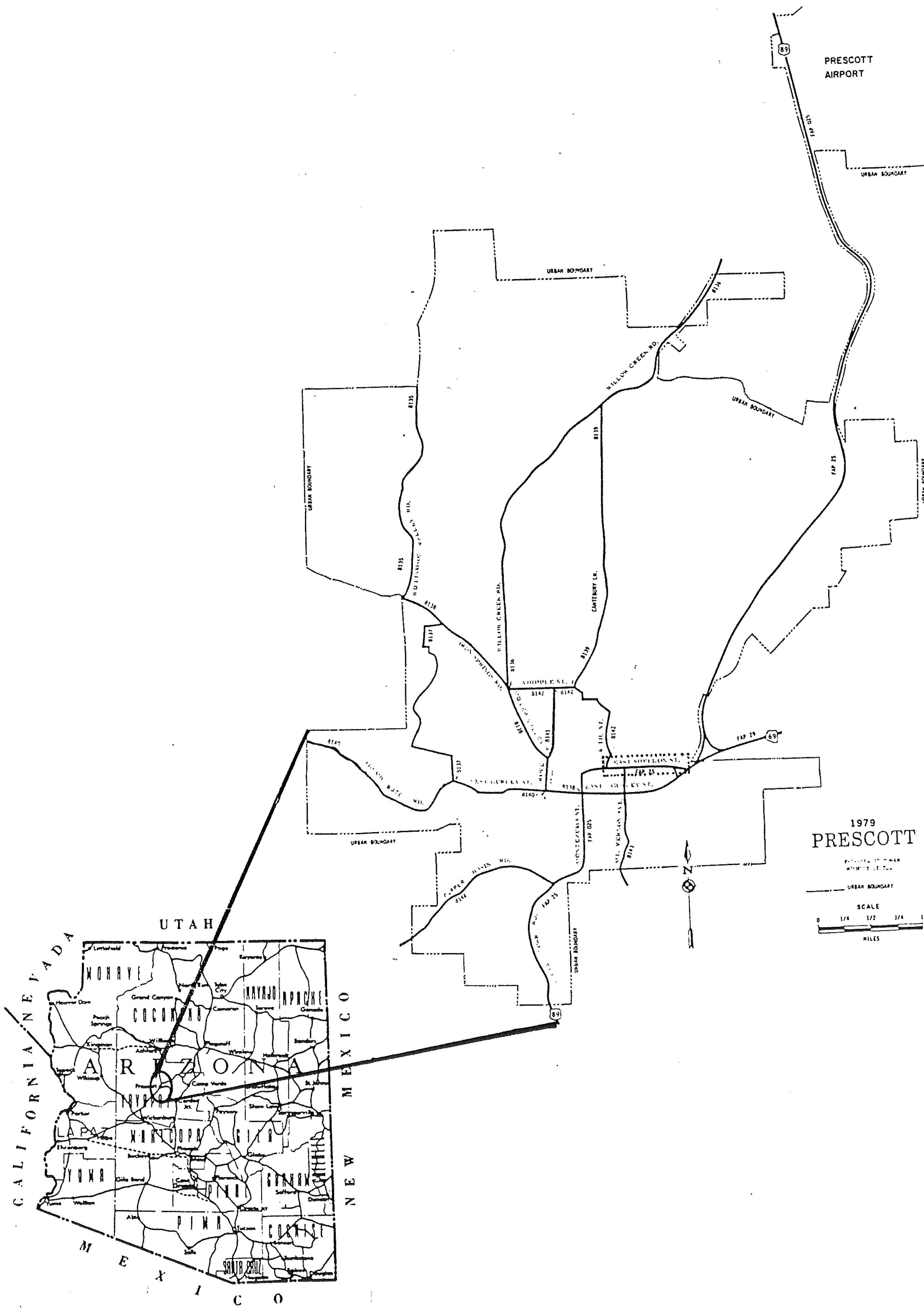
It is recommended that BPR be included for evaluation in the proposed research project on rejuvenating agents.

APPENDIX

BITUMINOUS PAVEMENT REJUVENATOR
EXPERIMENTAL PROJECT DATA

Test Site Location	Application Rate (GSY)	BPR Penetration Time (min.)	BPR Application Temp. (F)	Pavement Surface Temp. (F)	Ambient Air Temp. (F)	Test Section Size (sq. yd.)	Date Applied
N.W. Phoenix Shopping Mall	0.1-0.15	*	*	*	*	2	04-84
I-40 @ M.P. 130.03 WB	0.1	5	140	124	73	10	04-23-84
I-40 @ M.P. 133.4 EB	0.1	5-20	145	128	75	10	04-23-84
Sheldon Street Site #1	0.075	*	150	100	76**	130	07-19-84
Sheldon Street Site #2	0.2	30	150	108-130	81**	150	07-19-84

*Not Determined
**Rained Shortly After Placement


PRESCOTT
AIRPORT
URBAN BOUNDARY
WILLOW CREEK RD.
CANTEBURY LN.
WILLOW CREEK RD.
EAST GURLEY ST.
MONTEZUMA ST.
FAP 25
FAP 29
1979
PRESCOTT
URBAN BOUNDARY
SCALE
0 1/4 1/2 3/4 1
MILES
UTAH
NEVADA
CALIFORNIA
NEW MEXICO
MEXICO
ARIZONA
MOHAVE
COCONINO
NAVAJO
APACHE
YAVAPAI
MARICOPA
GILA
GRAHAM
YUMA
PINAL
PIMA
COCHISE
SANTA CRUZ