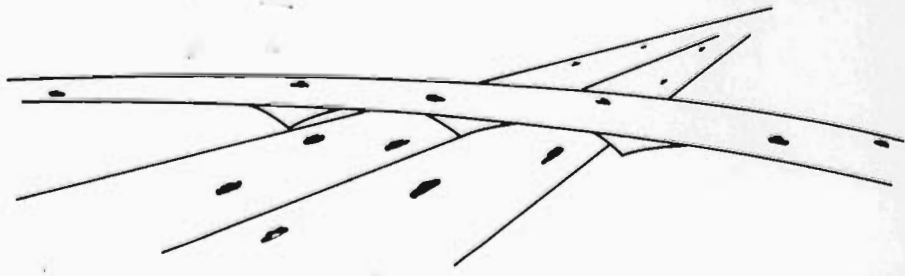


# DEPARTMENTAL RESEARCH

Report Number



## SUPPLEMENT TO REPORT NUMBER SS 9.0

# PERFORMANCE OF METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

TEXAS HIGHWAY DEPARTMENT

SUPPLEMENT TO
REPORT NUMBER SS 9.0

# PERFORMANCE OF METAL REINFORCED BITUMINOUS OVERLAYS IN TEXAS

ASSEMBLED BY
PAVEMENT DESIGN SECTION
HIGHWAY DESIGN DIVISION

MATERIAL FURNISHED BY
DISTRICT 2, 12 and 24

TEXAS HIGHWAY DEPARTMENT
JUNE 1971

Table of Content

## Supplement for District 2 - Fort Worth

The following typical sections and photographs pertain to three projects that have been in service in District 2 since 1966. Minor crack sealing has been necessary on one of these projects, whereas the other two projects have been maintenance free. The present surface conditions of the three projects indicate that an additional five years of service can be expected without any appreciable maintenance being necessary.

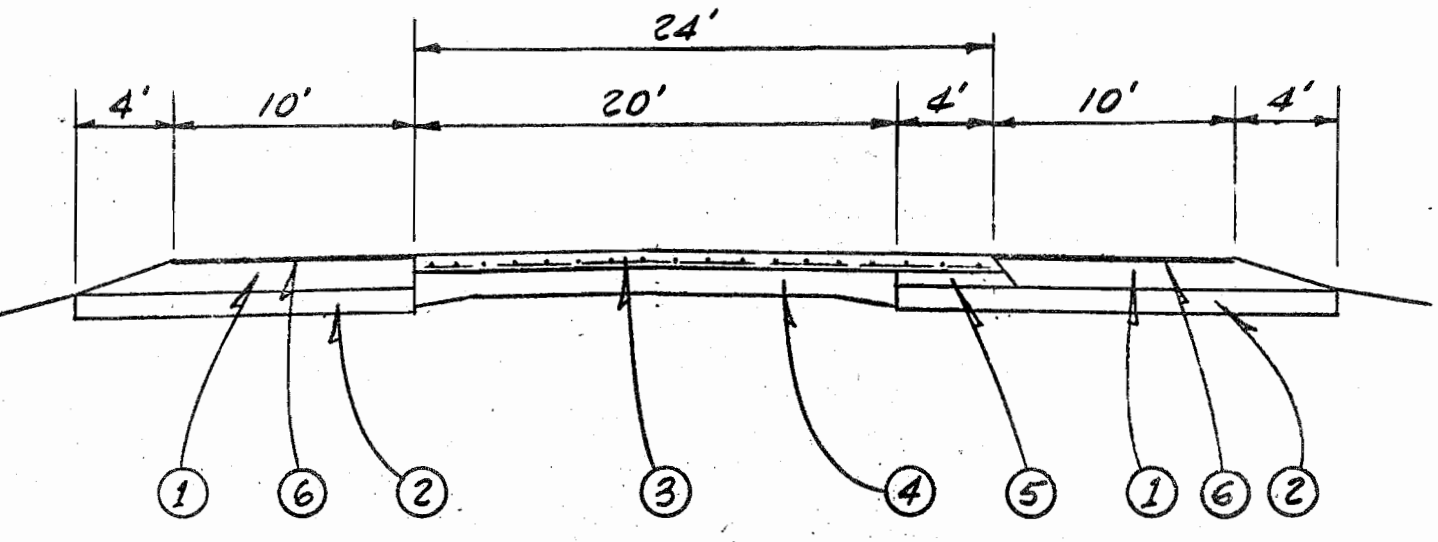
Two photographs are inserted to show how overlays without metal reinforcing normally require continuous maintenance operations consisting of joint sealing and occasional pavement repairs. The presence of equipment and personnel on through lanes during these repairs creates a hazard to the traveling public. Metal reinforcement in bituminous overlays eliminates the expensive joint sealing and pavement repairs and not only saves money but also eliminates the traffic hazard.

Tarrant County
Project F 1116(7)
S.H. 114: From Denton County Line
To 1.4 miles West of Grapevine

Overlay Construction Completed May, 1968.

1971 ADT - 6220

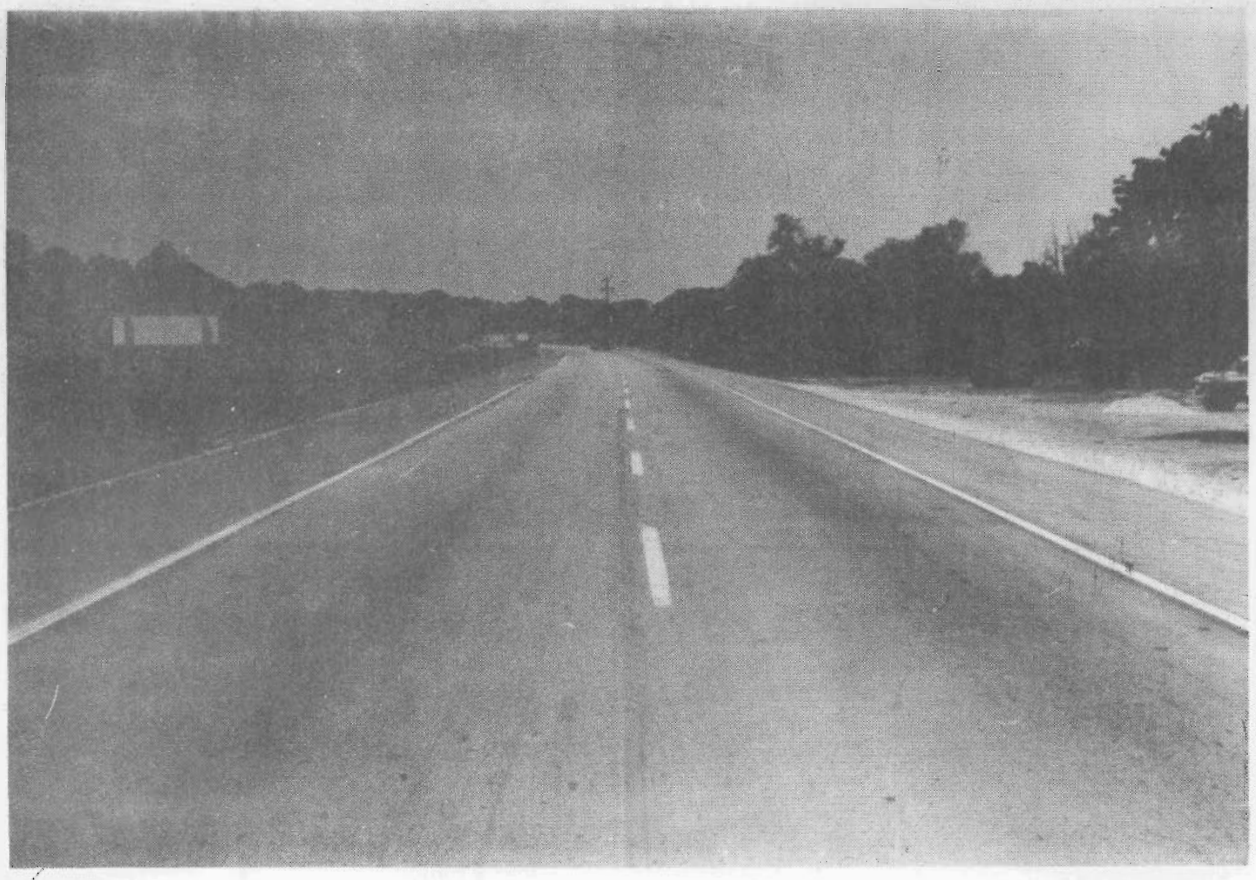
1971 Equivalent - Kip Single Axle Loads 10,815,000

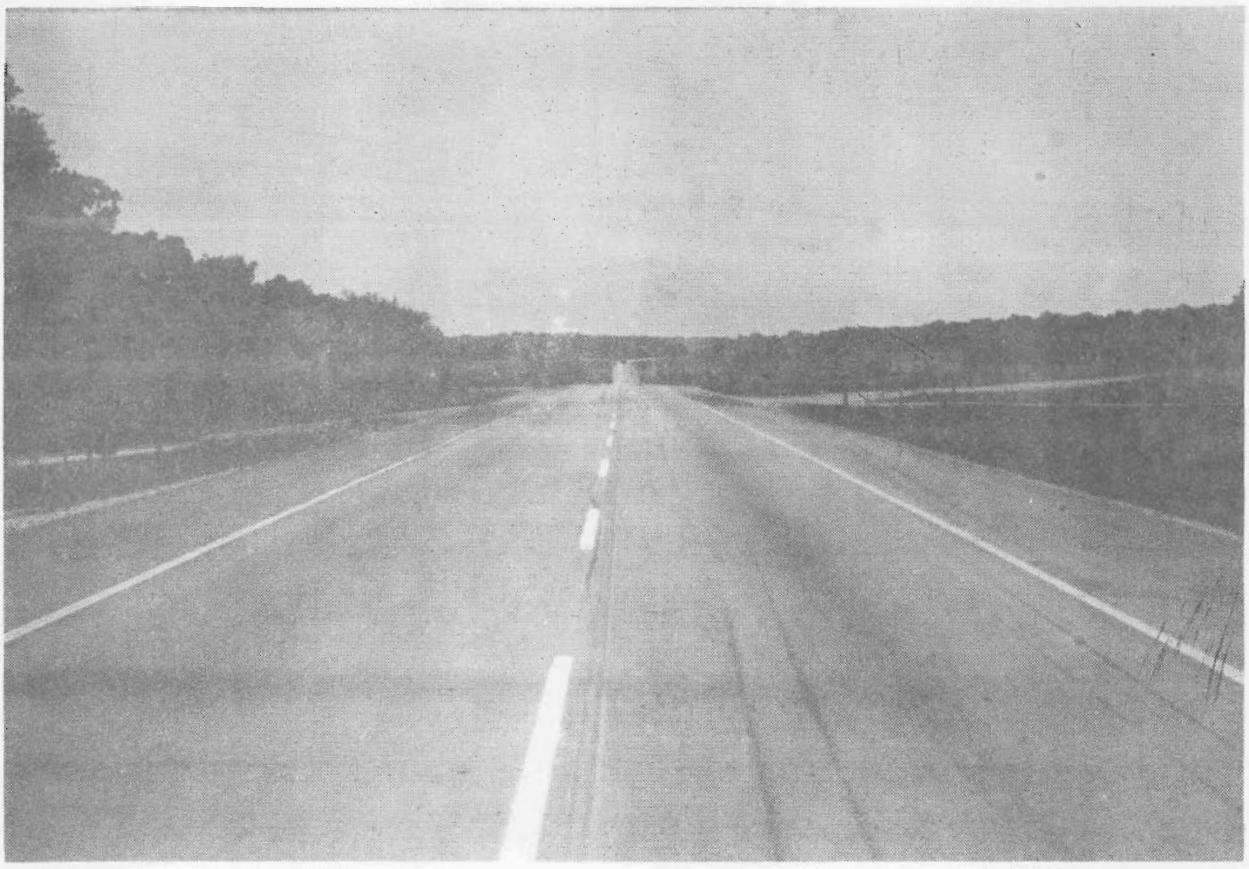



TYPICAL SECTION
(WITH WIRE)

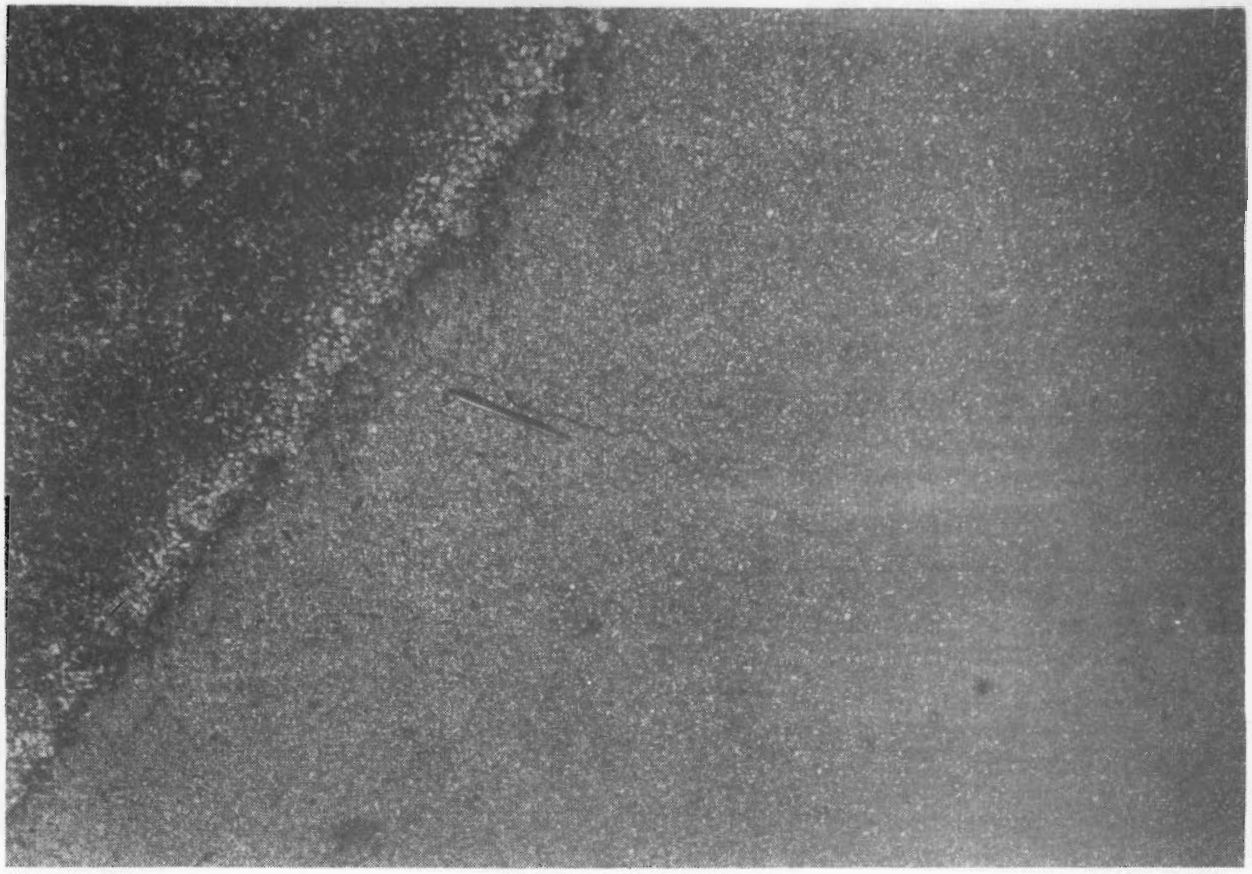
(1) Flexible Base
(2) Lime Treated Subgrade
(3) 550 #/S.Y. Asph. Conc. Pvmt. w/3"x6"x # 10 Wire Fabric Reinf.
(4) Exist. Concrete Pavement
(5) 440 #/S.Y. Asph. Conc. Pvmt., Type "A"
(6) Two Course Surface Treatment

This photograph shows the transition from a non-reinforced asphaltic concrete overlay to an asphaltic concrete pavement with wire reinforcement.





The hair-line cracks appear so infrequently that crack sealing has not been necessary on this project.



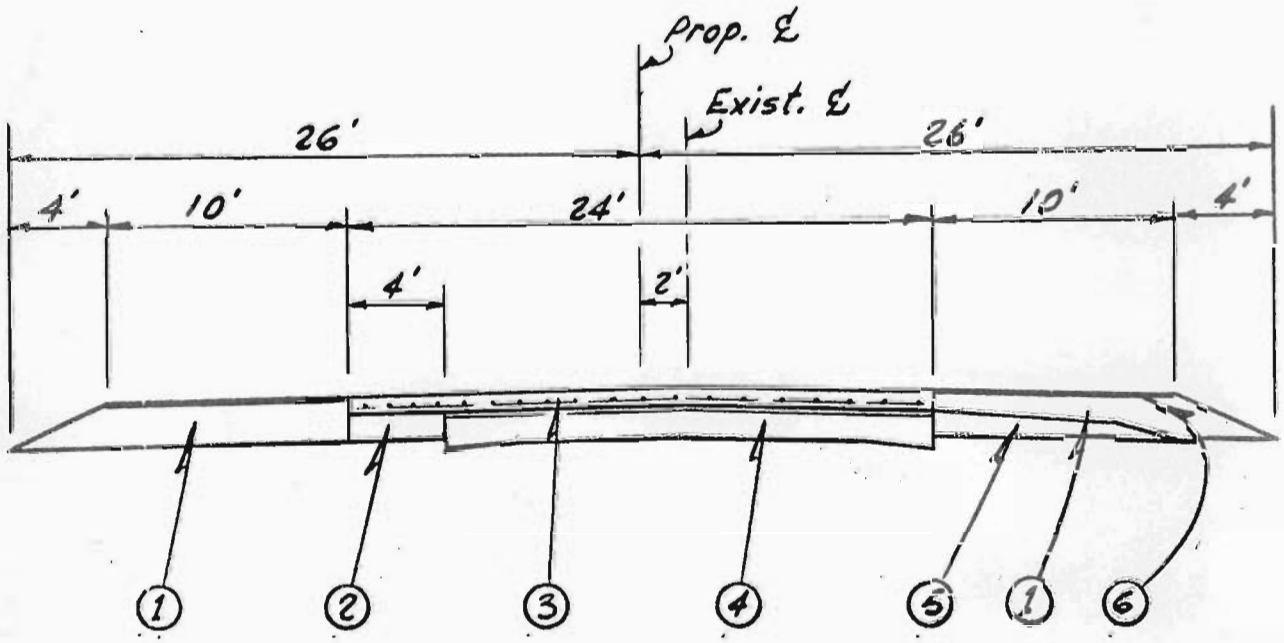
The typical transverse hair-line crack. These cracks appear approximately every four hundred to six hundred feet.

Wise County
Project F 1116(9)
SH 114: From US 81 & 287 South of Rhome
To Denton County Line

Overlay Construction Completed November, 1966.

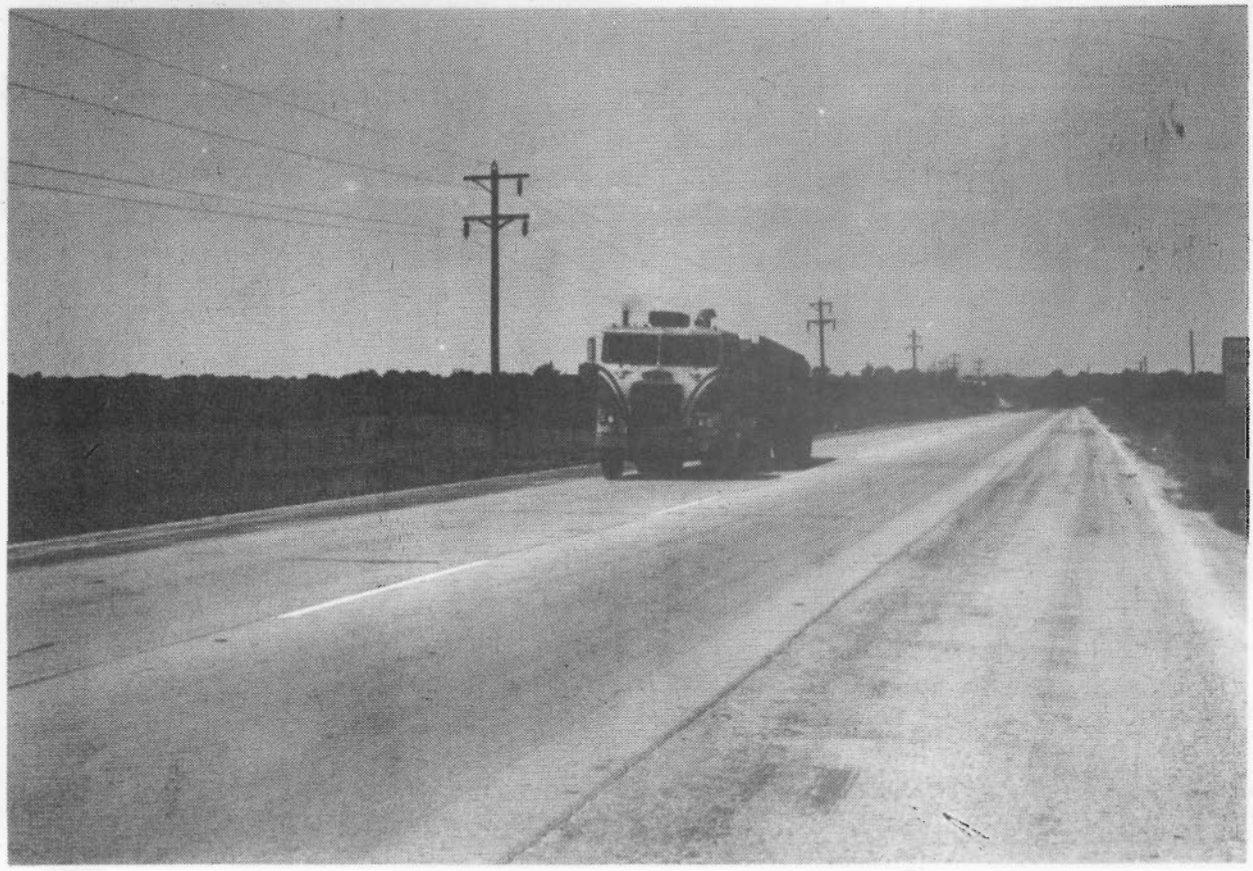
1971 ADT - 4280 70% Rock Trucks

1971 Equivalent - Kip Single Axle Loads 10,668,000



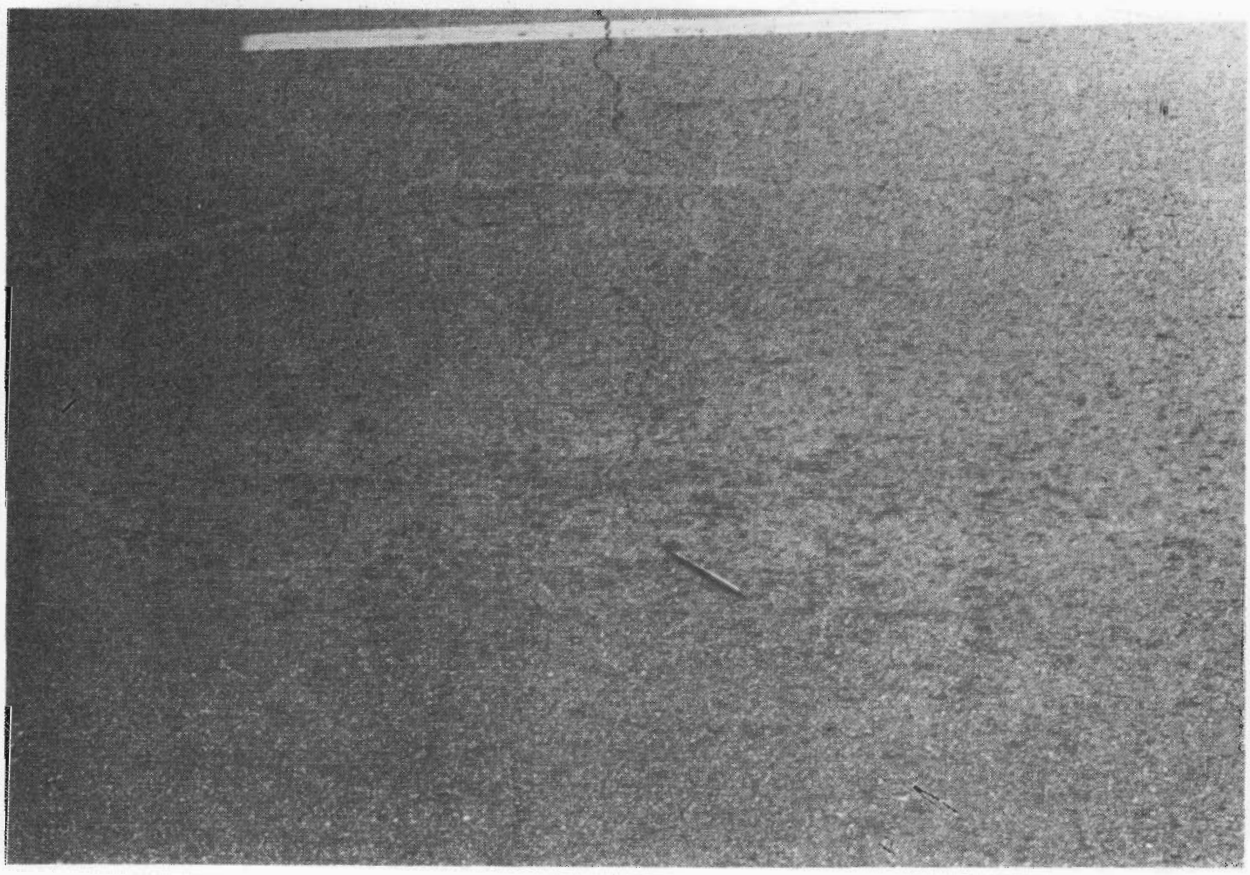

TYPICAL SECTION
(WITH WIRE)

(1) Flexible Base
(2) 8" Class "A" Conc. (Reinf.)
(3) 450#/S.Y. Asph. Conc.Pvmt. w/3"x6"x # 10 Wire Fabric Reinf.
(4) Exist. Conc. Pvmt. & Asph. Overlay
(5) Exist. Base
(6) Two Course Surface Treatment & Prime



(WITH WIRE)

3,000 trips a day are made by rock trucks ranging in total weight from legal loads up to 110,000 lbs. A few cracks have been sealed in the loaded lane. These cracks are the hair-line type and could have been left unsealed.



(WITH WIRE)

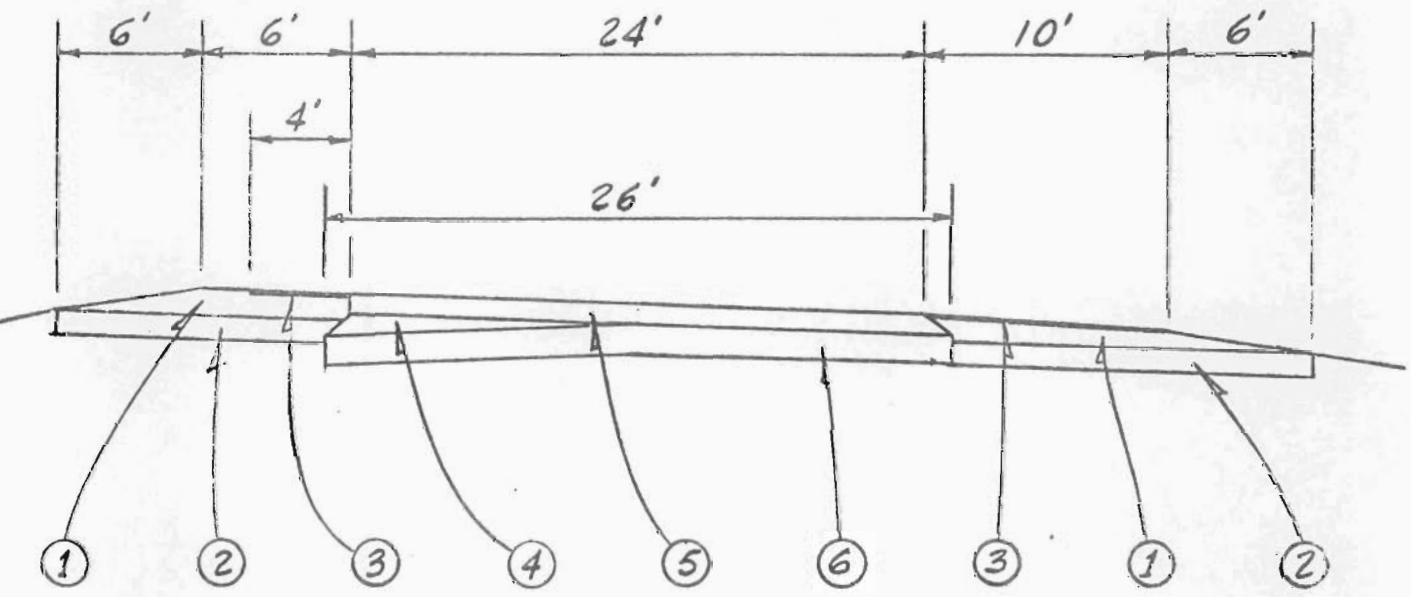
Typical hair-line crack that has not been sealed.

These two photographs represent the remaining portion of the project showing that crack sealing has not been necessary.

Johnson County
Project I 35W-5(47)390
I 35W: From South of Alvarado
To North of Grandview

Overlay Construction Completed March 1966

1971 ADT - 6840

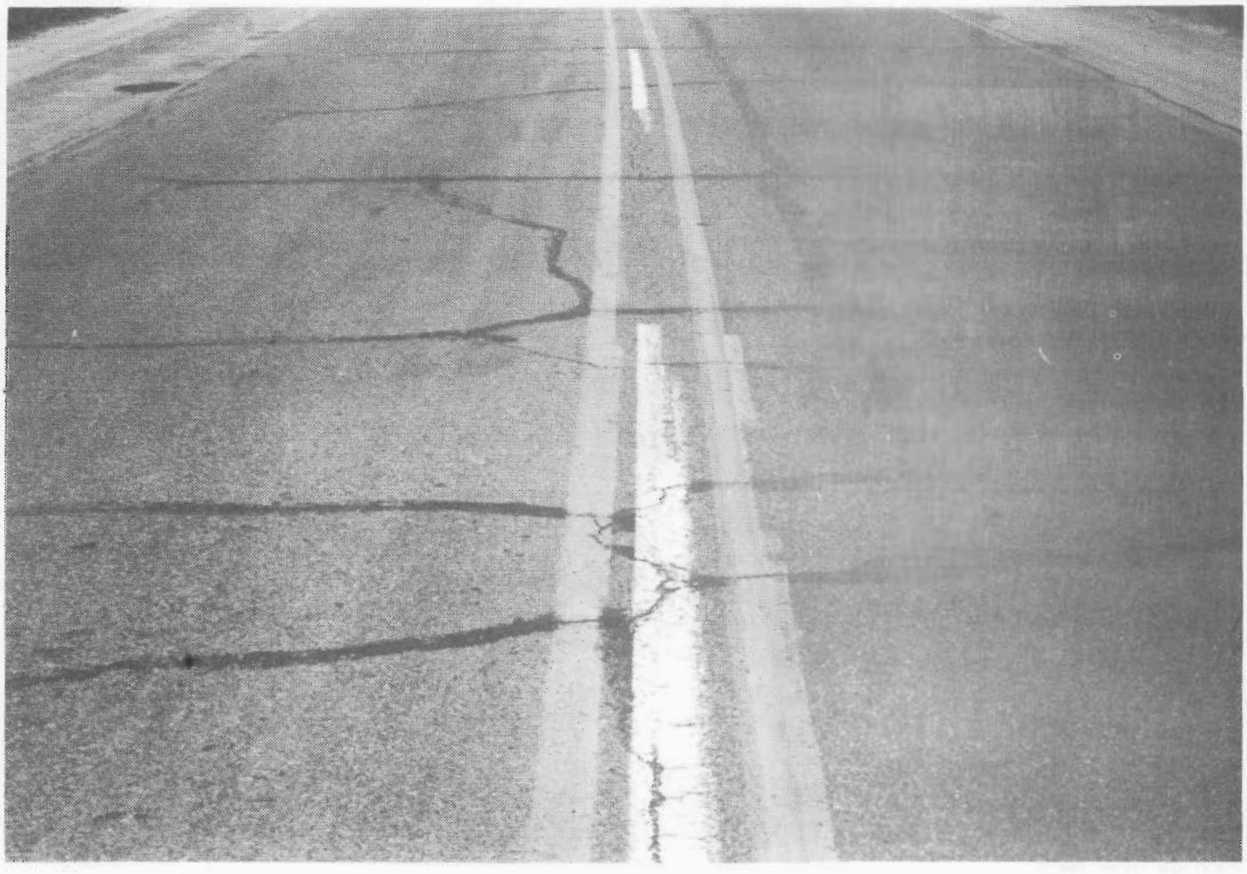



TYPICAL SECTION
(WITH WIRE)

(1) Flexible Base
(2) Lime Stabilized Subgrade
(3) Two Course Surface Treatment
(4) ACP Level Up
(5) 550 #/S.Y. Asph. Conc. Pvmt. w/3"x6"x # 10 Wire Fabric Reinf.
(6) Exist. Concrete Pavement

The hair-line cracks have appeared so infrequently that crack sealing has not been necessary on the entire project.

A typical hair-line crack that appears infrequently throughout the project.



These two photographs show the crack condition of State Highway 114 between Projects F 1116(7) and F 1116(9). The old concrete pavement has been overlaid with non-reinforced hot mix asphaltic concrete.

## SUPPLEMENT FOR DISTRICT 12 - HOUSTON

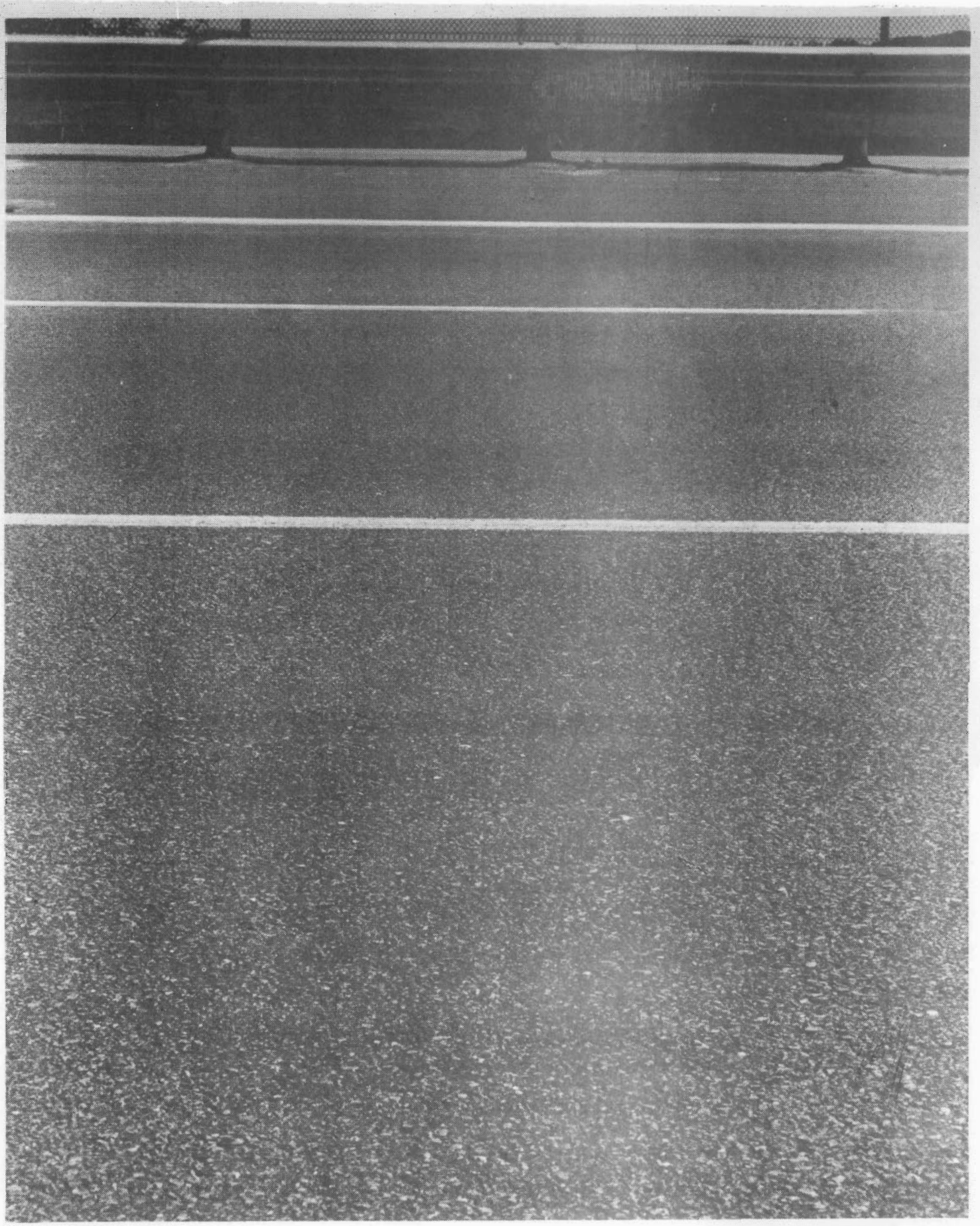
In this section photographs show comparisons of bituminous overlays with wire and overlays without wire. Photographs 18 thru 24 show one specific example of a project where a reinforced bituminous overlay is needed at this time. A discussion of that project is made just prior to those photographs.

IH 45 AT CLEAR CREEK

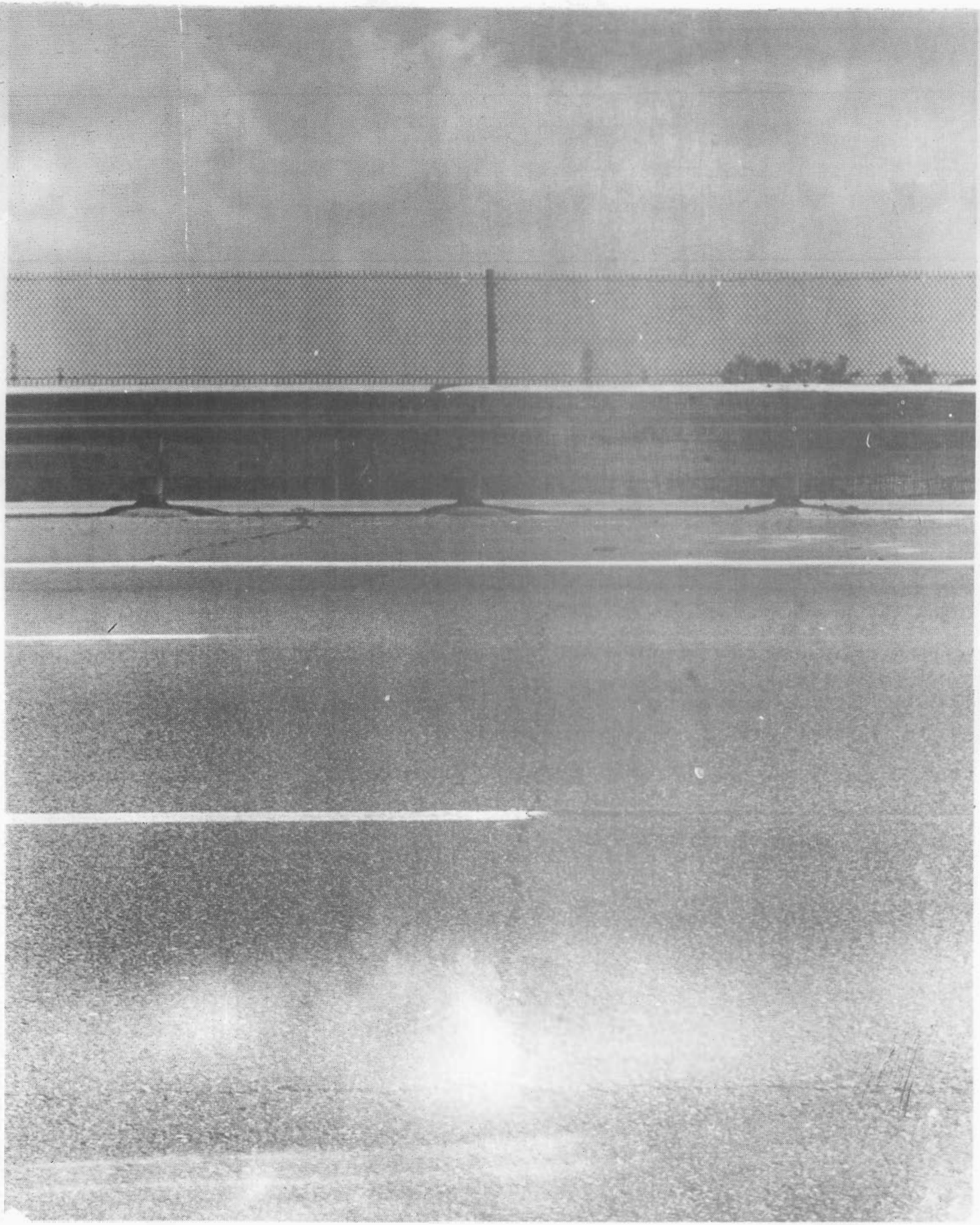
No. 1 & 2: Comparison of transverse joint with mesh and without mesh. These joints are in southbound lane N. of Clear Creek Bridge.

No. 3 & 4: Northbound lane looking South. Note how crack disappears as we enter mesh section in foregound Knife on pavement. Note both longitudinal and transverse openings.

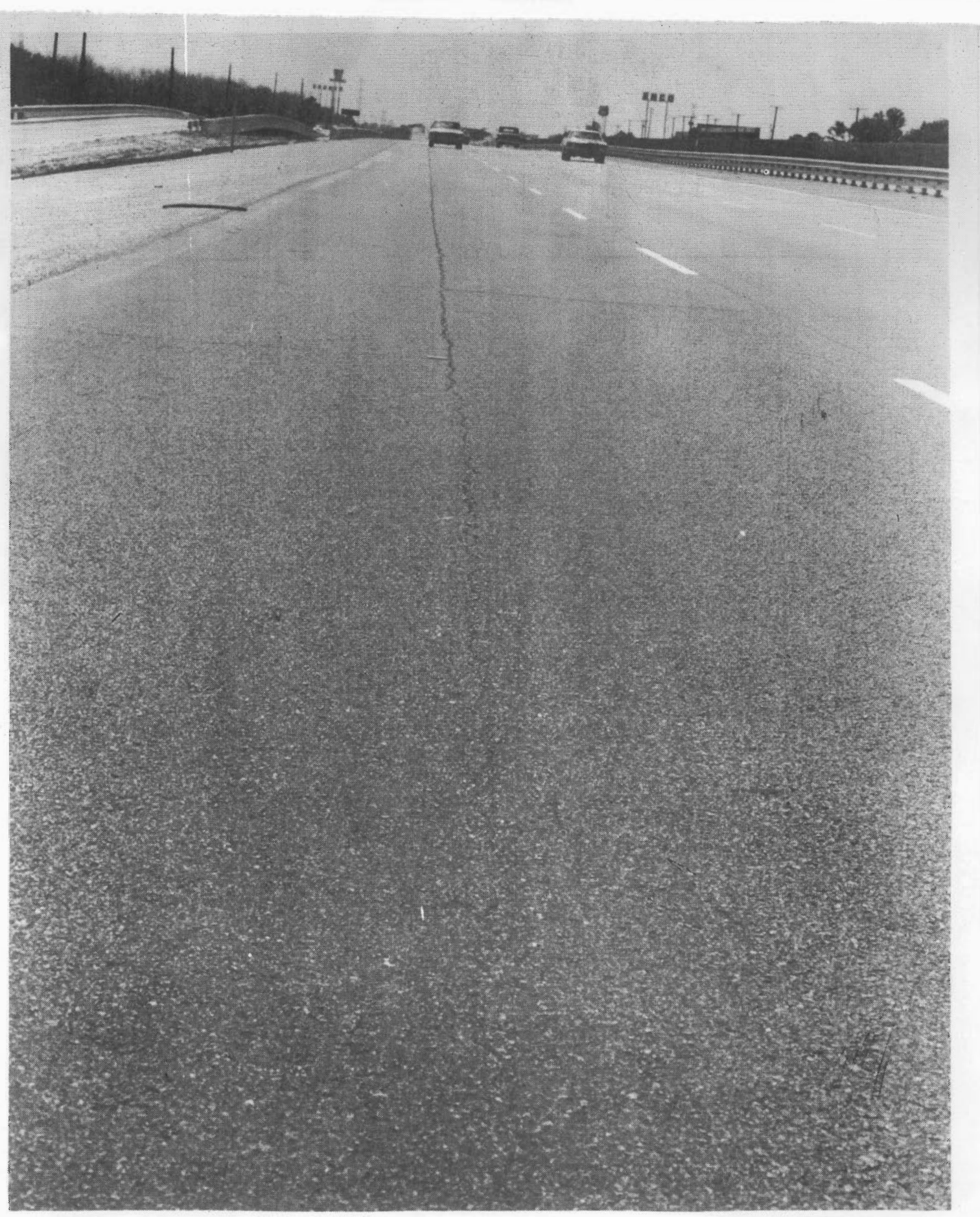
No. 5: Transverse joint opening in unreinforced section, North of Clear Creek on southbound lane.



IH 45: AT CLEAR CREEK - No. 1
(with mesh)



IH 45: AT CLEAR CREEK - No.2
(without mesh)



IH 45: AT CLEAR CREEK - No. 3

IH 45: AT CLEAR CREEK - No. 4

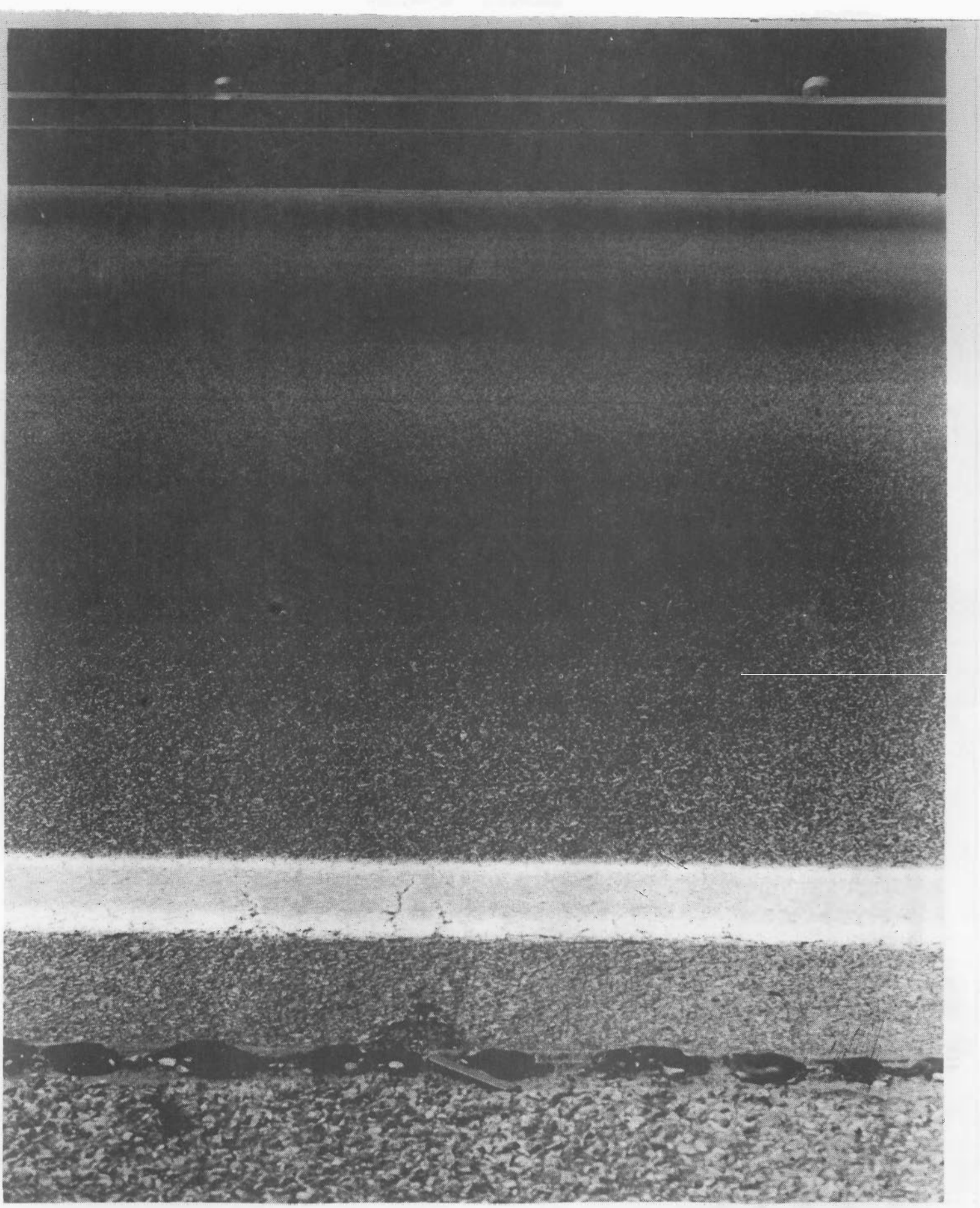
IH 45 AT CLEAR CREEK - No. 5

IH 45: NORTH OF FUQUA ON SOUTHBOUND LANES

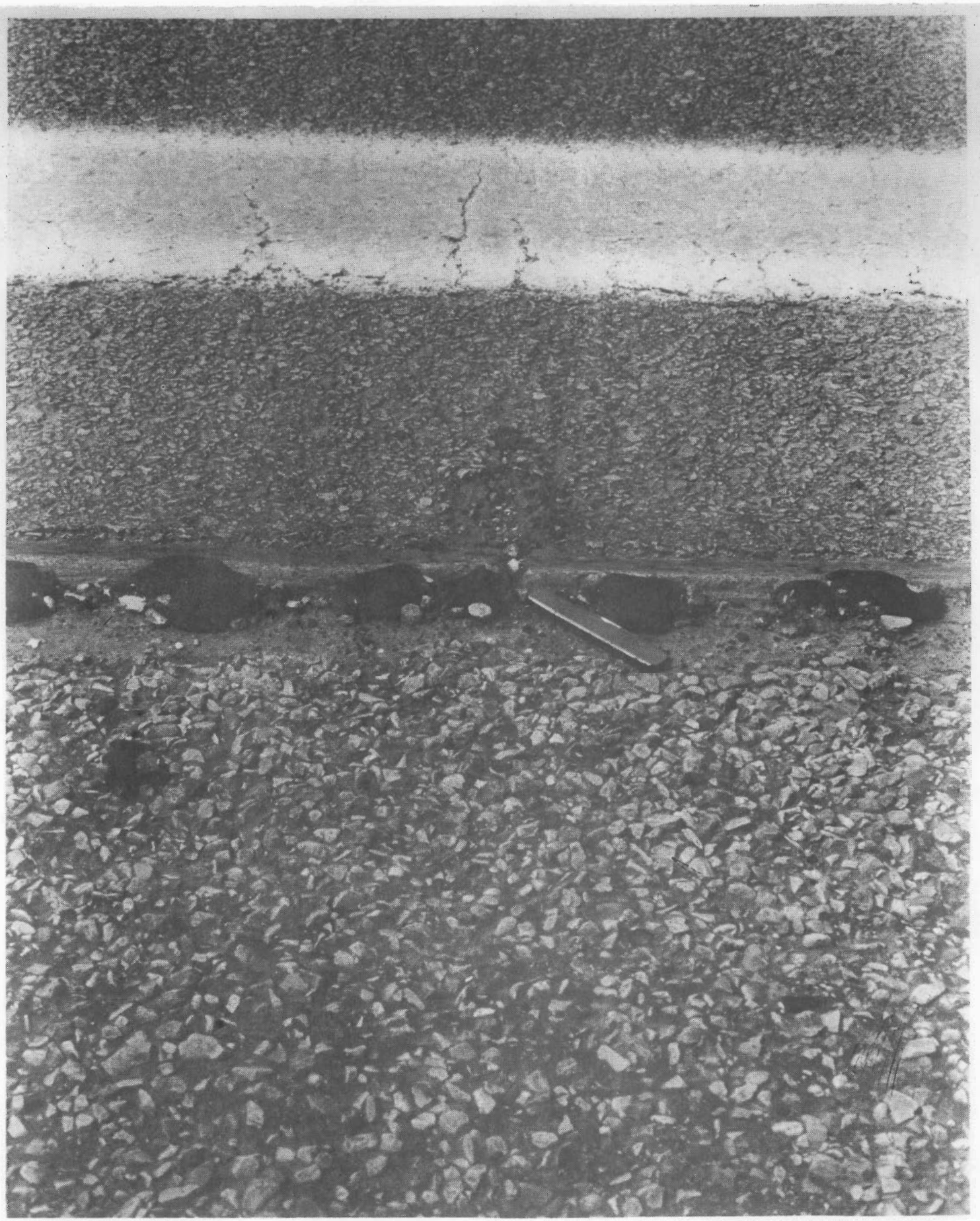
No. 6 & 7 Note slight transverse joint opening at 1" board joint. Knife is at median curb joint line. Longitudinal joints did not come through.

IH 45: SOUTHBOUND LANE TO NORTH OF FUQUA

No. 8 Note no longitudinal joints open under reinforcing mesh area. Transverse joints are only slight openings. Note longitudinal joint in median.



IH 45: NORTH OF FUQUA SOUTHBOUND LANES - No. 6



IH 45: NORTH OF FUQUA SOUTHBOUND LANES - No. 7

IH 45: SOUTHBOUND LANE TO NORTH OF FUQUA - No. 8

## IH 45: BETWEEN CLEAR CREEK AND FM 518

No. 9: Southbound lane looking north. Compare with photo 10 which was taken opposite this picture. (with wire)

No. 10: Northbound lane looking north, compare with photo 9 which was taken opposite this picture. Note crack pattern which reflects all concrete joints. (without wire)

No. 11: Northbound lane showing reflection of expansion joint taken opposite photo 12. (without wire)

No. 12: Southbound lane taken opposite 11. (with wire)

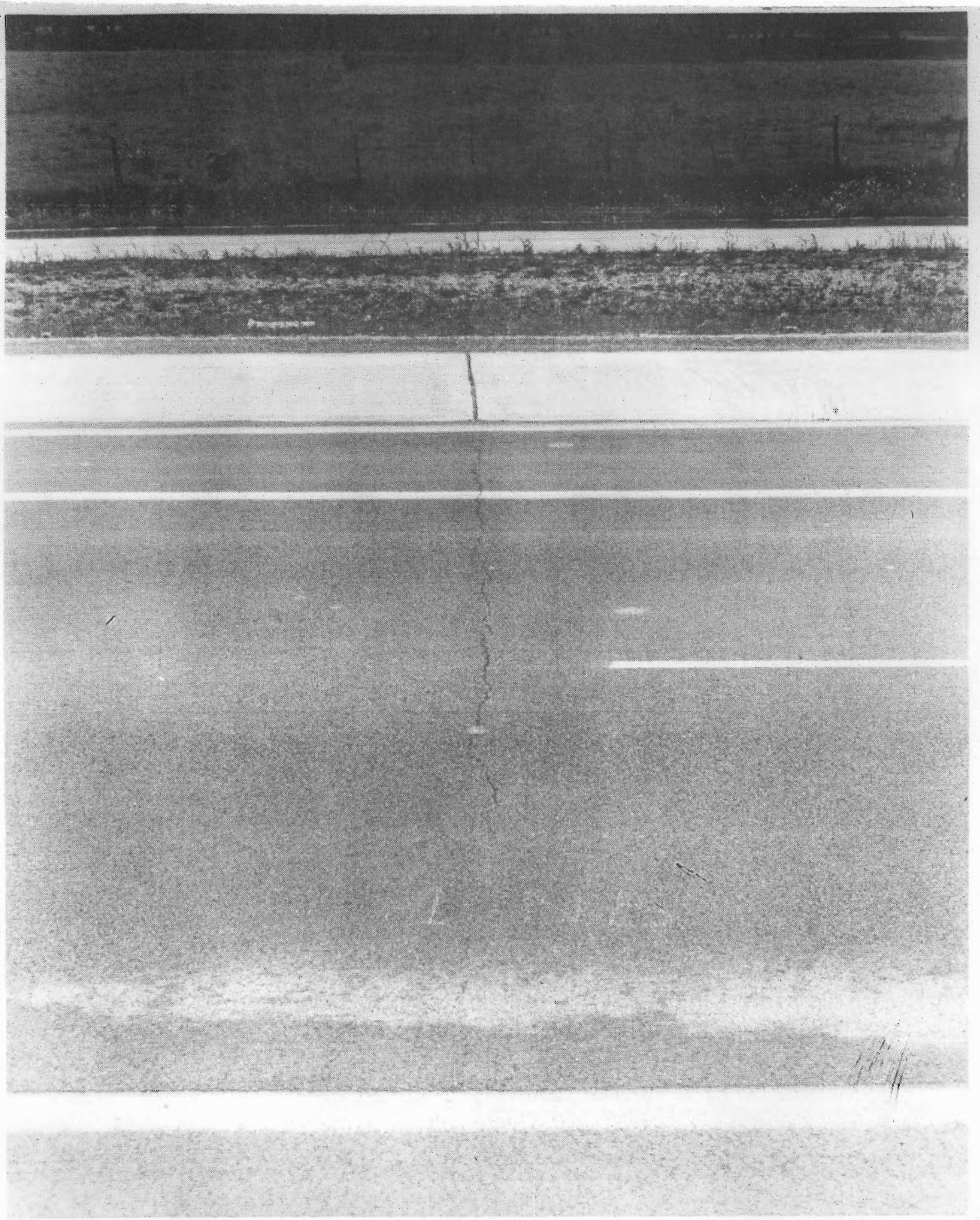
No. 13: Northbound lane showing reflection of expansion joint. Taken opposite photo 14. (without wire)

No. 14: Southbound lane taken opposite photo 13. (with wire)

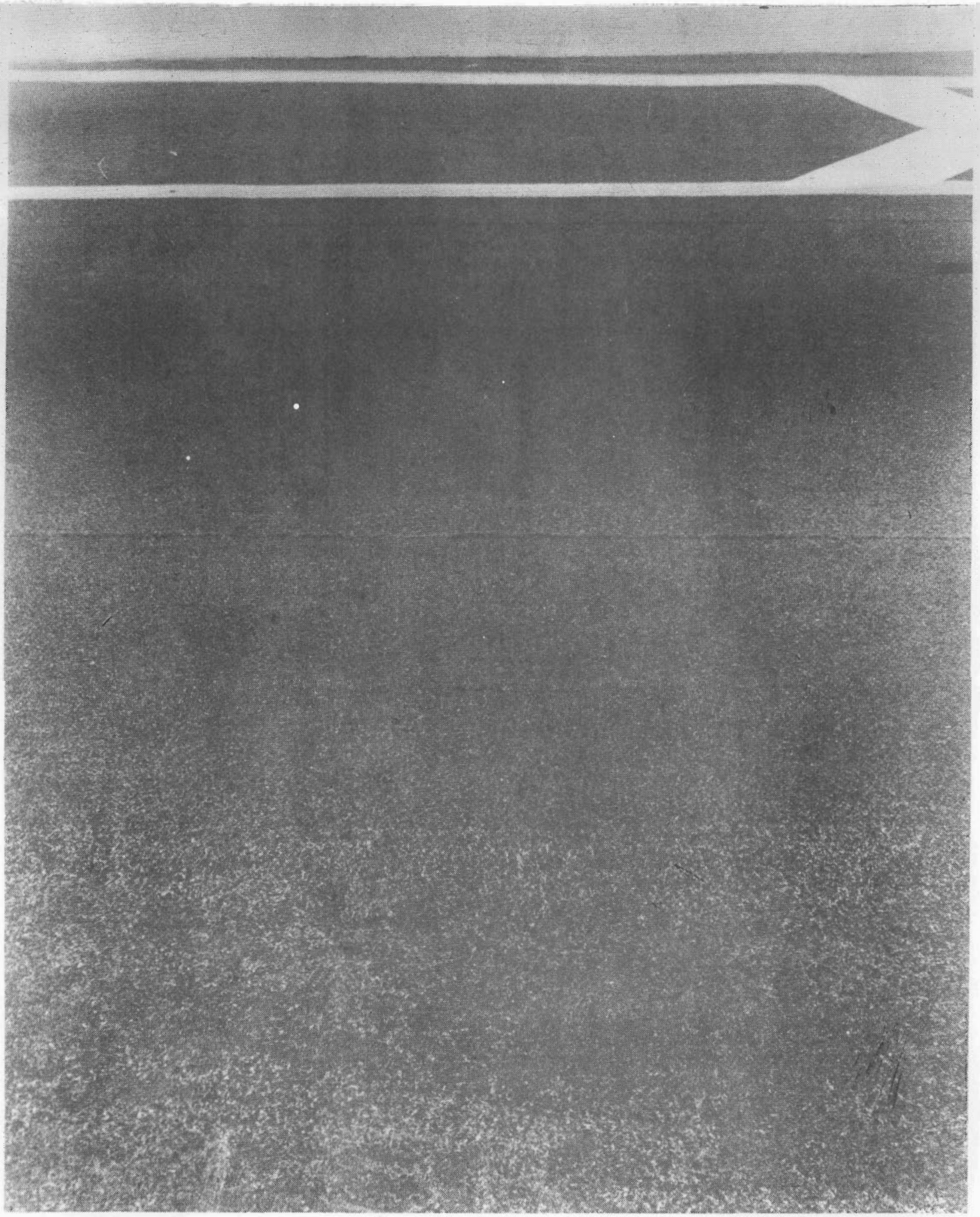
No. 15: Southbound lane showing reflection of expansion joint in section with wire.

IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 9

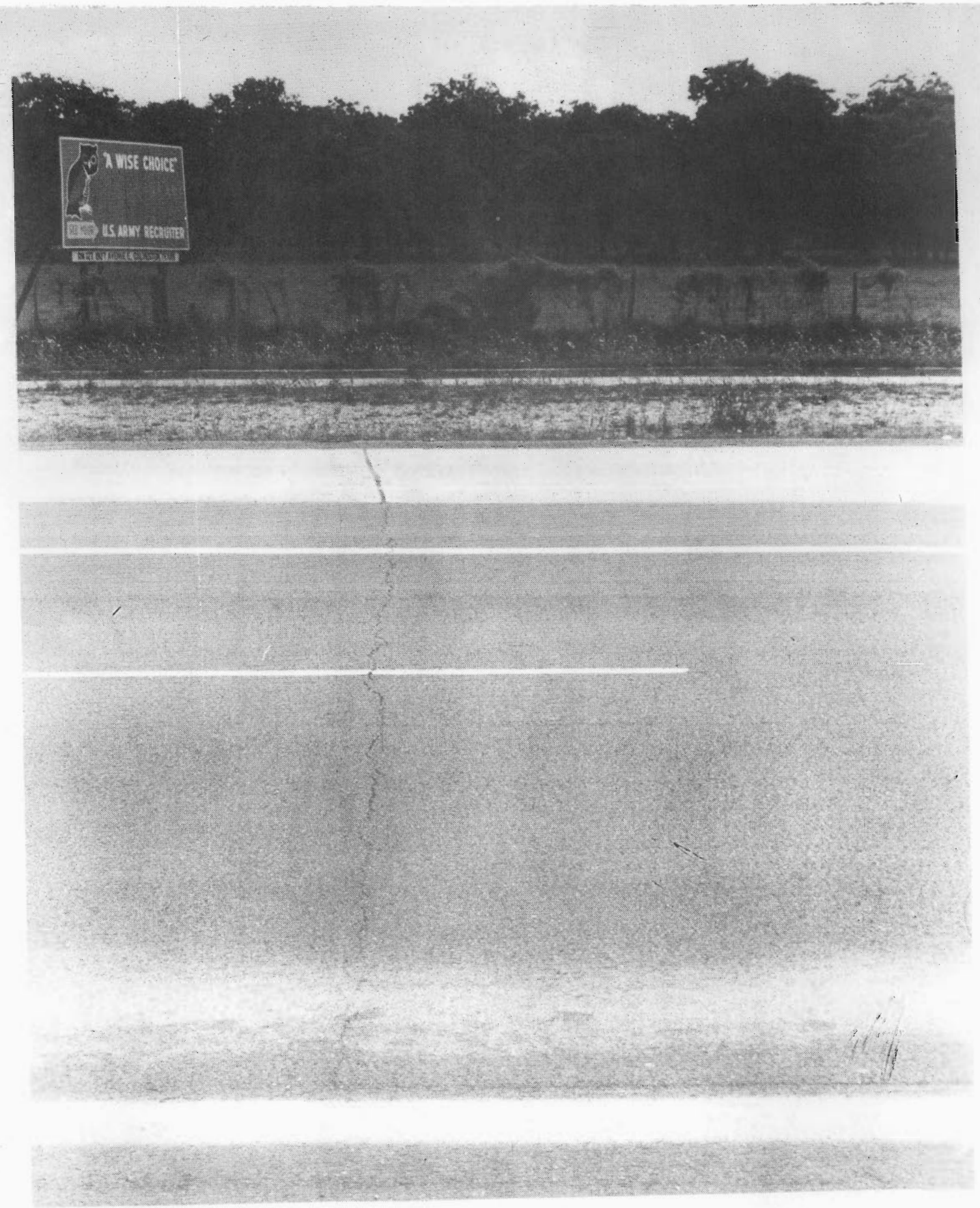
IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 10



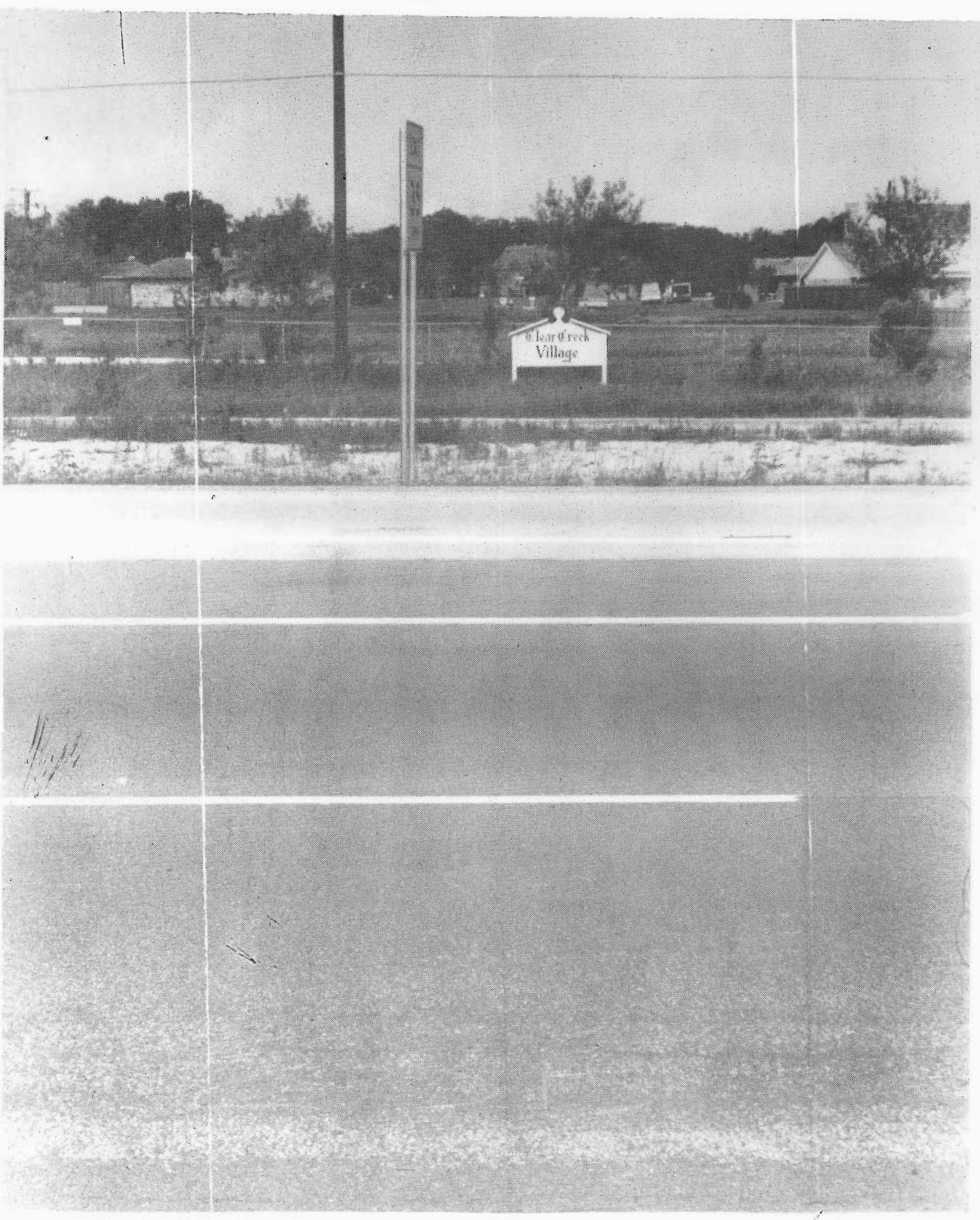
IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 11



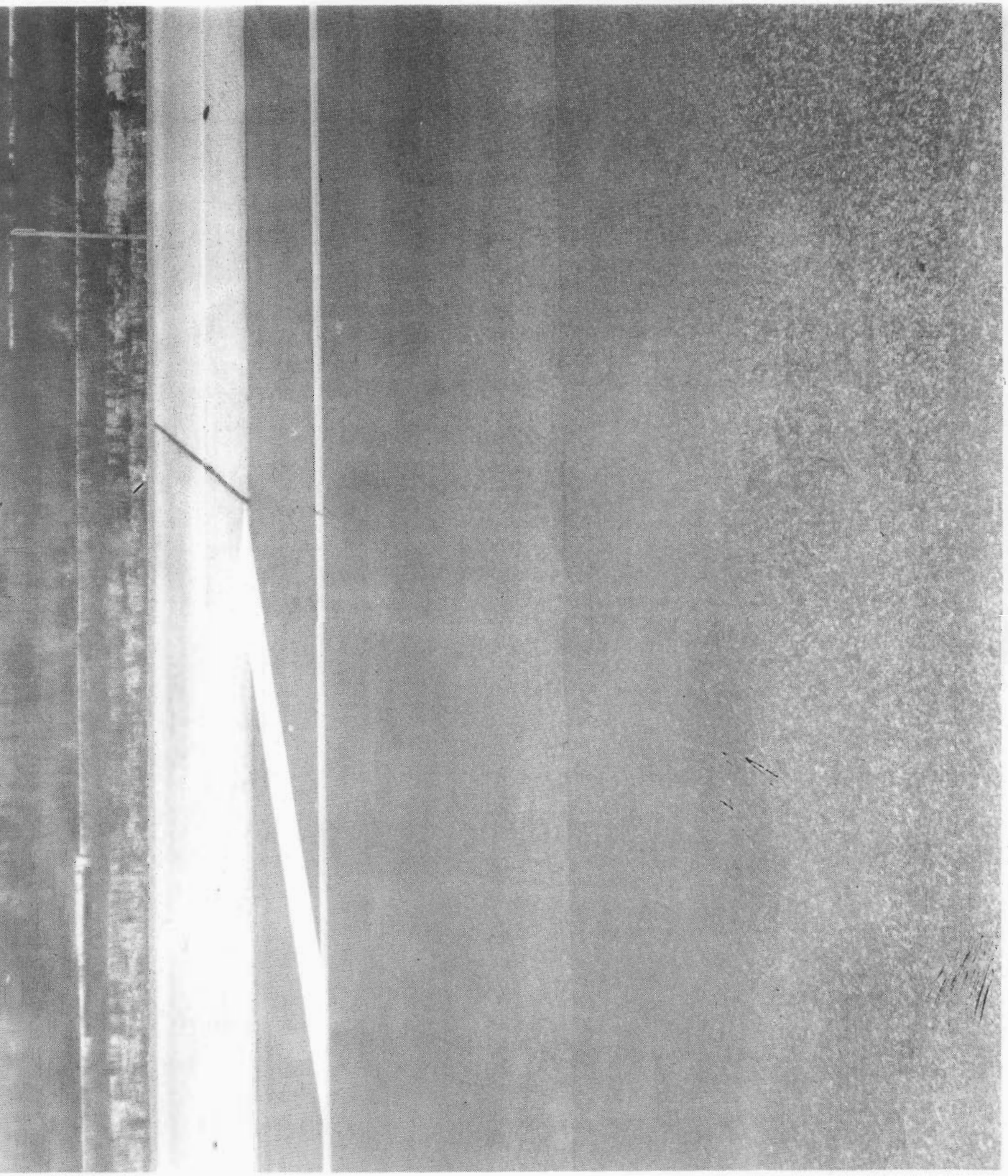
IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 12




IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 13




IH 45: BETWEEN CLEAR CREEK AND FM 518 No. 14

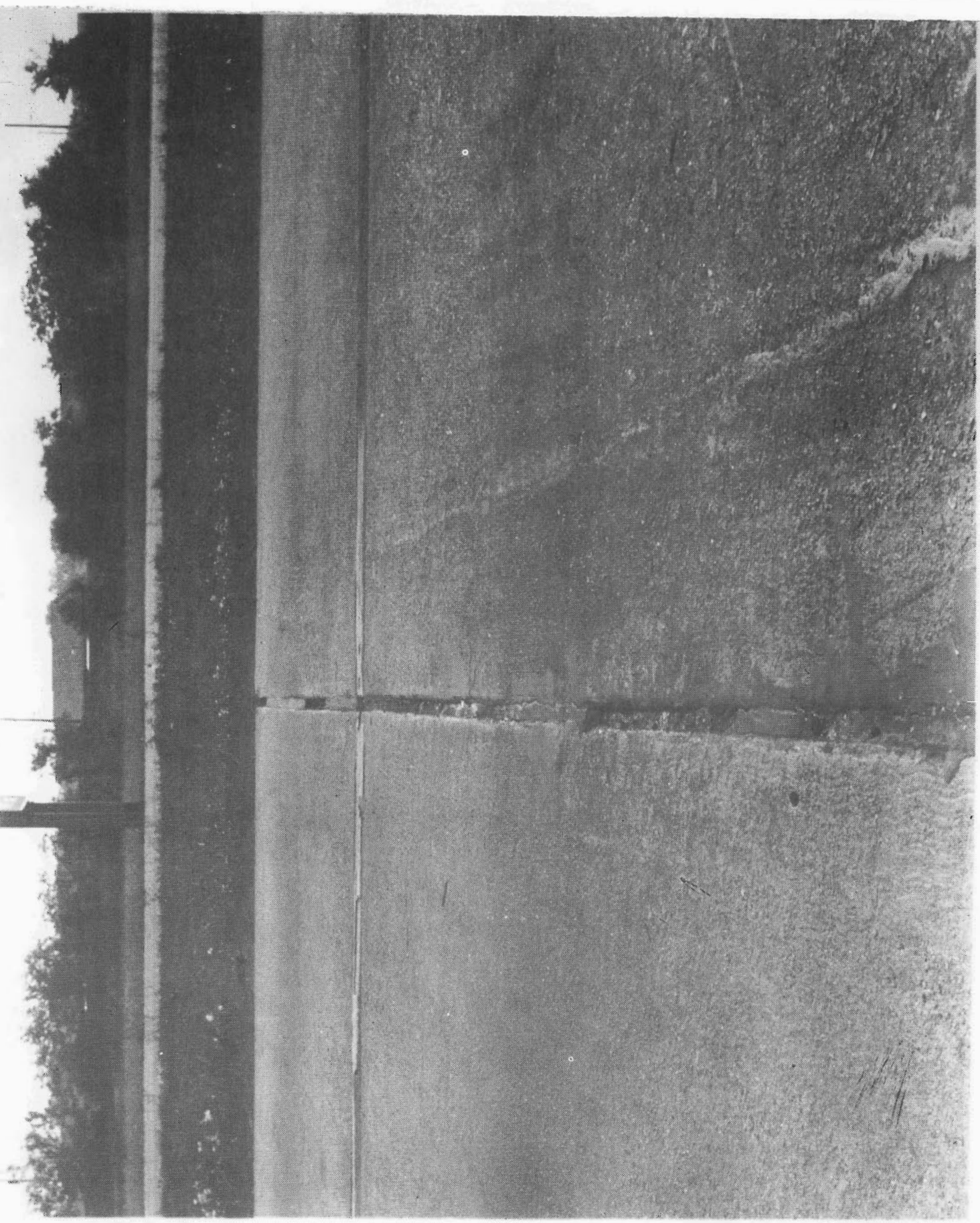


IH 45: BETWEEN CLEAR CREEK AND FM 158 No. 15

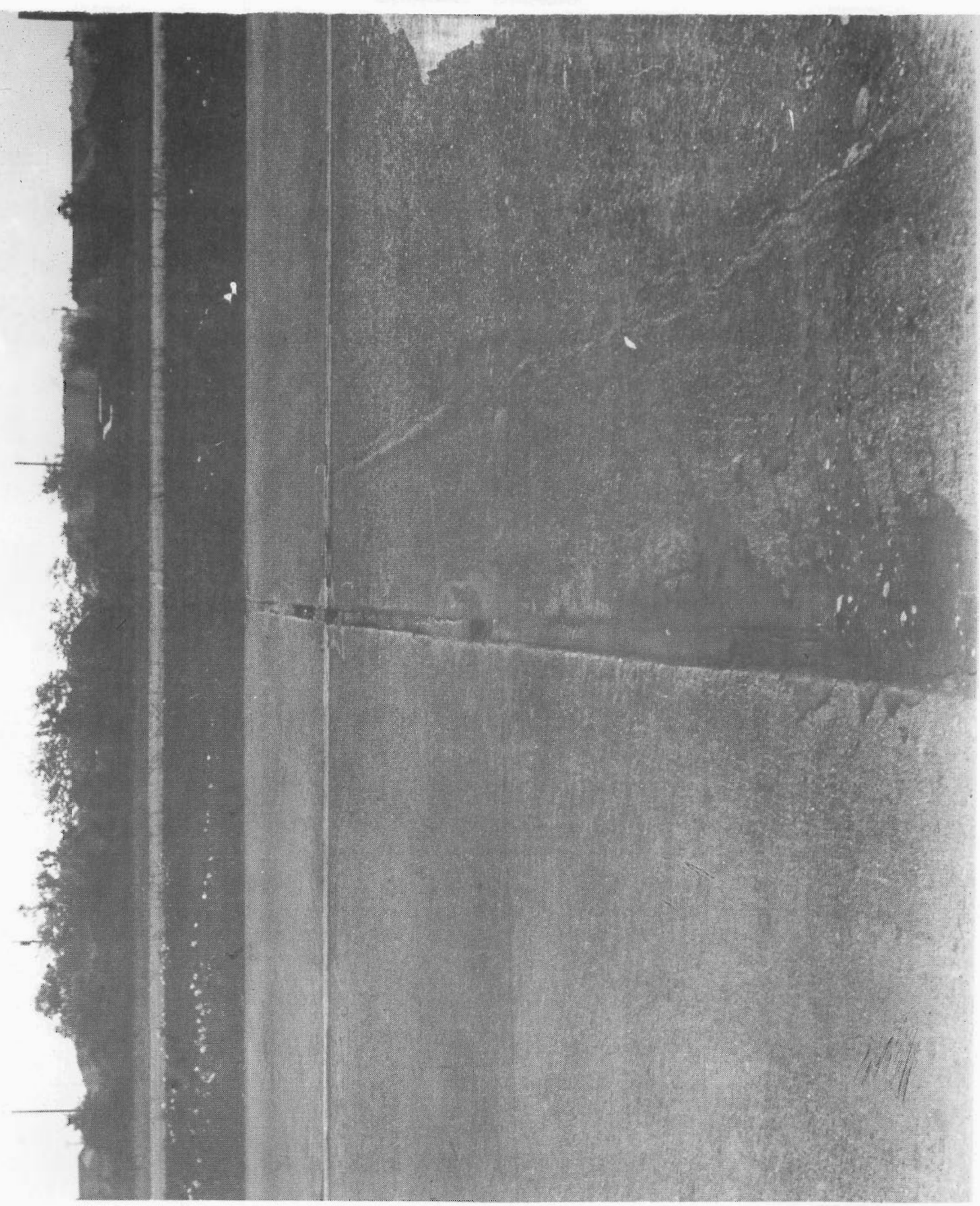
IH 45: SOUTHBOUND LANE - SOUTH OF FM 518 OVERPASS

No. 16 & 17: 1" board expansion joint in concrete pavement without overlay. Joint material is spread over pavement in foreground.

This pavement is typical of pavement where wire reinforced overlays have been placed.



IH 45: SOUTHBOUND LANE - SOUTH OF FM 518 OVERPASS - No. 16



IH 45: SOUTHBOUND LANE - SOUTH OF FM 518 OVERPASS - No. 17

Photographs No. 18 thru 24 show the existing condition of a non-reinforced overlayed concrete pavement located in Harris County on I.H. 10 from Oates Road in Houston to East of Frankie Street. The original pavement structure of this section of I.H. 10 consists of 12" shell concrete base with ACP surfacing of 3/4" in some instances and 1" in others. Overlays have been placed periodically in sections by Maintenance Forces. The total depth of the overlays is estimated to two and one-half inches.

The above-mentioned photographs taken on I.H. 10 also point out the deterioration of transverse joints in non-reinforced bituminous overlays. This section is in need of widening and additional structure.

A wire reinforced bituminous would be desirable for this pavement for the following reasons.

1. The geometrics of the project are such that narrow widenings of five and seven feet would be required for most of the facility. As shown on the attached photographs taken on I.H. 10 within the limits of this project, the widths of the longitudinal joints would be excessive and permit saturation of the non-stabilized subbase under the existing pavement and the heavy clay subgrade predominant throughout the project which would weaken the pavement structure and possibly result in pumping. We would point out that the joints shown in the photographs of I.H. 45 are at 12-foot widenings. We would expect wider joints for the narrower widenings.

2. If CRCP overlay section proposed for the project on I.H. 10 between Carpenter's Bayou and Brookshire Drive is used on this project, the result would be the use of five different typical sections and the necessary transitions between sections. This is due to the change in the profile grade dictated by the CRCP overlay at fixed elevations such as at Hunting and Greens Bayous, and to the geometrics of the project.

3. Last but not the least, the CRCP overlay would make traffic handling much more difficult than the bituminous overlay because the latter could be done under traffic. If the CRCP overlay is utilized, four lanes of traffic would have to be handled on one travelway or traffic detoured to the frontage roads and through the at-grade intersections. Either of these two methods of handling traffic would be extremely hazardous considering the 1970 ADT of 61260 on this project.

4. As shown in all photographs of bituminous overlays without wire, the reflective cracking from the joints cannot be tolerated on a Interstate Highway.

IH 10: EASTBOUND LANE AT OATS ROAD LOOKING EAST (WITHOUT WIRE)

No. 18: Note joint where pavement was widened for outside lane. Mercury Drive overpass in background. Knife on pavement.

IH 10: EASTBOUND LANE TO WEST OF HOLLAND AVENUE

No. 19 & 20: Note spalling of joint where outside lane was added. Transverse joints also opening up.

IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS

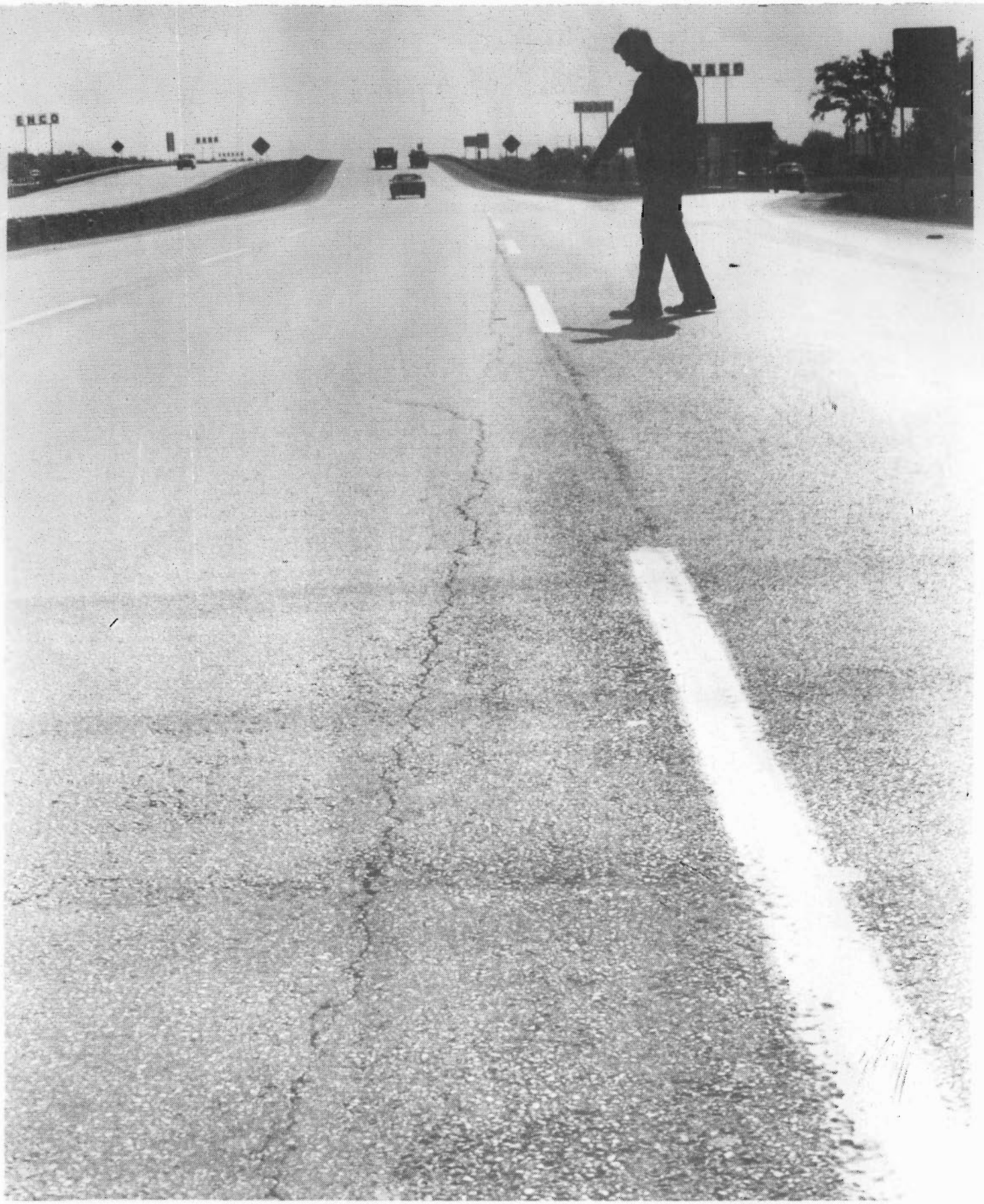
No. 21: Note pavement edge widening. Edge of asphalt to right of solid stripe. Note crack in asphalt midway between dashed line and solid line. Note transverse joints. Note cratering of longitudinal joint.

No. 22: Closeup of cratering in longitudinal joint.

No. 23: Note cratering in transverse joint. Note edge of asphalt near edge of stripe. Note joint in shell concrete in foregound.

No. 24: Joints in Shell Concrete Pavement are not extreme. See knife.

No. 25: Compare joints in shell concrete pavement to cratered joint in asphalt overlay in background.

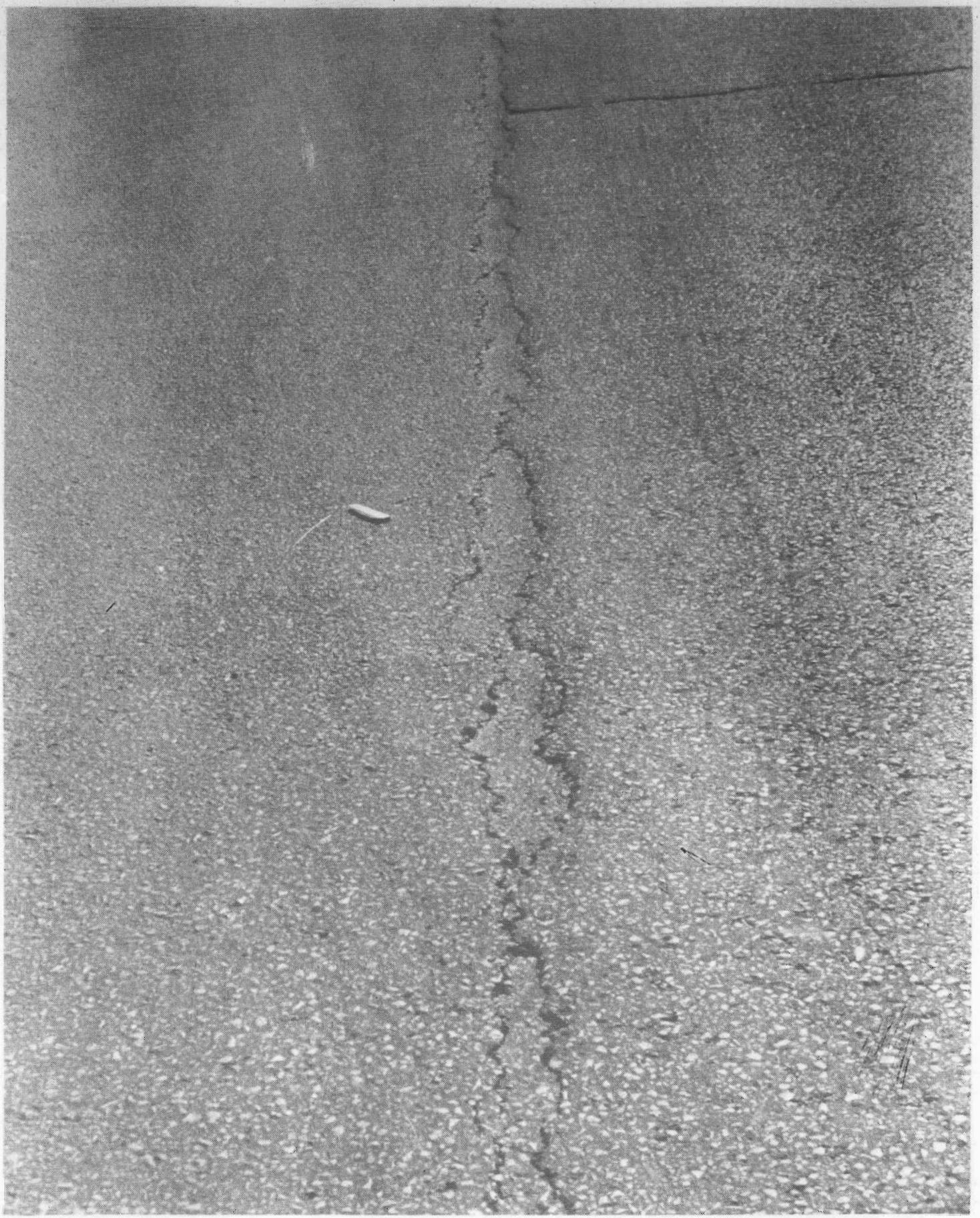



IH 10: EASTBOUND LANE AT OATS LOOKING EAST - No. 18

IH 10: EASTBOUND LANE TO WEST OF HOLLAND AVENUE - No. 19

IH 10: EASTBOUND LANE TO WEST OF HOLLAND AVENUE - No. 20

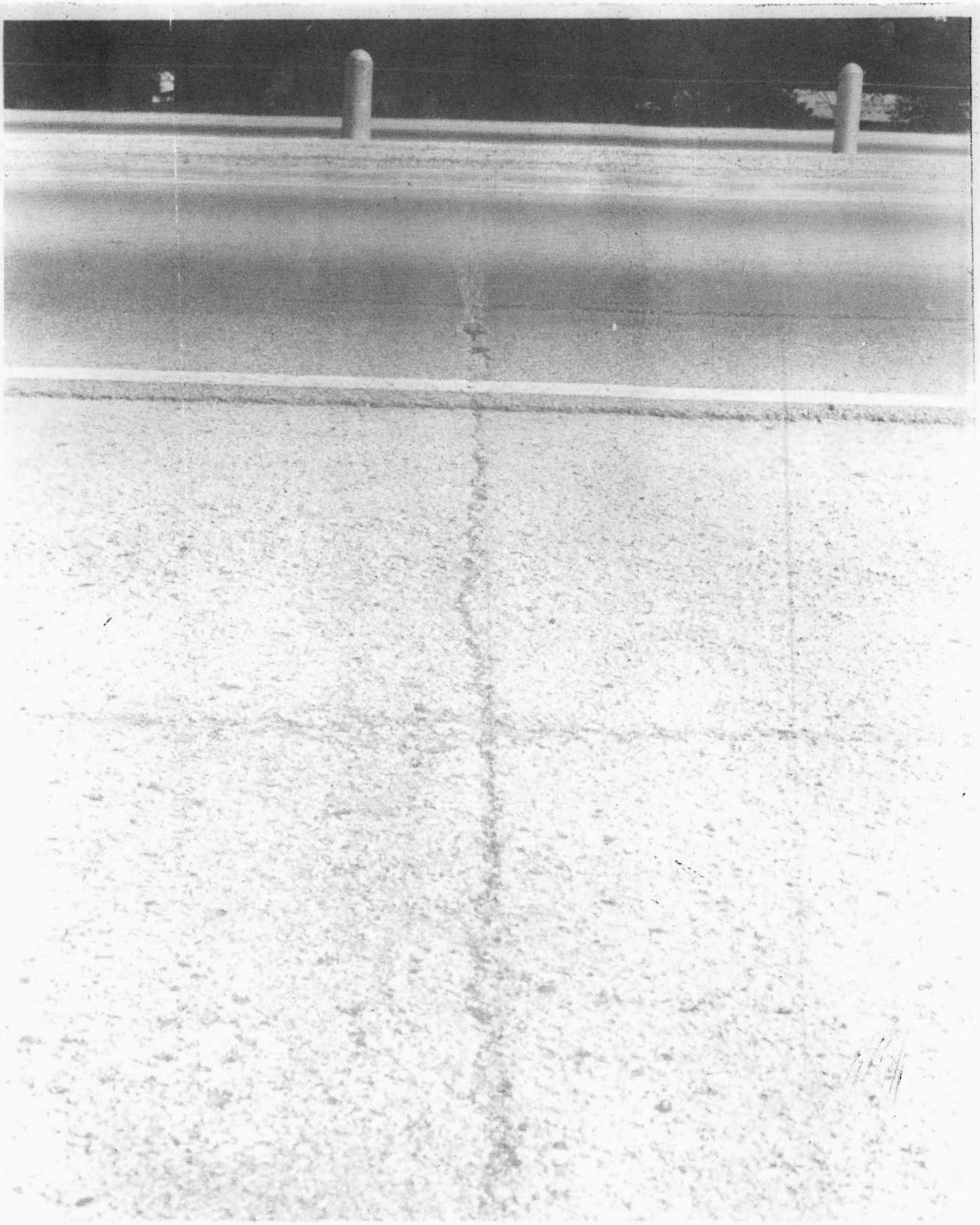
IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS - No. 21



IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS - No. 22

IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS - No. 23

IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS - No. 24



IH 10: EASTBOUND LANE TO WEST OF NORMANDIE OVERPASS - No. 25

IH 45: NORTHBOUND LANE NORTH OF CLEAR CREEK BRIDGE.

No. 26: Asphalt overlay has no mesh reinforcing. Open to traffic 6 months. Longitudinal joint opens up at widening joint. Foreground shows new patch in overlay.

No. 27: Asphalt overlay has no mesh reinforcing. Open to traffic 6 months. Longitudinal joints open at pavement widening joint.

IH 45: NORTHBOUND LANE NORTH OF CLEAR CREEK BRIDGE - No. 26

IH 45: NORTHBOUND LANE NORTH OF CLEAR CREEK BRIDGE - No. 27

IH 45: PROJECT I 45-1(64)031, FROM ALMEDA-GENOA ROAD TO FM 1959 SOUTHBOUND - NORTH OF SOUTH BELT INTERCHANGE.

No. 28 Pavement widened 6' in outside lane in 1965 & overlaid with hot mix & wire fabric. No evidence of crack penetration along widening joint. Small crack in foreground in transverse 1" expansion joint. Note wide longitudinal joint outside limits of wire mesh.


IH 45: PROJECT I45-1(64)031, FROM ALMEDA - GENOA ROAD TO FM 1959 SOUTHBOUND - NORTH OF SOUTH BELT INTERCHANGE - No. 28

## Supplement District 24 - El Paso

Three wire reinforced overlay projects have been placed in the El Paso District. Two projects I10-1(108)026 and I10-1(114)032 were constructed in 1968. Short sections of the mesh reinforcing was omitted on both projects for test purposes and to date there is no visible difference between the reinforced and unreinforced sections. The numerous large shrinkage cracks which existed in the "semi-rigid" flexible base and HMAC surface have not appeared in the HMAC strengthening and overlay. This crack pattern may not be evident for a number of years. It is estimated that the value of the reinforcing will not become evident until the cracks are reflected through the heavy overlays and the vertical movement of adjacent HMAC slabs become obvious. This time element could vary greatly depending upon many things. The life and service obtained from future thin overlays on top of these relatively thick, reinforced sections, may well be the final determining factor.

A third project using mesh reinforcing in HMAC heavy overlay was placed in 1962 under I 10-1(54)079: This strengthening was placed over the east bound lanes which were originally constructed in 1937 of jointed, reinforced concrete pavement placed on sub-grade varying from cohesionless sand and gravel to extremely active bentonite clays with the result that after 25 years of service as U.S. 80, the rigid slabs were broken, rocking, and almost intolerable for travel. The 5½" reinforced HMAC is in excellent condition to date with a few narrow transverse cracks beginning to appear which, as yet, do not show any vertical displacement. We would guess that this pavement will go another 3 or 4 years at which time it is likely that a thin (1" +) overlay will extend the serviceability another 8 or 10 years. We doubt this level of serviceability could be maintained at the same total cost without the use of reinforcing under these particular conditions. The above estimates of the three projects life are opinion based on District 24's observations and experience with similar situations. Possibly observation of these three projects for another few years will definitely indicate the advanteges or disadvantages of reinforcing. At this time, and until proven otherwide, District 24 feels the 60¢ or 70¢ per S.Y. for mesh is good insurance when correcting a certain type of distress in pavements.