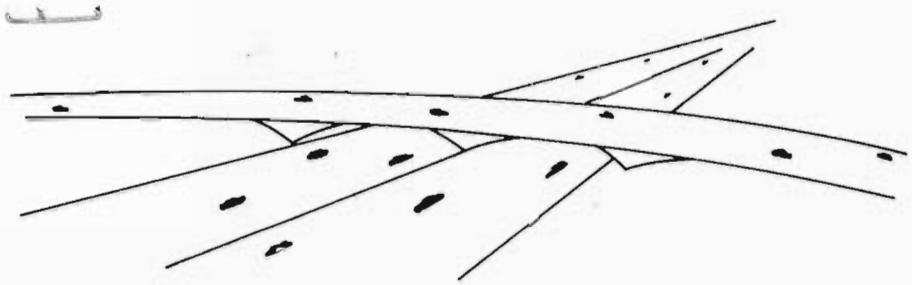

DEPARTMENTAL RESEARCH

Report Number SS 9.0

PERFORMANCE OF METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

TEXAS HIGHWAY DEPARTMENT

PERFORMANCE OF

METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

by

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Associate Designing Engineer

Special Study 9.0

Conducted by
Texas Highway Department
Highway Design Division

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ABSTRACT

This report was initiated after reviewing the Bureau of Public Roads' Informational Memorandum CMPS-1 dated March 1, 1968, to determine where Texas had placed wire reinforced bituminous overlays and how they were performing. At that time, several projects using wire reinforced asphaltic concrete overlays were planned for construction and up until that time it was believed that wire reinforced overlays were performing as desired.

The objective of this study was to determine if wire reinforcements in bituminous overlays were assisting in controlling reflective cracks.

ACKNOWLEDGMENT

The author wishes to express his sincere appreciation to Mr. Wiley E. Carmichael, District Engineer, Mr. Frank Hebner, Jr., District Construction Engineer and Mr. Edward B. Williams, Engineering Technician V of District 12; Mr. Franklin Young, District Engineer, Mr. Emanuel D. Parmer, Assistant District Engineer and Mr. Cecil E. Norris, Senior Designing Engineer of District 20; and Mr. R. W. Crook, District Engineer and Mr. Robert L. Towles, Senior Construction Engineer, of District 2; all for their recommendations based on experience in placing wire reinforced asphaltic concrete overlays and their help in gathering data for this project. Special thanks is given to Mr. R. S. Williamson, Engineer of Field Operations, Highway Design Division, for the technical suggestions made during this investigation.

PERFORMANCE OF
METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

I. BACKGROUND

The first wire mesh reinforced asphaltic concrete constructed in Texas was on U.S. Highway 69 just north of Port Arthur in Jefferson County in 1945. It was placed on a badly broken 9"-6"-9", 20 ft. width concrete pavement as an experiment to reduce reflective cracking at joints. On this first section, 200 ft. in length, a two-course overlay of cutback asphaltic concrete was placed, the first overlay being 1 in. thick, followed by a second overlay of 1½ in. The reinforcement, consisting of 6 inch, No. 10 gage wire mesh, was placed between the courses. This 200 ft. section on US 69 was inspected during the first nine years after it was placed. It was observed that during this period, cracks in the reinforced overlay developed at a slower rate with somewhat less opening than the unreinforced section on each side. Since then, approximately forty projects have been constructed in Texas. There have been two reinforced overlays of flexible pavements on Interstate Highway 45 north of Houston (in 1961 and 1963) and one on US Highway 69 east of Port Arthur near the Neches River (1958). All three of these sections have performed exceptionally well. As a general rule, these projects were placed over a subgrade which had highly plastic clay and over existing concrete pavement that was in an advanced stage of deterioration which required reconstruction and strengthening. In fact, on most of the sections of highway chosen for wire reinforced overlays, mud-jacking or undersealing had been required before the overlay. Major repairs of joints had been performed on some sections as often as twice a year.

Therefore, the conditions of these sections prior to overlaying presented some of the worst possible conditions of pavement structure on which wire reinforced asphaltic concrete overlays could have been placed.

Asphaltic concrete overlays with wire reinforcement were chosen for the following reasons: (1) Materially reducing the cracking both as to number of cracks and width and length, thus preventing ravelling at joints; (2) Reducing the rate of cracking; and (3) Reducing maintenance by sealing and preventing premature overlays.

II. OBSERVATIONS

After examining the pavements in the field, it has been found that wire reinforcement in asphaltic concrete overlays did reduce the rate of cracking but, after a few years, the concrete joints usually reflected through the overlays. However, the wire mesh did control the size of these cracks and prevented pavement failures at the joints. These cracks over transverse concrete joints, where they had not been sealed, could not be detected by visual inspection from a car at 30 miles per hour. As a general rule, these transverse cracks could only be observed in a moving vehicle by driving on the shoulder at a slow speed.

The maintenance expenditures for highways with reinforced asphaltic concrete overlays has generally been less than for unreinforced overlays. The additional cost of maintaining non-reinforced overlays over concrete pavement is that of continual sealing, mud-jacking, removing high ridges that normally developed over expansion joints in concrete pavement and in patching spalled areas to maintain a satisfactory riding surface. When repairing failures at the concrete joints, it is usually necessary to break out the concrete near the joints and refill with asphaltic concrete.

Of the forty projects placed, eleven have required additional asphaltic concrete overlays. Seven of the additional overlays have been placed to correct slick pavements and one to correct settlement of the subgrade. Two projects have required additional overlays to correct the transverse section because of insufficient asphaltic concrete cover over the wire reinforcement. Only one project required a pavement overlay due to failure of the original construction, this being on S.H. 159 in Austin County, north of Bellville.

III. EXPERIENCE

In the following, the Texas Highway Department's experience with wire reinforced overlays is enumerated in the suggested format of Bureau of Public Roads' Informational Memorandum CMPB-1.

1. In observing wire reinforcement in bituminous overlays for more than twenty years, it has been noted that reinforced overlays have controlled reflective cracking much better than non-reinforced sections. The difference appears to be greatest for the early life up to ten years. On U.S. 90 in Liberty County, transverse joint cracks are being controlled by wire placed in 1947.

2. Reinforced overlays have performed exceptionally well over longitudinal joints in controlling and preventing reflective cracking, especially in cases where concrete pavement was widened with flexible pavement or with hot mix asphaltic concrete pavement.

3. In the twenty years of placing reinforced overlays, Texas has placed approximately 250 miles of reinforced ACP overlays with depths varying in placement from 300#/SY to 885#/SY with the wire always sandwiched between layers of asphaltic material.

The most similar to placing the wire reinforcement directly on the concrete pavement was in Jefferson County from Spur 214 southerly which was constructed in 1966-67. In this particular case, a one course surface treatment was placed on the concrete. This has not been down long enough for a service record; but, thus far, it appears to be performing satisfactorily. The exact depth of asphalt concrete required depends on the situation and should be determined by the Design Engineer. As a general rule, it has been found that the existing pavement should be leveled-up where required and a dense graded asphaltic concrete of approximately 75#/SY to 100#/SY should be placed below the wire. A minimum of 400#/SY of asphaltic concrete placed over the wire with the desirable being 450#/SY. Also, it has been found that placement of the material above the wire should be in three courses, approximately a 175#/Sy course to overlay the wire, then a 150#/SY intermediate course and a 125#/Sy surface course.

4. Texas has used a 6"x12" No. 9 gage wire mat, 6"x6" No.10 gage wire mat, 6"x6" No. 10 gage wire rolls and 3"x6" No. 10 gage wire rolls. In the Beaumont District, the best results were obtained with 6" x6" No. 10 gage wire rolls. In the Houston District, the best results were accomplished with 3"x6" No. 10 gage wire rolls.

5. In early experience with sheets of wire mesh, some ravelling of the second course did occur, particularly in spots over loose wire ends where sheets were lapped and in areas where overlays were overlays were thinner than usual. After these ravelling areas were patched and the third course placed, there was very little additional trouble.

6. In observing wire mesh in the many miles that have been placed, only a few locations have had a noticeable amount of corrosion with very few strands having ruptured at any of these locations. We can only speculate that placing the mesh between overlay layers prolongs the life of the mesh since we have not placed mesh directly on concrete pavement prior to overlays. It is noted that most of these wire overlays were placed in the Beaumont and Houston areas near the Gulf Coast with an average of over fifty inches of rain a year.

7. Throughout our experience with wire mesh, its use as reinforcement in overlays has presented certain construction problems; but, thanks to the ingenuity of the contractors and the work of dedicated employees, these problems have been worked out.

   a. Texas has done very little fastening of the wire mesh to the underlying layer of sheet asphalt overlay with large staples because it was soon found that when the asphaltic concrete began heating the wire, the staples came out with the movement of the reinforcement. Sleds have been improvised and attached to the paver to hold the wire mesh down as asphaltic concrete is being placed and to keep the wire mesh from catching in the paver. (See Appendix A for details of one method of placement).

   b. Sheet reinforcement of half pavement widths has presented problems but with proper lap, fastening and the use of improvised aids, this problem has been overcome.

   c. In regard to the use of roll reinforcement, this has presented problems but the conditions have been controlled by the use

of hold down devices, tensioning devices, and improvised tools such as a crimping device to eliminate waviness in the mesh.

8. Based on an average cost for wire reinforcements at $0.35 per SY and asphaltic concrete pavement at $8.00 per ton, wire costs the equivalent of 0.8 inch of asphaltic concrete pavement.

9. Very dense graded asphalt should be used for leveling up small depressions and for filling and sealing over cracks and joints. It provides a good surface for placement of the wire mesh and probably helps to seal off moisture and minimize corrosive action. Based on experience, it is presumed that porous, open graded, or dry mixes should not be placed adjacent to reinforcement in overlays.

IV. DOCUMENTATION

A formal research project by Texas on metal reinforcements in bituminous overlays has not yet been undertaken. This study represents a brief survey only to observe the performance and use of this type of construction.

In Appendix B are pictures, cross sections and traffic data for each of the projects studied. These projects include a number of reinforced overlays in place for more than eight years, with two of these projects having been in place for more than twenty years. The observation for the projects in District 20 were made on June 20, 1968 and June 21, 1968, and in District 12 on June 25 through 28, 1968.

V. CONCLUSIONS

Wire reinforcement placed in asphaltic concrete overlays is controlling the width of reflective cracks which give the following benefits:

1. Decreases required sealing, joint repairing, mud-jacking or undersealing, patching of spalled areas and reduces the need for overlays because of pavement failures at reflective cracks.

2. The size of bumps and ridges are reduced which usually formed across reflective cracks, thus reducing driving hazards since longitudinal cracks along these ridges cause a steering problem. (See reference projects Nos. 2, 3, 4, 5, 13 and 17 for examples of controlling longitudinal cracks).

3. When maintenance is reduced, the hazard of workers and maintenance equipment being on the road is reduced. Additional road user cost that would be created by detouring traffic is eliminated. (See reference project No. 1 which gives an example of additional overlays required on sections without wire).

Based on this study, it is believed that adequate evidence has been given that wire reinforcements should not be considered experimental when placed in bituminous overlays and that this reinforcement will provide effective crack control over a period of time to justify the additional cost.

IV. RECOMMENDATIONS

1. Rigid Pavements:

It is recommended that asphaltic concrete overlays be reinforced with wire mesh when used over concrete pavement which is in poor condition in order to control reflective cracking and obtain an

adequate pavement structure. On existing concrete pavement in good condition, a regular asphaltic concrete overlay may prove adequate, except on high volume highways where maintenance of the pavement joints must be kept at a minimum for safety and convenience to the traveling public.

2. Flexible Pavements.

On a number of flexible pavements, Texas is presently experiencing failures similar to those in rigid pavements. These flexible pavements have formed wide transverse cracks at intervals of 20 to 30 feet which eventually result in pumping similar to rigid pavements, with ultimate map cracking failures near these transverse cracks. On this type of pavement problem, it is recommended that wire reinforced asphaltic concrete overlays be used, especially on high volume roadways. (For examples of projects with reinforced overlays of flexible pavement, see reference projects 5, 28 and 29).

3. Placement.

When wire reinforcements are used, it is recommended that the existing pavements be leveled-up if necessary and a dense graded asphaltic concrete of approximately 75#/SY to 100#/SY be placed beneath the wire with a minimum of 400#/SY of asphaltic concrete placed above the wire in three courses. The reinforcements should be wire rolls, no smaller than No. 10 gage, with either 3"x6" or 6"x6" mesh to be chosen by the Design Engineer to meet the requirements involved.

4. Sealing.

Extreme care should be taken in sealing the cracks appearing in these reinforced sections. Since they are generally hairline in size, any asphalt seal tends to sit on top of the pavement and not penetrate the crack, thus causing a small ridge and a visible black wide line which, to the traveling public or an untrained observer, may tend to bias their opinion of the condition of the roadway. (See reference projects Nos. 9, 10, 14, 22 and 24).

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4. Huff, T. S., "Methods of Widening and Resurfacing Old Concrete Pavements", Texas Highway Department, No. 11, pp 37-42, 1952.

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APPENDIX A

-Placement of Wire Reinforcements in an Asphaltic Concrete Overlay-

PLACEMENT OF WIRE REINFORCEMENTS IN AN ASPHALTIC CONCRETE OVERLAY

The following descriptions and sixteen photographs show one method as used on SH 114, Tarrant County, Reference No. 30, to place wire fabric in an asphaltic concrete.

The wire is unrolled (Photographs 1 and 2) with the rolls of wire spliced together (Photograph 3).

On the first day of this operation, the Contractor tried laying the wire mesh with very little and sometimes no crimping of the longitudinal wires. Considerable buckling of the mesh occurred and the Contractor became convinced that more crimping of the wire was needed in order to absorb the expansion and contracting of the wire caused by the extreme changes in temperature. The Contractor designed a mechanical crimper (Photographs 4, 5 and 6) which proved to be very helpful in accomplishing the crimping operation in a uniformly horizontal plane (Photograph 7) as well as accelerating the placement of the wire fabric. A few isolated slack areas in the fabric still had to be eliminated by hand crimping (Photograph 8).

Tension on the wire fabric was applied by a winch on an A-frame truck pulling on a saw toothed transverse header (Photograph 9) after the mechanical crimping had been completed. Tension was maintained by parking a piece of equipment on the wire fabric (Photograph 10); a steel beam sled was pulled along beneath the laydown machine (Photographs 11, 12 and 13) to flatten the wire fabric as the overlay operation was in progress. Photographs 14, 15 and 16 show the laydown machine placing the asphaltic concrete while holding down the wire.

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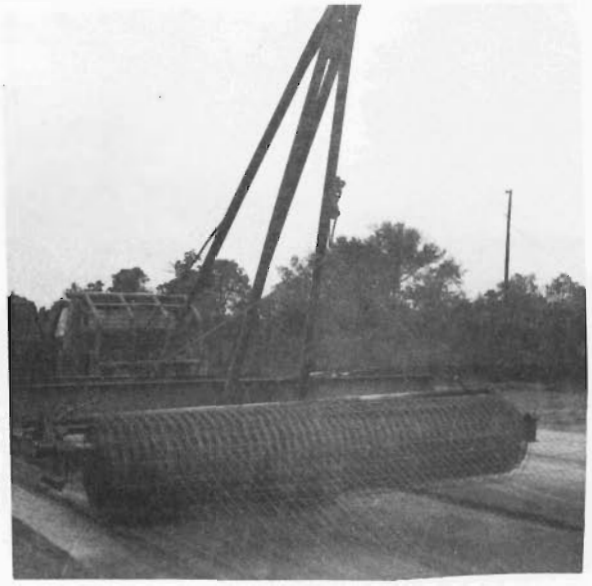

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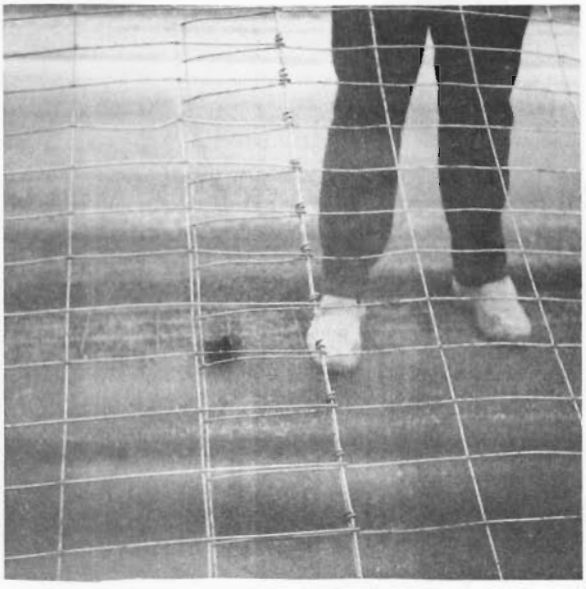

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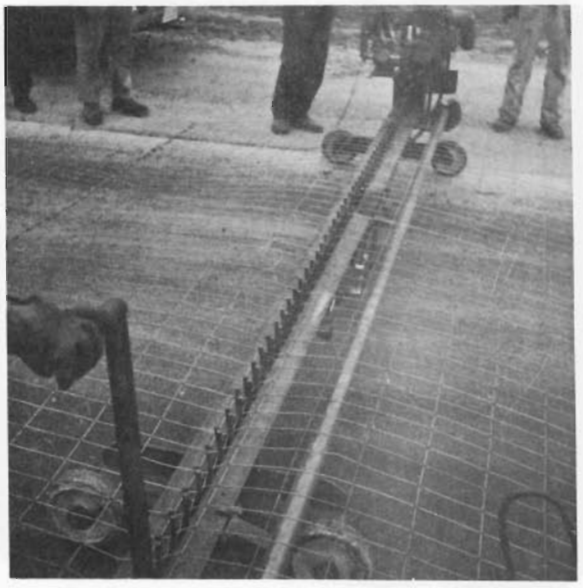

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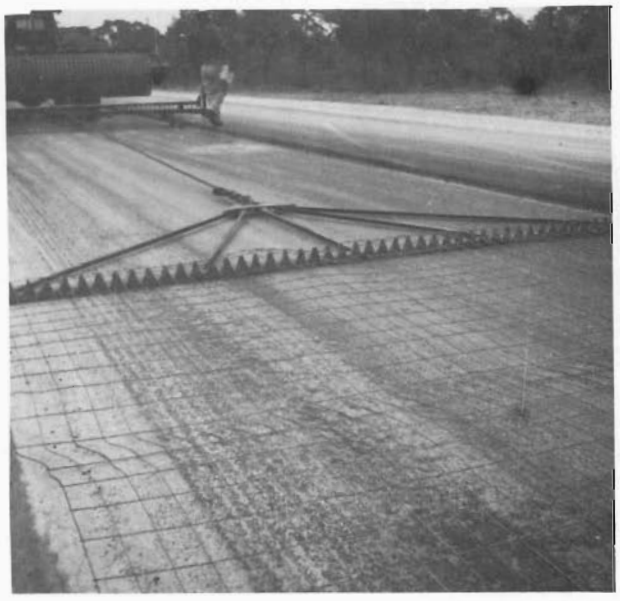

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APPENDIX B

DOCUMENTATION ON METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

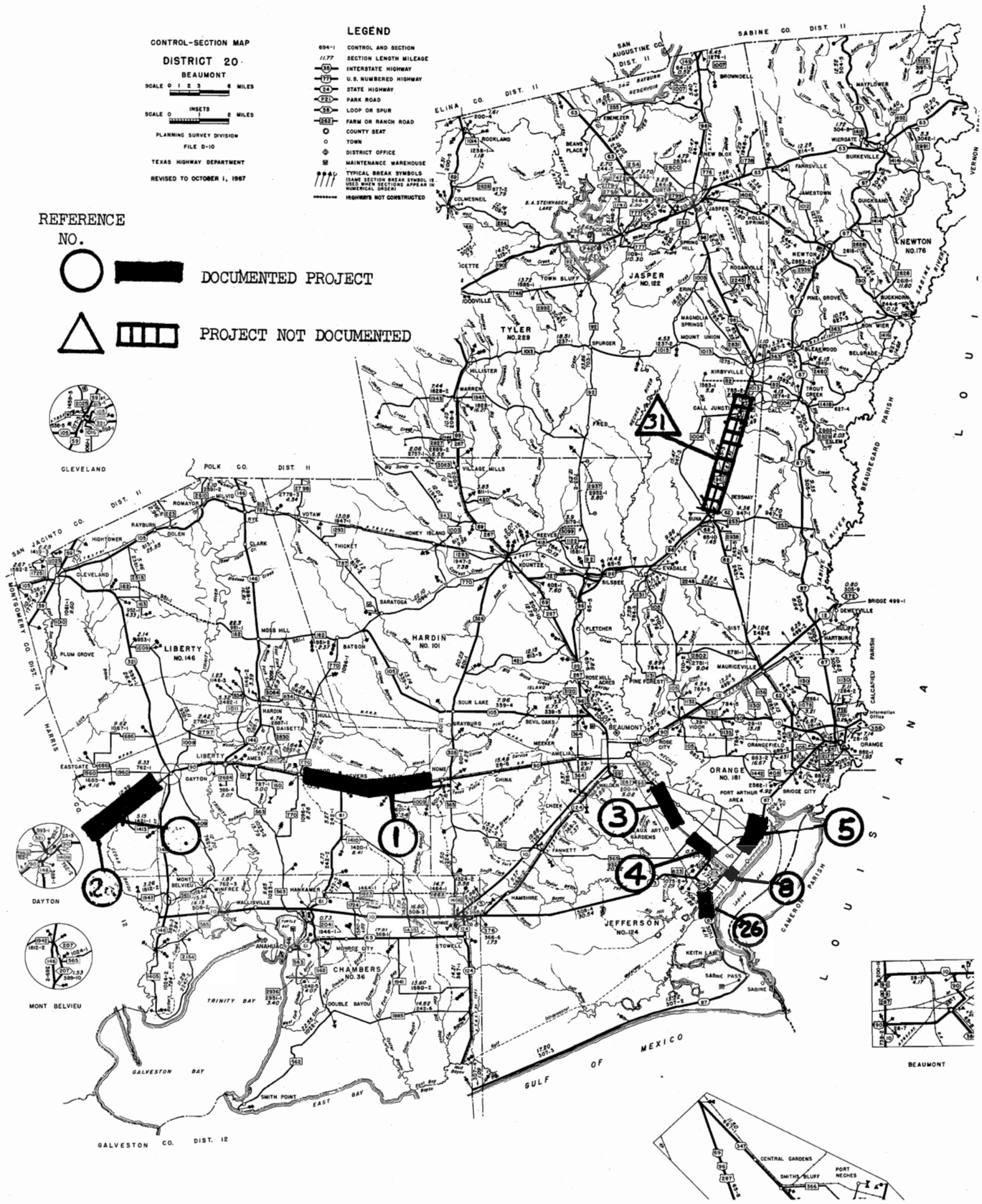
LIST OF METAL REINFORCED OVERLAYS
PROJECTS DOCUMENTED IN REPORT

REFERENCE NO.	COUNTY	PROJECT	HIGHWAY	YEAR COMPLETED
1	Liberty	C 28-5-19	U.S. 90	1947
2	Liberty	M 28-3-19 & 28-4-13	U.S. 90	1947
2a	*Harris	C 27-8-40	U.S. 90	1951
3	Jefferson	C 65-8-43	U.S. 69	1954
4	Jefferson	F 53 (19)	U.S. 69	1957
5	Jefferson	DU 652 (8)	S.H. 87	1958
6	Brazoria	DF 388 (6)	S.H. 35	1959
7	Brazoria	C 111-4-9	S.H. 288	1959
8	Jefferson	C 65-12-4	Loop 114	1960
9	Brazoria	C 178-2-17 & 18	S.H. 35	1960
10	*Harris	C 178-1-14	S.H. 35	1962
11	Fort Bend & Brazoria	C 192-1 & 2-12 & 10	S.H. 6	1961
12	Fort Bend	C 192-1-15	S.H. 6	1963
13	Galveston	F 598 (4)	S.H. 6	1961
14	Brazoria	C 188-5 & 6 13 & 25	S.H. 36	1962
15	Harris	C 27-9-37	U.S. 90A	1962
16	*Fort Bend	C 27-8-40	U.S. 90A	1957
17	Fort Bend & Brazoria	S 778 (5)	S.H. 36	1962
18	*Fort Bend	Near S 778(5)	S.H. 36	1959
19	Matagorda	C 241-2-14	S.H. 60	1963
20	Fort Bend	C 543-3-11	F.M. 762	1963
21	Brazoria	C 111-9-9	S.H. 288	1964
22	Galveston	C 628-1-6	S.H. 341	1965
23	Harris	I 45-1(64)031	I.H. 45	1965
24	Brazoria	C 192-3-8	S.H. 6	1966
25	Galveston	F 598 (5)	S.H. 6	1965
26	Jefferson	SU 654 (4) & S 654 (5)	S.H. 87	1967
27	Matagorda	S 428 (5)	S.H. 60	1967
28	Harris	I 45-1(39)061	I.H. 45	1961
29	Harris & Montgomery	I 45-1(119)67	I.H. 45	1963
30	Tarrant	F 1116 (9)	S.H. 114	1967

* Project without wire which are shown for comparison.

LIST OF METAL REINFORCED OVERLAYS
PROJECTS NOT DOCUMENTED IN REPORT

REFERENCE NO.	COUNTY	PROJECT	HIGHWAY	YEAR COMPLETED
31	Jasper	F 30 (11)	U.S. 96	1966
32	Brazoria	C 179-2-39	S.H. 35	1960
33	Austin	S 304 (3)	S.H. 159	1961
34	Austin	C 187-4-7	S.H. 36	1962
35	Matagorda	F 534 (8)	S.H. 35	1966
36	Austin	C 187-4-8	S.H. 36	1967
37	Austin & Waller	I 10-7(28)736	I.H. 10	1967
38	Harris	I 10-7(116)760	I.H. 10	1967
39	Matagorda	S 428 (3)	S.H. 60	Under Construction
40	Harris & Galveston	I 45-1(42)024	I.H. 45	Under Construction
41	Johnson	I 35-W-5(47) 390	I.H. 35W	1966
42	Wise	F 1116 (7)	S.H. 114	1967
43	Hill	I 35-4(9)360	I.H. 35	1959
44	Hudspeth	I 10-1(54)079	I.H. 10	1963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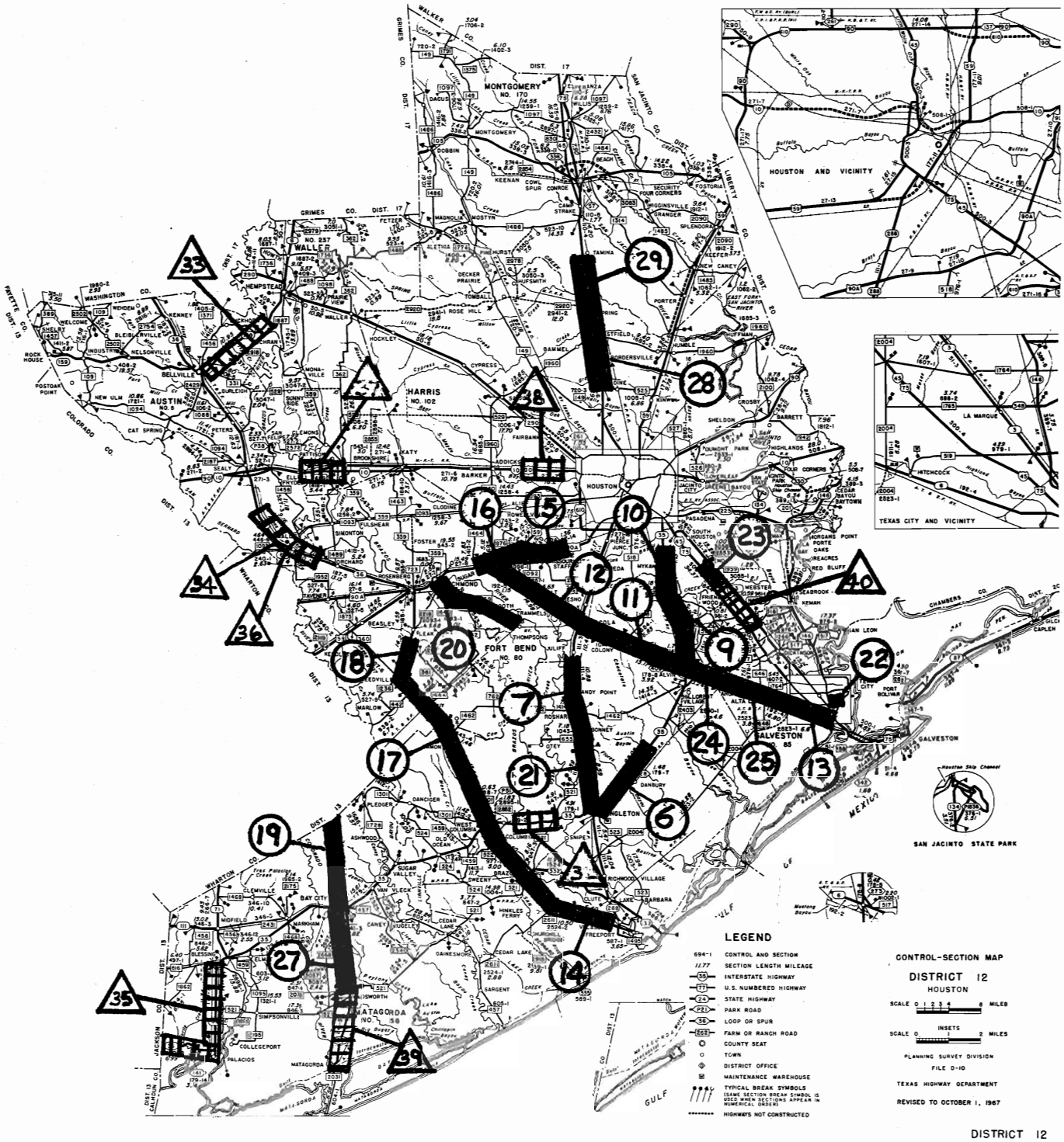
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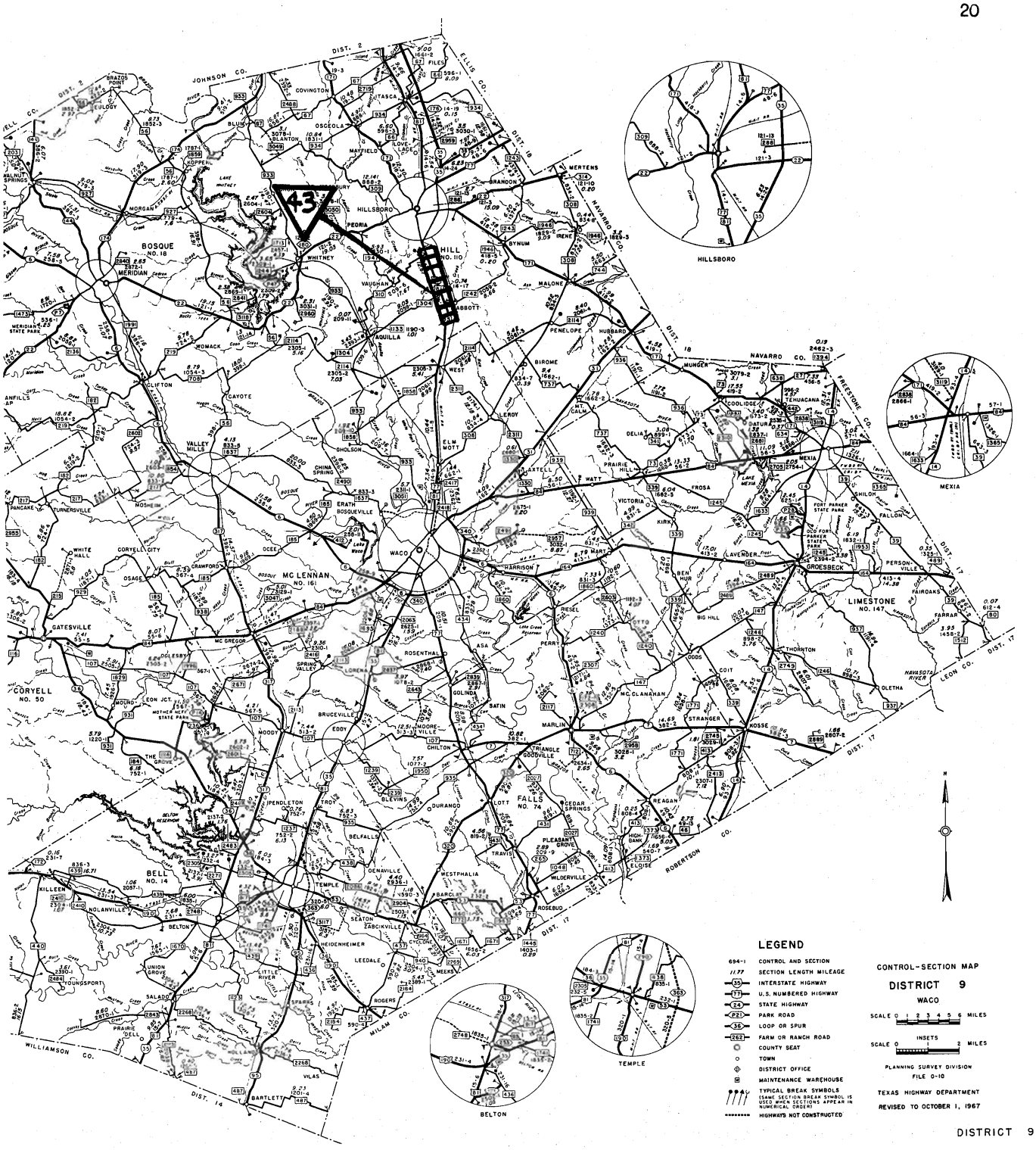
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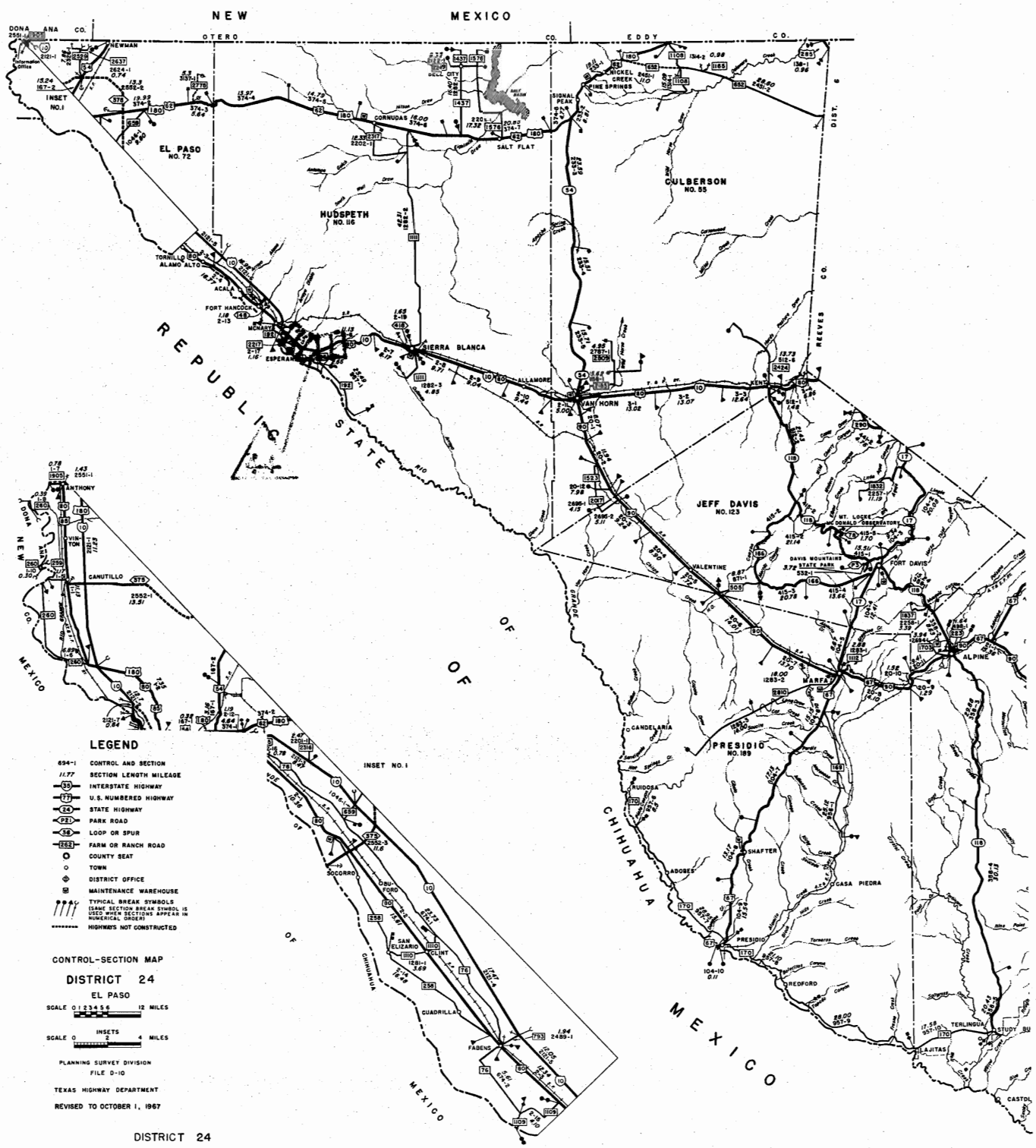
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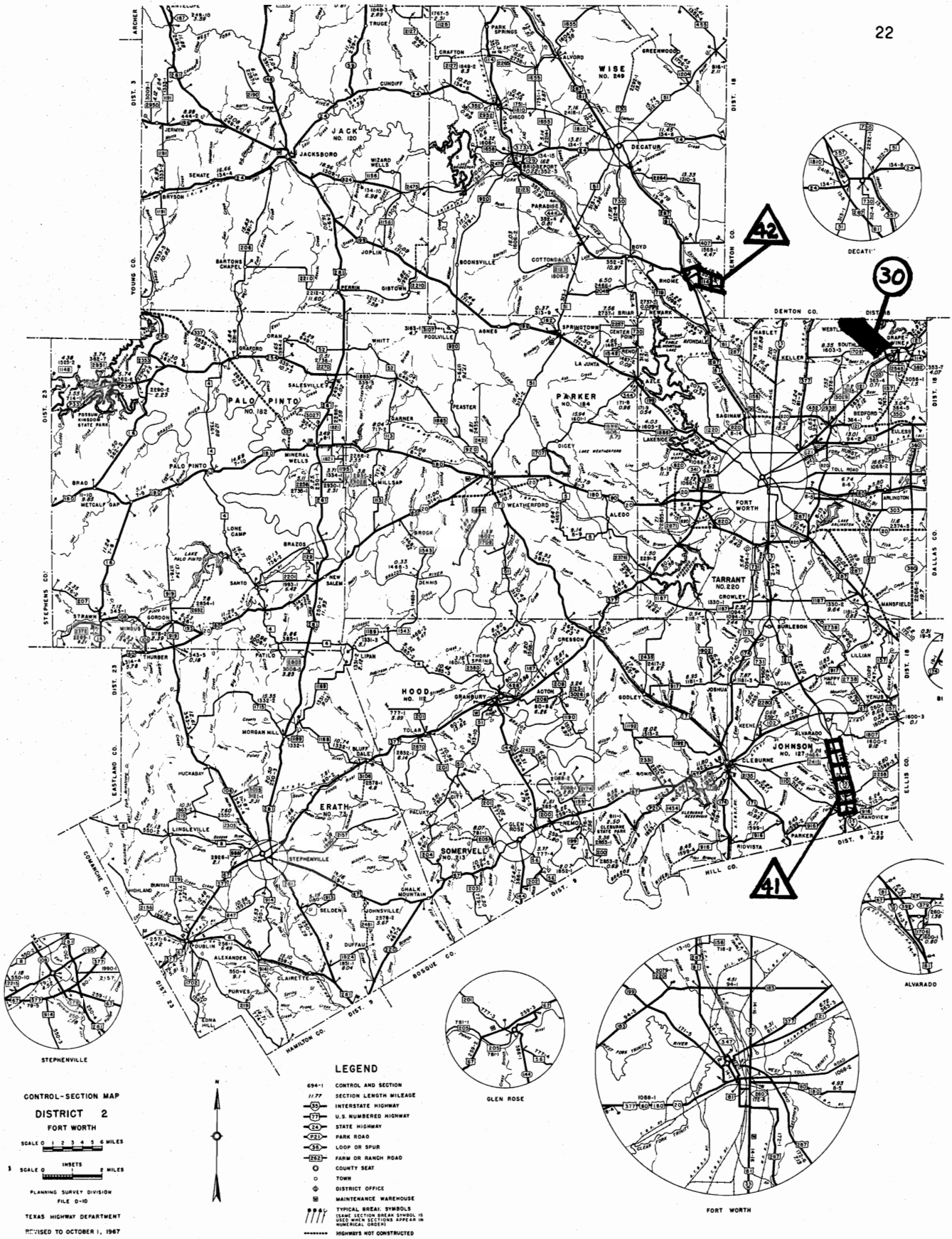

CONTROL-SECTION MAP

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PLANNING SURVEY DIVISION

FILE 0-10

TEXAS HIGHWAY DEPARTMENT

REVISED TO OCTOBER 1, 1967

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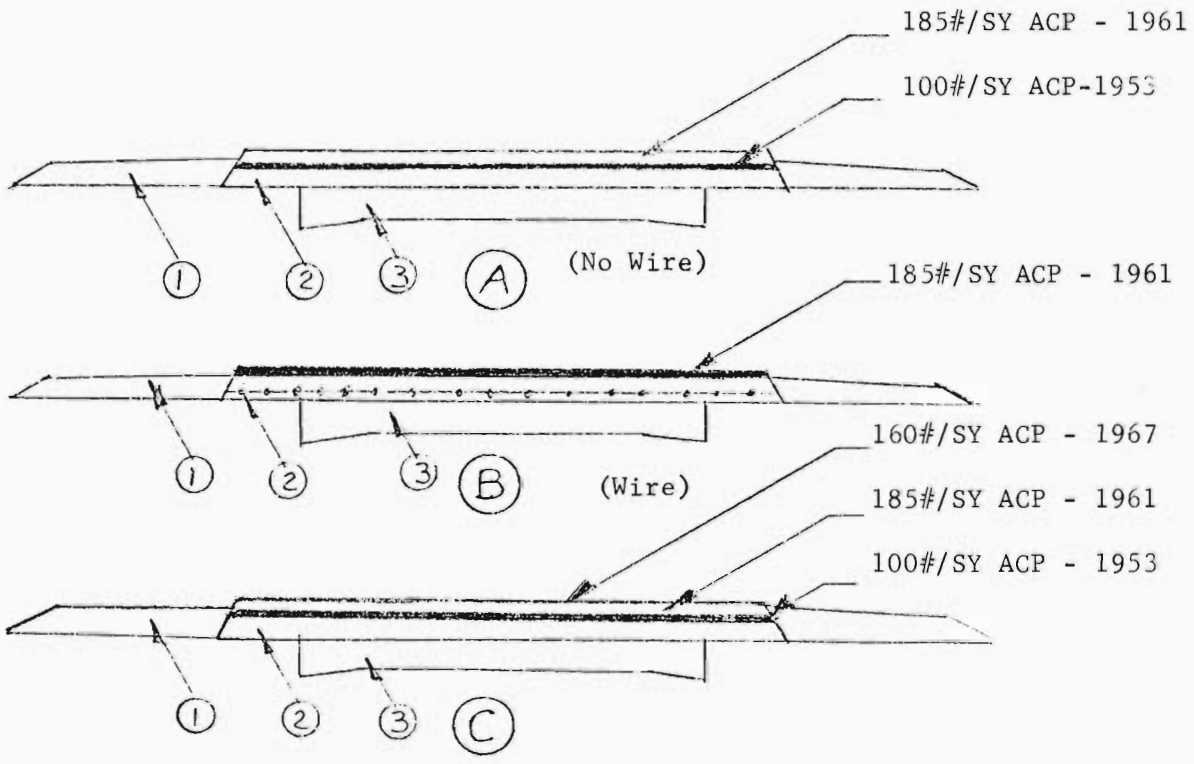
- TOWN
- DISTRICT OFFICE
- MAINTENANCE WAREHOUSE
- TYPICAL BREAK SYMBOLS (SAME SECTION BREAK SYMBOL IS USED WHEN SECTIONS APPEAR IN NUMERICAL ORDER)
- HIGHWAYS NOT CONSTRUCTED

Reference No. 1
Liberty County
U.S. 90: From Jefferson County Line
To 1.0 Mile East of Raywood
Project C 28-5-19
Construction of Original Overlay in 1947

1947 ADT = 3460
1959 ADT = 5980
1962 ADT = 4380
1968 ADT = 3100
1947-68 Equivalent 18 Kip Single axle loads - 4,144,312



(NO WIRE)
TYPICAL SECTIONS A, B, AND C

LIMITS

(A) Jefferson County Line to 1.8 Miles West

(B) 1.8 Miles West of Jefferson County Line, West 1.5 Miles

(C) 3.3 Miles West of Jefferson County Line, West 2.6 Miles

MATERIALS

(1) Flexible Base

(2) 486#/SY ACP - Constructed 1947

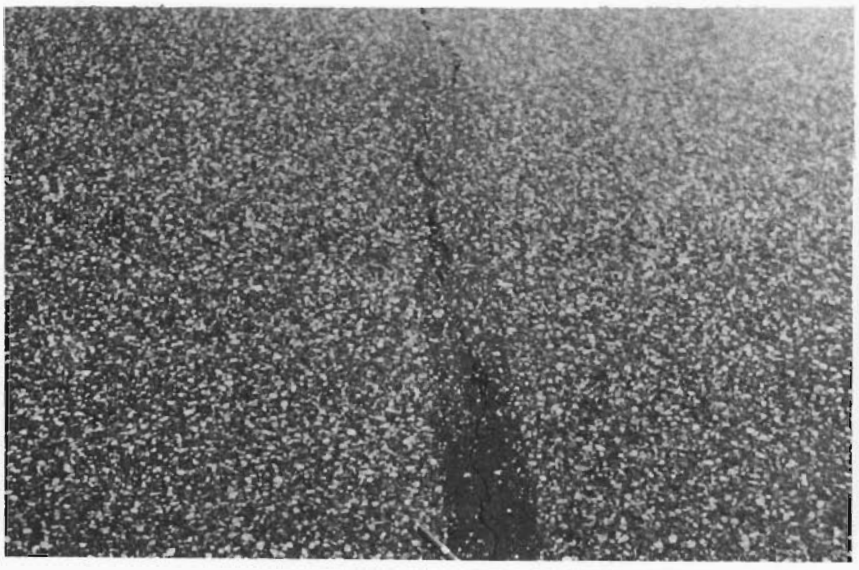
(3) 20 ft. Old Concrete Pavement

Typical sections A, B and C sketch the three different cross sections in existence within the limits of this project and show the history of asphaltic concrete overlays since 1947 when each of these sections was widened and overlaid with 486#/SY of Asphaltic Concrete Pavement, with Section B being the only one which included wire reinforcements. These sections are shown in an attempt to establish a comparison between reinforced overlays and non-reinforced overlays.

In comparing these three sections, it must be borne in mind that wire mats were placed over old concrete pavement which was in the worst shape at that time.

(WITHOUT WIRE)
TYPICAL SECTION A

The cracks in this section were hairline size to about ¼ in. in width and had been sealed.



(WITH WIRE)
TYPICAL SECTION B

This shows a close up of a transverse crack on a wire reinforced pavement section with cracks varying from hairline to 3/8 in. This section also has longitudinal cracks near the centerline ranging from hairline size to 1/4 in.

(WITHOUT WIRE)
TYPICAL SECTION C

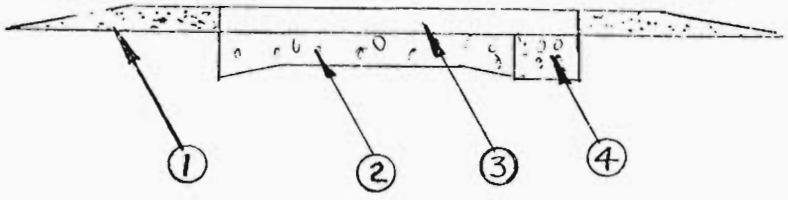
This shows a close up of a hairline transverse crack. This section is in the best shape of the three but its latest overlay was in 1967 and it has had two more overlays than the wire section.

Reference No. 2
Liberty County
Projects M 28-3-19 & M 28-4-13
US 90: From Dayton to Harris County Line
Construction of overlay completed 1947

Reference No. 2a
Harris County
US 90: Near Liberty County Line
Construction of Overlay Completed 1951

1947 ADT = 4280
1958 ADT = 7630
1962 ADT = 4730
1968 ADT = 3430

1947-1968 Equivalent 18 kip single axle loads = 5,592,204



TYPICAL SECTION
(BOTH WITH AND WITHOUT WIRE)

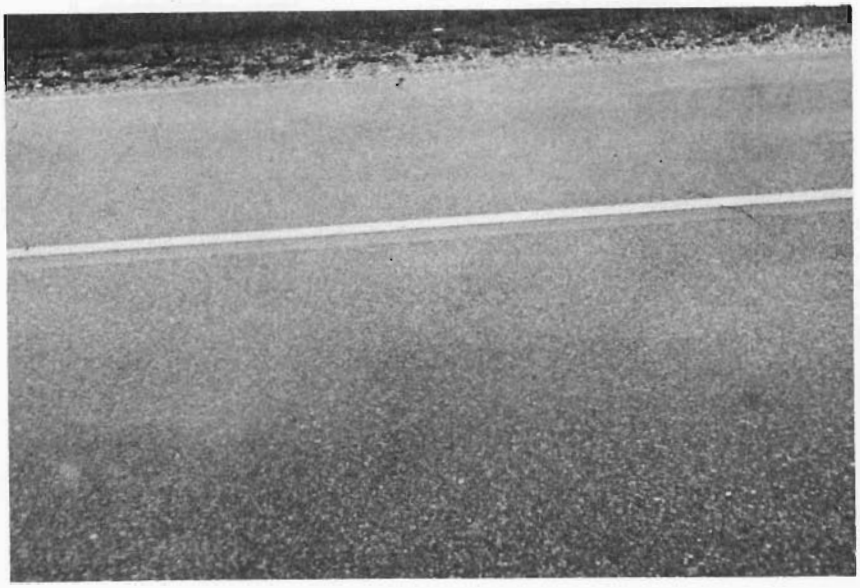
(1) Flexible Base

(2) Old Concrete Pavement

(3) Liberty County
With Wire - 6" X 12" - #9 Ga
160 #/SY - 1964
120 #/SY - 1955
400 #/SY - 1947

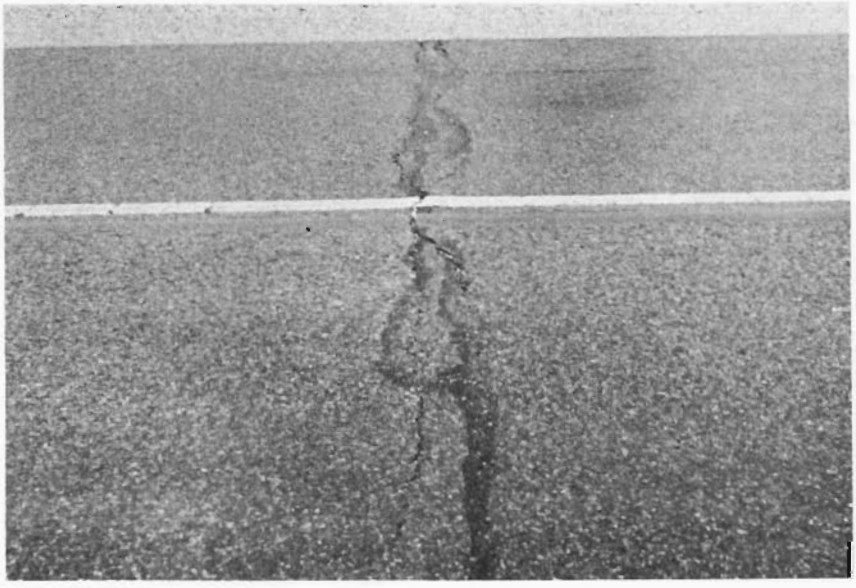
Harris County
Without Wire
185 #/SY - 1961
350#/SY - 1952

(4) Widened with concrete



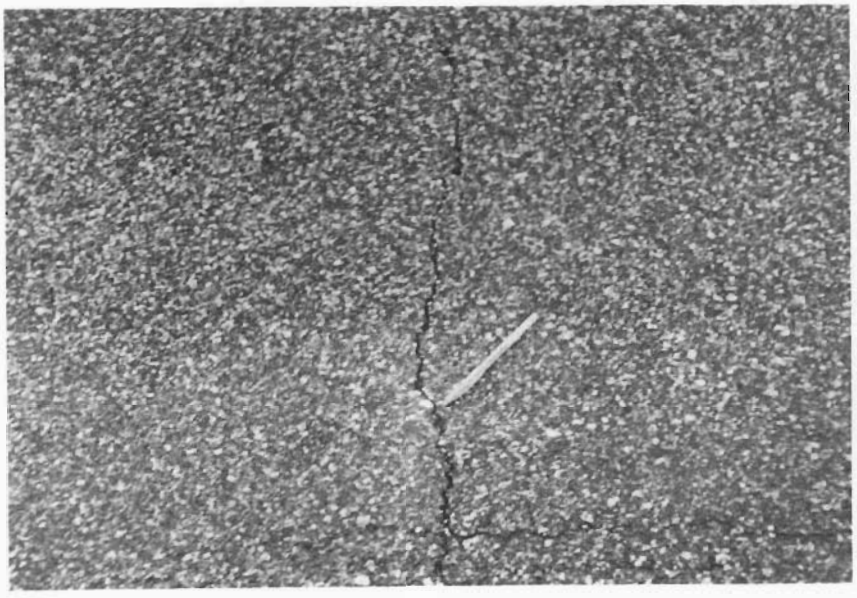
(WITH WIRE)
LIBERTY COUNTY

Shows a transverse crack as viewed from the side of the road.



(NO WIRE)
HARRIS COUNTY

Shows a typical transverse crack in the Harris County project. These transverse cracks were located at 80 ft. centers and generally from 1/8 in. to 1 in. across and gave a sharp bump to a 1967 Chevrolet when passing over it at 55 MPH.



(WITH WIRE)
LIBERTY COUNTY

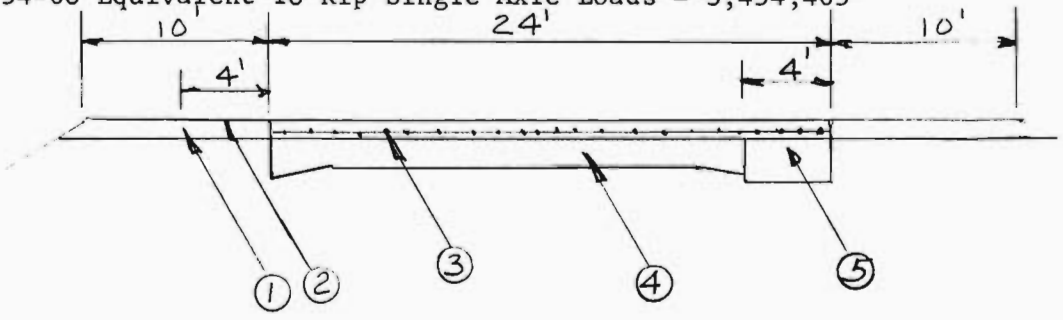
Shows a closeup of a transverse and longitudinal crack as they occurred in the Liberty County Project. It is noted that this crack gave no bump when passing over it at 55 MPH in a 1967 Chevrolet.

Reference No. 3
Jefferson County
Project C 65-8-43
U.S. 69: From SH 347 to Near North City Limits
of Port Arthur

Overlay Construction Completed March, 1954

1954 ADT = 7160
1968 ADT = 12670

1954-68 Equivalent 18 Kip Single Axle Loads = 3,454,465



TYPICAL SECTION
(WITH WIRE)

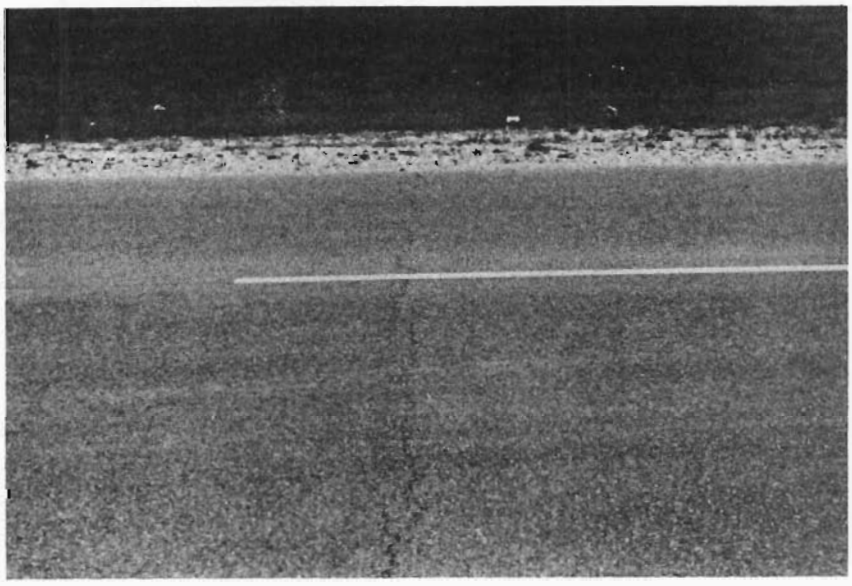
(1) Flexible Base

(2) One Course Surface Treatment

(3) 4" ACP Overlay with 6"x6" No. 10 Ga. Wire

(4) 20 Ft. Old Concrete Pavement

(5) Widened with concrete



(WITH WIRE)

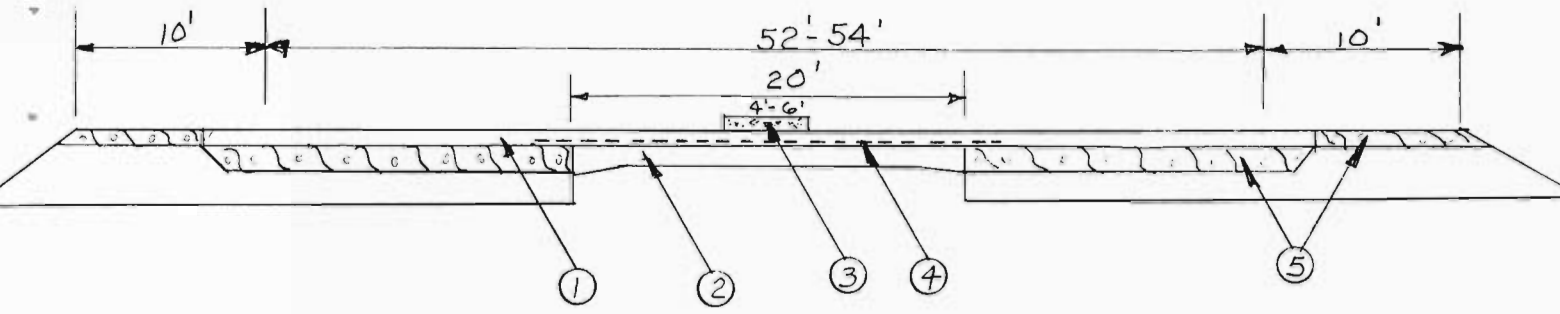
This shows a typical transverse crack with width varying from hairline to 1/8 in. in size and occurring about every 15 ft. This pavement was overlaid with an additional 100 #/SY ACP in 1967. Note that a longitudinal crack has not occurred at the construction joint between the old concrete and the 4 ft. widening.

Reference No. 4
Jefferson County
Control 65-8-53
Project F 53 (19)
U.S. 69: From FM 365 to 39th Street
in Port Arthur

Construction of Overlay Completed June, 1957

1957 ADT = 9220
1968 ADT = 14,480

1957-68 Equivalent 18=kip single axle loads = 3,175,775



TYPICAL SECTION
(WITH WIRE)

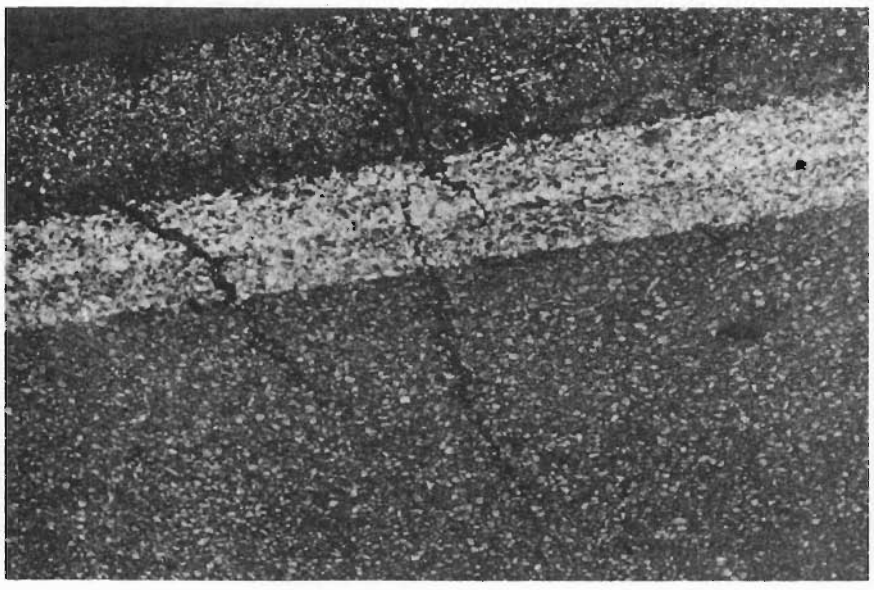
(1) 8" ACP

(2) Old Concrete Pavement

(3) Concrete Median

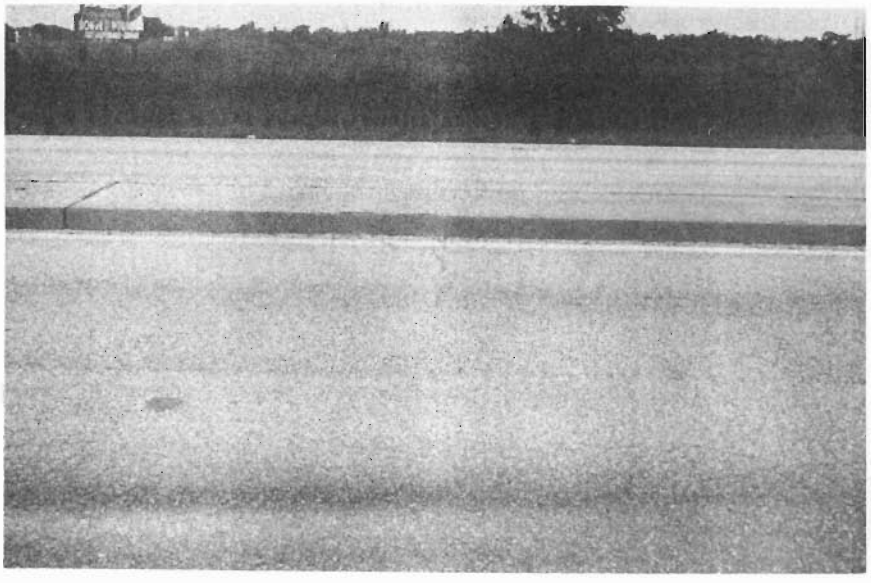
(4) 6"-6" No. 10 Gage Wire Mesh 2" Above Old Pavement

(5) Sand Shell



(WITH WIRE)

Transverse cracks near median on the above project.



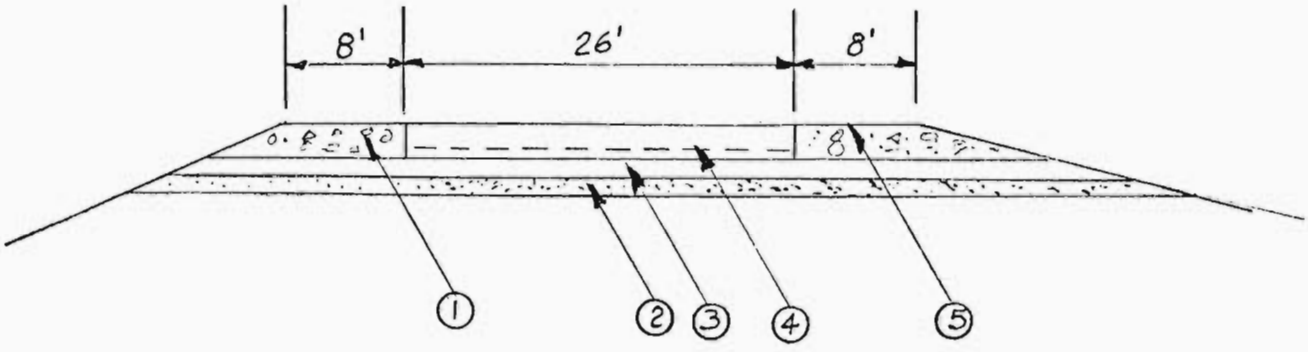
(WITH WIRE)

This same pavement crack is shown in both of the above pictures. Transverse cracks in the section varied in width from 1/4 in. in the median and to hairline size in about 3 ft. There was only one transverse crack about every 100 ft. and no longitudinal cracks apparent between the existing concrete pavement and flexible base widening.

Reference No. 5
Jefferson County
Project DU 652 (8)
Control 306-3-32
State Highway 87: From West End of Neches River Bridge
To 0.5 Mile East of SH 347

Construction Completed November, 1958
This section was overlaid due to sinking of the roadway in 1966 and not because of cracking.

1958 ADT = 8450
1968 ADT = 11570
1958-68 Equivalent 18-kip single axle loads = 2,736,773



TYPICAL SECTION
(WITH WIRE)

TYPICAL SECTION
(WITH AND WITHOUT WIRE FABRIC)

(1) Sand Shell Base

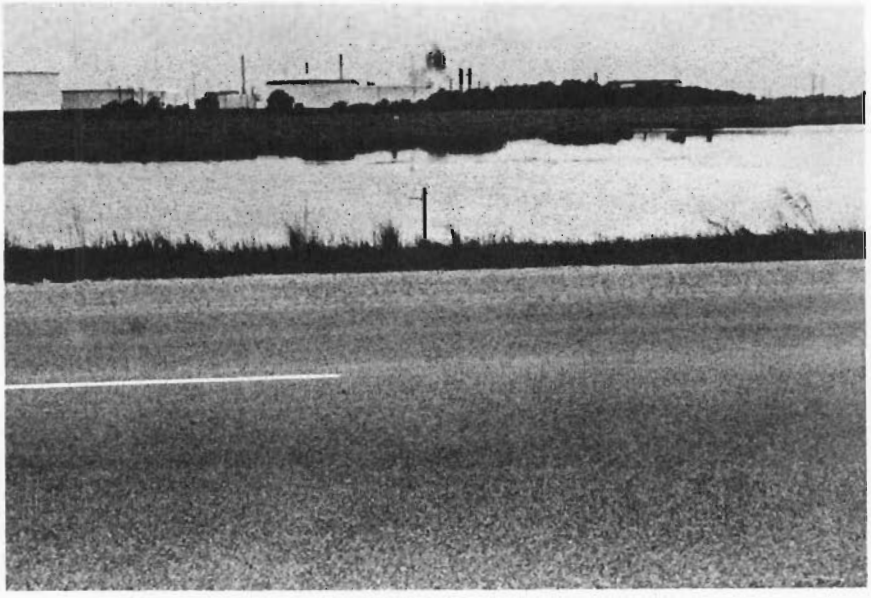
(2) Existing Sand Shell Base

(3) Sand Shell Base

(4) Wire Reinforced Section
165#/SY ACP
725#/SY ACP

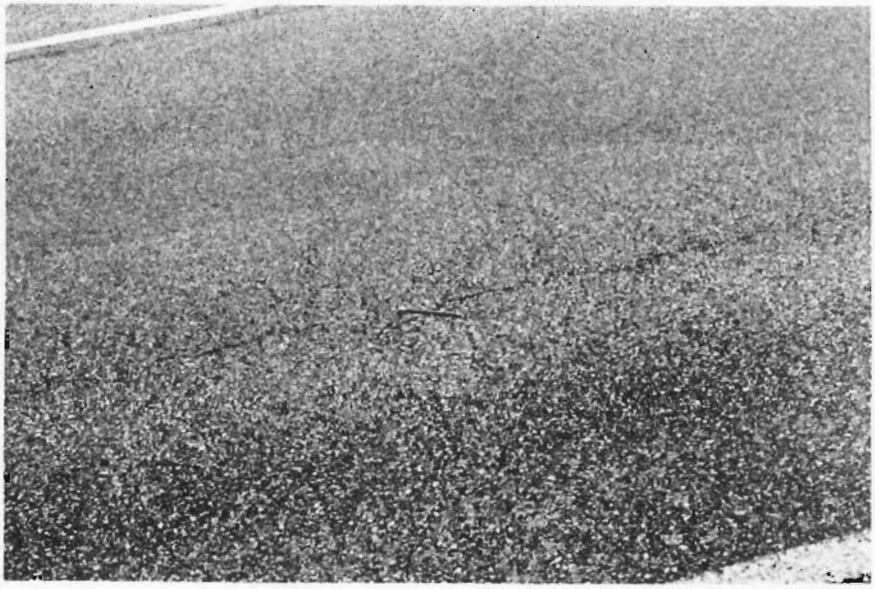
ACP Without Reinforcements
220 #/SY ACP
330 #/SY ACP

(5) One Course Surface Treatment



(WIRE REINFORCED ACP IN A FLEXIBLE DESIGN)

Of the wire reinforced section at which there were no longitudinal or transverse cracks. Wire reinforcements were placed only in a curve section located on the worst subgrade in this marsh land area.



(NO WIRE REINFORCEMENTS)

Minor longitudinal cracking appearing in the section without wire which is located adjacent to the wire reinforced section.

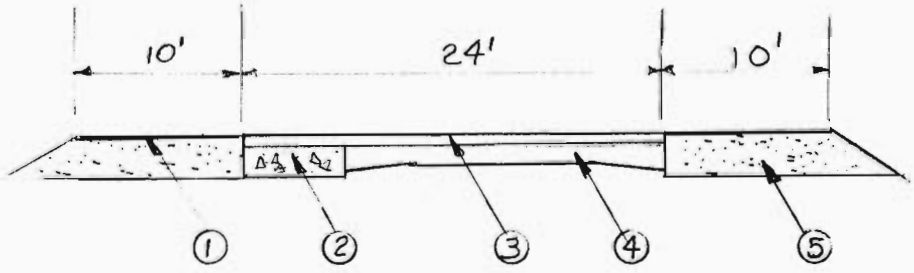
Reference No. 6
Brazoria County
Project DF 388 (6)
SH 35: From 11.5 Miles NE of Angleton
To Angleton

Construction Overlay Completed March, 1959

In 1966 a seal coat was added to this section to correct slick pavement.

Again in 1967 a 100#/SY overlay of ACP was added to correct slick pavement.

1959 ADT = 3440
1968 ADT = 5710
1959-68 Equivalent 18-kip Single Axle Loads = 1,049,518



TYPICAL SECTION
(WITH WIRE)

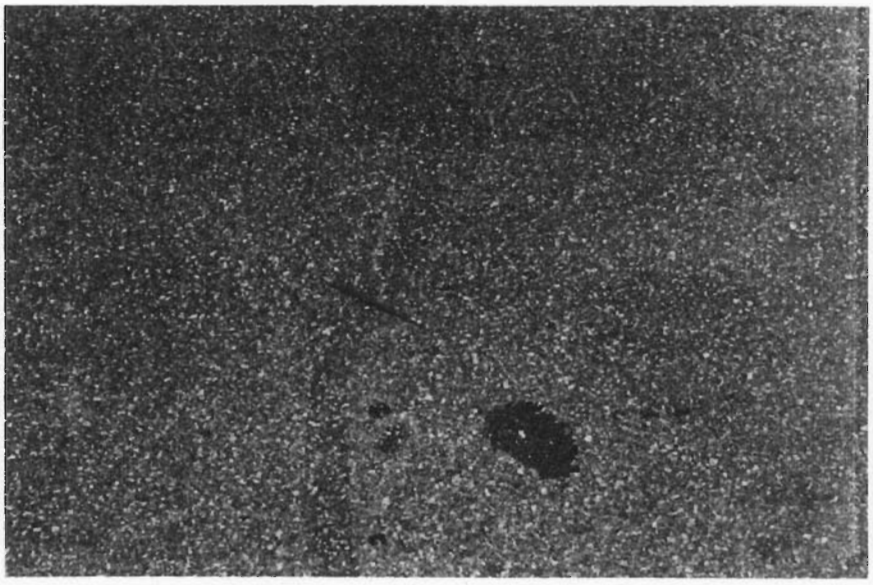
(1) Surface Course

(2) Widened with Concrete (4')

(3) 600#/SY ACP with 6"x6"-10 ga. Wire

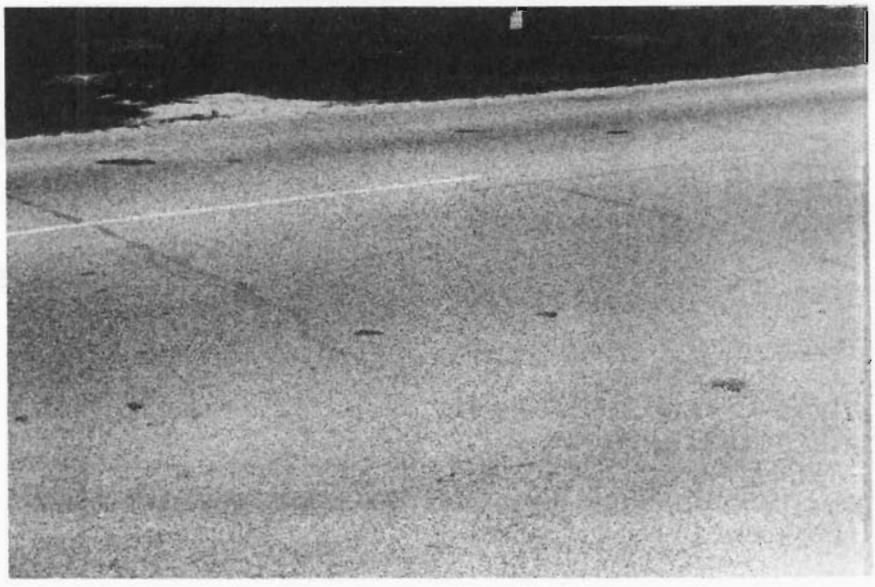
(4) Old Concrete Pavement (9"-6"-9")

(5) Flexible Base



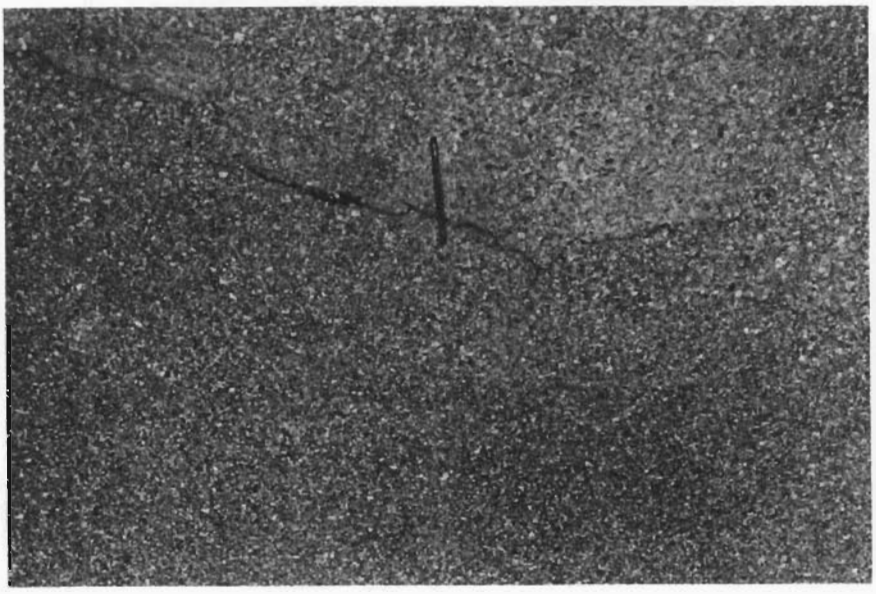
(WITH WIRE)

The above transverse crack would be very hard to detect if not for the light seal and is typical of the cracks on this project located near the city limit of Angleton.



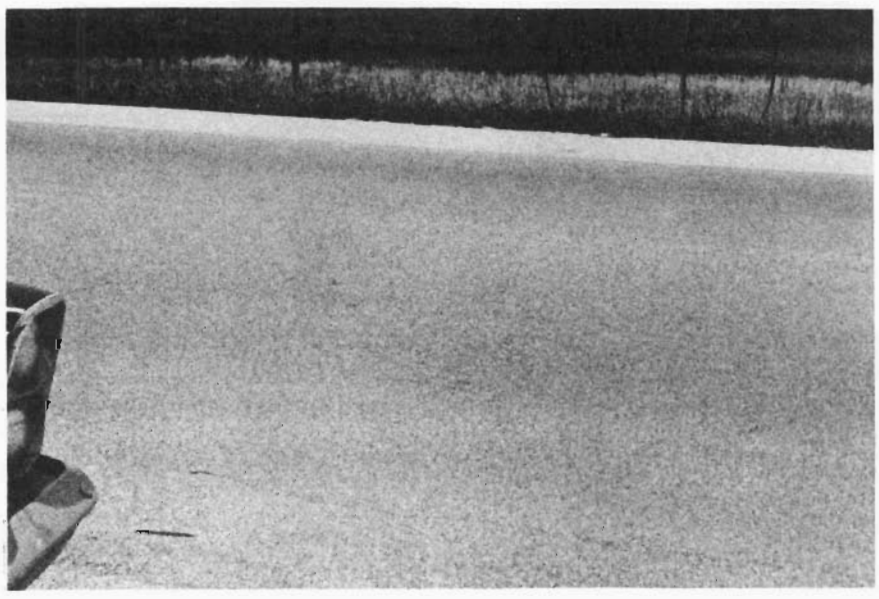
(WITH WIRE)

This shows a cross roadway view of the top picture. All cracks in this section near Angleton were hairline in size.



(WITH WIRE)

The dark spot is water which appeared after a car rolled at a creeping speed over the shoulder of the road. This roadway is 3.6 miles north of Angleton.



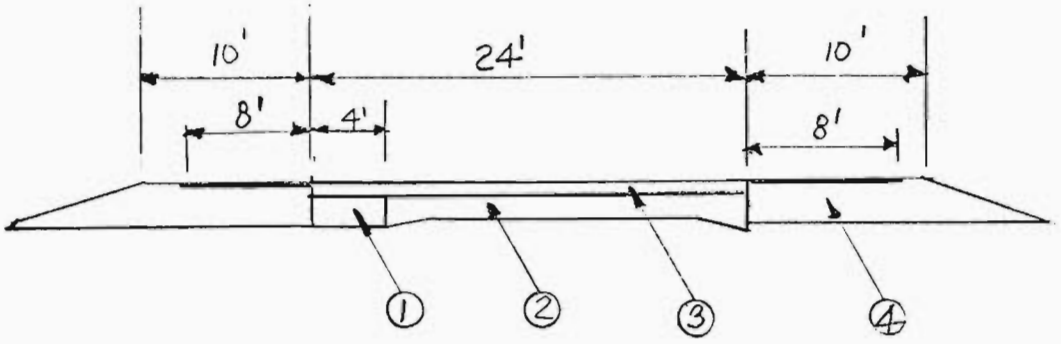
(WITH WIRE)

This shows a side view of the same pumping crack. This section of roadway is the only one observed with major pumping occurring on a wire reinforced overlay; however, all cracks are near hairline in size.

Reference No. 7
Brazoria County
Project C 111-4-9
SH 288: From 8.6
To Fort Bend County Line

This construction overlay was completed in October, 1959.
This section had a seal coat in 1967 for slickness and is being overlaid again at the present time with a 100#/SY of ACP again for slickness.

1959 ADT = 3820
1968 ADT = 5110
1959-68 Equivalent 18-Kip Single Axle Loads = 2,852,702



TYPICAL SECTION
(WITH WIRE FABRIC)

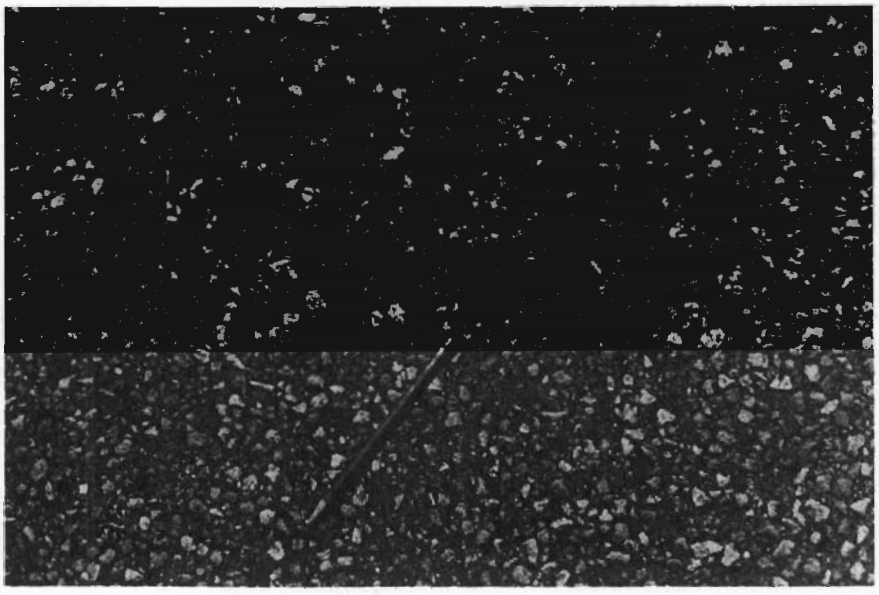
(1) Widened with Concrete (4')

(2) Original Old Concrete (20'-9"-6"-9")

(3) 350#/SY to 550#/SY ACP - 3"x6" No. 10 ga. wire fabric.

(4) 13.5" Flexible Base

(5) 8 ft. One Course Surface Treatment



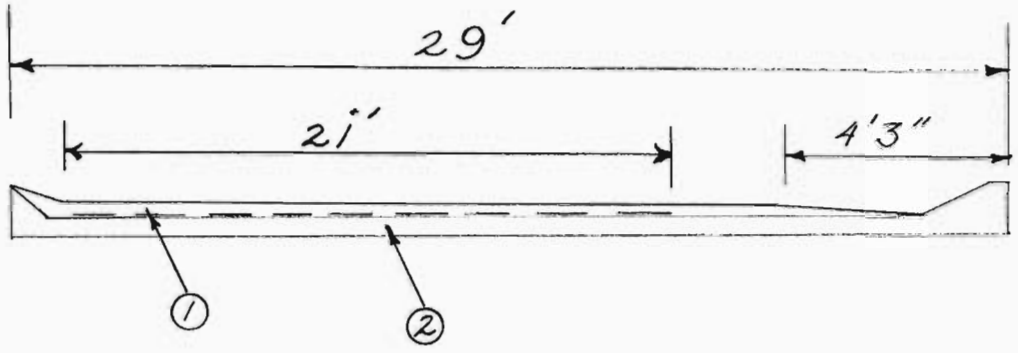
(WITH WIRE)

This is a very minor transverse crack and is the only crack that could be found in several hundred yards of roadway.

Reference No. 8
Jefferson County
Loop 114: From SH 87 (16th Street)
To Proctor Street in Port Arthur
Project C 65-12-4
Construction of Overlay Completed January, 1960

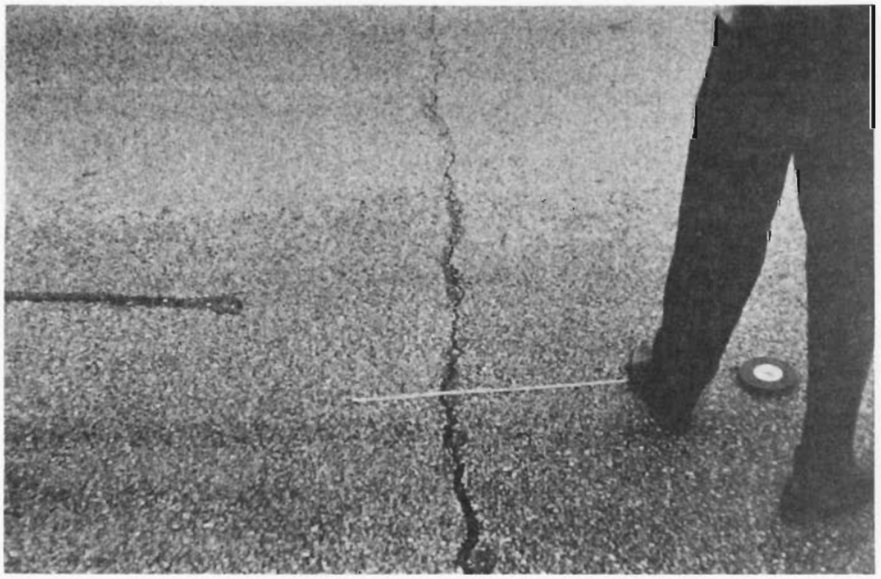
1960 ADT = 11,070
1968 ADT = 13,960

Equivalent 18 kip single axle loads = 1,060,289



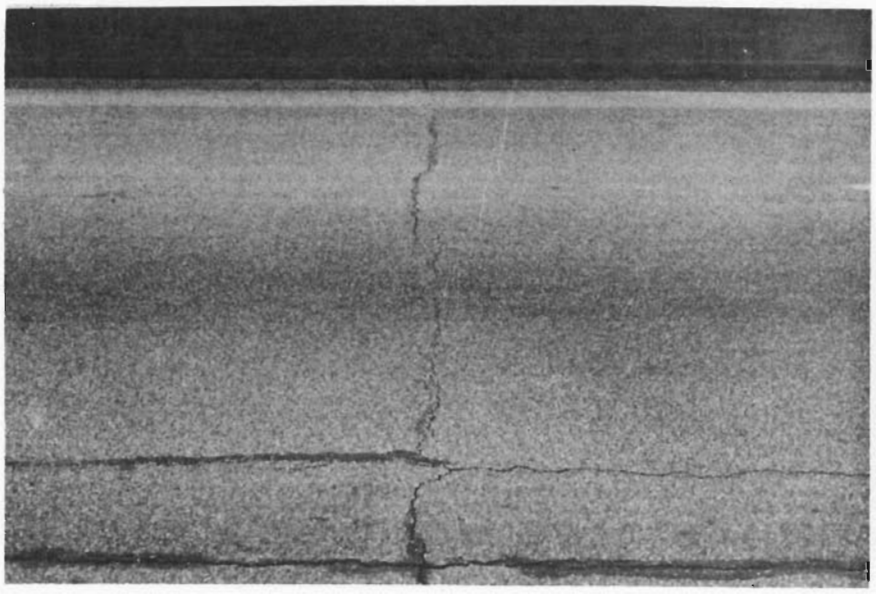
TYPICAL SECTION
(WITH WIRE)

(1) 300#/SY ACP with wire
(2) Old 6" Concrete Pavement



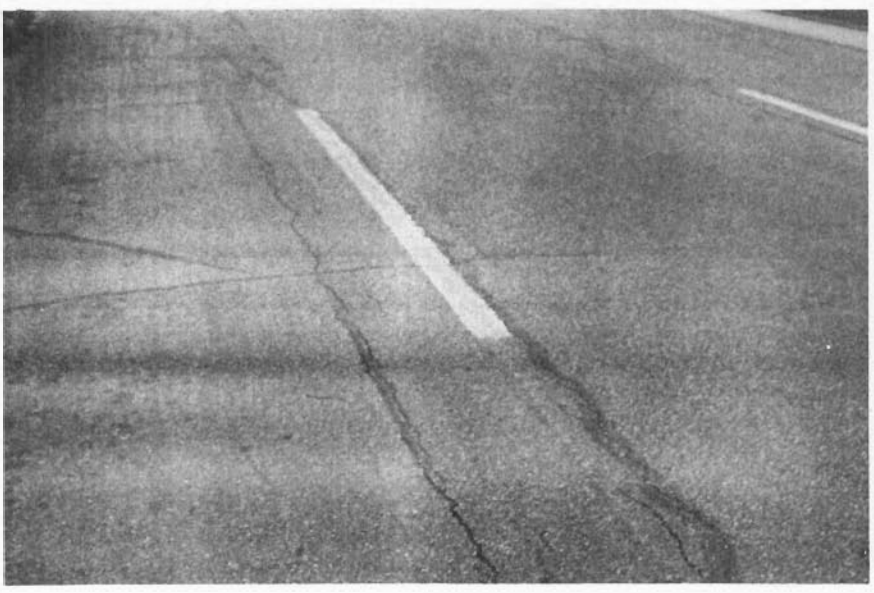
(WITH WIRE)

This shows a transverse crack varying from an inch to hairline size. The wide part of the crack occurs over ACP without wire.



(With Wire)

Another transverse crack with two longitudinal cracks appearing at the edge of the parking lane with the inside crack being located at the edge of wire mat. These transverse cracks were spaced at an average of 10' and extended the entire pavement. Where wire was placed (in the travel lane section), the cracks were only 1/16 inch to 1/4 inch in width, while the shoulders had cracks of 1/2 inch to 3/4 inch in width.



(With Wire)

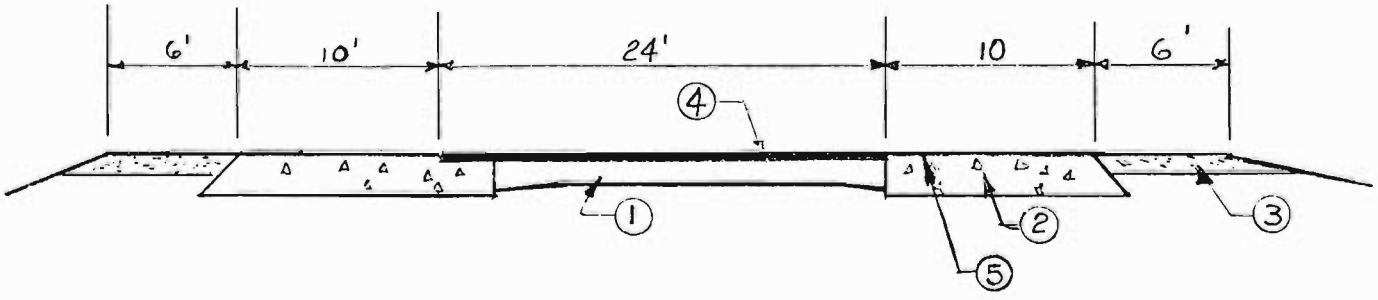
The above shows a view down the roadway on this section showing the general pattern of cracking. Longitudinal cracks were generally about 1/4 inch in width and occurred over about 90 percent of the project.

Reference No. 9
Brazoria County
Project C 178-2-17 & 18
S.H. 35: From .140 mile South of Harris County Line
To S.H. 6

Overlay Construction Completed June, 1960

1960 ADT = 4260
1968 ADT = 8010

1960-68 Equivalent 18-kip single axle loads = 975,085



TYPICAL SECTION
(WITH WIRE)

(1) Existing 20'-Concrete Pavement - 9-6-9

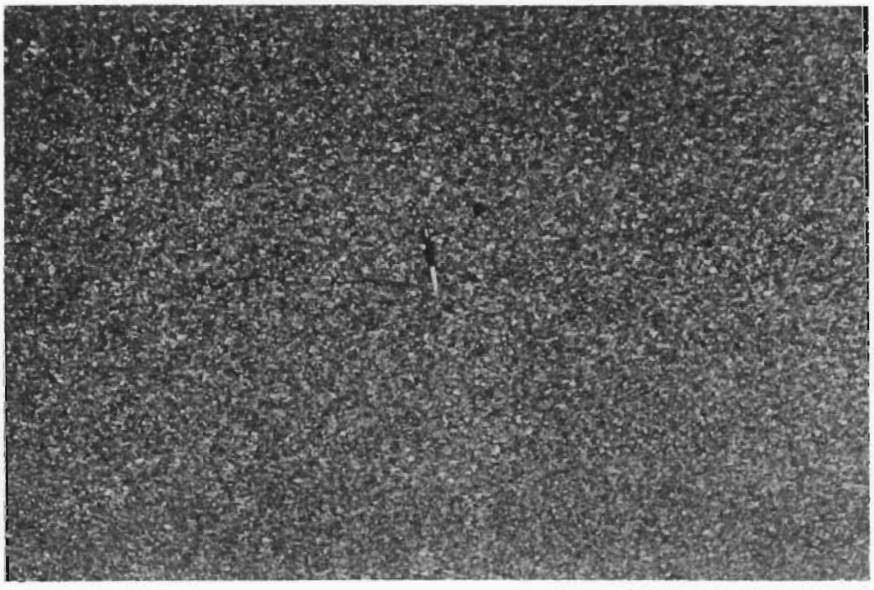
(2) 14" Cement Stabilized Base

(3) Flexible Base Sand Admixture

(4) 350" ACP with 24' of 3"x6" - 10/10 wire mesh

(5) One Crse. Surf. Treat. over 100#/SY ACP

The following four pictures show typical transverse cracks on the above section. These type cracks are typical throughoutthe wire reinforced overlay. The following cracks on this roadway were at an average spacing of approximately 45'. Where wire and asphalt concrete was not extended over the construction joint a longitudinal crack did appear between the flexible base widening and the old concrete pavement. On the widened side where the wire and asphalt was extended over this construction joint, no crack appeared.



(WITH WIRE)

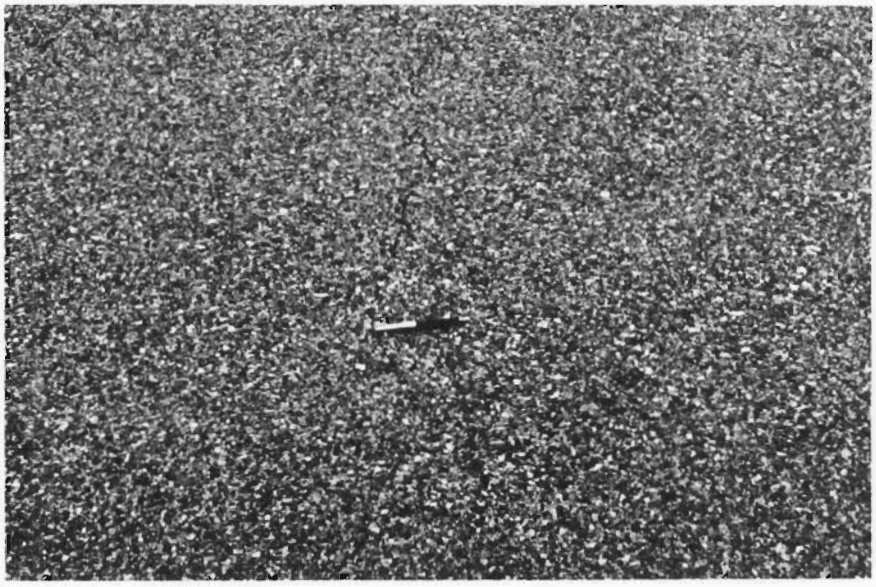
This is a typical transverse crack that has not been sealed.

(WITH WIRE)

This is a typical transverse crack with spot sealing.

(WITH WIRE)

This picture is taken to show a hairline crack with excessive asphalt seal.

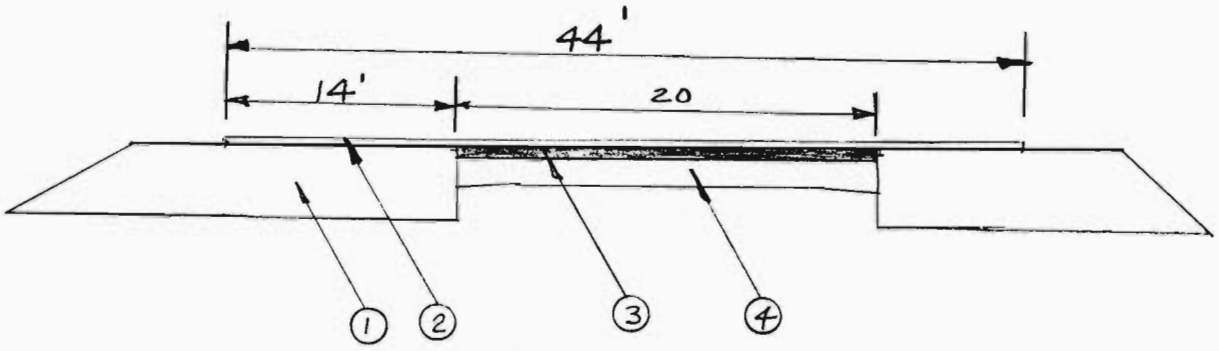


(WITH WIRE)

This is one of the most severe transverse cracks observed in this project.

Reference No. 10
Harris County
Project C 178-1-14
SH 35: 1 Mile North of Fort Bend County Line
(Just north of Project 178-2-17)

Construction of Overlay Completed 1962
1968 ADT = 8010



TYPICAL SECTION
(NO WIRE)

(1) 14" Cement Stabilized Base

(2) 200#/SY ACP

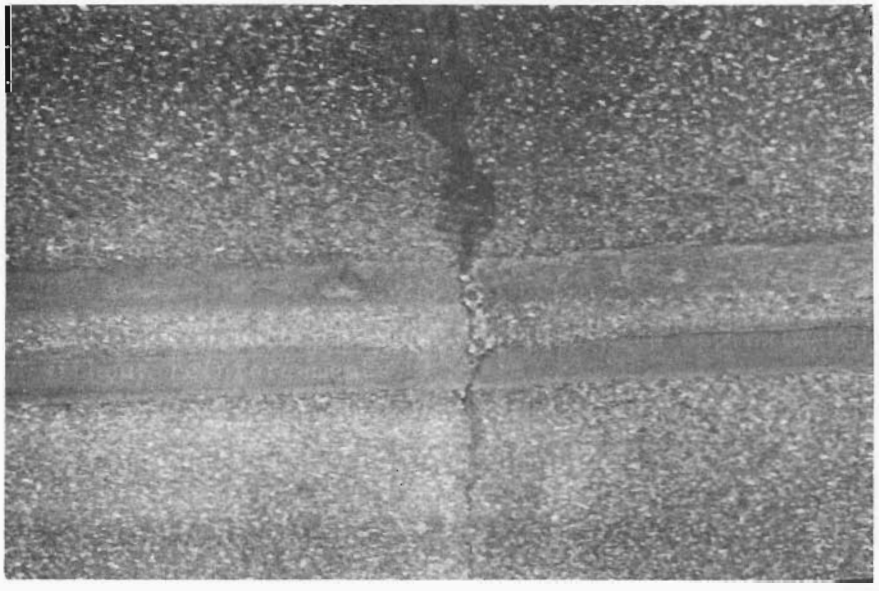
(3) 150#/SY Asphalt Stabilized Base

(4) 20 ft. Existing Concrete Pavement

This is an old concrete pavement overlaid with approximately 200#/SY of ACP without reinforcements.

(WITHOUT WIRE)

This is an example of a bad crack that occured when wire reinforcements were not used in an asphaltic concrete overlay.



(WITHOUT WIRE)

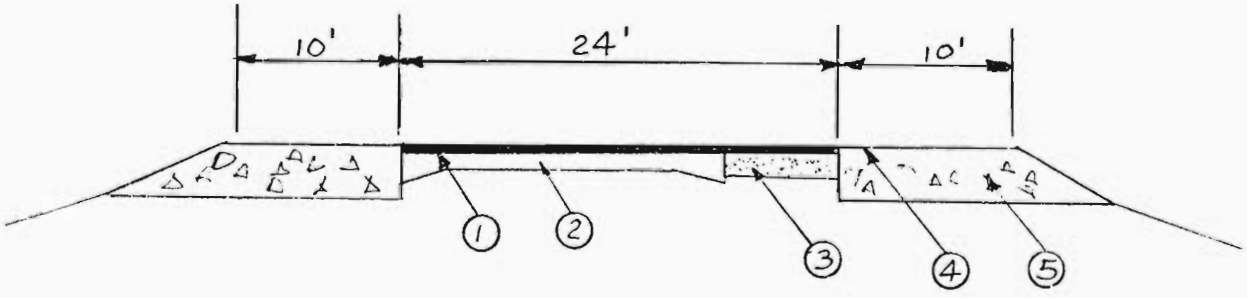
The pavement here at the crack has raised up about one inch.

Reference No. 11
Fort Bend and Brazoria Counties
Project C 192-1&2-12&10
SH 6: From SH 288 to Beginning of Approach to
Underpass at GC & SF Railroad in Alvin

Construction of Overlay Completed in September, 1961

1961 ADT - 1820
1968 ADT - 3730

1961-68 Equivalent 18 kip single axle loads - 352,613



TYPICAL SECTION
(WITH WIRE)

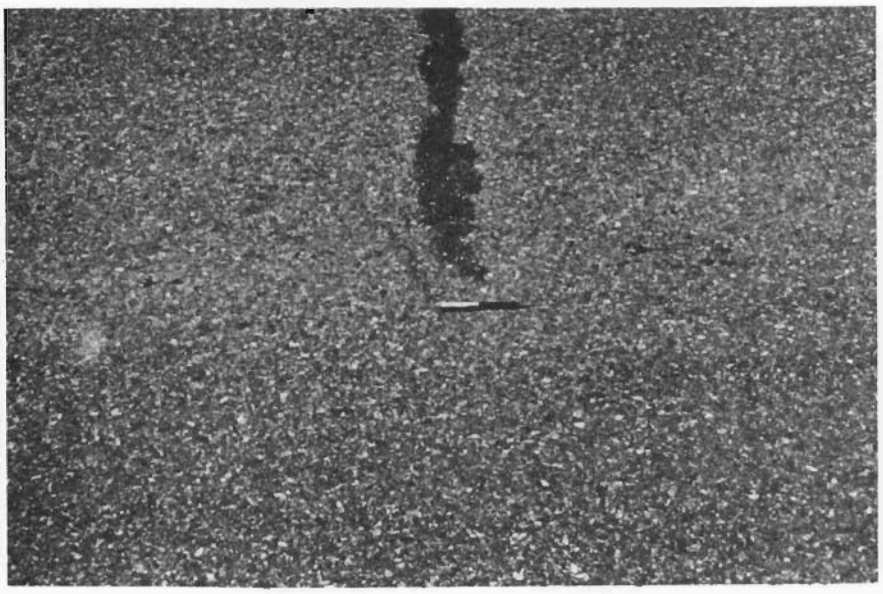
(1) 500#/SY ACP 75#/SY - Levelup
24 ft. - 3"-6" No. 10 Ga. Wire
150#/SY - Above Wire
125#/SY - Intermediate
150#/SY - Wearing Surface

(2) 20' - Old Concrete (9-6-9)

(3) New Concrete 7"

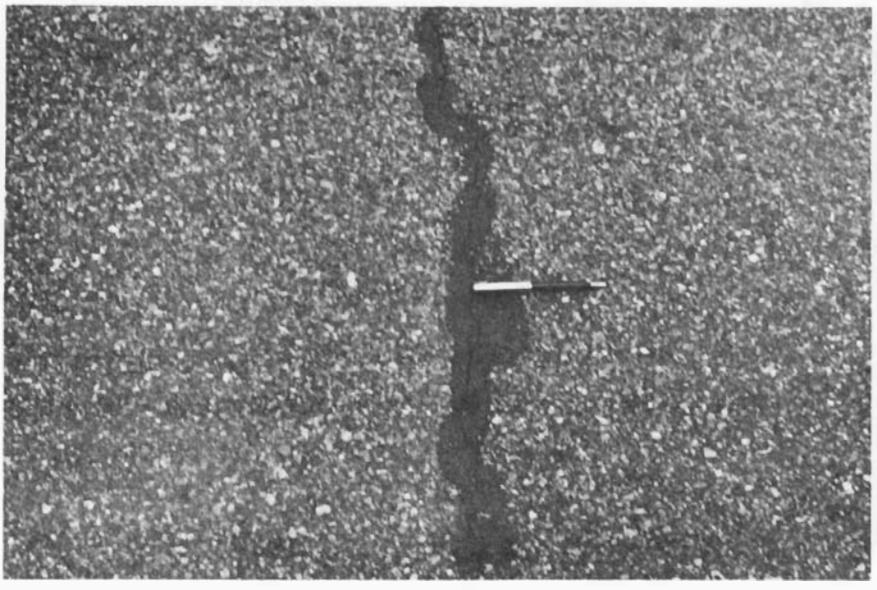
(4) 200#/SY ACP

(5) Flexible Base



(WITH WIRE)

Typical transverse crack which is hairline to 1/8 in. in width and is spaced at about 15 ft. with every other one going across both lanes.



(WITH WIRE)

Another transverse crack similar to the above.

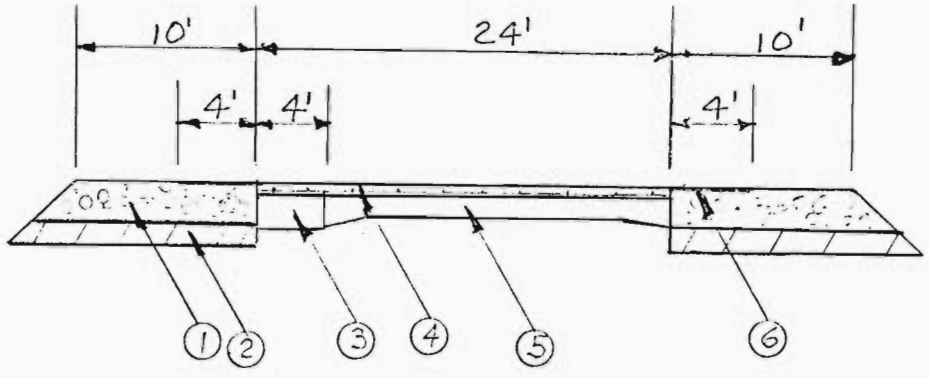
Reference No. 12

Fort Bend County
Project C 192-1-15
SH 6: From US 59 1.0 Mile West of Sugarland
To SH 288 at Arcola

Overlay Construction Completed November 1963

1961 ADT - 1400
1968 ADT - 2760

1961-68 Equivalent 18 Kip Single Axle Loads = 203,949



TYPICAL SECTION
(WITH WIRE)

(1) Flexible Base
(2) Existing Flexible Base
(3) Existing pavement widened with Concrete
(4) 500#/SY ACP with 3"x6" - 10 ga. wire mesh
(5) Old 9"-6"-9" Concrete Pavement
(6) One Course Surface Treatment

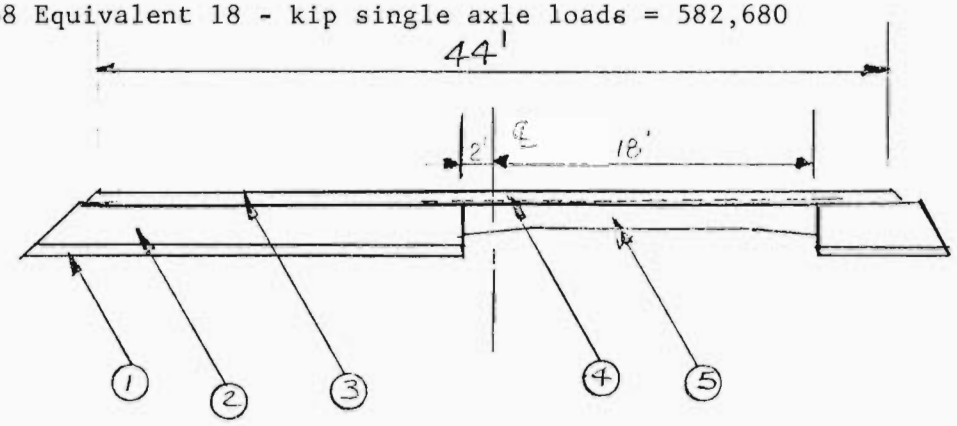
Crack patterns were very similar to those observed on SH 6 just east of Arcola (Project C 192-1-12). No additional photographs were obtained of this section. It is noted that crack spacings did tend to be a little closer together but with sections of 100 ft. or longer with no cracks at all.

Reference No. 13
Galveston County
Project F 598 (4)
SH 6: From IH 45
To FM 2004

Overlay Completed In September, 1961

1961 ADT = 4270
1968 ADT = 7050

1961-1968 Equivalent 18 - kip single axle loads = 582,680



TYPICAL SECTION
(WITH WIRE)

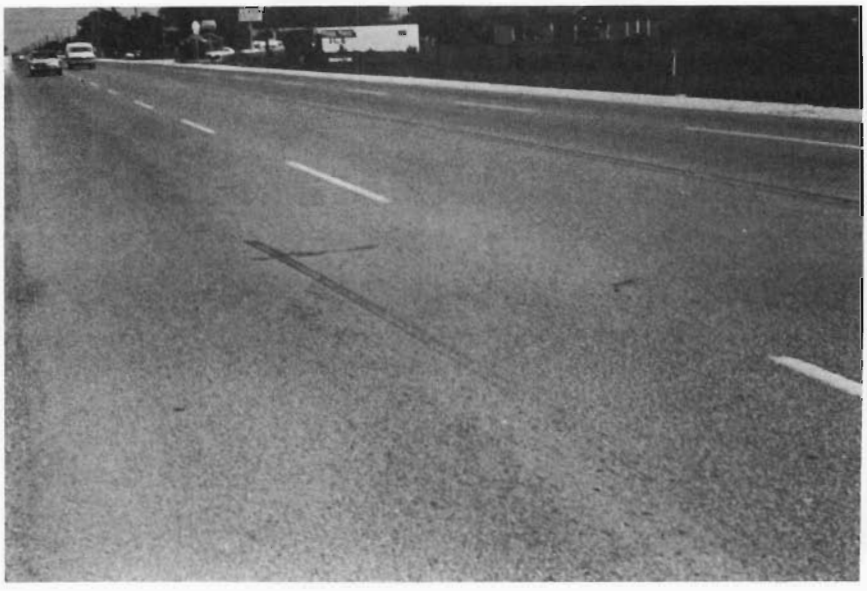
(1) Lime Stabilized Subgrade

(2) 14" Cement Stabilized Base

(3) 325#/SY ACP

(4) 450#/SY ACP with Wire Fabric

(5) Old Concrete Pavement (9"-6"-9")



(WITH WIRE)

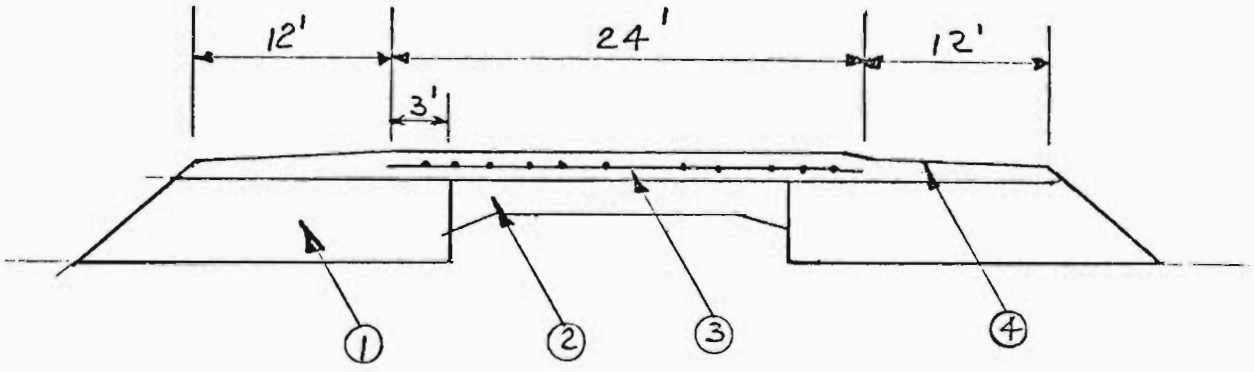
This section has very few longitudinal cracks as shown above. This roadway is located near the north end of this project and is in very good shape. Except for minor transverse cracking appearing in the left center of this picture, it would be hard to determine by sight the location of the old concrete pavement.

Reference No. 14
Brazoria County
Project C 188-5&6-13&25
SH 36: From Brazoria To 0.8 Mi. E. of Jones Creek

Construction of Overlay completed in May, 1962

1962 - ADT = 2420
1968 - ADT = 3350

Equivalent 18 kip single axle loads = 461,993



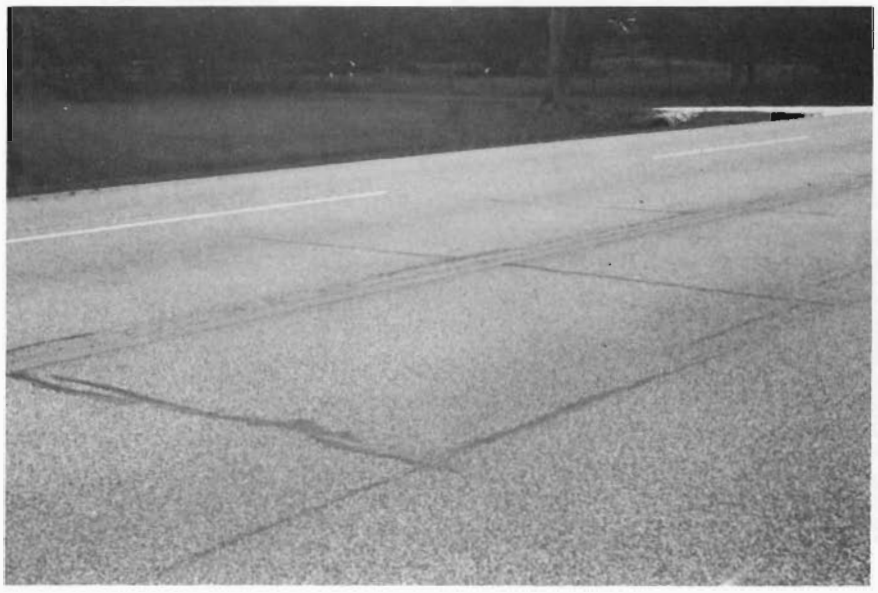
TYPICAL SECTION
(With Wire)

(1) 14" Cem Stab Sand - Shell Base

(2) Old Concrete Pavement

(3) 300-475 #/SY ACP with Wire Fabric

(4) 200 #/SY ACP with most sections having 10' Surface Treatment



(With Wire)

(With Wire)

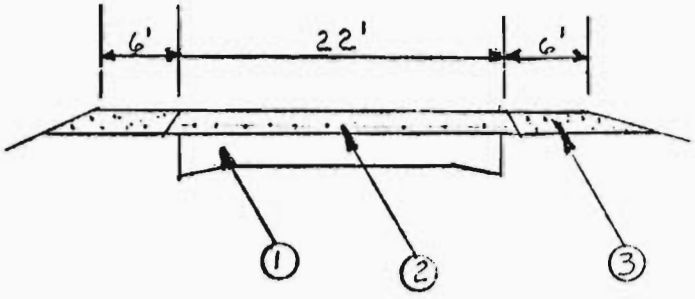
The above two pictures show patterns of longitudinal and transverse cracks on this section. Longitudinal cracks occuring on about 50% of this length of the project. Transverse cracks were spaced at 25' to 30'. Some cracks appearing as close as 15' apart. Both longitudinal and transverse cracks are very small and generally are hairline in size. This section gave a very smooth ride.

Reference No. 15
Harris County
Project C 27-9-37
US 59 or US 90A: From 0.85 Mile West of T&NO Railroad to
Fort Bend County Line

This overlay was completed in June , 1962

1962 ADT = 14740
1968 ADT = 16170

1962-68 Equivalent 18 kip single axle loads = 1,209,390

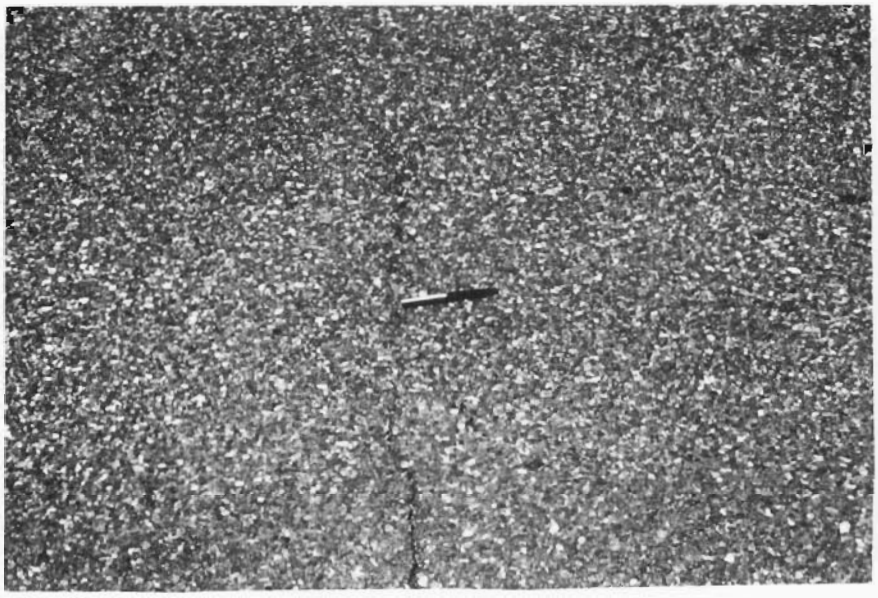


TYPICAL SECTION
(With Wire)

(1) 22' Old Concrete Pavement (8"-6-8)

(2) 500 #/SY -(75 #/SY level-up, 175 #/SY Wire Course, 125 #/SY Intermediate
22'-3"-6" No. 10 Ga Wire Fabric 125 #/SY Surface Course)

(3) 6" Flexible Base

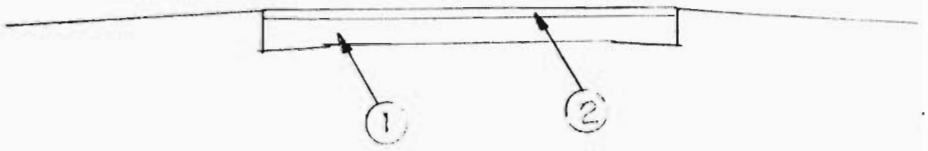


(WITH WIRE)

This shows a typical transverse crack on this section. Longitudinal cracks were not appearing in this section.

Reference No. 16
Fort Bend County
Project C 27-8-40
US 90A: Near Intersection of SH 6

ACP Overlay Completed 1957

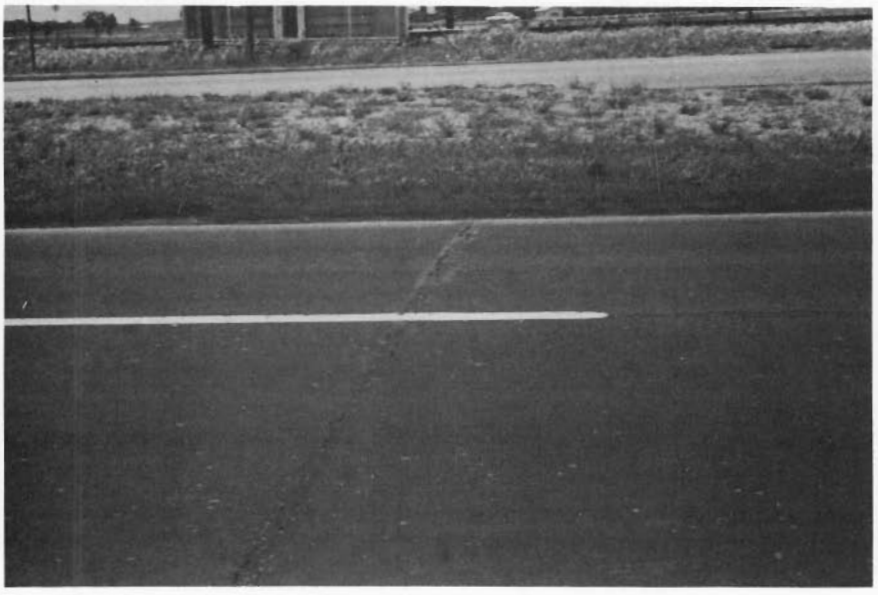


WITHOUT WIRE
200#/SY ACP OVERLAY

(1) Old 24 ft. Concrete Pavement

(2) 200#/SY ACP

The following pictures are of a 200#/SY overlay without wire which was placed in January, 1957.



WITHOUT WIRE
200#/SY ACP OVERLAY

This is the type crack we are guarding against. Picture taken near intersection of SH 6.

WITHOUT WIRE
200#/SY ACP OVERLAY

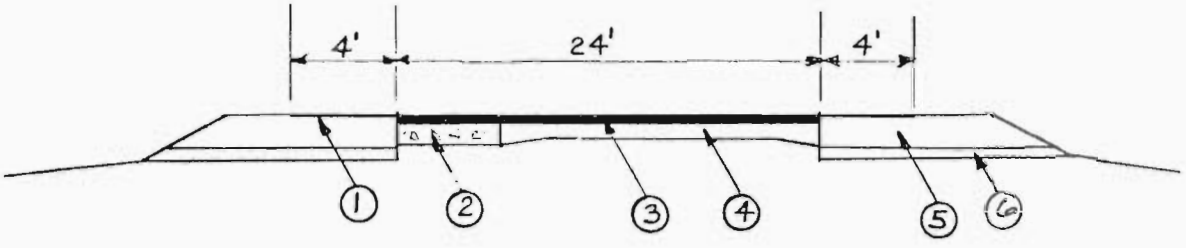
This is another example of a transverse crack on a regular ACP overlay. This is taken near the west city limit of Sugarland.

Reference No. 17
Fort Bend and Brazoria Counties
Project S 778 (5)
SH 36: From Station 604 in Needsville
To 1095.6 ft. South of SH 35 Inter. in West Columbia

Overlay Completed in June, 1962
1962 ADT = 1310
1968 ADT = 2020

1966-68 Equivalent 18-kip single axle loads = 379,581

Typical Section
(Wire Reinforced Overlay)



(1) One course surface treatment

(2) Widened with Concrete (6')

(3) 500#/SY ACP overlay with 3"-6"-10 gage wire mesh

(4) 18 ft. existing concrete pavement (9"-6"-9")

(5) Flexible Base

(6) Lime Stabilized Subgrade

(WITH WIRE)

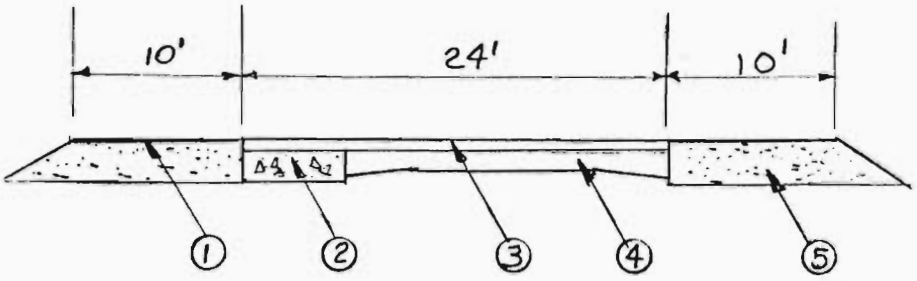
The above roadway is just south of Needville. Note that there is no longitudinal crack at the construction joint between the existing concrete pavement and the 6 ft. widened section.

(WITH WIRE)

This shows a close up of a transverse crack on the above roadway. These cracks generally started at 1/8 in. in width transitioning to hairline size in about 2 ft.

Reference No. 18
Fort Bend County
SH 36: One Mile South of Pleak
(Near North End of Project S 778 (5)
Overlay Completed in 1959)

Typical Section
(No Wire Fabric In Overlay)



(1) One course surface treatment

(2) Widened with Concrete (6')

(3) 250#/SY ACP (No wire fabric)

(4) 18 ft. concrete pavement (9-6-9)

(5) Foundation Course

(WITHOUT WIRE)

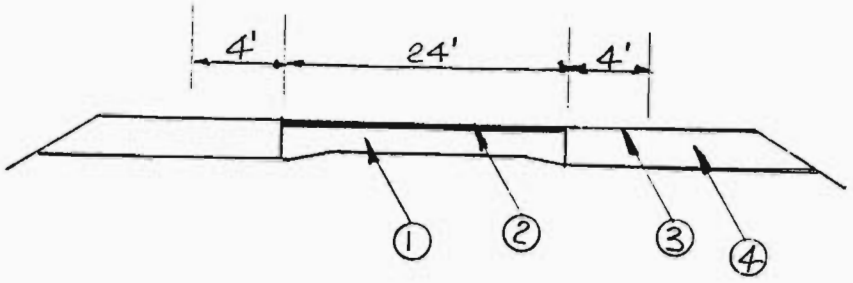
View showing numerous sealed cracks in this section.

Reference No. 19
Matagorda County
Project C 241-2-14
SH 60: From South City Limits of Bay City North
To Wharton County Line

This overlay was completed in March, 1963

1963 ADT = 1410
1968 ADT = 1870

1963-68 Equivalent 18 kip single axle loads = 171,491



TYPICAL SECTION
(With and Without Wire)

(1) Existing Concrete

(2) Section with 3"-6" No. 10 Ga Wire - 450 #/SY ACP
Existing 100 #/SY ACP

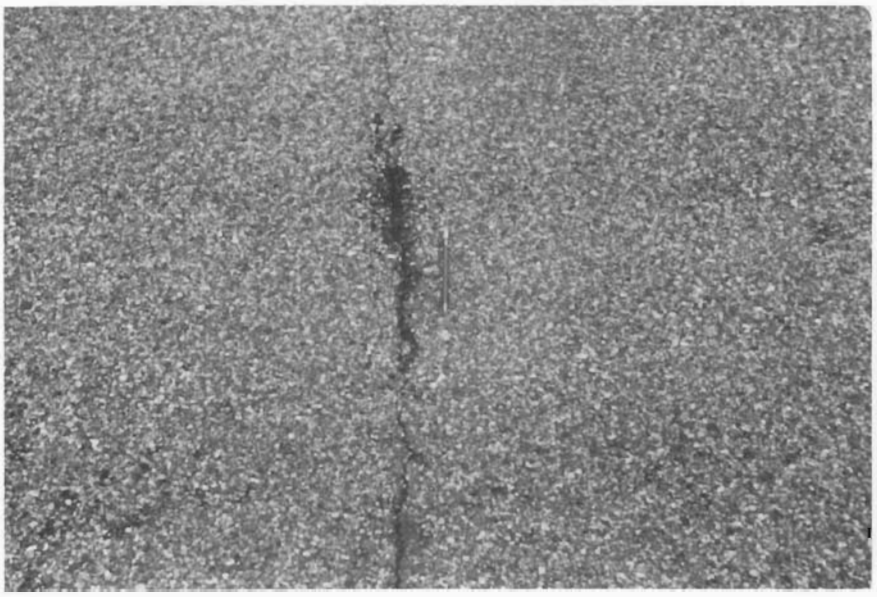
Section without wire - 300 #/SY ACP
Existing 100 #/SY ACP

(3) Flexible Base

(4) One Course Surface Treatment

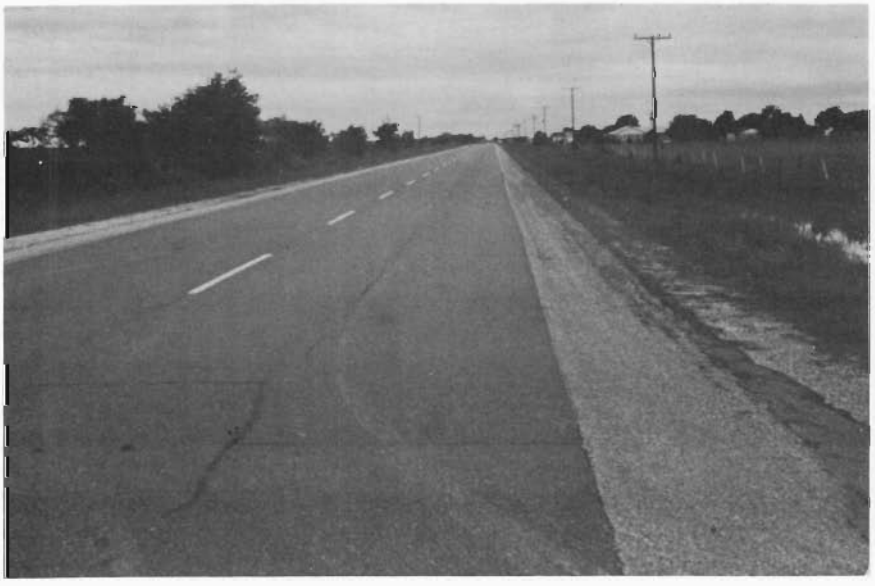
(With Wire)

This shows a transverse crack in the wire reinforced section in which the double line crack is forming. This type of crack was very rare in any of the other wire sections that have been observed but was rather common in this project. The double line cracks were still very tight and were generally hairline size to about 1/8 in. in width.



(Without Wire)

Ravelling is common in this section without wire while it was very uncommon in the section with wire. The ravel near the pencil is about an inch wide and deep.



(Without Wire)

This is just north of Bay City in a section with no wire reinforcements and was taken to show how the longitudinal cracks were forming in this section. These cracks range in widths up to 1/4 in. across.

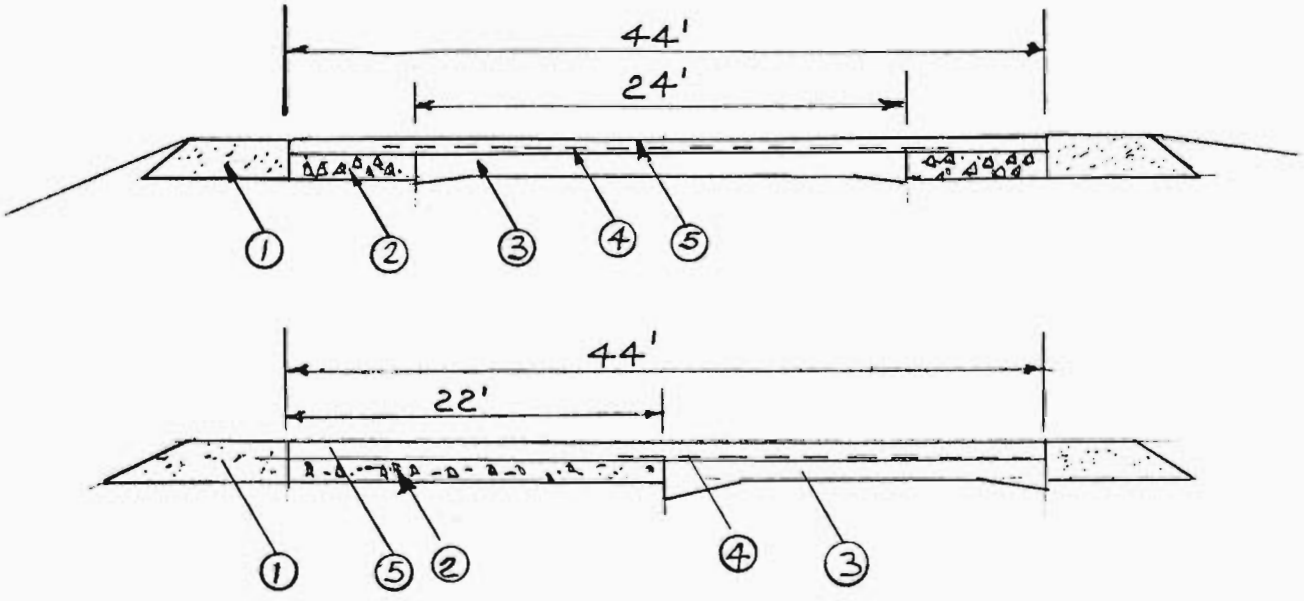
(Without Wire)

This is a close-up of the picture preceding which showed the view down the roadway.

Reference No. 20
Fort Bend County
Project C 543-3-11, etc.
FM 762 and FM 2759: From US 59 in Richmond to FM 1640

1963 ADT = 3670
1968 ADT = 4970

1963-68 Equivalent 18 kip single axle loads ~ 352,304



TYPICAL SECTIONS
(BOTH WITH WIRE)

(1) 13" Flexible Base

(2) Widened with Concrete

(3) Old Concrete Pavement

(4) Wire Mesh - 3"x6" No. 10 Gage
28 ft. - Top Section
24 ft. - Bottom Section

(5) 500#/SY ACP

The following three pictures were taken on this project near the city limits of Richmond.

(WITH WIRE OF TOP TYPICAL SECTION)

Showing a closeup of a hairline crack which had been sealed.

(WITH WIRE-TOP TYPICAL SECTION)

(WITH WIRE-BOTTOM TYPICAL SECTION)

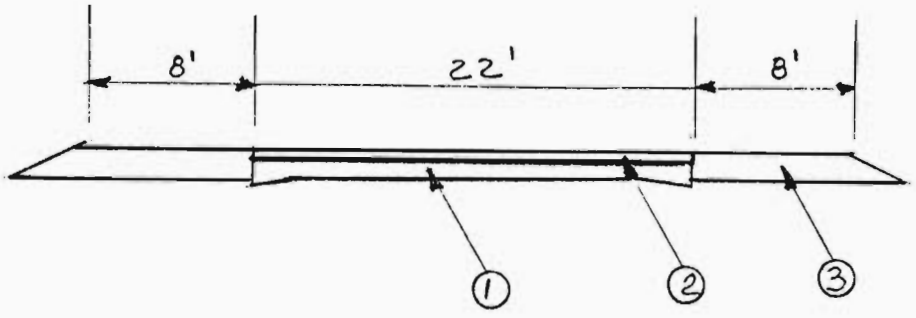
This longitudinal crack was caused by swelling of the base and subgrade beneath the new concrete placed after this section was widened. It is noted that this crack is located near the edge of the wire.

Reference No. 21
Brazoria County
Project C 111-9-9
SH 288: From SH 35 North
To FM 521

Construction of this Overlay was completed in December, 1964

1964 ADT = 4510
1968 ADT = 5110

1964-68 Equivalent 18 kip single axle load = 2,852,702



TYPICAL SECTION
(Both With and Without Wire Fabric)

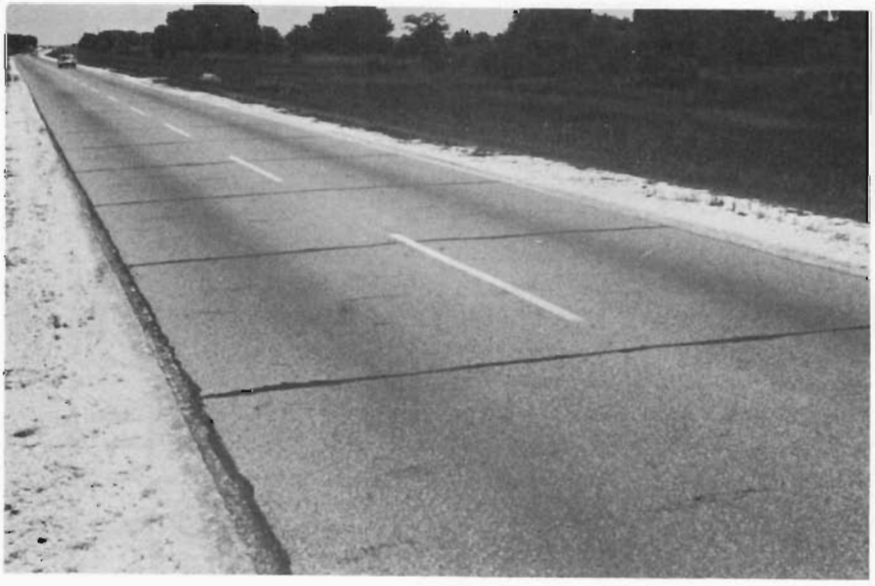
(1) Old Concrete Pavement

(2) With Wire Fabric - 500 #/SY ACP Without Wire Fabric - 200 #/SY ACP

(3) Shell Shoulder

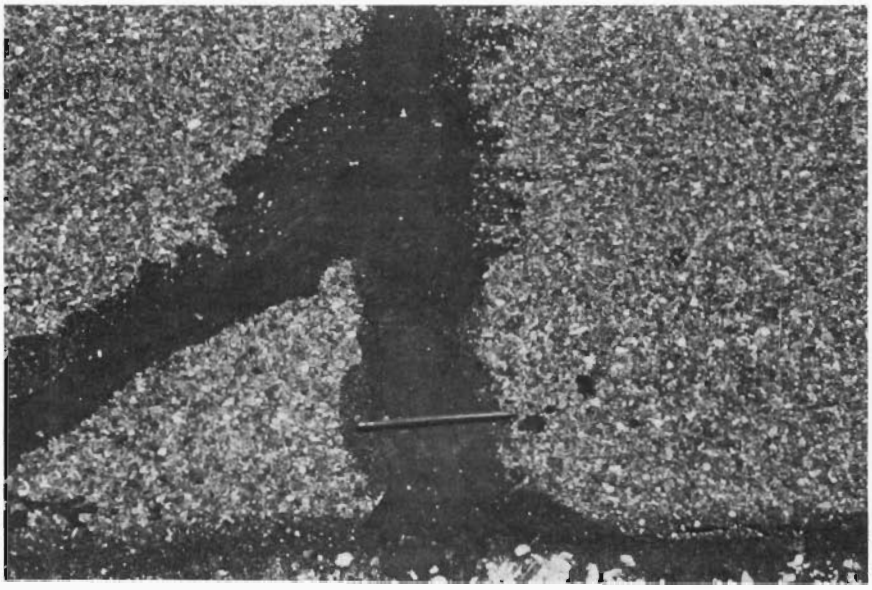
(With Wire)

This roadway is about .3 Mile South of FM 521. The cracks were generally hairline in size.



(Without Wire)

This picture was taken 3.2 Miles South of FM 521. Note the old concrete joint reflecting through.



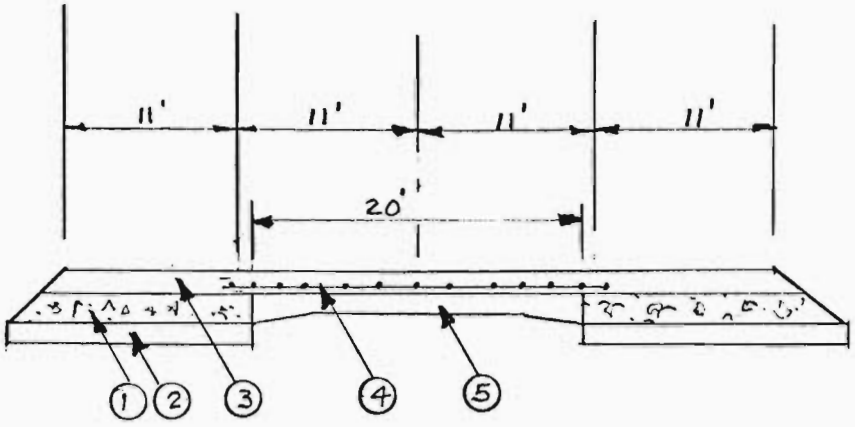
(Without Wire)

It is noted that asphalt in this seal can be picked up by the heal of a shoe. This closeup was taken at the position the cameraman was standing when taking the view down the roadway on the section without wire above.

Reference No. 22
Galveston County
Project C 628-1-6
SH 341: From SH 3 to Loop 197

Overlay Construction Completed January, 1965

1967 ADT = 5250



TYPICAL SECTIONS
(WITH WIRE)

(1) 10" Cement Stabilized Base

(2) 6" Lime Treated Subgrade

(3) 400#/SY ACP - (No Wire)

(4) 500#/SY ACP - (With wire - 24' wide)

(5) Old Concrete Pavement

(WITH WIRE)

Noted that the longitudinal crack is appearing near the edge of the wire and outside of the construction joint between the concrete and the flexible base

(WITH WIRE)

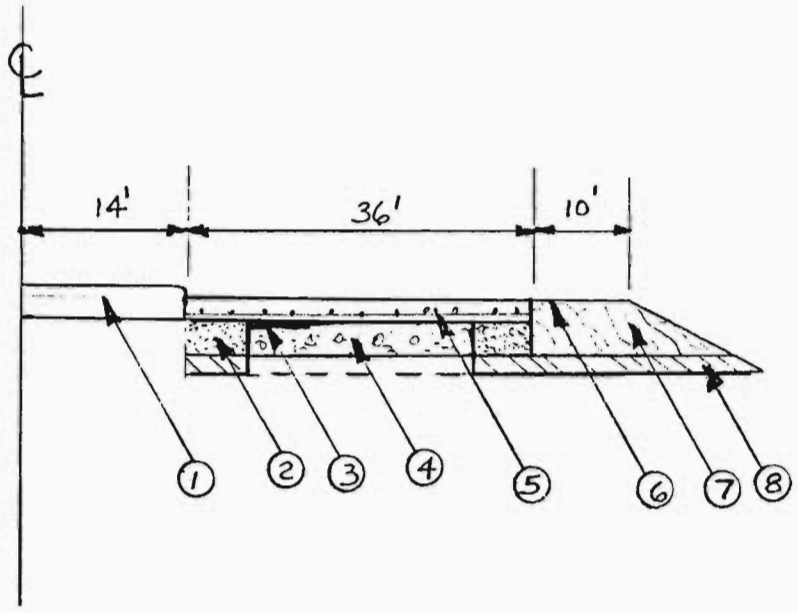
The above two pictures show the general pattern of cracking on this highway. The longitudinal and transverse cracks are about hairline in size with a light seal.

Reference No. 23
Harris County
Project I 45-1(64)031
IH 45: From Almeda-Genoa Road to FM 1959

Construction Overlay Project Completed March, 1965

This project was overlaid with 100#/SY in 1967 to eliminate slickness.

1967 ADT = 36,000



(1) Median

(2) Cement Stabilized Base

(3) ACP to reverse crown

(4) 8" Old Concrete Pavement

(5) 500 #/SY ACP with wire

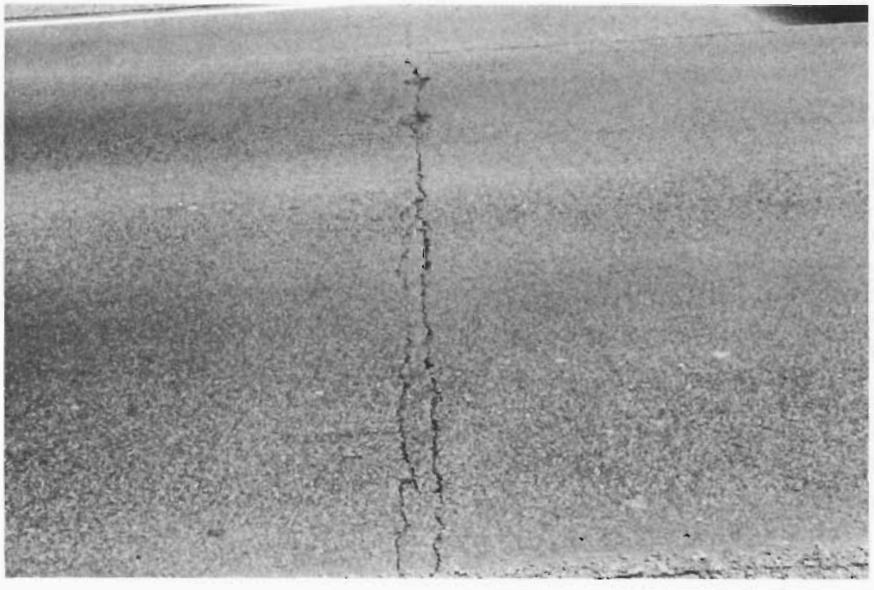
(6) Surface Treatment

(7) Flexible Base

(8) Lime Treated Subgrade

(With Wire)

These cracks were about 30 to 40 feet apart.



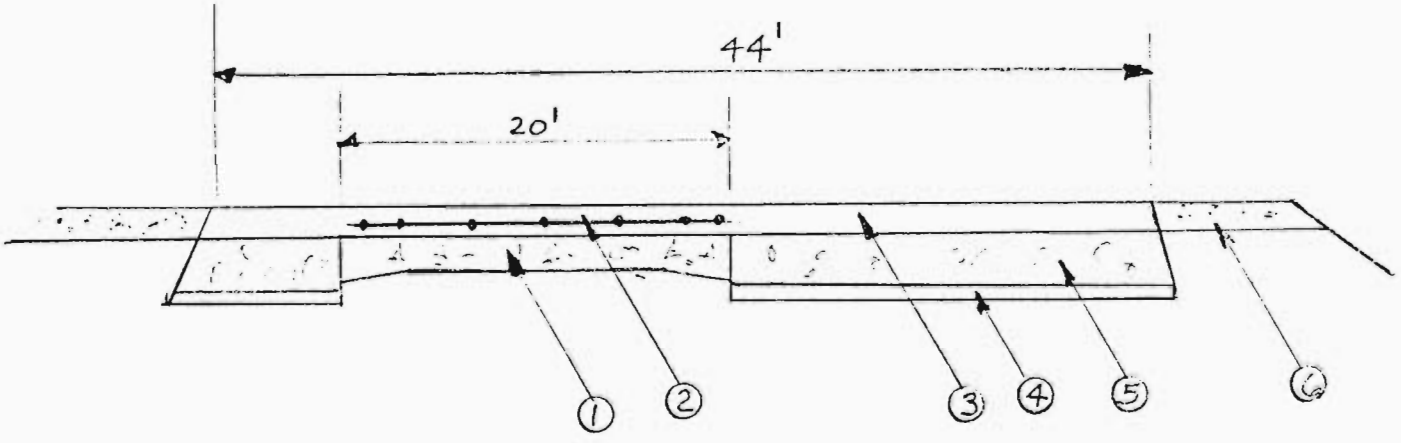
(Without Wire)

This is taken just north of the end of project I 45-1(64)031 and shows a light overlay without wire which was placed in the early 60's and appears to be about to ravel at this joint.

Reference No. 24
Brazoria County
Project C 192-3-8
SH 6: From Alvin
To Galveston County Line

Construction of the Overlay on this project was Completed June, 1966

1967 ADT = 5820



TYPICAL SECTION
(With Wire)

(1) Old Concrete Pavement 7"

(2) 550 #/SY ACP With Wire Fabric

(3) 475 #/SY ACP Without Wire

(4) Stabilized Subgrade

(5) 12" Cement Treated Base

(6) Flexible Base

(With Wire)

(With Wire)

The above two pictures show the general pattern of cracking on S.H. 6. The cracks were generally hairline in size and the seals tended to exaggerate their size. One thing that these pictures do not show at this location that was evident when driving over the project is that the cracks over the flexible base were more frequent and wider than cracks over the wire reinforced sections.

Reference No. 25

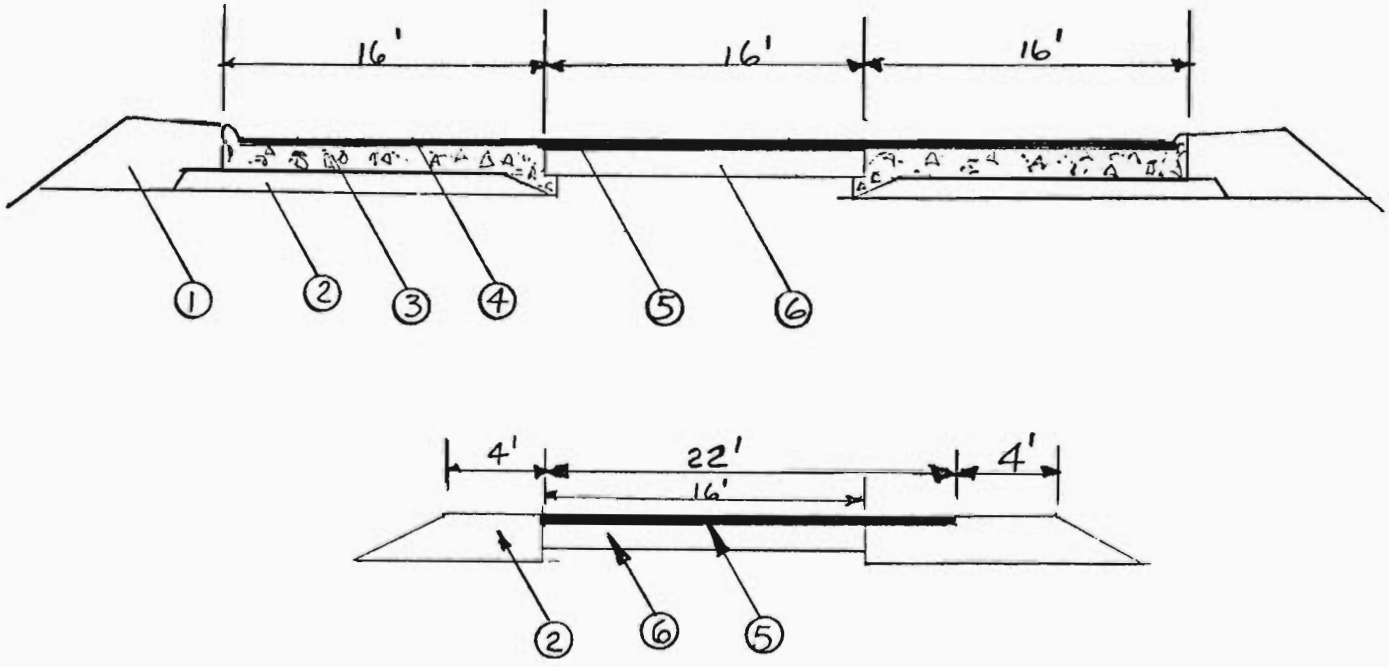
Galveston County
Project F 598(8)
SH 6: From FM 1764 to Brazoria

Construction Completed 1966

The cross section, traffic data and crack patterns for this project were about the same as Reference Project 24.

Reference No. 26
Jefferson County
State Highway 87: From Spur 214
South 1.4 Miles
Project SU 654 (4) & S654 (5)
Construction of Overlay April, 1967

1966 ADT = 8140



TYPICALS SECTIONS
(BOTH SECTION WITH WIRE)

(1) Flexible Base

(2) Cement Treated Base

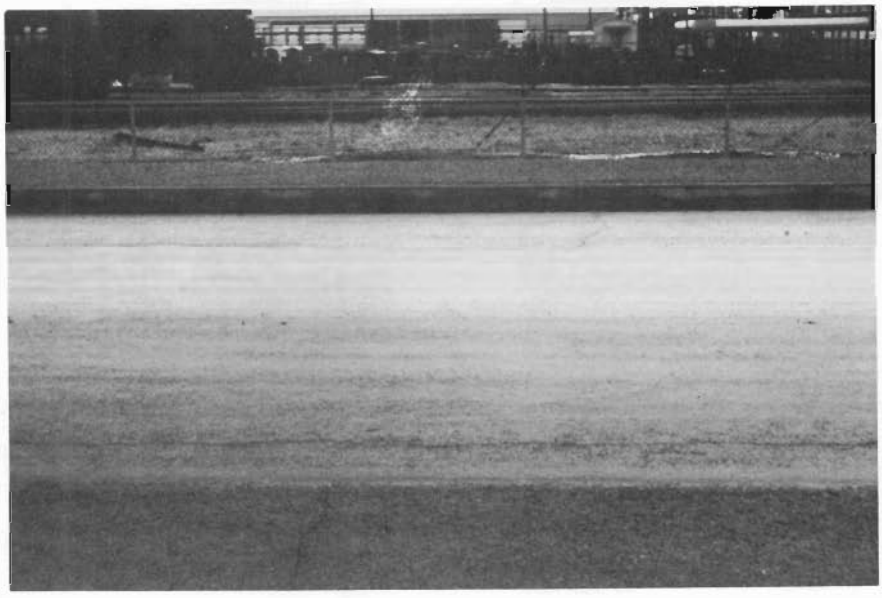
(3) Widened with Concrete

(4) 110#/SY ACP

(5) Top Section
110#/SY ACP - Surface Course
100#/SY ACP - Intermediate Course
115#/SY ACP - Wire Course
Wire Fabric (Ty 2 - 15'6" Wide)
Seal Coat

Bottom Section
110#/SY ACP Surface Course
100#/SY ACP Intermediate Course
115#/SY ACP Wire Course
Wire Fabric (Ty 2 - 21'6" Wide)
75#/SY Level-Up

(6) Old Concrete Pavement



(WITH WIRE)

This is the only section that wire was placed directly on a seal coat. This section has hairline to 1/8 in. transverse cracks at about 20 ft. spacings, with slightly larger cracks going across the concrete widening. Longitudinal cracks were hairline to 1/8 in. in width.

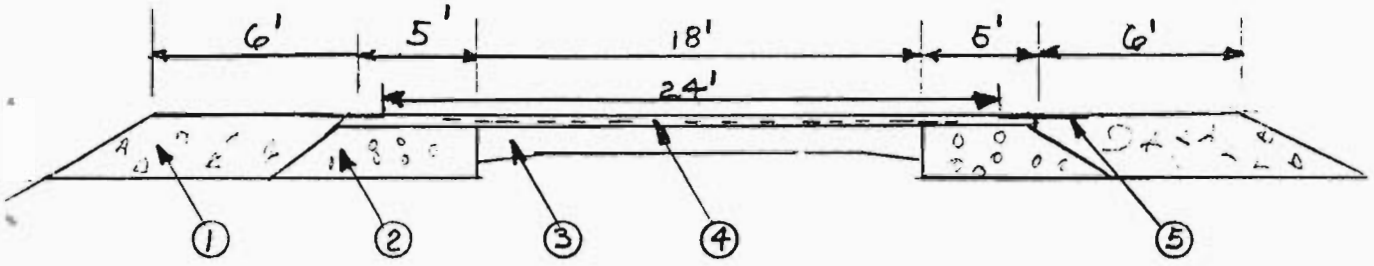
(WITH WIRE)

On the above rural section, there were no cracks.

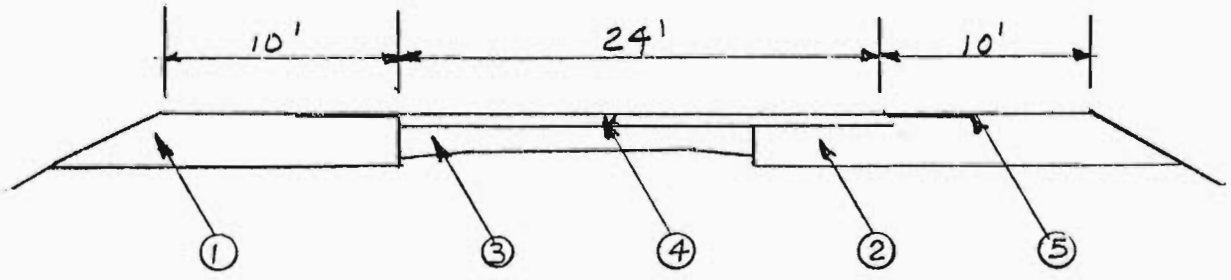
Reference No. 27
Matagorda County
Project S 428 (5)
SH 60: From Bay City to FM 521

Overlay Completed in December, 1967

1967 ADT = 1480



TYPICAL SECTION
(WITH WIRE-3"-6" NO. 10 GA)



TYPICAL SECTION
(WITHOUT WIRE)

(1) Flexible Base

(2) 12" Cement Stabilized Base

(3) Old Concrete Pavement

(4) ACP - Top Section
with wire
500#/SY

Bottom Section
without wire
200#/SY

(5) One Course Surface Treatment

Pictures were taken just south of the intersection of SH 60 and FM 2668.

(WITHOUT WIRE)

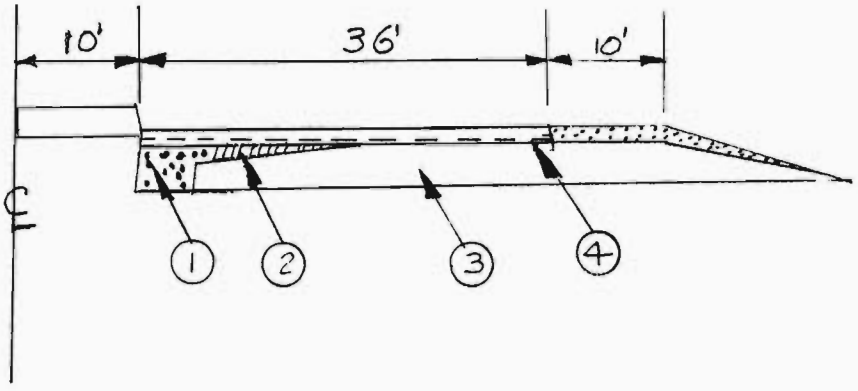
This picture is taken looking north and shows immediate sealing required on an overlay that is not reinforced.

(WITH WIRE)

This picture was taken by turning around and looking south.

Reference No. 28
Harris County
Project I 45-1(39)061
I.H. 45: From FM 525 to FM 1960
Construction of Overlay Completed December, 1961

1961 Traffic = 6800
1968 Traffic = 21440
1961-68 Equivalent 18 kip single axle loads = 2,400,000



(WITH WIRE)
TYPICAL SECTION

(1) Flexible Base

(2) ACP Level-up

(3) 15" Existing Iron Ore Flexible Base

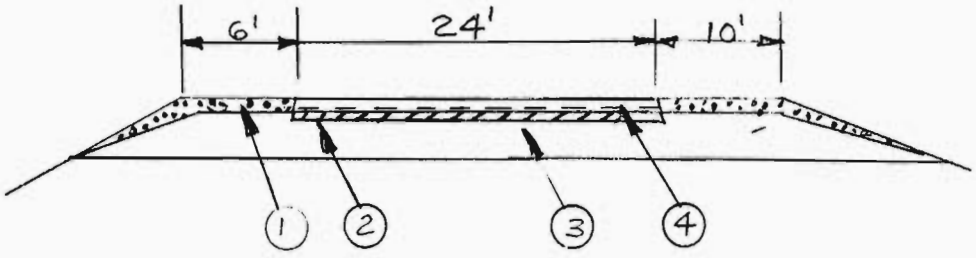
(4) 400#/SY ACP with wire 3"x6" - 10 gage - 325#/SY Over Wire

No pictures are available on this section. The wire reinforced asphalt concrete overlay on this project has required little maintenance and has performed exceptionally well. Crack patterns have developed on the surface of the reinforced asphaltic concrete overlay but the width of these cracks has been controlled to the extent that sealing has been necessary only on a small percentage of the cracks.

Reference No. 29
Harris and Montgomery Counties
Project I 45-1(119)67
I.H 45: From 0.2 Mile North of FM 1960
To Spring Creek
Construction of Overlay Completed April, 1963

1963 ADT = 10,640
1968 ADT = 21,440

1963-68 Equivalent 18-kip single axle loads = 2,080,145



TYPICAL SECTION
(With Wire)

(1) Addition Flexible Base

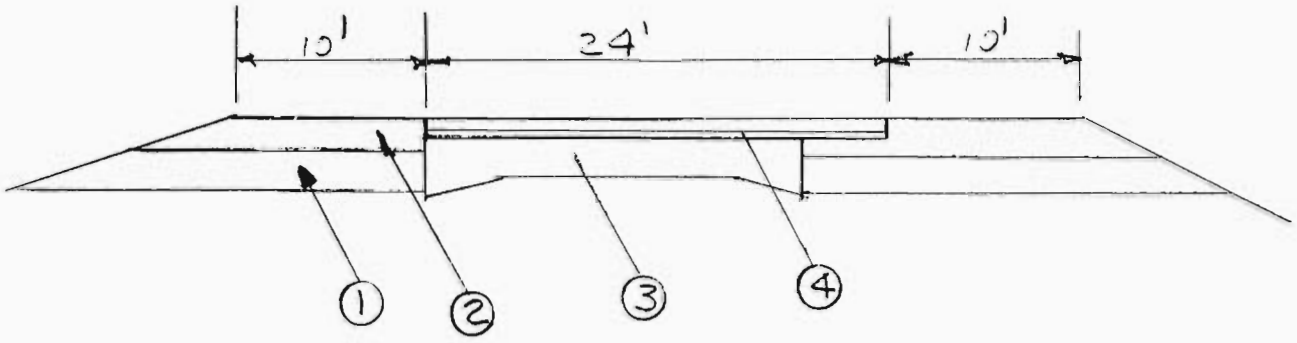
(2) Existing Hot Mix ACP

(3) Existing Flexible Base

(4) 400 #/Sy ACP with 3" x 6" #10 ba Wire

No pictures are available at this time for this section. The wire reinforced asphaltic concrete overlay on this project has required little maintenance and has performed exceptionally well. Cracks have developed on this project but the size of these cracks has been controlled to the extent that sealing has been necessary only on a very small percentage of the cracks. Consequently these cracks can only be detected by close observation from a vehicle traveling at a very slow speed.

Reference No. 30
Project F1116(7)
SH 114: From Denton County Line
To 1.4 Miles West of Grapevine



(WITH WIRE)
TYPICAL SECTION

(1) 6" Lime Treated Subgrade
(2) 8" Lime Stabilized Flexible Base
(3) Existing Concrete Pavement
(4) 340#/SY ACP
3"x 6" #10 Ga. Wire
110 #/SY ACP

An accurate evaluation of the use of the wire fabric reinforcing on this project will have to be deferred until the pavement has been in service for a few years. There are, as yet, no obvious faults as far as pavement soundness, riding surface, or appearance are concerned. This project was used earlier in this report to demonstrate placement techniques.