ARIZONA DEPARTMENT OF TRANSPORTATION

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CRACK AND SEAT CONCRETE PAVEMENT

Construction Report

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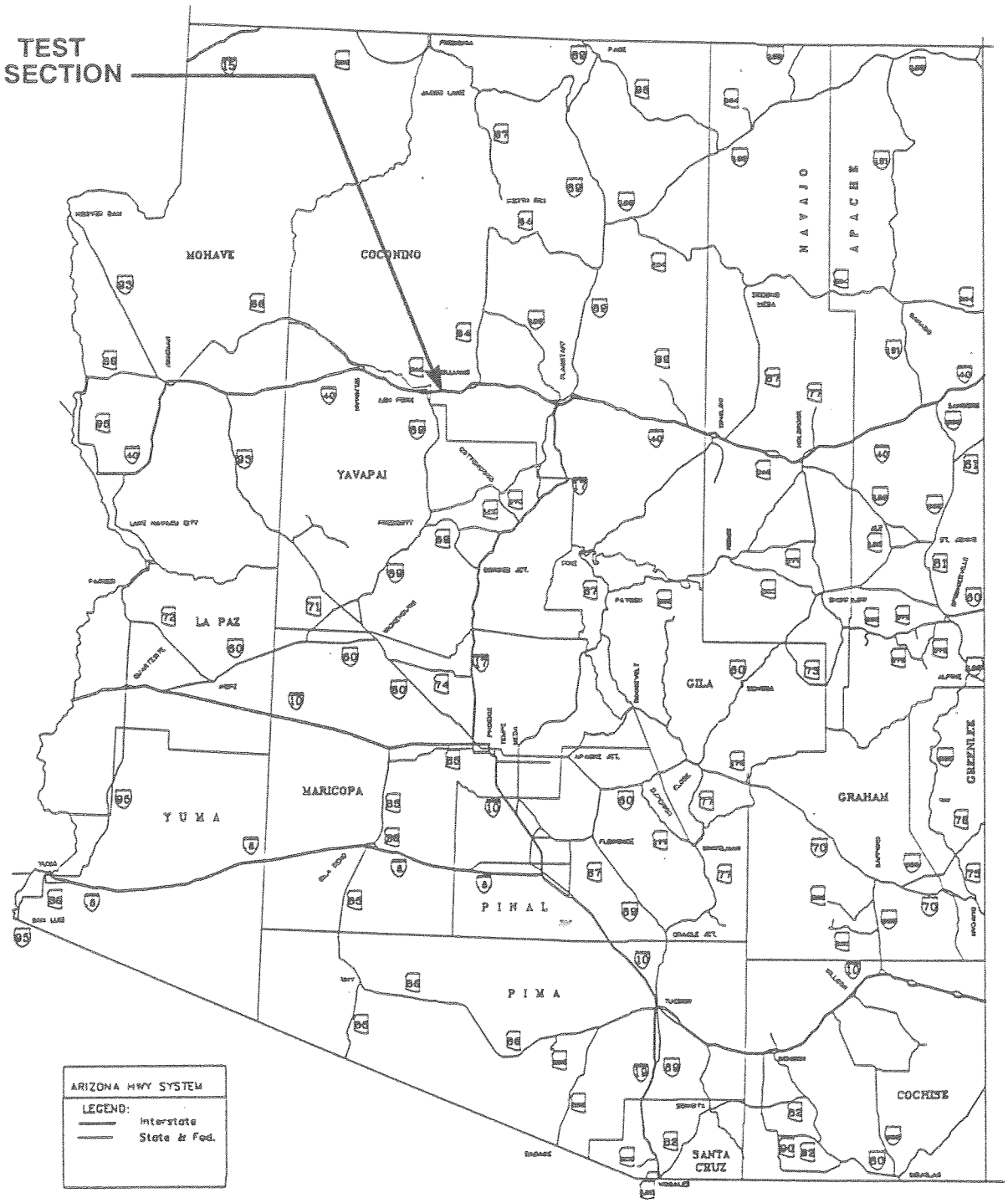
September 1987

Prepared for:

Arizona Department of Transportation
206 South 17th Avenue
Phoenix, Arizona 85007
in cooperation with
U.S. Department of Transportation
Federal Highway Administration



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16. ABSTRACT

Prevention of reflective cracking in HMAC overlays placed over PCCP has been based on experience gained from trial and error methods of in-service pavements in many states.

Arizona receltly utilized this technique on a PCCP section of Interstate 40 between MP 152.1 and MP 158.6 EB and WB prior to placing a 4 inch HMAC overlay. Two sections, 500' in length, were cracked and seated on the WB roadway using 2 ft. x 2 ft. and 4 ft. x 6 ft. patterns, respectively. The remaining six miles of project IR-40-3(59)C were cracked and seated using a 3ft. x 3 ft. pattern for both the EB and WB roadways.

A Michigan whiphammer was used for cracking the pavement and a fifty ton pneumatic roller used for seating it. Visual identification of the cracking was difficult, but indicated a spider-web like crack pattern has been produced.

The project, constructed in the fall of 1986, will be evaluated by ADOT annually for five years as Project AZ8604. The evaluation of this construction experimental feature will document the performance of the crack and seat technique and the effects of varying the crack pattern

A nine month evaluation is inclued with the construction report.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

A. Background and Problem Statement

Portland Cement Concrete Pavements (PCCP) are often rehabilitated by overlaying with asphalt concrete. Even when special care is taken, reflective cracks will often occur in the overlay at locations matching the transverse joints and existing cracks of the underlying concrete. In some instances, once the cracks have developed and stress is relieved in the overlay, little further deterioration occurs. However, in the majority of cases, the cracked areas continue to deteriorate. The combination of water infiltration, change in temperature, and traffic leads to raveling and crumbling of the overlay. Vertical movement at slab joints and cracks can be caused by lack of subgrade support, voids under the slabs, frost action, and soft or wet subgrades. Consequently, maintenance measures become ineffective and the overlay's service life is shortened considerably.

Cracking and seating of the PCCP is the process of cracking the pavement into smaller-than-joint-length pieces and rolling the area to seat the pavement against the subgrade. This process is used in an effort to prevent or delay the reflection of cracking through the asphalt overlay.

Many states have tested various methods of reducing reflective cracking: New York experimented with mesh reinforcement and stone-dust bond and sawing; California experimented with fabrics and open-graded interlayer; Virginia experimented with sand-bond breaker and high strength fabrics. Some of these treatments worked well and some failed. New York and California also experimented with the cracking and seating of PCCP.

Reports from those states demonstrated that the crack and seat works well for certain crack patterns, but works poorly for others.

Unit costs of various reflection crack control methods are as follows:

Method	*cost per square Yard of Pavement
Cracking and Seating	$ 0.20 - 1.00
One-inch Hot Mix Asphalt Overlay	$ 1.40 - 1.80
Engineering fabric	$ 1.00 - 1.50
Four-inch asphalt-treated open graded interlayer	$ 5.50 - 7.00
Six-inch granular base course interlayer	$ 1.00 - 3.00
Stress absorbing membrane	$ 1.00 - 1.20
Sawing and sealing Hot Mix Asphalt at 40-foot intervals	$ 0.80 - 1.30
Four-foot width joint reconstruction at 80-foot intervals	$ 2.50 - 3.00

* Reference No. 7

Arizona's past experience with reflective crack treatment includes the use of an asphalt-rubber stress absorbing membrane placed between the PCCP and the asphalt concrete overlay, fabric interlayers, fibrous additives in the hot mix asphalt concrete (HMAC) , sawing and sealing, and a break and seat project in 1970.

B. Objective

Due to Arizona's limited experience with the crack and seat rehabilitation techniques the FHWA and ADOT agreed to an experimental construction project. The objective was to evaluate the constructability and long term field performance of several crack spacings. It is anticipated that the long term monitoring of these sections will provide additional insight into the effectiveness of the crack and seat process applied in Arizona.

This experimental project is located on Interstate 40 near Williams, Arizona (See Appendix A for vicinity map) and consists of four sections:

1) Between MP 152.1 & 152.2 West Bound(WB); spacing pattern 6'X4'
2) Between MP 152.2 & 152.3 WB; spacing pattern 2'X2'
3) Between MP 152.3 & 158.6 WB; spacing pattern 3'X3'
4) Between MP 152.1 & 158.6 East Bound(EB); spacing pattern 3'X3'

The test sections for this project are the 2'X2' & the 4'X6' sections. The Arizona Transportation Research Center (ATRC) will monitor this project for five years. There was no standard or control section in this project, i.e., HMAC overlaying a non-cracked PCCP, to compare the cracked and seated sections against.

II. Factors of Influence on the Success of Crack and Seat

A number of factors influence the technique of cracking and seating:

A. Existing Pavement Characteristics:

The characteristics of a pavement determines the required impact energy for a particular cracking pattern. Such characteristics include the strength of the slab, joint spacing, extent of damage or disintegration, and joint condition.

The pavement section for both the east and west bound directions consisted of 6" subgrade seal, 4" of cement treated base and an 8" portland cement concrete. The west bound was constructed in July, 1967, while the east bound was constructed in July, 1968. The concrete used for the PCCP was tan in color in the WB direction, while it was gray in the east bound direction. This difference in color is due to the difference in aggregates types.

The PCCP for this project was constructed of 4000 psi concrete (class P) with joints spaced at 15' intervals. Joint faulting averaged 40% in travel lanes and 15% in passing lanes. The average faulting (difference in elevation across a joint or crack) was 1/4" with a maximum of 3/8". The severity level of such faulting is considered to be medium according to the Highway Pavement Distress Identification Manual.

Spalls were frequently seen throughout the project and some cracks were found to be as wide as 1". Although the joints were sealed, the sealant was loose and had separated from the joints. Many of the broken slabs had not been sealed. The slabs which were sealed, however, appeared to have been oversealed. This is visible in Figures 1 and 2. Aside from the cracks and the faults, the concrete pavement had only a few areas patched with asphalt concrete.

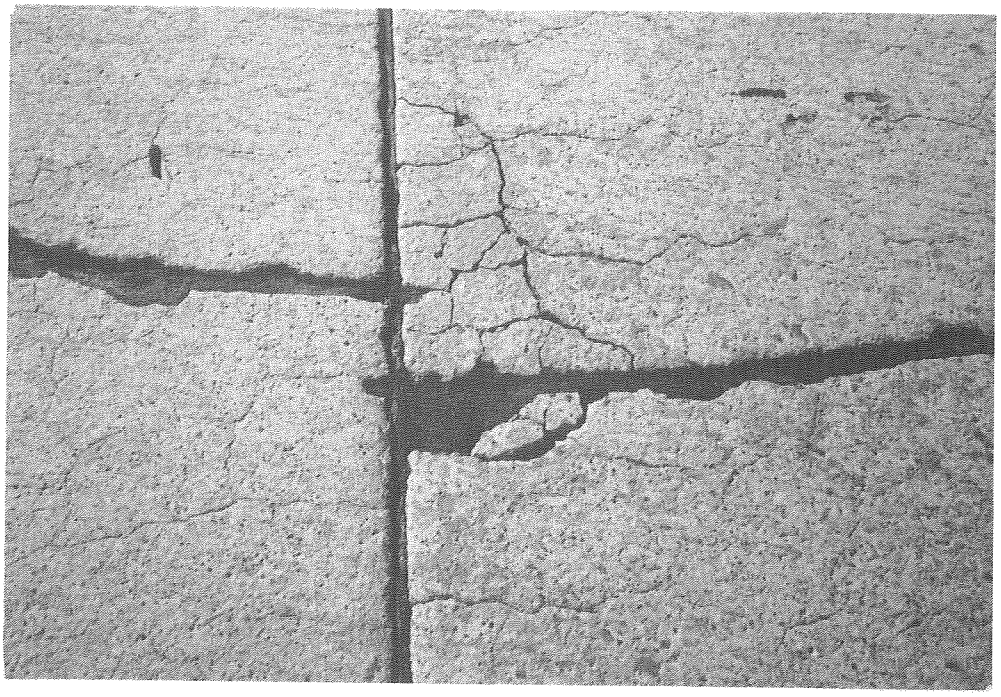


Figure 1. Typical Severe Cracking of the PCCP Near Joints

Figure 2 Typical Block Cracking of the PCCP

Mu-Meter testing indicated that the average friction numbers for the EB lanes in 1984 was 49, with a low of 33 at MP 152. The average friction number for the WB lanes in 1984 was 52 which is in the good range with a low of 30 at MP 158. The average Mu-Meter values in 1983 were 51 and 44 for WB and EB respectively.

Mays meter tests indicate a gradual increase in roughness in recent years. The average Mays roughness at MP 152 between the years 1978 and 1984 was 327 and 168 for the EB and the WB lanes respectively.

Dynaflect deflection tests were performed in September 1984. Table 1 below shows results of the Dynaflect deflection tests conducted at MP 152 WB for the travel and passing lanes. Areas with cracked slabs appeared noticeably weaker at the joints than non-cracked areas.

Table 1 Dynaflect Deflection Tests
at MP 152 WB

	Driving Lane					Passing Lane					Spreadability
	Sensor #					Sensor #					
	1	2	3	4	5	1	2	3	4	5	55%
Mean Deflection (mills)	1.08	0.84	0.48	0.22	0.08	0.66	0.65	0.34	0.21	0.09	

Twenty seven soil samples were collected at different locations between MP 152 and MP 159. The soil ranged from gravel (GP) to clay (CH) with plasticity index ranging from NP to 38. Presence of cinders, sands, and silty sands was also reported (copies of the subgrade data are in Appendix E). R-value ranged from 8 to 88 with an average value of 59. The modulus of subgrade reaction (K-value) had an average value of 846 pounds per cubic inch. Moisture content determination indicated that in most areas it was below the optimum moisture content.

B. Cracking Process and Size of the Cracked Pieces:

The cracking of the PCCP was accomplished using a whiphammer (Figure 3). The whiphammer utilized a centrally mounted impact device which was thrown against the pavement with a whip-like action impacting the pavement with a rectangular foot print (typical dimensions of approximately 4.5" x 7.0"). The special provisions specified cracking patterns of 3'x 3', 4'x 6' and 2' x 2' (See Appendix B for a copy of the special provisions).

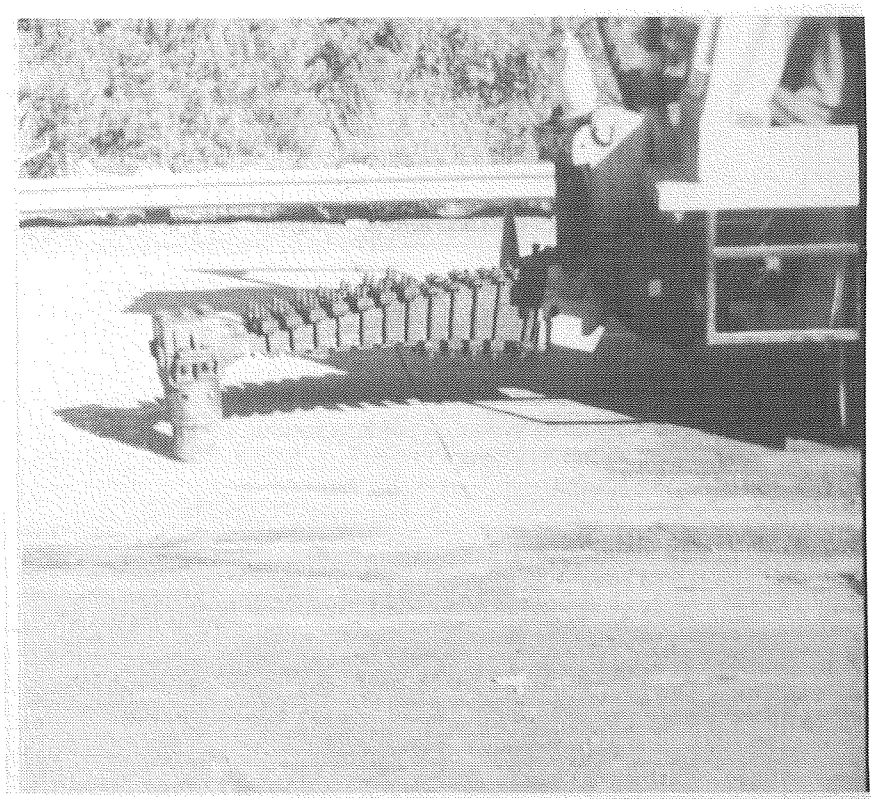


Figure 3 The Whiphammer Used for Cracking the PCCP

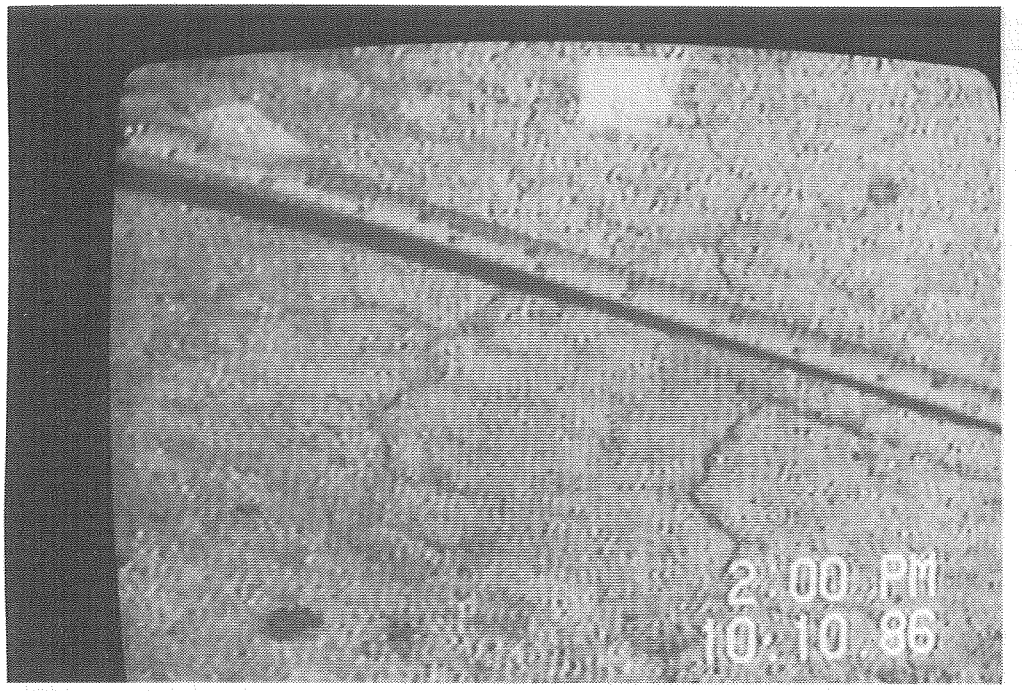


Figure 4 Typical Cracking Pattern of the Whiphammer

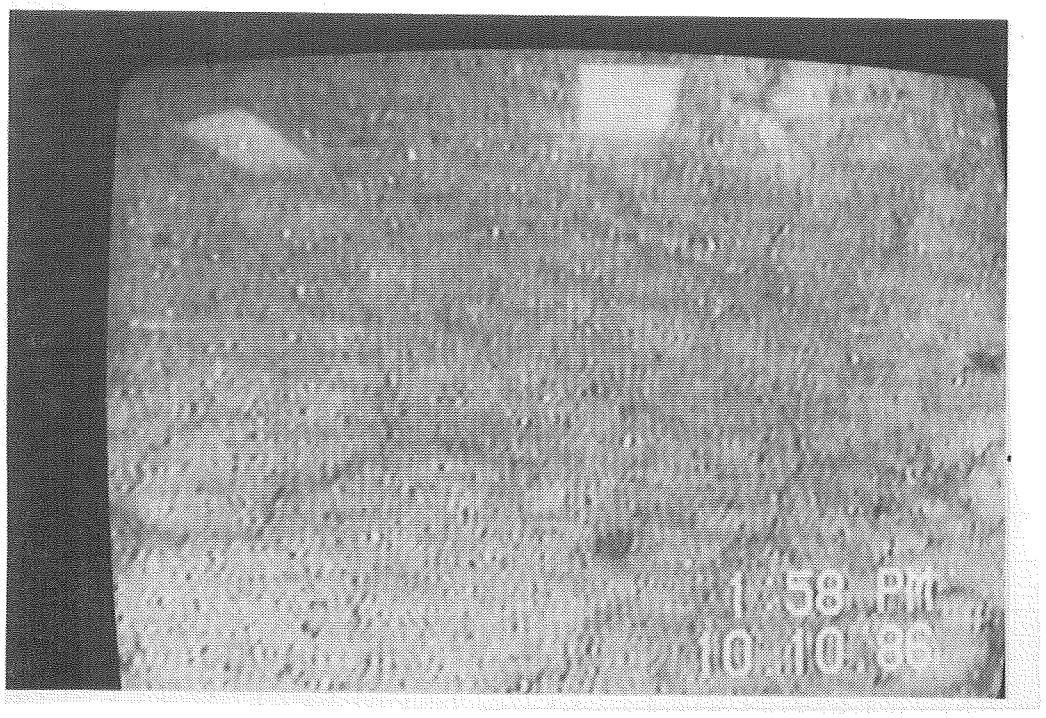
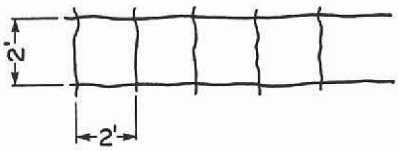
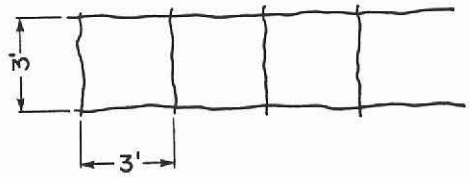


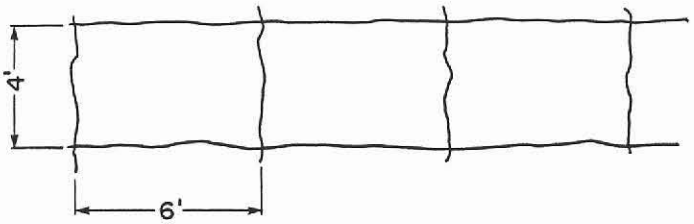
Figure 5 Typical Cracking Pattern of the Whiphammer



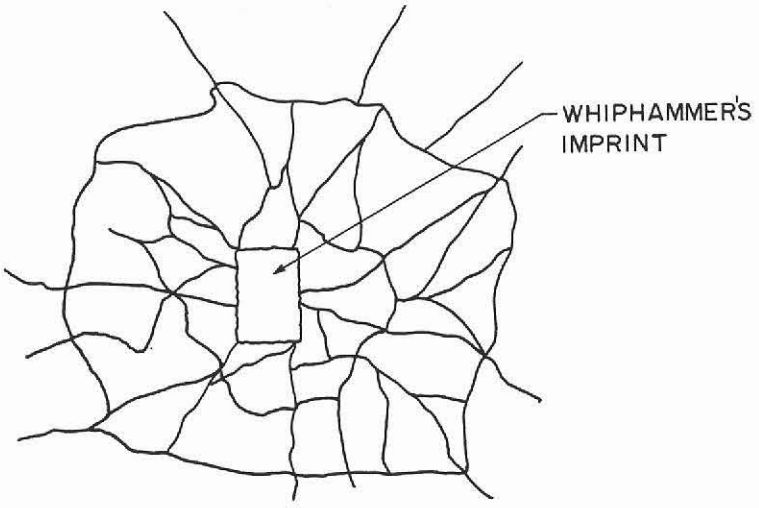
EXPECTED 2' x 2' CRACKING PATTERN



EXPECTED 3' x 3' CRACKING PATTERN



EXPECTED 4' x 6' CRACKING PATTERN



TYPICAL "SPIDER WEB" CRACKING PATTERN
PRODUCED BY THE WHIPHAMMER

Figure 6 Rendering of the Expected and the Produced Cracking Pattern

The size of the cracked pieces ranged between four and nine square feet. The cracked pieces were generally not square but were usually diamond or triangular in shape. A "Spider web" type of cracking pattern was produced by the Whiphammer. The cracks were not visually detectable on a dry pavement; therefore the pattern was checked periodically by applying water to the cracked surface so that the cracks could be more readily detected. Figures numbered 4 and 5 show a typical cracked PCCP. Figure 6 shows a rendering of the expected and the produced cracking pattern. Cores, randomly taken, verified that the hairline cracks penetrated the full depth of the slab (Figure 7).

The whiphammer was capable of operating at a rate of 2000 sq. ft/hr;however, the machine was not operated at this rate because other construction features limited its production. To establish the specified cracking patterns, varying energy and striking patterns were used until a satisfactory cracking pattern was established. Also different heads, on the Whiphammer were tried. This was not a difficult or time consuming task and was necessary as each concrete was different.

With all cracking equipment, care should be exercised when working near joints and edges to avoid spalling or longitudinal cracking. During the cracking operation the whiphammer was not allowed to strike the slabs within one foot of a joint or edge. The cracks were generally at a skew to the longitudinal joint.

The cracking process is designed to break the slab into smaller sections in order to reduce localized horizontal movements.

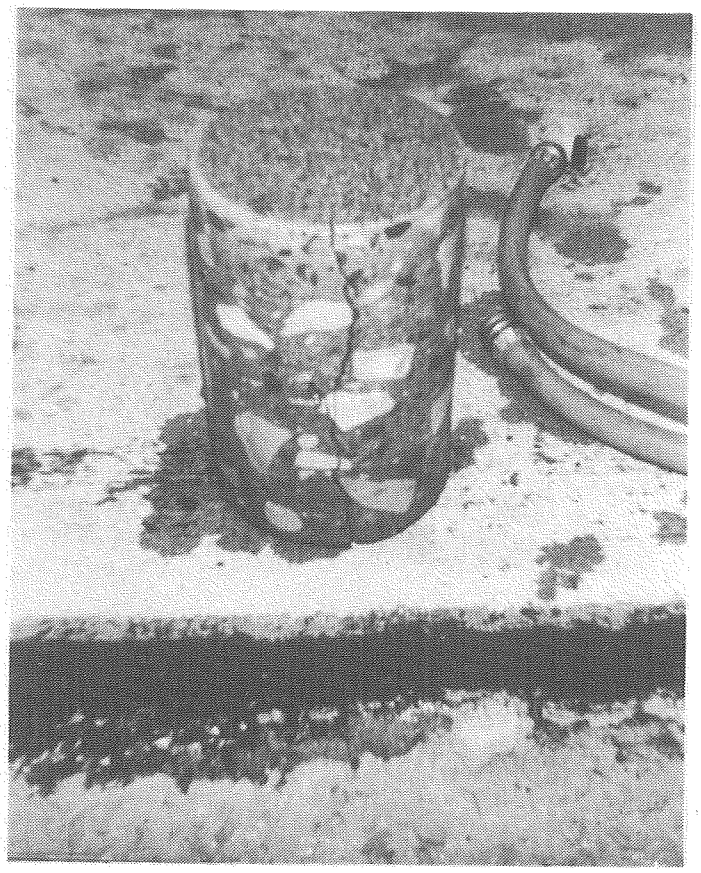


Figure 7 Core Thru the Cracked PCCP

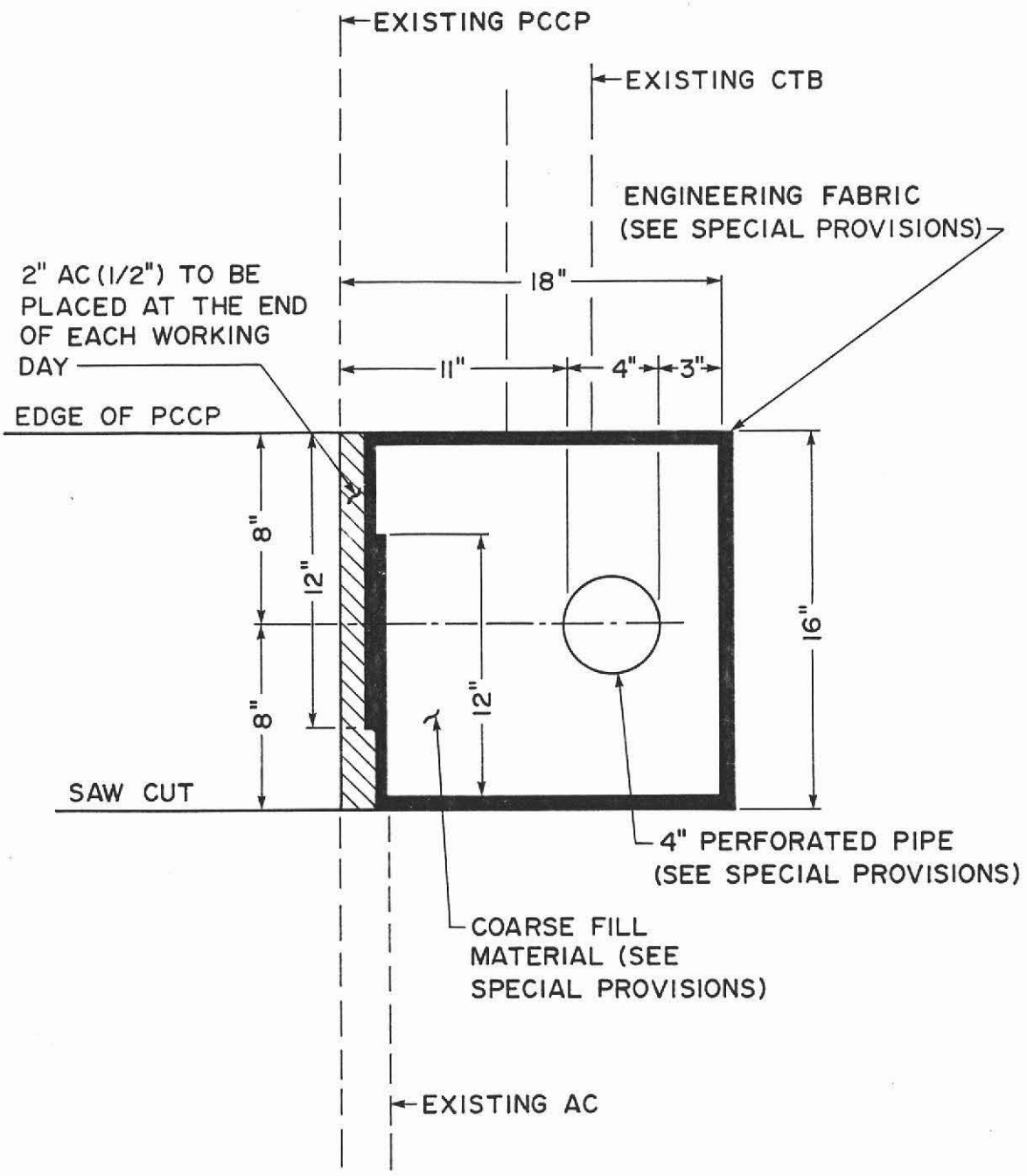


Figure 8 Collector Trench Drainage Design

C. Subgrade Quality and Drainage:

Good subgrade support and drainage are essential to the success of the crack and seat process. Subgrade support influences the optimum size of the cracked pieces. Experience from several states indicate, in general, the better the subgrade support, the larger the size of the cracked pieces. Presence of water in the subgrade will cause loss of subgrade support which leads to rocking of the slabs and subsequent distress in the HMAC overlay.

The quality of the subsurface materials is highly suspect in the same areas that the slabs in the PCCP were in very poor condition. Since many of the broken slabs had not been sealed, water was allowed to intrude into the base materials. To ensure proper drainage, a collector trench was constructed on the edge of the PCCP (Figure 8 shows a typical section of the collector trench). The installation of the subsurface drainage collector system exposed approximately nine inches of the base material and it was observed that free water was frequently present at less than nine inches below the bottom of the slabs.

D. Seating:

Seating is important to provide a stable supporting layer of the HMAC overlay. This process is designed to "seat" the cracked pieces and thus fill any possible voids in the subgrade, resulting in reduction of differential deflections at joints and cracks caused by the voids.

The seating of the cracked PCCP slabs was conducted by rolling the slabs with at least 2 passes of a 50 ton "wagon-like" tire roller filled with sand ballast (Figure 9). Traffic was not allowed on the cracked and seated pavement for about 72 hours, and in general, the bottom 2 inch lift of the HMAC overlay was laid within 72 hours after the crack and seat operations, as per the special provisions.

The crack and seat process was conducted in october 1986, while the placement of the HMAC finished in November 1986.

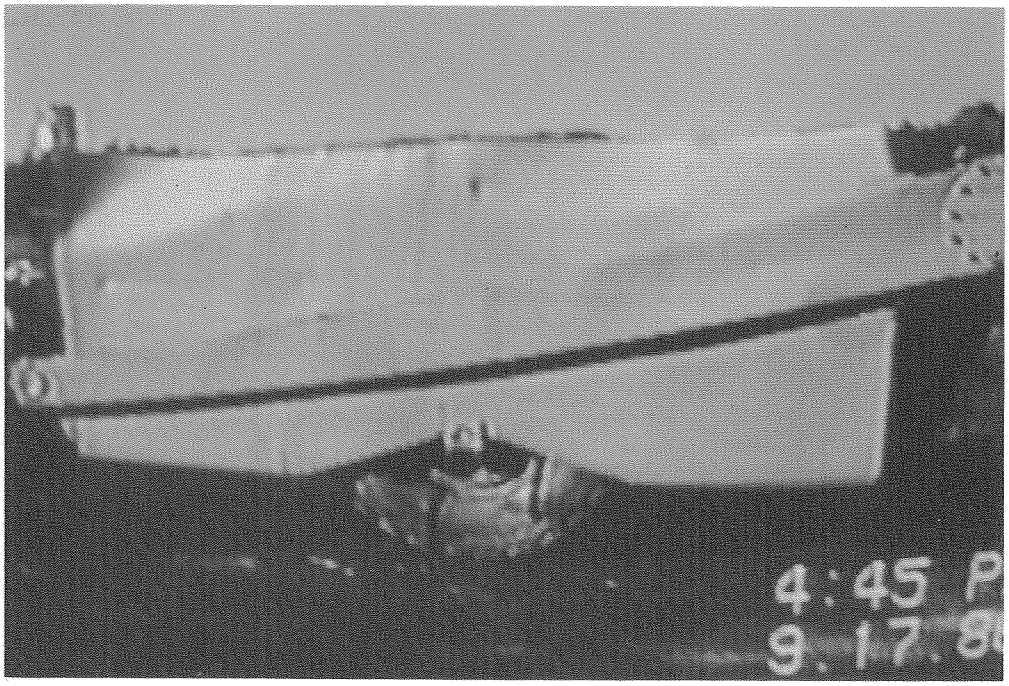


Figure 9 Tire-Roller Used for Seating the Cracked PCCP

III. EVALUATIONS

The design required four inches of asphalt concrete overlay. The HMAC mix design was in accordance with ADOT's specifications section 406 (copy of the design memorandum is in Appendix C).

During the construction of the bottom 2 inch lift of the HMAC overlay, various areas showed bumps directly above the transverse joints of the PCCP slabs. The areas with severe bumps (height equal to or greater than 1/8") were milled out and replaced with HMAC overlay. The bumps did not show through the top 2 inch lift.

It is believed that the joints were filled with rubber sealant and when the HMAC was placed over them the rubber sealant causing asphalt bumps in the overlay. The temperature of the HMAC during placement ranged between 280 ^{O}F to 290 ^{O}F which was within the range specified (250^{O}F to 300^{O}F).

Obtaining HMAC density was very difficult at times. The bottom 2" lift of HMAC produced a total of 19 failing lots, while the top 2" lift produced 12 failing lots. Figure 10 and Figure 11 show lot locations with respective percent compliance. Compliance of at least 80% was required as per the specifications.

For the test sections between MP 152.1 and MP 152.3 WB, lots 35 and 39 showed 55% and 86% compliance respectively for the bottom 2" lift. while for the 2" top lift, lots 62 and 56 showed a 17% and 91% compliance respectively. Table 2 shows Typical HMAC Test Results.

Three months after the construction of the HMAC overlay four reflective (3' x 3') cracks were present between MP 155 and MP 156 EB. The road between MP 155 and MP 156 EB is hilly with a grade of about 3 to 4%. Many spots in the HMAC started to ravel where the asphalt was being stripped off the aggregate.

Cracks in the HMAC were visible along the right edge of the road section between MP 153 and MP 154 EB. These cracks are believed to be above the drainage collector trench. Possibly these cracks are the result of trucks being driven over the edge of the road, to allow faster vehicles to pass them, causing differential longitudinal cracks between the HMAC overlay road and the different HMAC mix overlay for the shoulder.

IV. Change Orders and Force Accounts

Eight change orders and two force accounts were issued during the construction of the project.

Change order no.1 was requested by the contractor because of lack of availability of asphalt concrete (1/2" mix) during the construction of the collector trench. Asphalt concrete (miscellaneous structural) quantities was substituted for the asphalt concrete (1/2" mix) quantities. The contract time was not changed. The overall cost of asphalt concrete was reduced by $2,283.00.

Change order no.6 was requested by the contractor to do the following:

(1) Delete subsection 406-10.08(E) construction requirements; compacting and smoothing; courses greater than one and one-half inches in nominal thickness; of the 1985 supplemental specifications for the bottom lift of asphaltic concrete.

(2) Add the end product asphalt concrete specifications for compaction, modified as attached, for the bottom lift of asphalt concrete.

(3) Accept the bottom lift of asphalt concrete between westbound station 375 (approx.) and 557 (approx.) as is, with no adjustment in contract price. This will include AC density lots 17,18,19,21,22,24,25,27 and 28. These AC density lots will be excluded from the pay factor tabulation.

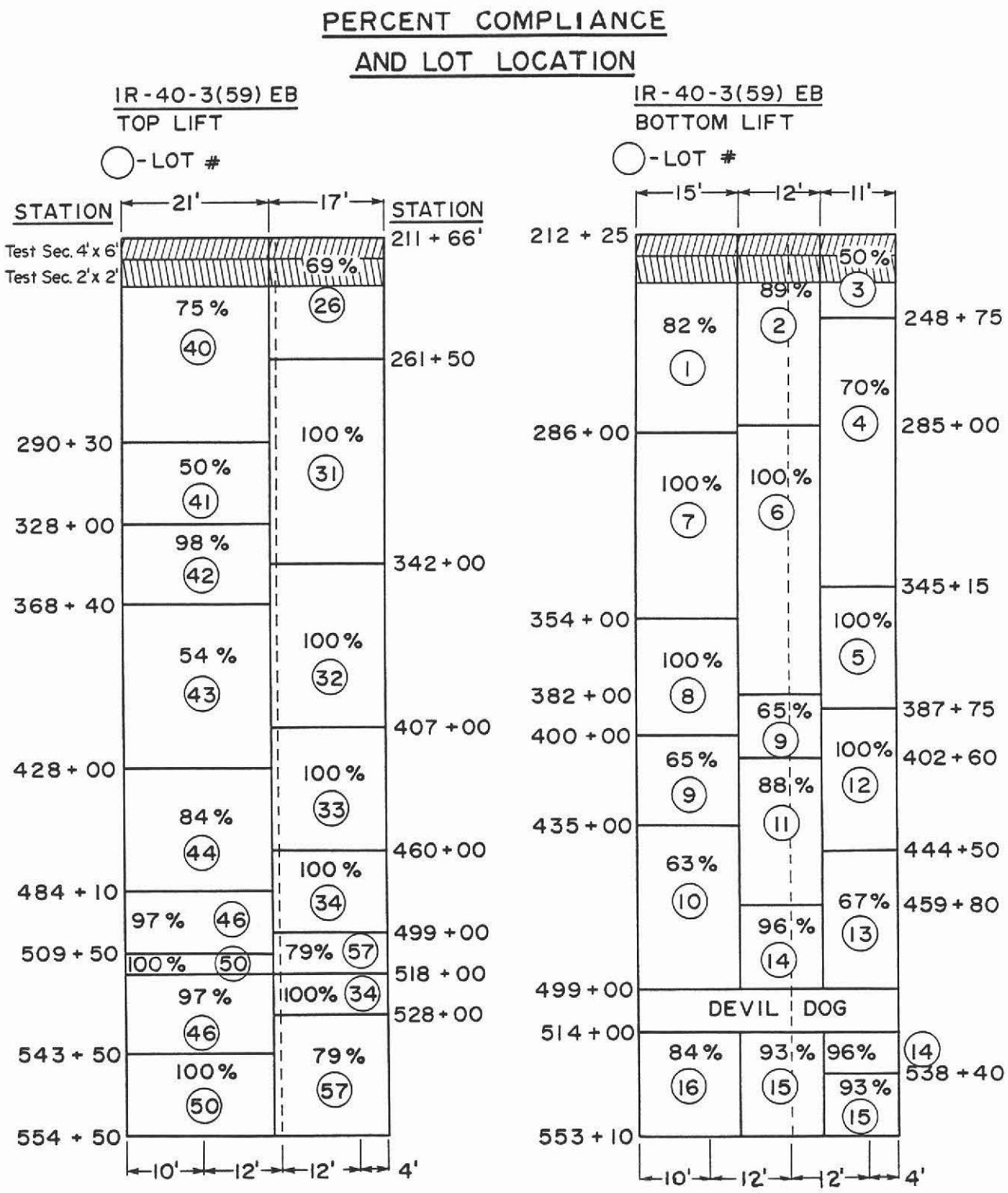


Figure 10 Percent Compliance and Lot Location for the East Bound Roadway

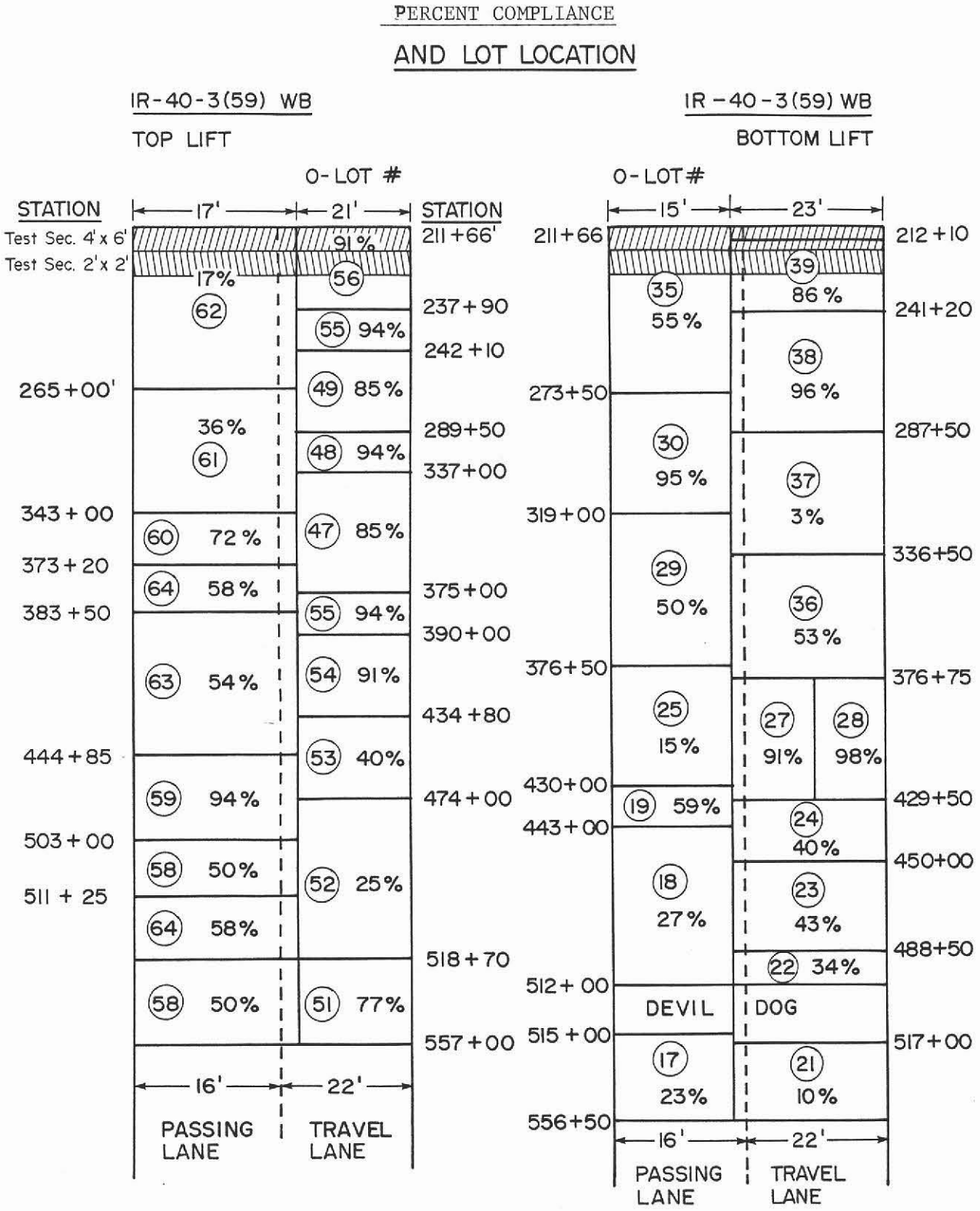


Figure 11 Percent Compliance and Lot Location for the West Bound Roadway

Table 2 Typical HMAC Test Results

LOT #	DIRECTION*	LANE** P OR T	%ASPHALT	AVERAGE DENSITY (%)	AVG. BULK DENSITY	STANDARD DEVIATION	LOT COMPLIANCE
35	WB-BL	P	5.78	95.2	151.1	1.56	56%
39	WB-TL	T	5.77	95.4	150.0	0.37	86%
30	WB-BL	P	5.56	96.4	148.2	1.34	95%
38	WB-BL	T	5.21	96.3	149.5	0.81	96%
37	WB-BL	T	5.19	93.0	149.6	1.23	3%
29	WB-BL	P	5.63	95.0	148.3	2.75	50%
36	WB-BL	T	5.42	95.1	149.0	1.14	53%
25	WB-BL	P	5.37	94.4	149.2	0.85	15%
27	WB-BL	T	5.56	96.1	149.0	1.24	91%
28	WB-BL	T	5.61	96.7	148.2	1.44	98%
19	WB-BL	P	5.14	95.2	149.7	1.24	59%
24	WB-BL	T	5.68	94.8	149.3	1.09	40%
18	WB-BL	P	5.39	93.7	149.7	3.01	27%
23	WB-BL	T	5.45	94.7	149.3	2.56	43%
22	WB-BL	T	5.48	94.5	149.2	1.75	34%
17	WB-BL	P	5.30	93.2	149.7	3.55	23%
21	WB-BL	T	5.54	93.3	149.4	2.05	10%
62	WB-TL	P	5.70	93.9	150.2	1.13	17%
56	WB-TL	T	5.65	96.6	149.8	1.25	91%
55	WB-TL	T	5.25	96.7	149.6	1.16	94%
49	WB-TL	T	5.36	95.8	149.4	0.78	85%
48	WB-TL	T	5.17	95.9	149.5	0.62	94%
61	WB-TL	P	5.19	94.6	150.0	1.03	36%
60	WB-TL	P	5.41	95.3	150.0	0.50	72%
47	WB-TL	T	5.49	95.7	149.5	0.67	85%
64	WB-TL	P	5.32	95.3	150.4	1.36	58%
55	WB-TL	T	5.25	96.7	149.6	1.16	94%
54	WB-TL	T	5.26	96.0	149.8	0.77	91%
63	WB-TL	P	4.86	94.2	150.0	1.88	34%
53	WB-TL	T	5.42	94.7	149.6	1.13	40%
59	WB-TL	P	5.11	95.7	149.8	0.49	94%
58	WB-TL	P	5.18	95.0	149.9	0.72	50%
52	WB-TL	T	5.40	94.9	149.6	1.45	25%
51	WB-TL	T	5.32	95.8	149.7	1.04	77%

* WB-BL = West Bound Bottom Lift
WB-TL = West Bound Top Lift

** P = Passing
T = Travel

(4) Accept the AC density lots on the top lift which fail to meet specifications by nuclear test methods, in accordance with subsections 406-10.08(E) of the 1985 supplemental specifications, but are acceptable on cores.

(5) Accept AC density lots 51,53,63 and 64 (top lift) and apply an appropriate adjustment in the contract price in accordance with the schedule provided within the end product AC specifications for compaction. The percent compliance shall be utilized as the PT and pay factor extracted from the table. Once determined, the negative pay factor is final and can be offset by subsequent passing lots which would produce a positive pay factor.

(6) Accept AC density lots 43 and 62, top lift, at an adjustment in the contract unit price of -$3.00 per ton.

(7) Reduce item number 4060004, AC (1/2" mix), by 33,971.35 tons at the contract unit price of $15.00 per ton.

(8) Establish item number 4060004A, AC (1/2" mix) (adjusted cost), at a unit price of $14.29392 per ton. The total quantity is 33,971.35 tons.

The reasons the contractor requested the above changes were:

(1) (2) Because of AC density lot failures which precluded the continuation of AC production under subsection 406-10.08(E) (4) of the 1985 supplemental specifications, the contractor requested this change to provide a mechanism by which AC paving could be maintained. This change is in conformance with subsection 105.03, conformity with plans and specifications.

(3) Prior to any work by the contractor in this area the PCCP slabs showed substantially greater deterioration than the other areas of the project. The contractor expended extensive compactive effort in full cooperation with the Department, in attempting to meet the density specifications, however, the condition of the existing roadway promoted an environment in which obtaining the specified density requirements led to other undesirable characteristics in the finished product. The literature available on crack and seat procedures would suggest an approach different from that used in the crack and seat process in areas such as this.

(4) The core method of determining density is recognized as being more precise than the nuclear gauge method.

(5) The end product asphalt concrete specifications for compaction provides a recognized schedule of contract unit price adjustment for density lot compliance attained.

(6) As allowed under the end product asphalt concrete specifications for compaction, the Engineer believes that the material is of sufficient quality that it may be accepted at the maximum negative pay factor adjustment of $3.00.

(7)&(8) To provide a mechanism by which payment can be made with an appropriate pay factor adjustment applied.

The cost adjustment due to change order no.6 was reduced by $23,986.49.

All the other change orders are not related to the objective of this report.

One of the two force accounts (force account no. 2) is related to the objective of this report. In this force account authorization was given by ADOT to the contractor to remove the randomly located severe bumps in the bottom lift of the AC caused by the underlying PCCP joint filler material. The removal was accomplished through the use of a small milling machine

and other incidental equipment and labor. The cost of this force account was $15,000.00, and the contract time was not changed.

Copies of change orders numbered 1 and 6, and copy of force account no.2 are included in Appendix F.

V. CONCLUSIONS and RECOMMENDATIONS

Although the bumps developed in the HMAC overlay could be attributed to the placing of the hot mix over the asphalt rubber sealant, one should investigate the possibility of seating as the cause . No method was provided in the contract to evaluate the seating process other than monitoring the number of passes the 50 ton roller made.

There is no evidence showing that there is any relation between the crack and seat operation and the non-compliance of the compaction densities. Additional research is needed to investigate whether asphalt rubber-sealants cause bumps when overlaid with HMAC.

It cost $ 0.80 per square yard to crack and seat the PCCP slabs. In other states where a regular program exists for the crack and seat, costs have stabilized in the $ 0.25 - 0.50 per square yard.

The choice of 4" thickness (reliability = 80%) for the overlay may be on the thin side since four reflective squared cracks were visible in the HMAC overlay in March 1987. Back calculations of the overlay thickness using the 1986 AASHTO Guide recommend a thickness of 5.5" for 90% reliability. It is recommended that Non Destructive Testing be done on a cracked and seated PCCP in order to back calculate layer moduli including the effective moduli of the broken PCCP and then the structural layer coefficients of the layer and the resulting value of the structural number.

It is recommended that an experimental research project be conducted on a section of highway using the crack and seat technique and compare this to a control section where no cracking and seating has been done. From such a research study one would be able to better assess the effectiveness of the crack and seat technique in preventing reflective cracking in Arizona.

It is also recommended that the following be considered if a crack and seat operation is to be utilized:

a- Full pavement condition survey should be performed before the crack and seat operation.

b- Falling weight deflectometer tests should be performed at the following time intervals:

1- Prior to cracking and seating the pavement
2- After cracking but prior to seating
3- During the rolling process i.e. seating
4- After the cracking and the seating operations

c- The AASHTO Guide for design of pavement structures should be used for the design of the AC overlay.

d- Using back-calculation procedures, one should establish the structural coefficients for each crack spacing pattern and compare them with those of the AASHTO procedure.

e- Any method which can be used to evaluate whether seating is necessary, prior to bidding, should be investigated and then analyzed during construction.

f- A cost analysis study should be done in order to determine if the delay in reflective cracking, due to crack and seat, actually extends the life of the pavement as opposed to conventional overlays and if so, is it cost effective.

Other construction recommendations that should be incorporated in the special provisions include:

a- The collector trench was constructed on the edge of the PCCP. This proved to be a problem when lane closures forced traffic to use the lane next to the trench. The traffic periodically drifted on top of the trench which overstressed the 2" of AC over the coarse backfill material and created a rut above the backfilled trench. The special provisions should read: " No traffic shall be allowed on backfilled trench until the top lift of the AC overlay has been placed".

b- The special provisions dictated that seating be accomplished no more than 24 hours prior to the AC overlay and not more than 72 hours after cracking. The seating process could possibly be more effective if it was performed at night when the temperatures are lowest; the concrete slabs contract as they cool down, and the cracks will grow wider and should make seating more effective.

VI. NINE MONTH SURVEY

A. Pavement Condition

On June 11, 1987 a nine month pavement condition survey was conducted. The following is a description of the pavement condition and photographs showing the cracked sections.

In the WB roadway between MP 158 and 157 one 3'x4' reflective crack was visible in the travel lane. A 10' long transverse crack was also visible at about 2" away from this 3'x4' crack. (Photograph #1(a) and (b)).

In the EB roadway several reflective cracks were visible. Between MP 153 and MP 154 there were three transverse cracks of low severity (width of the crack was less than 3/8"), 3' to 4' long. The cracks extend from the edge of the travel lane shoulder stripe inwards towards the center line (Photographs # 2,3 and 4). Photograph #4 also shows the edge crack that is believed to be along the trench drain.

Between MP 153 and MP 154 three additional parallel transverse reflective cracks were visible with a spacing of 31.9' and 25.6'. One of these cracks was of medium severity (crack width = 0.4") and a length of about 6' (Photograph # 5).

Between MP 155 and MP 156 and at the top of the hill seven severe 3'X3' reflective cracks were visible. These cracks are shown in photographs # 6 and # 7.

All the reflective cracks seen at the time of the survey were in the travel lane. No cracks were visible in the passing lane of the east or west bound directions.

The reflective cracks seemed to occur in areas where the road is not level. The level sections of the road were crack-free.

Longitudinal edge cracks were only apparent between MP 153 and 154 EB, and it is believed that these edge cracks occur above the trench drain as mentioned in section III of this report.

Raveling seemed to have increased in severity from low to medium in the EB travel lane and at the construction joint along the center line of the road. Medium severity is defined as when more of the aggregates have worn away and the surface texture is moderately rough and pitted.

The WB travel lane had many raveling spots of low severity with few spots along the center line of medium severity.

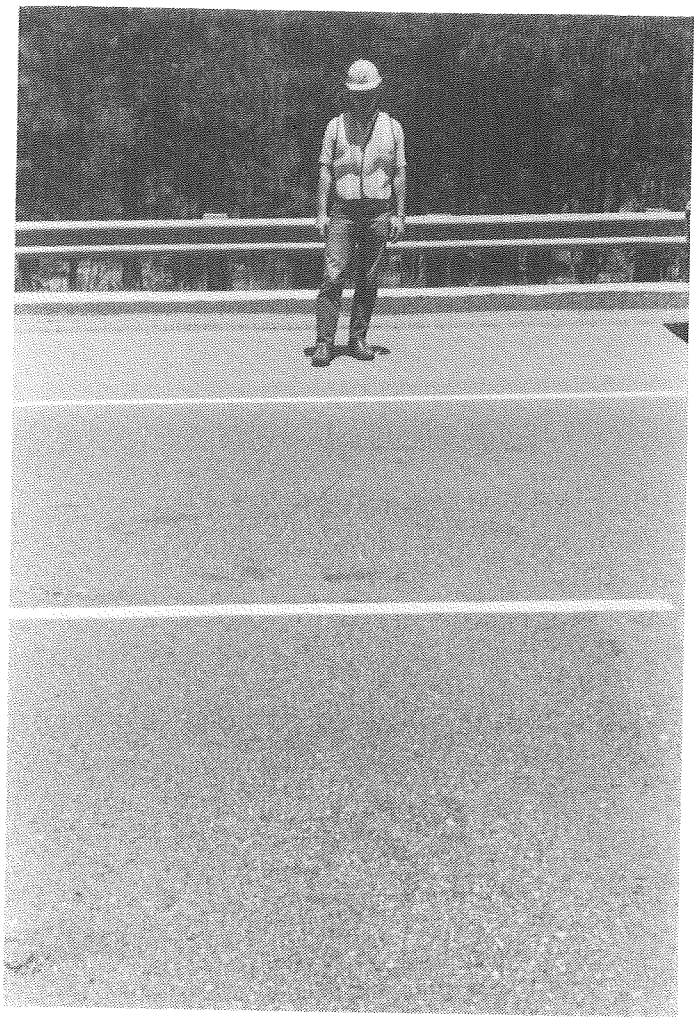
B. Remarks

In superimposing the subgrade data and the lot compliance results over the locations of the developed cracks, one can observe that there is no significant relation between them.

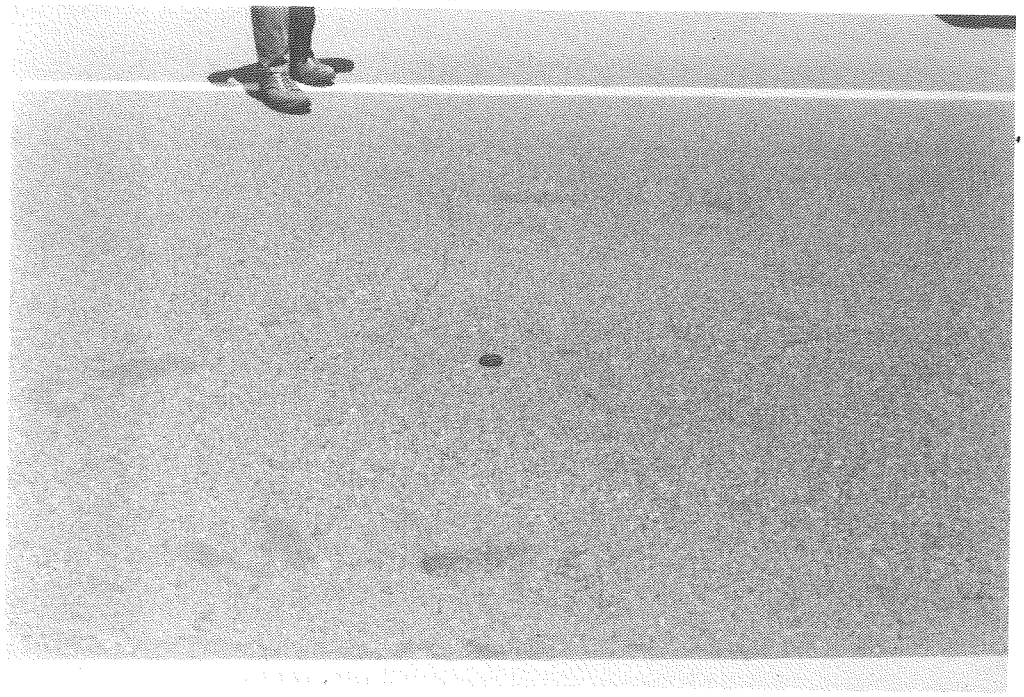
While other states (California, New Mexico and Kentucky) have reported that the crack and seat process has been successful, Arizona needs to further investigate the effectiveness of this process by changing some of the construction and/or design parameters such as:

. HMAC overlay thickness
. Cracking Pattern
. Cracking Method
. Seating Method.

Falling Weight Deflectometer Tests were conducted on four sections of this project on August 11, 1987. Results of such Non Destructive Tests will be included in the final report describing the findings of the experimental section (after conducting a second survey during the winter season), along with the back calculations for the structural coefficients of the pavements' layers and the thickness of the overlay. Appendix D shows the workplan for this project.

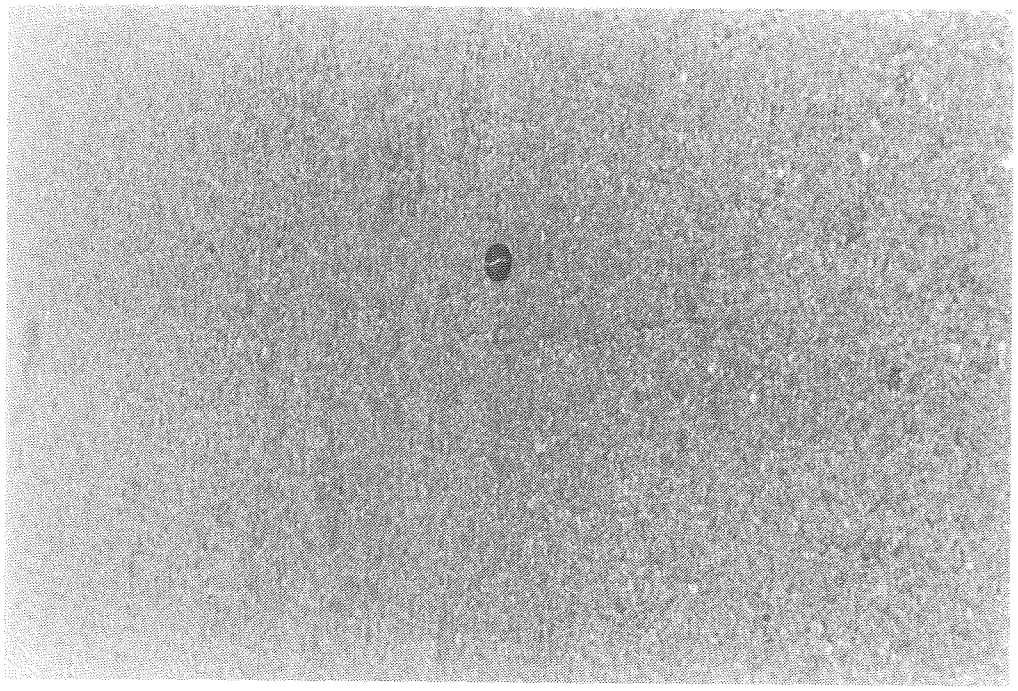


Photograph #1(b)

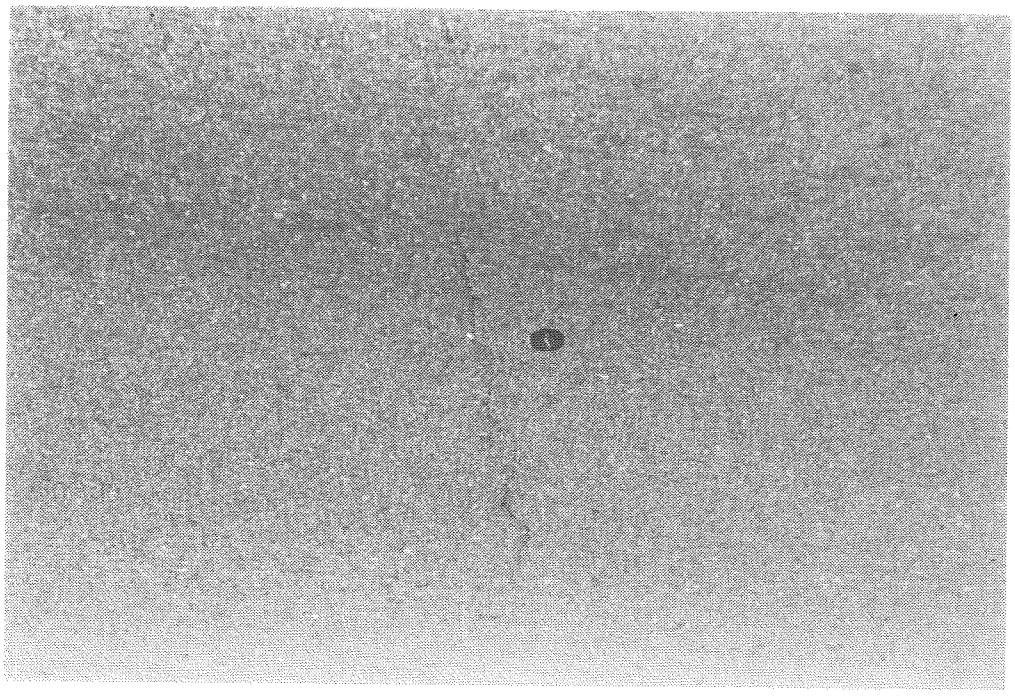


Photograph #1(a)

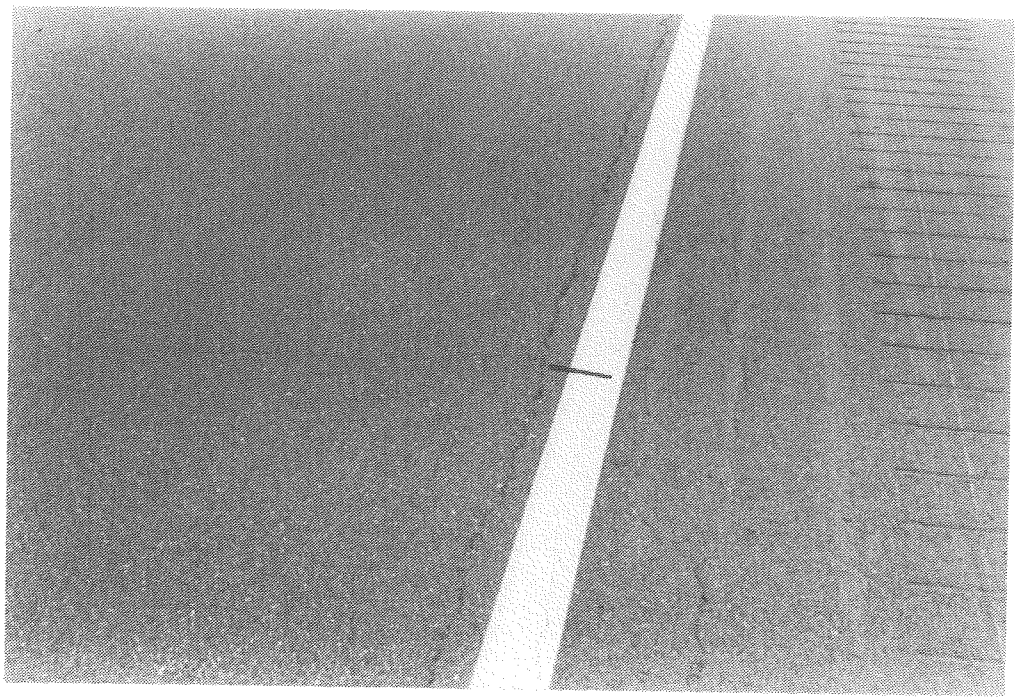
10 ft Longitudinal Crack and 3'x4' Reflective Crack - WB



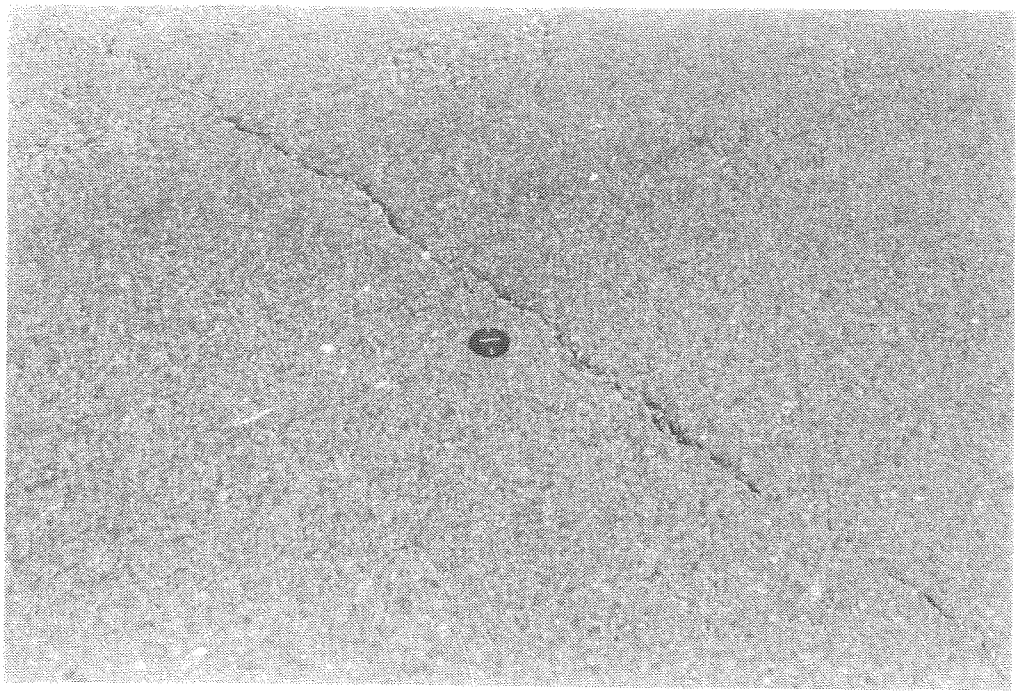
Photograph #2 Low Severity Transverse Crack - EB
Between MP 153 and 154



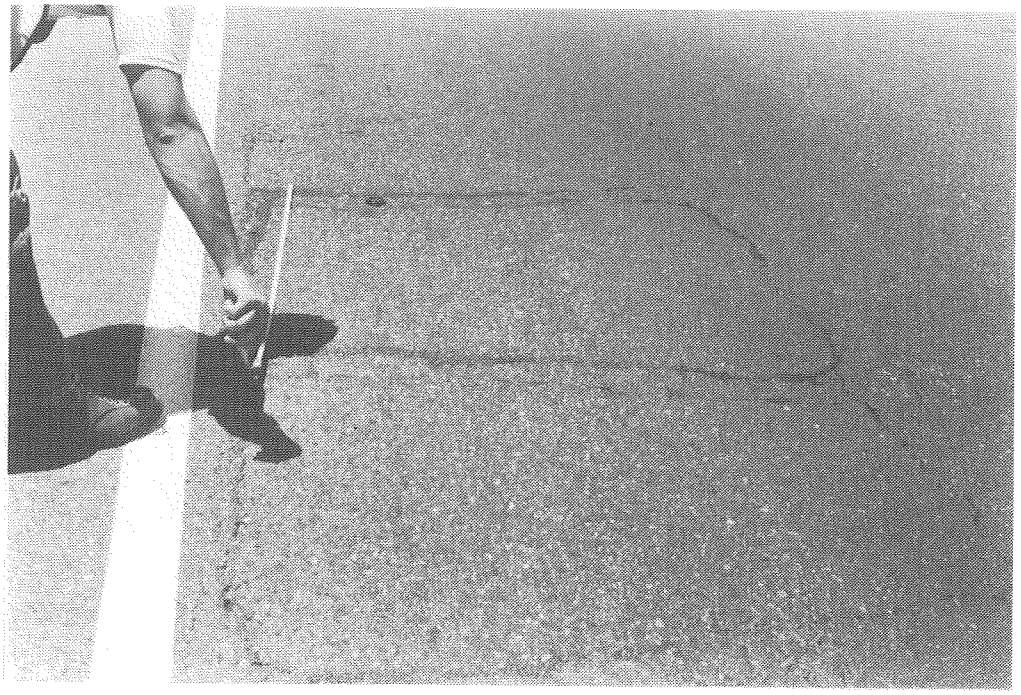
Photograph #3 Another Low Severity Transverse Crack - EB
Between MP 153 and 154



Photograph #4 Transverse and edge crack - EB between MP 153 and 154



Photograph #5 Medium severity crack - EB between MP 153 and 154



Photograph #6 3(3'x3') reflective "Rocking" cracks - EB between MP 155 and 156

Photograph #7 4 severe 3'x3' reflective "Rocking" cracks at the EB between MP 155 and 156

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1. Noonan, J.E. and McCullagh, F.R. "Reduction of Reflection Cracking in Bituminous Overlays on Rigid Pavements". Engineering Research and Development Bureau, New York State Department of Transportation Report 80, June 1980.

2. Smith, Roger D. " CALTRANS Uses Cracking and Seating". Asphaltnews, May 1986, Vol 9, No. 2.

3. McGhee, K.H. "Efforts to Reduce Reflective Cracking of Bituminous Concrete Overlays of Portland Cement Concrete Pavements". Virginia Highway Transportation Research Council, December 1987.

4. Schormeier, R.H. "Eleven-year Pavement Condition History of Asphalt Rubber Seals in Phoenix, Arizona". ASTM STP 724. December 1980, pp 13-21.

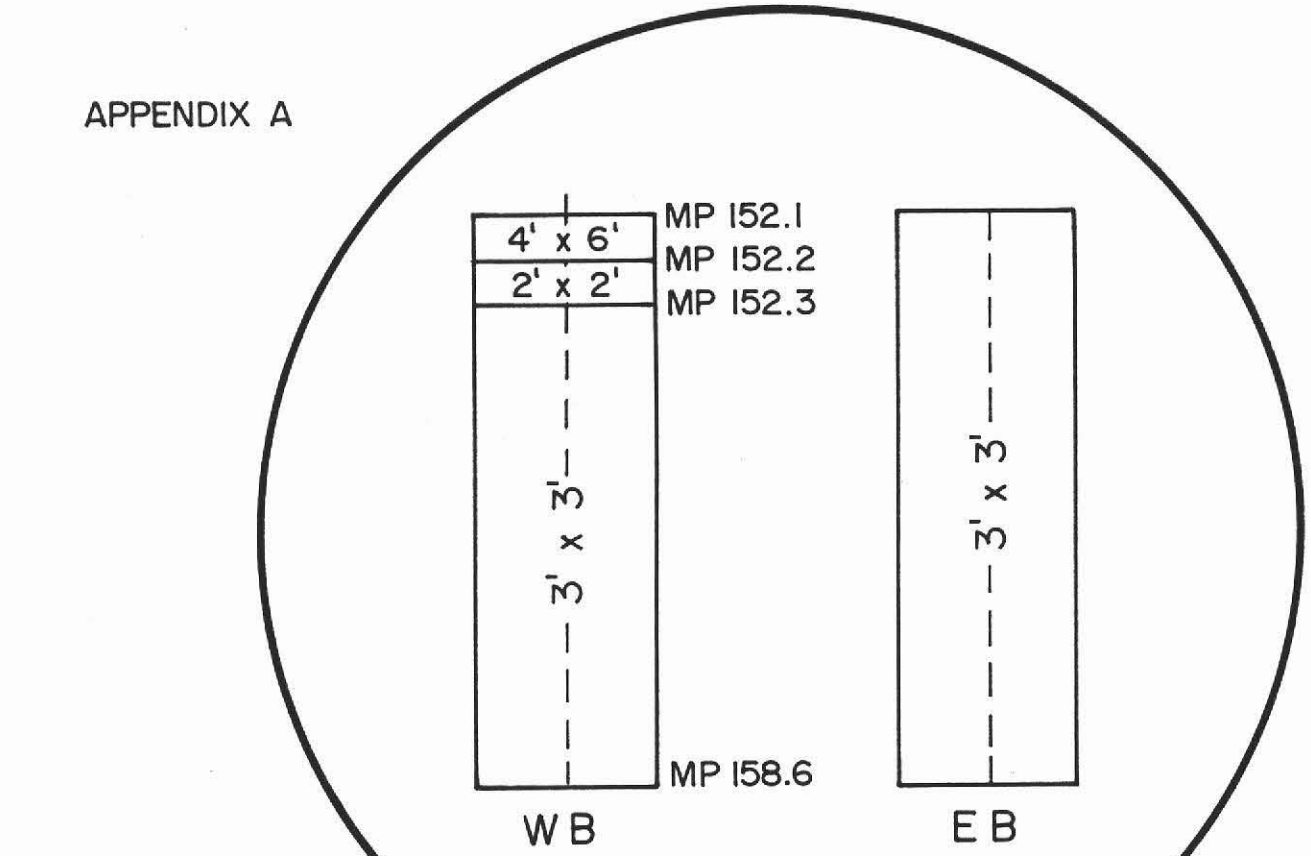
5. Crawford, C. Cracking and Seating of PCC Pavements Prior to Overlaying With Hot Mix Asphalt. State of the Art Report, National Asphalt Pavement Association Information Series 91, March 1985.

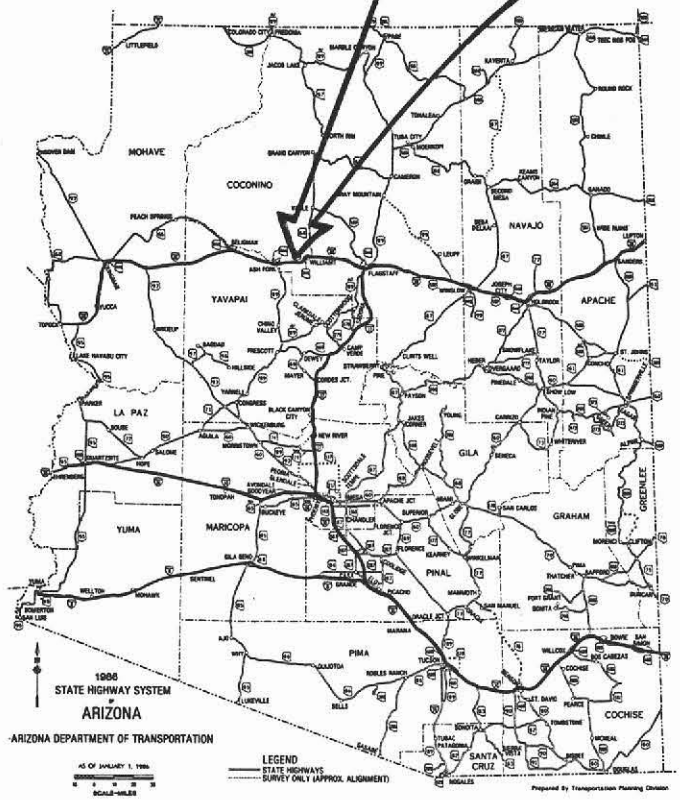
6. Smith, R. E., Darter, M. I., Herrin, S. M. Highway Pavement Distress Identification Manual. U.S. Department of Transportation/Federal Highway Administration, March 1979.

7. "Does PCC cracking and Seating Work?" Better Roads, January 1986.

8. Guide for Design of Pavement Structures. American Association of State Highway and Transportation Officials, 1986.

APPENDIX A





VICINITY MAP

SPECIAL PROVISIONS

ARIZONA PROJECTS

IR-40-3 (59) AND RS-581 (2)P

ASHFORK-FLAGSTAFF HIGHWAY AND KINGMAN-SELIGMAN HIGHWAY
(Welch O.P. - Williams) and (Seligman Street))

CRACK AND SEAT P.C.C.P., OVERLAY AND RESURFACING

PROPOSED WORK:

The proposed work is located in Coconino and Yavapai Counties. Project IR-40-3 (59) is on Interstate Route 40 beginning at Milepost 152.1, approximately 10 miles west of the City of Williams and extending easterly to Milepost 158.6 for a distance of approximately 6.5 miles and consists of cracking and seating the existing portland cement concrete travel lanes; constructing a subsurface drainage system; reconstructing slopes and improving median drainage; reconstructing new concrete bridge barrier and guard rail; furnishing and placing an asphaltic concrete overlay and other incidental work. Project S-581 (2)P is on State Route 66 beginning at Milepost 139.93 in Seligman, and extending easterly to Milepost 142.74 for a distance of approximately 2.81 miles and consists of removing the existing pavement and replacing it with either recycled or new asphaltic concrete, at the contractor's option, and other incidental work.

ITEM 4010210 - CRACK AND SEAT PORTLAND CONCRETE PAVEMENT:

Description:

The work under this item consists of furnishing all equipment and labor necessary for cracking and seating the existing concrete pavement at the locations shown on the project plans and in accordance with the requirements of these special provisions, following the removal of existing bituminous patch material, if present, and prior to placement of the new asphaltic concrete overlay.

Equipment:

Equipment to be used for cracking concrete pavement shall be capable of impacting the pavement with a variable force which can be controlled in magnitude and point of impact. This should produce the desired cracking without extensive surface spalling along the crack or without excessive shattering of the pavement or base. Unguided free falling weights such as "headache balls" shall not be used. The equipment for seating the cracked concrete shall be a 50 ton pneumatic tired roller.

Construction Methods:

Following removal of any existing bituminous patch material if present, the existing concrete pavement shall be cracked by such equipment and by such a method so as to produce full depth, generally transverse hairline cracks at a nominal longitudinal spacing of 3 feet x 3 feet, except at Milepost 152.1-152.2 (Westbound) and at Milepost 152.2-153.3 (Westbound) where the nominal spacing shall be 4' x 6' and 2' x 2' respectively. Care shall be taken to prevent the formation of a continuous longitudinal crack.

Before cracking operations begin, the Engineer will designate test sections. The contractor shall crack the test sections using varying energy and striking patterns until a satisfactory cracking pattern is established. This energy and striking pattern will then be required for the remainder of the project unless the Engineer determines that conditions have changed such that a satisfactory cracking pattern is no longer being produced. Adjustments shall then be made to the energy and/or striking pattern as required to re-establish a satisfactory cracking pattern. When cracking the test sections, the contractor shall furnish and apply water to dampen the pavement following cracking to enhance visual determination of the cracking pattern. The contractor shall furnish and apply water to a test section at least once each day to verify that the specified crack pattern is being maintained. The pavement cracking tool shall not impact the pavement within one foot of another break line, random crack, pavement joint, or edge of pavement. A screen satisfactory to the Engineer shall be provided to protect vehicles in the adjacent lane from flying chips during the cracking process when necessary.

ARIZONA DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

206 South Seventeenth Avenue Phoenix, Arizona 85007

BRUCE BABBITT
Governor

CHARLES L. MILLER
Director

W.O. FORD
State Engineer

June 4, 1986

ADDENDUM

(2)

TO ALL CONTRACTORS AND OTHERS INTERESTED IN PROJECTS IR-40-3 (59) ASHFORK-FLAGSTAFF HIGHWAY AND RS-581 (2)P KINGMAN-SELIGMAN HIGHWAY SCHEDULED FOR BID OPENING ON FRIDAY, JUNE 13, 1986 AT 11:00 A.M.

REVISIONS TO THE SPECIAL PROVISIONS:

ITEM 4010210 - CRACK AND SEAT PORTLAND CEMENT CONCRETE PAVEMENT:

On sheet 33 of 59 of the Special Provisions, the first paragraph under the subtitle "Construction Methods" shall be revised to read:

Following removal of any existing bituminuous patch material, if present, the existing concrete pavement shall be cracked by such equipment and by such a method so as to produce full depth, generally transverse hairline cracks at a nominal spacing of 3 feet x 3 feet square, except at Milepost 152.1-152.2 (Westbound) and at Milepost 152.2-152.3 (Westbound) where the nominal spacing shall be 4' x 6' and 2' x 2' respectively.

In the event that existing slabs are already cracked into segments, these segments shall be cracked further into nominally equal-sized square or rectangular pieces having longitudinal and transverse dimensions not more than 3.5 feet nor less than 2.5 feet wherever feasable.

On Sheet 34 of 59 the fourth paragraph shall be deleted and replaced with the following:

Cracked pavement segments shall be seated not more than 24 hours prior to receiving the asphalt concrete overlay.

Cracked concrete pavement shall in no case remain exposed to traffic more than 72 hours. If this 72-hour requirement is not met, cracking operations shall be suspended until all cracked pavement has been covered by at least the first Asphaltic concrete leveling course.

Cracked concrete pavement shall be maintained while open to traffic.

ITEM 7010001 - MAINTENANCE AND PROTECTION OF TRAFFIC:

701-3.02: Maintenance and Protection of Traffic of the Standard Specifications is modified to add:

All the signs called "Special" on sheet 35 of 36 of the project plans of Project IR-40-3(59) are Department furnished.

The contractor shall pick them up at the maintenance yard in Flagstaff at 5701 E. Railhead Avenue, and return them at the same address at the completion of the project.

It shall be contractor's responsibility to maintain the signs clean and in legible conditions throughout the construction time.

ITEM 8080553 - PIPE (PVC PERFORATED) (4"):

On Sheet 51 of 59 of the Special Provisions under the subtitle "Materials" the third paragraph and gradation shall be revised to read as follows:

The coarse backfill material for the perforated pipe shall conform to the following gradations:

Sieve Size	Percent Passing
1 1/2 inch	100
1 inch	50 - 75
1/2 inch	20 - 50
No. 4	0 - 15
No. 200	0 - 2.5

The combined bulk specific gravity range for the coarse backfill material shall be 2.35 to 2.85.

The combined water absorption range for the coarse backfill material shall be 0 to 2.5.

Resistance to abrasion for coarse backfill material will be determined in accordance with the requirements of AASHTO T 96 and shall meet the following requirement:

Maximum loss of 40 percent at 500 revolutions.

REVISION TO THE PROJECT PLANS:

On Sheet 35 of 36 of the Project Plans of Project IR-40-3(59) add Note No. 7: All the signs called "Special" are Department furnished.

DALLIS B. SAXTON, Engineer
Contracts and Specifications Services

81602
ES/Lata

APPENDIX C

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS SECTION

206 S. 17th AVENUE (127A), PHOENIX, ARIZONA 85007 PHONE (602) 255-7231

MATERIALS DESIGN MEMORANDUM

Gary L. Cooper
Assistant State Engineer

JANUARY 17, 1986

PROJECT

ASH FORK - FLAGSTAFF HWY
WELCH OP - WILLIAMS
I-40-3-459 PE
IR-40-3(59) CONST.
REHABILITATION

MEMORANDUM #85-82-1

MEMORANDUM TYPE: FINAL

This memo supersedes Memo #85-82 dated November 8, 1985 and refelects the following changes:

SECTION I - ITEM 1 - Added two experimental test sections.

- ITEM 2 - Added Item for Leveling quantities.

SECTION III - ITEM 2 - Borrow Source information was added.

SECTION I - PAVEMENT STRUCTURE

ITEM 1 - STRUCTURAL THICKNESS

LOCATION	DIRECTION	CRACK & SEAT	OVERLAY AC(1/2)
*MP 152.1 - 152.2	WB	4' X 6'	4"
*MP 152.2 - 152.3	WB	2' x 2'	4"
MP 152.3 - 158.6	WB	3' x 3'	4"
MP 152.1 - 158.6	EB	3' X 3'	4"

*Experimental test sections

ITEM 2 - ADDITIONAL QUANTITIES FOR LEVELING

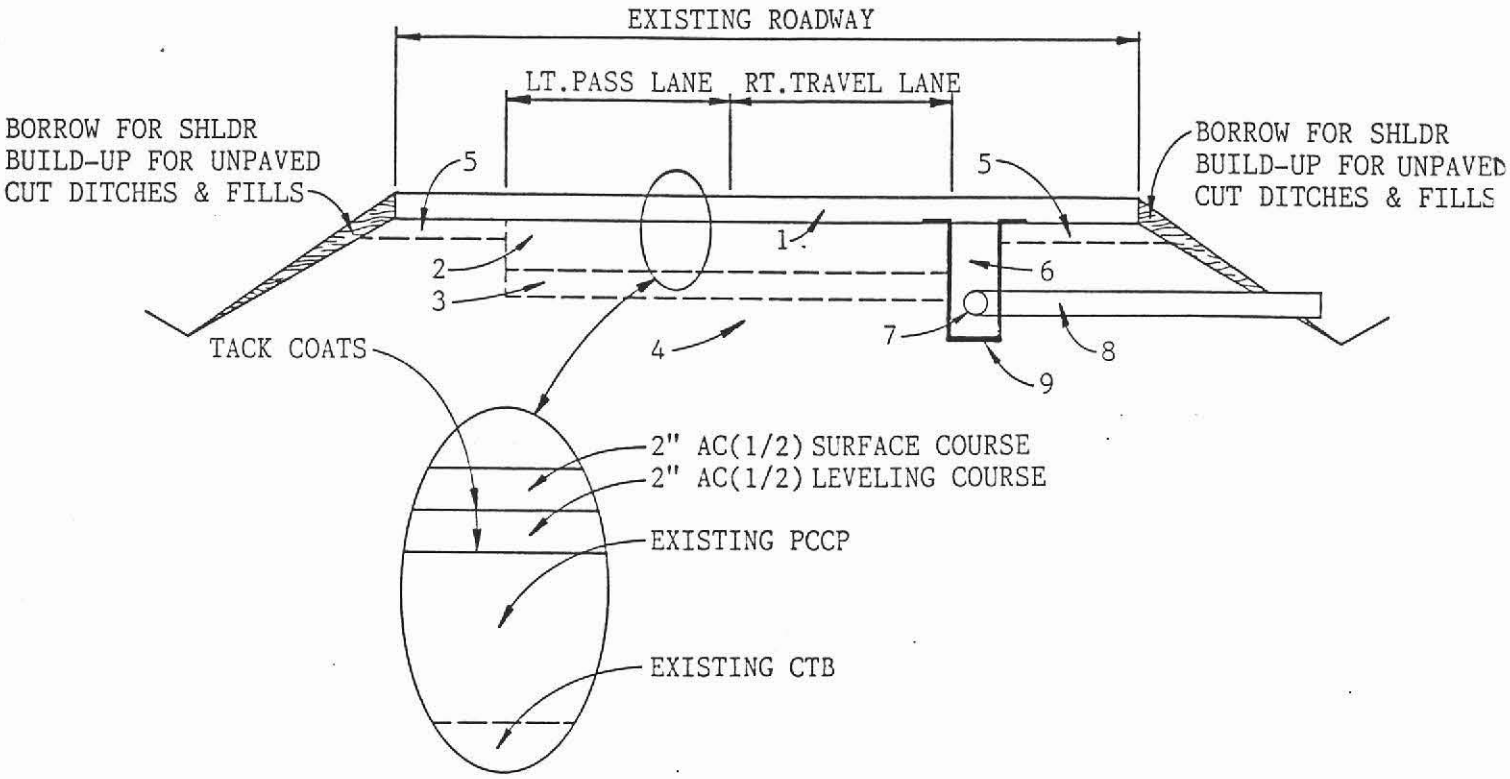
An additional 3,200 tons of Asphaltic Concrete (1/2") should be estimated for leveling purposes.

SECTION II - SURFACE TREATMENTS AND PAVEMENTS

ITEM 1 - TACK COAT

A tack coat shall be applied as necessary to provide proper bonding prior to the placement of each lift of AC over an underlying bituminous surface or PCCP. The tack coat shall be as specified in Section 404 of the Standard Specifications.

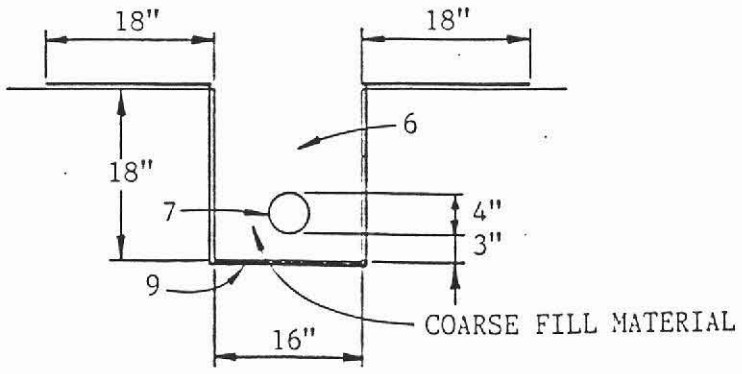
SUBSURFACE DRAINAGE DESIGN
IR-40-3(59)C
E.B. & W.B.



M.P. 152.1 TO 158.6
DESCRIPTION OF ELEMENTS

1. 4" AC OVERLAY
2. EXISTING 8" PCCP
3. EXISTING 4" CTB
4. EXISTING SUBGRADE
5. EXISTING AC SHOULDERS
6. COLLECTOR TRENCH - SEE DETAIL BELOW
7. PERFORATED COLLECTOR PIPE
8. OUTLET PIPE - 2% grade @ 400' SPACING
9. ENGINEERING FABRIC

*DRAINAGE TRENCH AND OUTLET SHALL BE DESIGNED TO DRAIN THE LOW SIDE OF THE PAVEMENT CROSS SLOPE.



SUBSURFACE DRAINAGE*
TRENCH DETAIL

ITEM 2 - ASPHALTIC CONCRETE (1/2)

The asphaltic concrete shall be as specified in Contracts and Specifications stored Spec. "ASP406".

For estimating purposes the unit weight of the bituminous mix is 152 pounds per cubic foot, the asphalt is 4.7 %, and the haul distance is 29 miles.

Asphalt shall be type AC-30.

The minimum index of retained strength shall be 70%.

The combined bulk specific gravity range shall be 2.35 to 2.85.

The combined water absorption range shall be 0 to 2.50.

ITEM 3 - BRIDGE OVERLAY DETAILS

The bridge decks at the following locations shall be overlaid with 2" AC(1/2) as specified in SECTION II,ITEM 2. Just prior to placing new AC, all existing bituminious material shall be removed from the bridge decks, and the bridge decks shall be throughly cleaned, to the satisfaction of the Engineer. A bridge deck membrane shall be placed on the following bridges, and as specified in SECTION II, ITEM 4.

LOCATION (EB & WB)	MP	MEMBRANE
DEVIL DOG TI OP	157.71	YES

The PCCP at bridge approaches shall be removed and replaced with 8"AC(1/2). The removal length shall be determined by Highway Plans.

ITEM 4 - BRIDGE DECK MEMBRANE

A bridge deck membrane shall be placed on Devil Dog TI OP as specified in contracts and specifications stored spec "PREBRANE".

ITEM 5 - RAMP OVERLAY DETAILS

The full thickness of the overlay shall be carried onto the on and off ramps to a point beyond the width taper of the ramps. The thickness of the overlay shall then be tapered to meet the grade of the existing bituminous pavement on the ramps. The length of the taper section will be determined by the Highway Plans Services.

ITEM 6 - CRACKING AND SEATING PCCP

Description:

This work shall consist of cracking and seating existing concrete pavement following removal of existing bituminous overlays, if present, and prior to placement of a bituminous overlay.

Equipment:

Equipment to be used for cracking concrete pavement shall be capable of impacting the pavement with a variable force which can be controlled in magnitude and point of impact. This should produce the desired cracking without extensive surface spalling along the crack or without excessive shattering of the pavement or base. Unguided free falling weights such as "headache balls" shall not be used. The equipment for seating the cracked concrete shall be a 50 ton pneumatic tired roller (See Spec.).

Construction Methods:

Following removal of any existing bituminous overlays, if present, the existing concrete pavement shall be cracked by such equipment and by such a method so as to produce full depth, generally transverse hairline cracks at a nominal longitudinal spacing of 3 feet X 3 feet except at MP 152.1-152.2 (WB) & MP 152.2-153.3 (WB) the nominal spacing shall be 4'x 6' and 2'x 2' respectively. Care should be taken to prevent the formation of a continuous longitudinal crack.

Before cracking operations begin, the Engineer will designate test sections. The contractor shall crack the test sections using varying energy and striking patterns until a satisfactory cracking pattern is established. This energy and striking pattern will then be required for the remainder of the project unless the Engineer determines conditions have changed such that a satisfactory cracking pattern is no longer being produced. Adjustments shall then be made to the energy and/or striking pattern as required to re-establish a satisfactory cracking pattern. When cracking the test sections, the contractor shall furnish and apply water to dampen the pavement following cracking to enhance visual determination of the cracking pattern. The contractor shall furnish and apply water to a check section at least once each day to verify that the specified crack pattern is being maintained. The pavement cracking tool shall not impact the pavement within 1 foot of another break line, random crack, pavement joint, or edge of pavement. A screen satisfactory to the Engineer shall be provided to protect vehicles in the adjacent lane from flying chips during the cracking process when necessary.

The contractor shall exercise care during breaking to protect, and prevent damage to underground utilities and drainage facilities. Only construction or hauling traffic is permitted over the newly cracked pavement.

Following cracking, the concrete shall be rolled with at least 2 passes until the concrete pieces are assured of being seated.

After all segments have been seated to the satisfaction of the Engineer, loose debris shall be cleaned from all joints and cracks by suitable compressed-air equipment. All spalls shall be patched with bituminous material to the satisfaction of the Engineer prior to overlay.

Placing of the Asphaltic Concrete overlay shall follow the breaking and seating operation as closely as is practicable and, in no case, shall the broken pavement remain exposed more than 24 hours. If this 24-hour requirement is not met, breaking operations shall be suspended until all broken pavement has been covered by at least the first Asphaltic Concrete leveling course.

Measurement and Payment

The completed work as measured for CONCRETE PAVEMENT CRACKING AND SEATING will be paid for at the contract unit price for the following contract item (pay item).

Pay Item	Pay Unit
Concrete Pavement Cracking	Square Yard

The contract price paid per square yard for cracking the existing concrete pavement shall include full compensation for furnishing all labors, materials, tools, equipments, and incidentials, and for doing all work in cracking the existing pavement, seating cracked pavement, maintaining the cracked pavement in suitable condition for use by traffic if required, cleaning the pavement, filling joints, cracks and spalls, furnishing and applying water as shown on the plans and these Special Provisions, and as directed by the Engineer.

SECTION III - MATERIALS SOURCES - GEOTECHNICAL REPORT

ITEM 1 - NONDESIGNATED SOURCES

No State designated aggregate source is set up for this project. Materials sources shall be as specified in Section 1001 of the Standard Specifications.

ITEM 2 - BORROW SOURCE (FOR SHOULDER BUILDUP)

DATE OF REPORT: November, 1985

PIT SERIAL NUMBER: 5991, Area 1

MATERIAL DESIGNATION: Borrow

Location and Description:

This source is located 4.6 miles north of the Pittman Valley T.I. on I-40 (M.P. 171.8) at an existing pit area known as the Frenchy Hill sand pit. The material consists of low-plastic to non-plastic volcanic sand and silt that is compact and lightly cemented. There is some fine gravel and some cobble sized rock, both consist of hard, light weight ryholite and are angular and abrasive. The sand is also angular and abrasive. There is from 1' to 2' of clayey silty sand overburden on unused portions of the pit area.

Extraction of Pit Material:

Moderate clearing of Juniper trees and grass will be required in the unused portions of Area 1. No stripping is necessary; however, the uper 2' of material should be removed and reserved for slope plating material because of its humus content. The contractor should be made aware of the "Master Pit Development Plan" required by the Forest Service.

The estimated amount of suitable material in Area 1 is 100,000 cubic yards after a shrink factor has been applied.

Investigation:

The investigation of this source consisted of the excavation of 31 test holes to depths of from 3 to 9 feet with a backhoe in 1959. In 1960 an additional 6 test holes were dug with a backhoe to depths of from 3 to 11 feet. In 1964, six more test holes 9 to 11 feet in depth were made with a backhoe. In 1977 sixteen borings were made to depths of from 15 to 45 feet with a continuous flight auger. In August, 1980, 3 additional test holes were dug by backhoe to depths of from 7 to 15 feet. No water was noted in any of the test holes or borings when made.

Information Available to Bidders:

The following information is available at the ADOT Materials Section, 206 South 17th Avenue, Phoenix, Arizona, 85007.

1. Drillers logs and labratory test results of samples taken from test holes made in 1959, 1960, 1977, and 1980.

2. Areal photography and topographic maps of genaral pit area.

Haul Road and Haul Distance:

The existing haul road is in good shape and will require no preparation prior to use. From the pit area it is 4.6 miles via graded U.S. Forest Service and paved county road to the Pitman Valley, T.I.. From this point it is 17 miles via I-40 to MP 255 . The total haul distance is 21.5 miles.

Legal haul limits must be observed on all paved roadways.

Factor

The estimated compacted weight of borrow is 100 pounds per cubic foot. A shrink factor of 15 percent should be applied. The pit may be measured and the borrow paid for on a volume basis.

SECTION IV - MISCELLANEOUS

ITEM 1- REMOVAL OF BITUMINOUS MAINTENANCE PATCH MATERIAL

The work under this item consists of removal of all existing bituminous maintenance patch material from the PCCP to the satisfaction of the Engineer. Removal area is approximately 7,000 square yards and the average thickness is 1/4".

ITEM 2 - SUBSURFACE DRAINAGE TRENCH

Description of Application:

The engineering fabric (subsurface drainage) shall be used in subsurface drainage applications such as lining trenches, pavement drains, or blanket drains. The engineering fabric shall provide a permeable layer of media, while retaining the soil matrix.

Material Requirements:

The engineering fabric shall be of nonwoven needle punched construction consisting of long chain filaments or yarns of polyester or polyproplene. The fabric shall be inert to commonly encountered chemicals hydrocarbons, mildew and rot resistant, resistant to insect and rodents, and shall comply with AASHTO Specification M-288-82.

The average roll minimum value (weakest principle direction) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the average roll minimum value (weakest principle direction) stipulated in the AASHTO Specification.

The gradation of virgin aggregate will be determined in accordance with the requirements of Arizona Test Method 201.

Sieve Size	Percent Passing
1 1/2 inch	100
1 inch	50 - 75
1/2 inch	20 - 50
No. 4	0 - 15
No. 200	0 - 2.5

The combined bulk specific gravity range for the virgin aggregate shall be 2.35 to 2.85.

The combined water absorption range for the virgin aggregate shall be 0 to 2.5.

Resistance to abrasion for virgin aggregate will be determined in accordance with the requirements of AASHTO T 96 and shall meet the following requirement:

Maximum loss of 40 percent at 500 revolutions.

Packaging and Identification Requirements:

The engineering fabric shall be provided in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, and debris. The fabric shall be free of defects or flaws which significantly affect its physical properties. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run.

Construction Details:

The engineering fabric shall be installed in accordance with the plans. Overlaps when necessary shall be 18 inches minimum. Securing pins shall be used when necessary to insure proper anchoring of the engineering fabric.

The drainage fabric shall be covered with the permeable backfill material within two weeks of its placement. Should the fabric be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and to meet the overlap requirement. Adjacent borders of the geotextile shall be overlapped a minimum of twelve (12) inches or sewn. The preceding roll shall overlap the following roll in the direction the material is being placed.

Securing Pins:

Securing pins for anchoring the fabric shall be 3/16 inch steel bars, pointed at one end and fabricated with a head to retain a

steel washer having an outside diameter of not less than 1.5 inches. The pin length shall be not less than 18 inches. U-shaped pins shall be an acceptable option.

Measurement and Payment:

Engineering fabric shall be measured for payment by the square yard in place. Measurement will be the nearest square yard. No allowance will be made for material in laps and seams. Payment, therefore will be made at the contract unit price for "Engineering Fabric (Subsurface Drainage)" which price and payment shall constitute full compensation for furnishing all labor, material, and equipment, and performing ail operations in connection with placing the engineering fabric as shown on the contract plans. No measurement of, nor payment for, will be included for securing pins, and all costs incidental thereto shall be included in the contract unit price. No measurement of, nor payment for, will be made for engineering fabric due to either contamination or damage due to either the fault or negligence of the contractor.

Aggregate materials used to backfill the subsurface drainage trench shall be as specified above. Hand methods for compaction of the backfill shall be used to assure that compaction does not damage the drain pipe.

Submitted _____ P.E.
Pavement Services Engineer

Approved _____ P.E.
Assistant State Engineer

SM

APPENDIX D

ARIZONA DEPARTMENT OF TRANSPORTATION

206 South Seventeenth Avenue Phoenix, Arizona 85007

ARIZONA TRANSPORTATION RESEARCH CENTER

BRUCE BABBITT
Governor

CHARLES L. MILLER
Director

February 12, 1986

Mr. Ed Wueste
Division Administrator
Federal Highway Administration
234 North Central Avenue, #330
Phoenix, AZ 85004

ATTN: Nate Banks

SUBJECT: Construction Experimental Feature "Crack and Seat Concrete Pavement prior to A.C. Overlay", PROJECT IR-40-3(59)
M.P. 152.1 to 152.2 West Bound
M.P. 152.2 to 152.3 West Bound

Dear Sir:

Enclosed is the workplan for the above referenced project for your review and approval. This test section has been requested by the FHWA Division office to expand on Arizona's limited experience with this rehabilitation strategy.

ADOT is requesting FHWA participation in the construction costs of this experimental feature. Report preparation and field evaluations will be supported by the Arizona Transportation Research Center. No additional funding will be requested for those efforts.

In the event you have any questions regarding this project or work plan, please contact Mr. Larry Scofield of my staff.

Respectfully,

F. R. McCullagh

Frank R. McCullagh, P.E.
Assistant State Engineer
Research Section

LS/cj

cc: Sam Maroufkani
Enclosure

"CRACK AND SEAT EXISTING CONCRETE PAVEMENT PRIOR TO OVERLAYING WITH ASPHALTIC CONCRETE"

ASH FORK - FLAGSTAFF HIGHWAY; WELCH OVERPASS - WILLIAMS
IR-40-3(59)C
AZ8604

PROBLEM STATEMENT

The process of rehabilitating concrete pavements by overlaying with asphaltic concrete requires the prevention of reflecting cracking by some mitigation method. Often times, Arizona has elected to utilize a stress attenuating membrane to provide the mitigation measures. For this project ADOT elected to crack and seat the concrete pavement alleviating the potential for reflective cracking. Although this procedure is common in the highway industry, mixed results have been obtained and no cencensus of opinion exists to support a specific construction procedure.

OBJECTIVE

The objective of this experimental construction feature is to evaluate the constructability and long term field performance of different crack spacings. The standard or "control" crack pattern for this project will be 3' X 3'. Two test sections will be constructed with longer and shorter 4' X 6' and 2' X 2' respectively, spacings to evaluate the performance of these alternate designs.

It is anticipated that the long term evaluation of these sections will provide additional insight into the effectiveness of the crack and seat strategy and the various patterns under specific Arizona conditions

WORKPLAN

The proposed workplan and report preparation will be in accordance with the procedures for Construction Experimental Features. At minimum, the following activites will be performed and reported.

Task I

Construct two test sections on Project IR-40-3(59)C with different crack and seat patterns. Test Section 1 @ M.P. 152.1 - 152.2 W.B. Utilize 4'x6' crack and seat pattern
Test Section 2 @ M.P. 152.2 - 152.3 W.B. Utilize 2'x2' crack and seat pattern
Control Section: Remainder of Project @ M.P. 152.3 - 158.6 W.B., M.P. 152.1 - 158.6EB Utilize 3'x3' crack and seat pattern.

Task 2

Document the construction procedures, equipment and problems.

Task 3

Perform visual condition and performance surveys at 6 months after construction, and 1 year intervals thereafter for a period of 5 years.

Task 4

Prepare a final report describing the findings of the experimental section.

cj

APPENDIX E

ARIZONA DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I 40-3-459 PROJECT LOCATION WELCH O.P.-WILLIAMS SAMPLED BY RON MUENKS

PROJECT TERMINI M.P. 152.5 TO M.P. 158.2 I40 EB DESIGNER _____ CONSTRUCTION TYPE OVERLAY

SAMPLE NUMBER	DISTANCE	R OR L	ROWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRE OTHER THAN GRADATION & PI
#1	12'	R	E.B.	M.P. 152.5	0	8"	70			9	19	CONCRETE N.S.	
					8"	12"		15				CRUSHED LIMESTONE (TAN) N.S.	
					12"	18"		02				CINDERS (RED) N.S.	
					18"	25"		25				CLAYEY SAND & GRV. (GRAY) N.S.	
					25"	39"		02	35			CINDERS CLINKERS, CLAY (RED)	("R-VALUE" 3 SMALL BAGS
					25"	39"		02	35			CINDERS CLINKERS, CLAY (GRAY)	(DENSITY)
					39"	39"		01				BASALT (TIGHT)	
#2	12'	R	E.B.	M.P. 153.5	0	8"	70			9	19	CONCRETE N.S.	
					8"	14"		15				CRUSHED LIMESTONE (TAN) N.S.	
					14"	20"		25				CLAYEY SAND & GRV. (GRAY) N.S.	
					20"	30"		02	35			CINDERS, CLINKERS, CLAY SOME LIMESTONE (RED)	(R-VALUE 3 SMALL BAGS
					20"	30"		02	35			CINDERS, CLINKERS, CLAY SOME LIMESTONE (RED)	(DENSITY)
					30"	30"		15				LIMESTONE (TIGHT)	

ARIZONA DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I 40-3-459 PROJECT LOCATION WELCH O.P.-WILLIAMS SAMPLED BY RON MUENKS

PROJECT TERMINI M.P. 152.5 TO M.P. 158.7 I 40 E.B. DESIGNER _____ CONSTRUCTION TYPE OVERLAY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
#3	12'	R	E.B.	M.P. 155.9	0	8"	70			9	20	CONCRETE N.S.	
					8"	12"		15				CRUSHED LIMESTONE (TAN) N.S.	
					12"	16"		02				OILCAKE & CINDERS (RED) N.S.	
					16"	23"		25				CLAYEY SAND & GRV. (GRAY) N.S.	
					23"	28"		02	35			CINDERS & CLAY (RED) N.S.	
					28"	40"		35	02			CLAY & CINDERS BASALT GRV. (BROWN)	"R-VALUE" (3 SMALL BAGS)
					28"	40"		35	02			CLAY & CINDERS BASALT GRV. (BROWN)	(DENSITY)
					40"	40"		35	02			CLAY & CINDERS BASALT GRV. & COBBLES (BROWN)	
#4	12'	R	E.B.	M.P. 158.2	0	8"	70			9	24	CONCRETE N.S.	
					8"	13"		15				CRUSHED LIMESTONE (TAN) N.S.	
					13"	16"		02				CINDERS (RED) N.S.	
					16"	22"		25				CLAYEY SAND & GRV. (GRAY) N.S.	
					22"	34"		35	02			CLAY CINDERS SOME CLINKERS (RED)	"R-VALUE" (3 SMALL BAGS)
					22"	34"		35	02			CLAY CINDERS SOME CLINKERS (RED)	(DENSITY)
					34"	34"		01	35			BASALT CLAY SEAMS (LIGHT GRAY)	

DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

(110)

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 EB SAMPLED BY RADNICK

PROJECT TERMINI M.P. 152-159 DESIGNER MERCER MARQUEKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
1	9'	R	E.B	152+00	0	7.8	72	43	AC	4	9	BLEEDING + RUTTING 0% CRACKS	
〃	〃	〃	〃	〃	7.8	11.0	75	25	SM			CLAY S+G	
〃	〃	〃	〃	〃	11.0	25.0	〃	02	SM			CINDERS	
〃	30'	〃	〃	〃	0	24.0	21	34	SG			SILTY CLAY B.S.	"R" VALUE
2	9'	R		152+5	0	80	72	51	PC			50% ALC	
〃	〃	〃		〃	8.0	12.3	〃	48	SM			C.T.B.	MOISTER TEST
3	9'	R		152+8	0	7.8	72	51	PC			50% ALC	
4	9'	R		153+02	0	8.0	72	51	PC			50% ALC	
5	6'	R		153+5	0	7.8	72	51	PC			50% ALC	
〃	〃	〃		〃	7.8	11.3	〃	48	SM			C.T.B.	MOISTER TEST
6	8'	R		153+99	0	8.0	72	51	PC			30% ALC	
〃	30'	〃		〃	0	24.0	21	35	SM			CLAY + BASALT B.S.	R VALUE

DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 E.B SAMPLED BY RUDNICK

PROJECT TERMINI M.P. 152-159 DESIGNER MERCER MARCUFKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
7	9'	R	E.B.	154.5	0	8.0	72	51	PC	4	9	30% ALC	
					8.0	12.5	75	48	SM			C.T.B.	MOISTER TEST
					12.5	16.0	5	32	SG			SILTY CLAY GRAVELY	" "
8	9'	R		155.0	0	8.0	72	51	PC		10	30% ALC	
9	9'	R		155.45	0	8.0	72	51	PC			SINKING 50% ALC	
					8.0	12.0	71	48	SM			C.T.B	MOISTER TEST
10	9'	R		155.9	0	8.3	72	51	PC			5% CRACKS	
					8.3	12.2	5	45	SM			C.T.B.	
					12.2	14.3		49	SM			OIL TREATED CINDERS	
					14.3	20.0	75	32	SM			CLAY GRAVELY	MOISTER TEST
11	30'	R		156.1	0	24	21	35	SC			CLAY & CINDERS B.S.	"R" VALUE & MOISTER TEST

ARIZONA DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 E.B. SAMPLED BY RUDNICK

PROJECT TERMINI 111.2, 153-159 DESIGNER MERCER MARQUEKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
12	6'	R	EB.	156.5	0	8.0	72	PC	51	4	10	5% CRACKS	
					8.0	11.8		SM	48			C.T.B.	
					11.8	14.3		SM	49			0.2 TREATED CINDERS	
					14.3	23.0	75	SM	32			CLAY & GRAVEL	
					23.0	26.0		SM	02			CINDERS B.S.	
13	9'	R		158.2	0	8.5	72	PC	51			0% CRACKS	
					8.5	12.5		SM	48			C.T.B.	
					12.5	22.0	75	SM	32			CLAY, GRAVEL & CINDERS	MOISTER TEST
	35'				0	24.0	21	SG	35			CLAY & BASALT B.S.	"R" VALUE MOISTER TEST
14	6'	L		153.5	0	8.0	72	PC	51		11	25% CRACKS	
15	7'	L		155.9	0	8.8	72	PC	51			0% CRACKS	
16	9'	R		159.98	0	9.3	72	PC	51			0% CRACKS	

...DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 W.B. SAMPLED BY RUDNICK

PROJECT TERMINI M.P. 152-159 DESIGNER MERCER MARQUEKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
28	9'	R	W.B.	153.0	0	8.0	72	PC	51	4	17	2% CRACKS	
					8.0	13.5		SM	48			C.T.B.	
					13.5	17.5		SM	02			OIL TREATED CINDERS	
					17.5	22.5	75	SM	25			SILTY CLAY S+G	
					22.5	29.5		SM	02			CINDERS	
	36'				0	24.0	21	SG	35			CLAY B.S.	MOISTER TEST R VALUE
29	8'	L		152.1	0	8.5	72	PC	51			2% CRACKS	
					8.5	13.5		SM	48			C.T.B.	
					13.5	17.3		SM	02			OIL TREATED CINDERS	
					17.3	25.0	75	SM	02			CINDERS	
					25.0	27.0		SM	25			CLAY S+G N.S.	
	30'				0	24.0	21	SG	35			CLAY & BASALT B.S.	

DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 W. B. SAMPLED BY RUDNICK

PROJECT TERMINI M.P. 153 – 159 DESIGNER MERCER MARQUFKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
25	9'	L	W.B.	155.0	0	9.3	72	PC	51	4	17	5% CRACKS	
					9.3	12.5	5	SM	48			C.T.B.	
					12.5	29.0	75	SM	02			CINDERS	MOISTER TEST
	30'				0	24.0	21	SG	35			CLAY B.S.	MOISTER TEST R VALUE
26	9'	L		154.0	0	8.0	72	PC	51			5% CRACKS	
					8.0	12.9		SM	48			C.T.B.	
					12.9	16.5		SM	02			OIL TREATED CINDERS	
					16.5	22.0	75	SM	24			SILTY SAG	
	30'				0	24.0	21	SG	34			SILTY CLAY B.S.	
27	7'	R		153.0	0	8.3	72	PC	51			0% CRACKS	

ARIZONA DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 W.B. SAMPLED BY RUDNECK

PROJECT TERMINI M.P. 152-159 DESIGNER MERCER MARQUFIKANT CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
21	8'	R	W.B.	158.4	0	8.0	72	PC	51	4	16	0% CRACKS	
22	9'	L		156.5	0	8.1	72	PC	51			CORED ON JOINT 30% ALC	
					8.1	15.3		SM	48			C.T.B	
					15.3	18.3	75	SM	02			OIL TREATED CINDERS B.S.	
	30'				0	24	21	SC	02			SILTY CLAY + CINDERS B.S.	"R" VALUE MOISER TEST
23	9'	L		155.8	0	8.3	72	PC	51			30% ALC	
					8.3	15.0		SM	48			C.T.B	
					15.0	18.3	75		02			OIL TREATED CINDERS	
					18.3	31.0			02			CINDERS B.S.	
	30'				0	20.0	21	SC	35			CLAY SOME CINDERS & BASALT B.S. MOISTER TEST	
24	7'	R		156.5	0	7.8	72	PC	51			0% CRACKS	

...DEPARTMENT OF TRANSPORTATION – MATERIALS SECTION

PRELIMINARY ENGINEERING SUBGRADE LOG

(USE CAPITAL LETTERS ONLY)

PROJECT NUMBER I-40-3-459 PROJECT LOCATION I-40 W.B. SAMPLED BY RUDNICK

PROJECT TERMINI M.P. 152-159 DESIGNER MERCER MARQUFANI CONSTRUCTION TYPE MAT SURVEY

SAMPLE NUMBER	DISTANCE	R OR L	RDWY.	MILEPOST OR STATION	DEPTH FROM	DEPTH TO	INVEST. MODE	MATL. DESC. #1	MATL. DESC. #2	DATE YEAR 85 MO.	DATE DAY	MATERIAL DESCRIPTION	TESTS REQUIRED OTHER THAN GRADATION & PI
17	6'	L	W.B.	160.0	0	9.0	72	PC	51	4	15	0% CRACKS	
18	9'	L		159.0	0	9.3	72	PC	51			0% CRACKS	
					9.3	13.0		SM	48			C.T.B.	
					13.0	18.5	75	SM	26			SAND	
					18.5	19.5		SG	33			CLAY & BASALT	%MOISTER TEST
	30'				0	24.0	21		35			" " " E.S.	"R" VALUE
19	7'	L		158.4	0	8.3	72	PC	51		16	SINKING 30% ALC	
					8.3	11.4		SM	48			C.T.B.	
					11.4	14.2	75		02			OIL TREATED CINDERS	MOISTER TEST
					14.2	25.5			02			CINDERS	
	24'	L			0	20.0	21	SG	35			CLAY & BASALT	
20	9'	L		157.4	0.5	8.5	72	PC	51			LARGE PATCH AREA 1/2" AC CRACKING & SINKING	
					8.5	15.3		SM	48			C.T.B.	
					15.3	20.5	75	SM	24			SILTY S & G	
					20.5	29.5		SG	35			CLAY CINDES & BASALT B.S.	

IRE

ARI IA DEPARTMENT OF TRANSPORTATIC

OFFICE MEMO

August 13, 1986

To: Robert R. Wachter
Chief Project Supervisor

From: E.F. Gentsch
District IV Engineer

Re: Project IR-40-3(59)
Ashfork - Flagstaff Highway
Change Order #1

Approval has been granted to use Asphaltic Concrete (Misc Structural) in place of Asphaltic Concrete (1/2" mix) when overlaying the collector trench.

The contractor has requested this change because of lack of availability of Asphaltic Concrete (1/2" mix) during collector trench construction.

Overall cost of Asphaltic Concrete is reduced by $2,283.00. Asphaltic Concrete (Misc. Structural) quantity is substituted for Asphaltic Concrete (1/2" mix) quantities. The contract time will not change.

Ervin L. Boren, Area Engineer, concurred on July 29, 1986.
Doug Forstie, Materials, concurred on July 28, 1986.
William Vachon, F.H.W.A., concurred on July 28, 1986.

Please see that prompt attention is given to processing a change order for the above mentioned change.

Richard A. Genteman

MER/EFG/sh
cc: R.A. Genteman, Deputy District Engineer
E. Boren, Area Engineer
✓FHWA, 005R
Field Reports, 133A
Operations Group, 174A
Chief Deputy State Engineer, 103A
Materials
State Construction Engineer - 172A
Asst. State Engineer - 215P
District File
File

8-9590 2/75
FORMERLY 8-9541

RIZONA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

FAE

SUPPLEMENTAL AGREEMENT

☒ Change Order
☐ Force Account Work Request

FA Project No. IR-40-3(59) Fund Code 82514 No. 6

Name of Project Ash Fork - Flagstaff Highway Contractor NPI/ENF Construction Co.

DESCRIPTION AND REASON

EQUEST: (1)To delete subsection 406-10.08(E) Construction Requirements; Compacting and Smoothing; Courses Greater Than One and One-half Inches in Nominal Thickness; of the 1985 Supplemental Specifications for the first two inch lift of Asphaltic Concrete.
(2)To add the end product Asphaltic Concrete Specifications for compaction, modified as attached, for the first two inch lift of Asphaltic Concrete.
(3)To accept the first two inch lift of Asphaltic Concrete between Westbound Station 375(approx) and 557(approx) as is, with no adjustment in contract price. This will include AC Density lots 17, 18, 19, 21, 22, 24, 25, 27 and 28. These AC Density lots will be excluded from the Pay Factor Tabulation.
(4)To accept the AC Density lots on the second two inch lift which fail to meet specifications by Nuclear Test Methods, in accordance with Subsections 406-10.08(E) of the 1985 Supplemental Specifications, but are acceptable on cores.
(5)To accept AC Density lots 51, 53, 63 and 64 (second two inch lift) and apply an appropriate adjustment in the contract price in accordance with the schedule provided within the End Product Asphaltic Concrete Specifications for Compaction. The percent compliance shall be utilized as the "PT" and the "Pay Factor" extracted from the table. Once determined, the negative pay factor is final and can not be offset by subsequent passing lots which would produce a positive pay factor.
(6)To accept AC Density lots 43 and 62, second two inch lift of AC, at an adjustment in the contract unit price of -$3.00 per ton.

Extension of Contract Time ☐ will ☐ will not be considered as a result of this Supplemental Agreement.

SUPPLEMENTAL AGREEMENT

☒ Change Order
☐ Force Account Work Request

FA Project No. IR-40-3(59) Fund Code 82514 No. 6

Name of Project Ash Fork - Flagstaff Highway Contractor NPI/FNF Construction Co.

DESCRIPTION AND REASON

(7) To reduce Item number 4060004, Asphaltic Concrete (1/2" mix), by 33,971.35 tons at the Contract Unit Price of $15.00 per ton.
(8) To establish Item number 4060004A, Asphaltic Concrete (1/2" mix) (Adjusted Cost), at a Unit Price of $14.29392 per ton. The total quantity is 33,971.35 tons.

REASON: (1) (2) Because of AC Density lot failures which precluded the continuation of Asphaltic Concrete production under Subsection 406-10.08(E)(4) of the 1985 Supplemental Specifications, the Contractor requested this change to provide a mechanism by which AC paving could be maintained. This change is in conformance with Subsection 105.03, Conformity with Plans and Specifications.
(3) Prior to any work by the Contractor in this area the PCCP slabs showed substantially greater deterioration than the other areas of the project. The Contractor expended extensive compactive effort in full cooperation with the Department, in attempting to meet the density specifications however, the condition of the existing roadway promoted an environment in which obtaining the specified density requirements led to other undesirable characteristics in the finished product. The literature available on crack and seat procedures would suggest an approach different from that used in the crack and seat process in areas such as this.
(4) The core method of determining density is recognized as being more precise than the nuclear gauge method.

Extension of Contract Time ☐ will ☐ will not be considered as a result of this Supplemental Agreement.

SUPPLEMENTAL AGREEMENT

☒ Change Order
☐ Force Account Work Request

FA Project No. IR-40-3(59) Fund Code 82514 No. 6

Name of Project Ash Fork - Flagstaff Highway Contractor NPI/FNF Construction Co.

DESCRIPTION AND REASON

(5) The End Product Asphaltic Concrete Specifications for Compaction provides a recognized schedule of Contract Unit Price adjustment for Density lot compliance attained.
(6) As allowed under the End Product Asphaltic Concrete Specifications for Compaction, the Engineer believes that the material is of sufficient quality that it may be accepted at the maximum negative pay factor adjustment of $3.00.
(7) (8) To provide a mechanism by which payment can be made with an appropriate pay factor adjustment applied.

COST ANALYSIS: First Two Inch Lift; AC Lots Subject to Cost Adjustment

Lot#	PT	PF	Tons	Dollars (+/-)	Accumulated
	82	0.00	1,568.71	0.00	0.00
2	89	+0.25	1,219.72	+304.93	0.00
3	50	-1.50	458.05	-687.08	-687.08
4	70	-0.50	1,476.37	-738.18	-1,425.26
5	100	+1.00	593.18	+593.18	-832.08
6	100	+1.00	1,428.73	+1,428.73	0.00
	100	+1.00	1,262.24	+1,262.24	0.00
	100	+1.00	836.02	+836.02	0.00
	62	-1.00	1,164.27	-1,164.27	-1,164.27
10	70	-0.50	1,221.47	-610.74	-1,775.01
11	81	0.00	794.14	0.00	-1,775.01
12	99	+1.00	885.83	+885.83	-889.18
13	67	-0.75	983.15	-737.36	-1,626.54
14	98	+0.75	887.03	+665.27	-961.27
15	98	+0.75	936.97	+702.73	-258.54
16	84	0.00	793.59	0.00	-258.54
17	57	-1.25	706.59	-883.24	-1,141.78

Extension of Contract Time ☐ will ☐ will not be considered as a result of this Supplemental Agreement.

EH5

AR INA DEPARTMENT OF TRANSPORTATI

OFFICE MEMO

November 5, 1986

To: Myron Robison
Project Supervisor
Org 4443

From: R.A. Genteman
District IV Engineer

Subject: Project IR-40-3(59), Ashfork - Flagstaff Highway
Force Account Number 2

Authorization is given to remove the randomly located bumps in the first lift of Asphaltic Concrete caused by the underlying PCCP joint filler material. The removal is to be accomplished through the use of a small milling machine and other incidental equipment and labor.

The estimated cost of equipment and labor is $15,000.00.

The contract time will not change.

Ervin L. Boren, Area Engineer, concurred on October 14, 1986.
Tom Schmitt, DDE, concurred on October 14, 1986.
Doug Forstie, Materials, concurred on October 16, 1986.
Bill Vachon, FHWA, concurred on October 16, 1986.

Please see that prompt attention is given to processing a Force Account Work Request for the above mentioned work.

R. A. Genteman

RAG/MR/sh
cc: Tom Schmitt, DDE
E. Boren, Area Engineer
FHWA - 005R
Field Reports - 133A
Operations Group - 174A
Chief Deputy State Engineer - 103A
Materials - 127A
State Construction Engineer - 172A
Asst. State Engineer - 215P
District file
project file