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WATER LEAKAGE ON A PRESTRESSED CONCRETE BRIDGE
B9 of 38-1-14, Dettman Road over US 12, Jackson

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Michigan State Highway Department
John C. Mackie, Commissioner
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WATER LEAKAGE ON A PRESTRESSED CONCRETE BRIDGE
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Early in the spring of 1958, the Research Laboratory Division was asked to investigate water leakage through the deck of a newly completed overpass, carrying Dettman Road over US 12 - I 94 in east Jackson. The superstructure had been constructed of prestressed concrete box girders, with a light wearing-surface covering of bituminous aggregate. Evidence of heavy water leakage was found, and a photographic record was made (Figs. 1-5). At the same time, for comparison, photos were taken of a nearby US 12 overpass at Sutton Road (B2 of 38-7-14), where a conventional concrete slab deck had been installed over prestressed concrete box girders, and the deck joints effectively sealed so that no leakage problem had developed (Fig. 6).

During the summer of 1958, Dettman Road, including this overpass, was resurfaced with bituminous aggregate. This surface treatment only partially and temporarily alleviated the leakage situation. As reflection cracks over the joints developed and enlarged, the situation again became serious.

A new pictorial survey was completed in February 1960, including views of a surface reflection crack at a joint and of the girder undersurface

(Figs. 7-9). While the reflection cracks on the deck surface are average in size for bituminous aggregate resurfacing projects, they are of sufficient magnitude to allow passage of water into the superstructure. Even though the wearing surface appeared dry during the survey of February 1960, enough water had leaked through the joints between the girders and was still being released to cause the undersurface dampness and icing condition shown in the photographs.

A second 1960 inspection, on September 27, showed that even several days after a rainfall, moisture was draining from within the beam structure and that distinct spall-like deterioration was taking place at beam corners (Fig. 10).

In summary, the evidence indicates the start of deterioration of concrete in the prestressed beams. Further, this deterioration may be taking place not only at the undersurface, but also between the beams where it is impossible to determine its extent or seriousness.

Consequently, it appears that some appropriate maintenance treatment should be undertaken at an early date to prevent further leakage.

Other Prestressed Bridge Projects

In March 1960, unusually heavy icing and draining water was observed on the undersurface of the US 31 bridge over the Great Sable River 11 mi south of Scottville in Mason County; this structure also has a deck composed of a bituminous concrete surface applied directly over prestressed

concrete box girders. Two other structures known to be of this structural type, which have not been visited for condition surveys, are the M 66 bridge over Grindstone Creek in Osceola County, and the M 72 bridge over Denton Creek at Pruddenville in Roscommon County.



Figure 1. Dettman Road overpass, US 12 near Jackson (B9 of 38-1-14), with view of deterioration of original light wearing-surface covering (4-11-58).

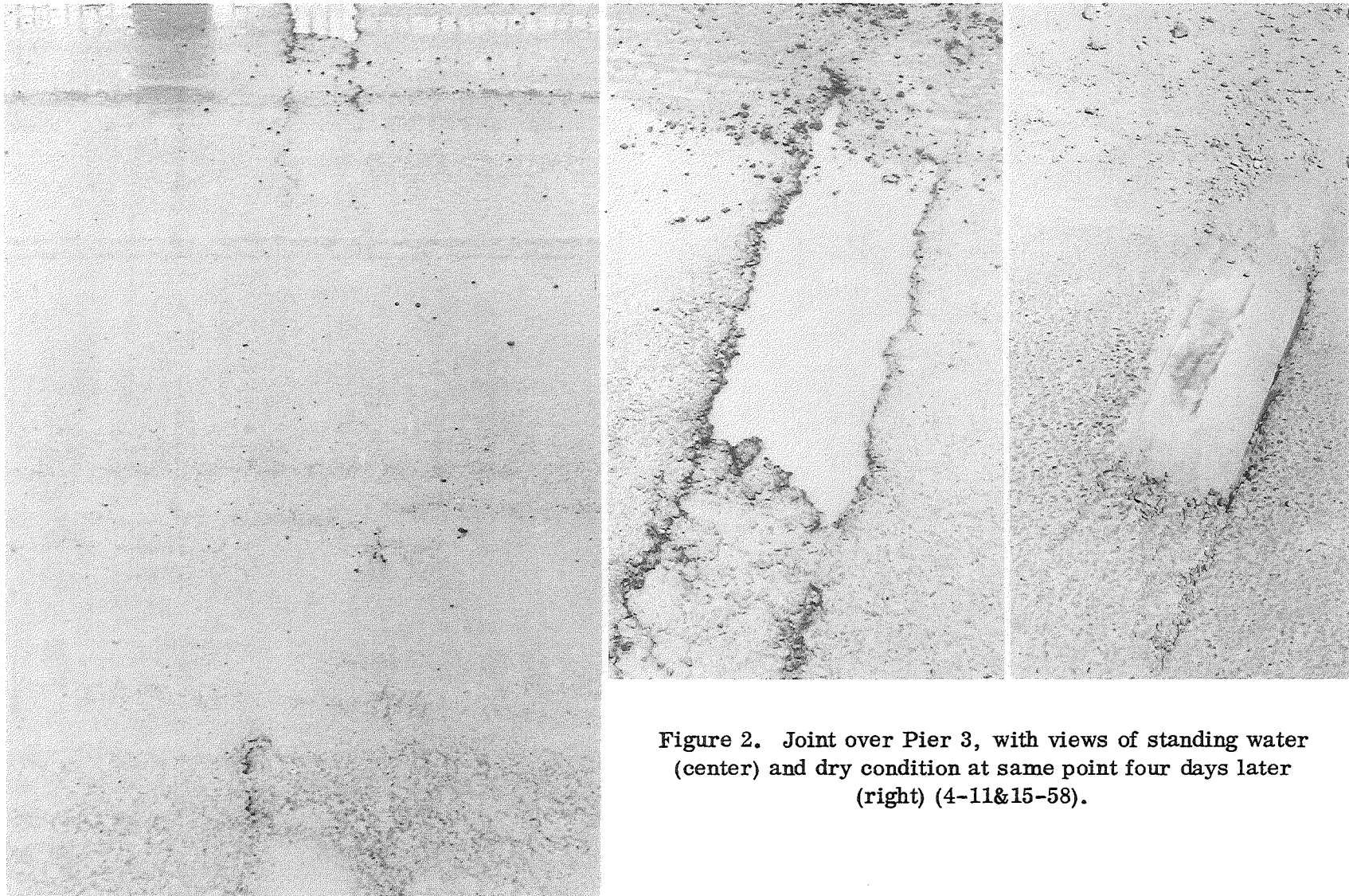


Figure 2. Joint over Pier 3, with views of standing water (center) and dry condition at same point four days later (right) (4-11&15-58).

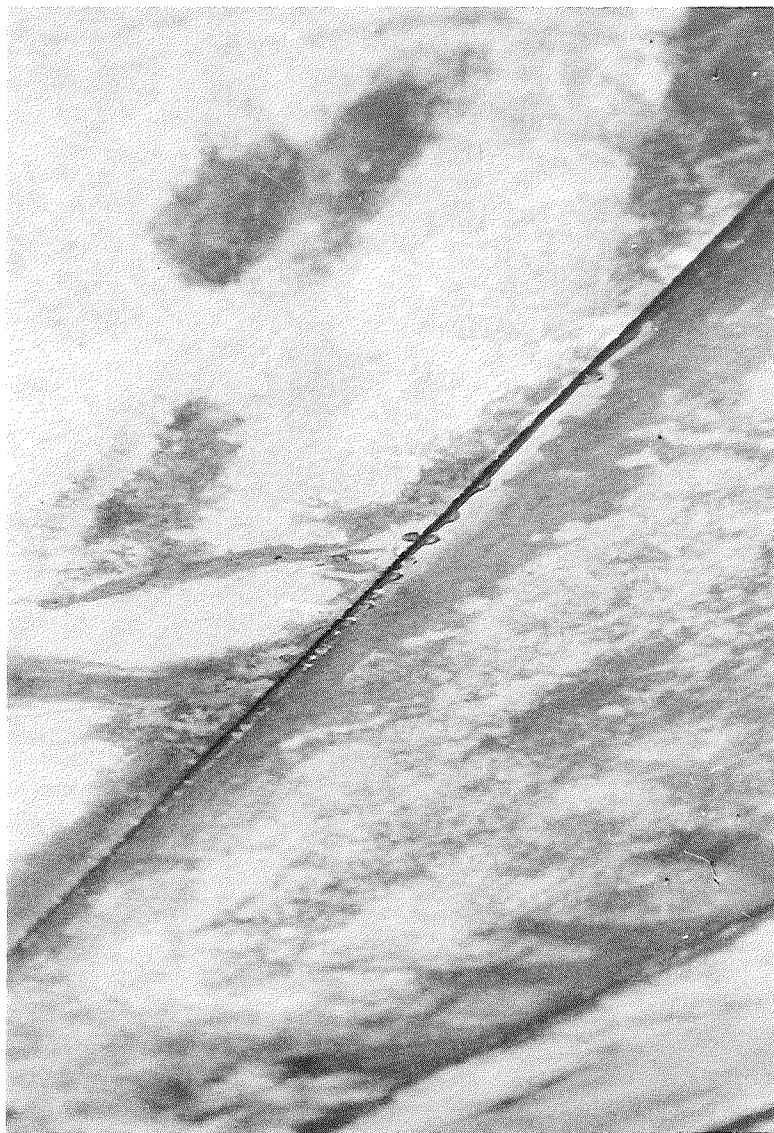


Figure 3. Undersurfaces of Span 1 (left) and Span 2 (right) with seepage in progress, showing stains from previous moisture (4-11-58).



Figure 4. Undersurface seepage on Span 3 (left), with view of drip pattern on the US 12 shoulder directly beneath a longitudinal joint (right) (4-11-58).

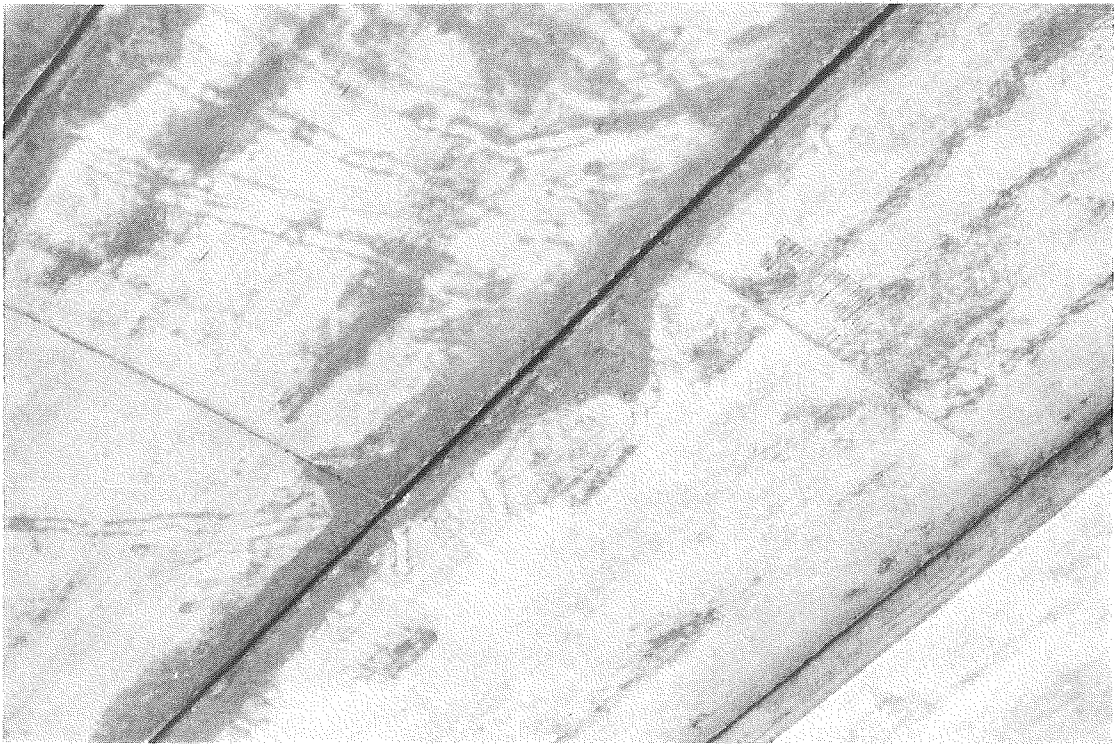
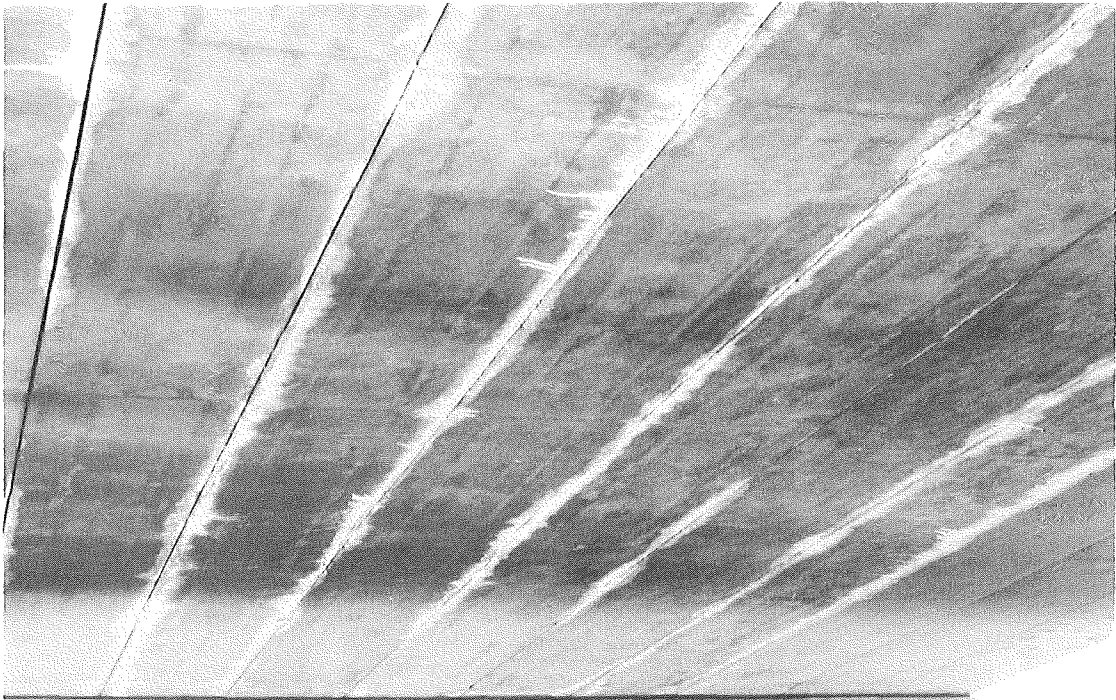


Figure 5. Water markings on undersurfaces of Span 4 (top) and Span 5 (bottom). Span 4 undersurface blackened by contractor's fires required for equipment maintenance (4-11-58).

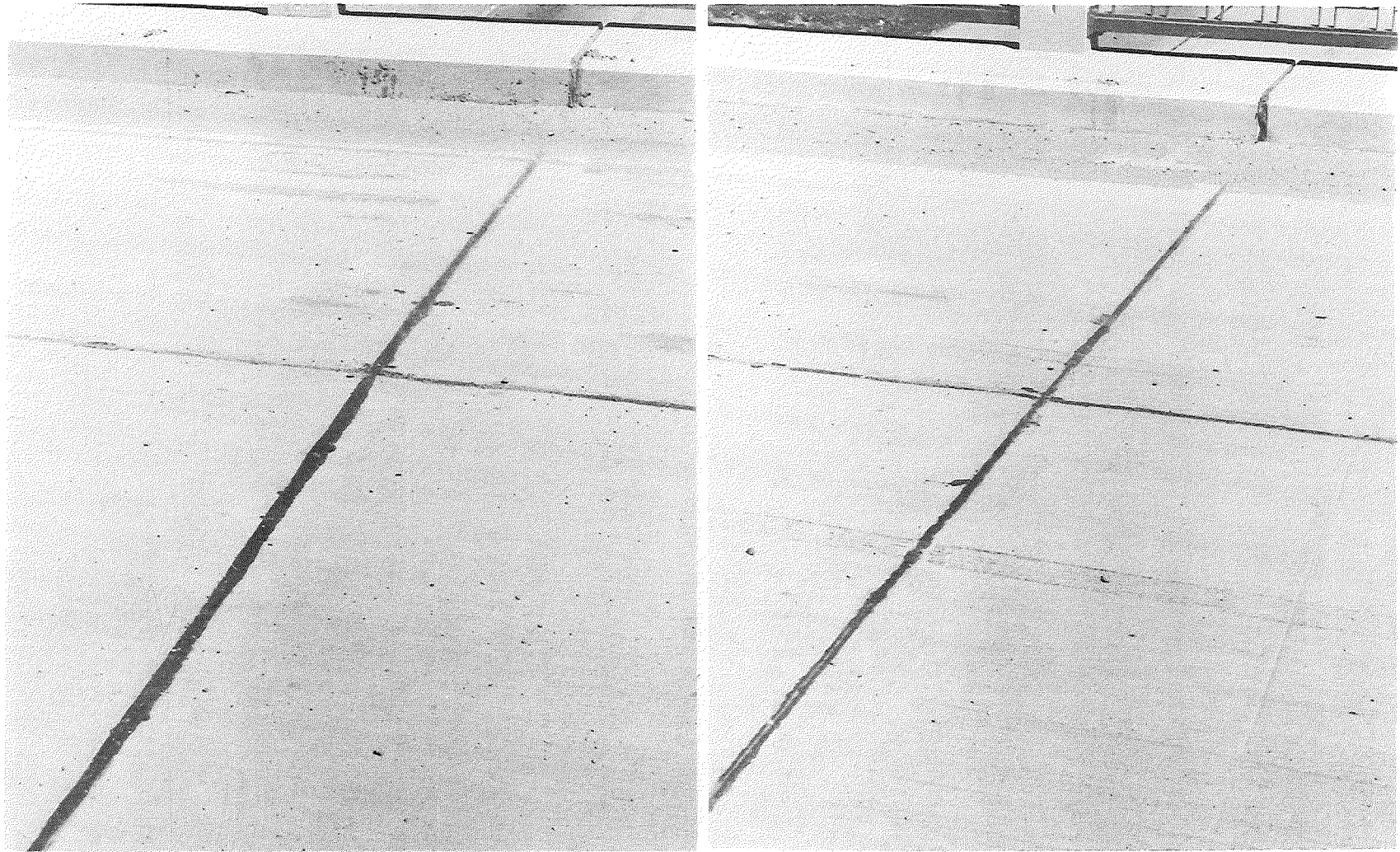


Figure 6. Sutton Road overpass on US 12 (B2 of 38-7-14), built at same time as nearby Dettman Road overpass, but with conventional concrete deck. Good joint sealing prevented leakage (4-15-58).



Figure 7. Dettman Road overpass with bituminous aggregate resurfacing (2-60).



Figure 8. Reflection crack over joint (left), with view of moisture conditions at curb adjacent to same crack (2-60).

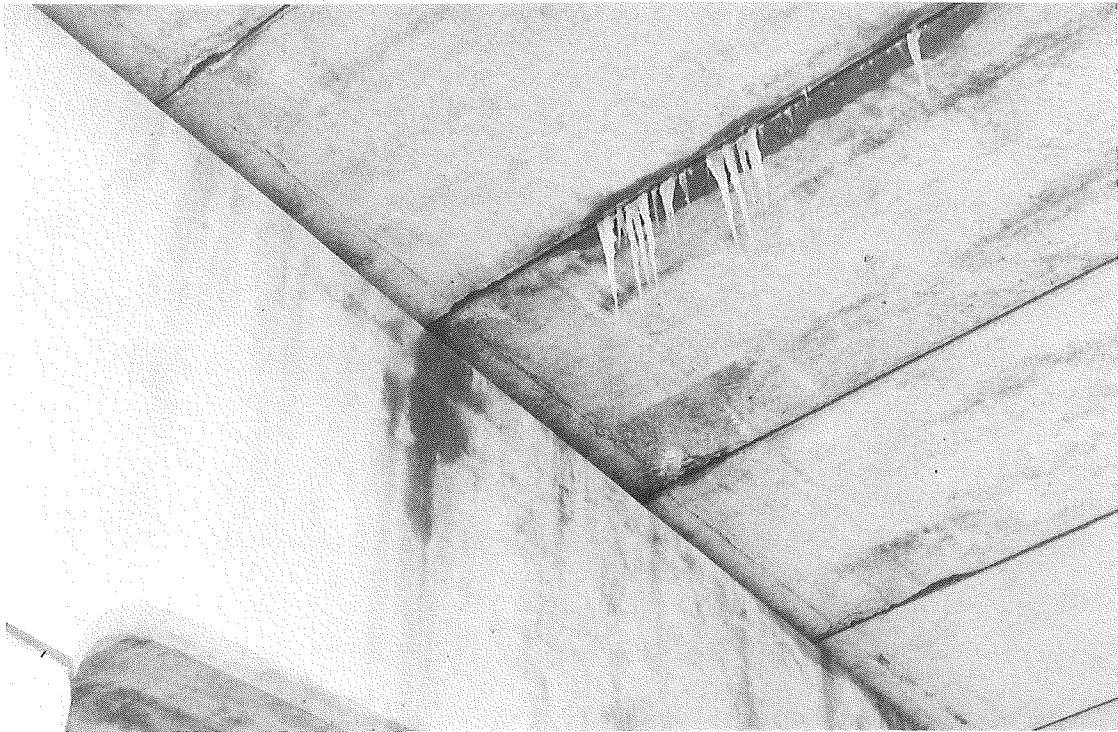
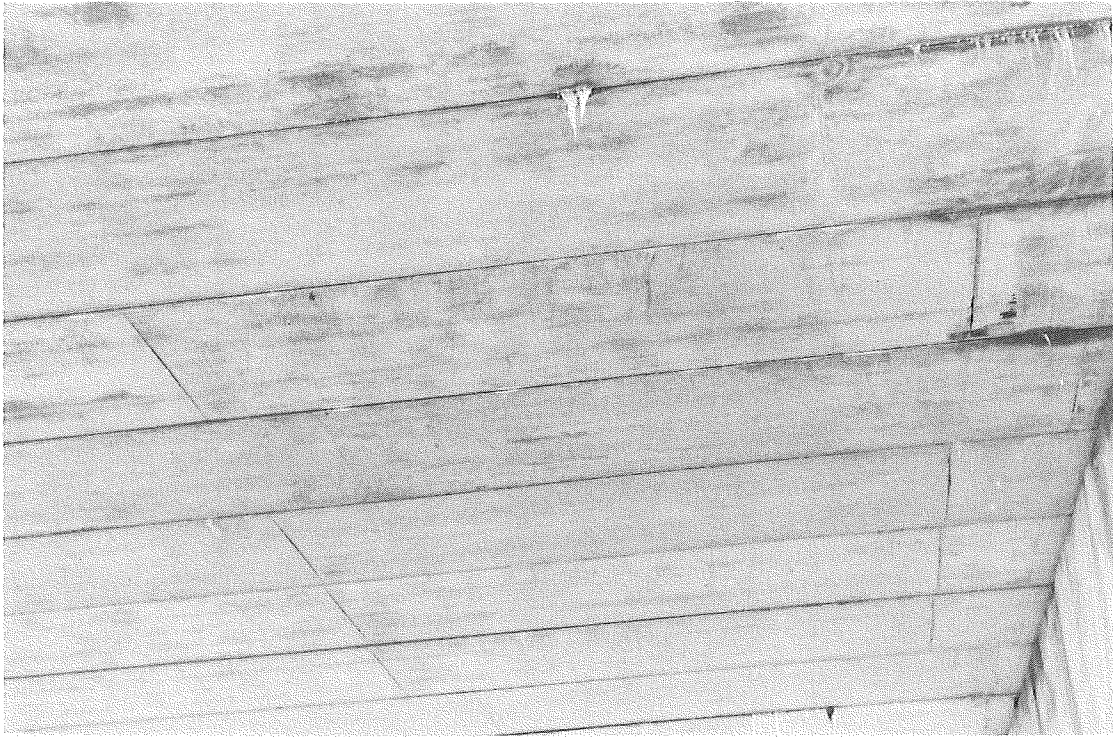


Figure 9. Undersurface conditions on Dettman Road overpass (2-60).

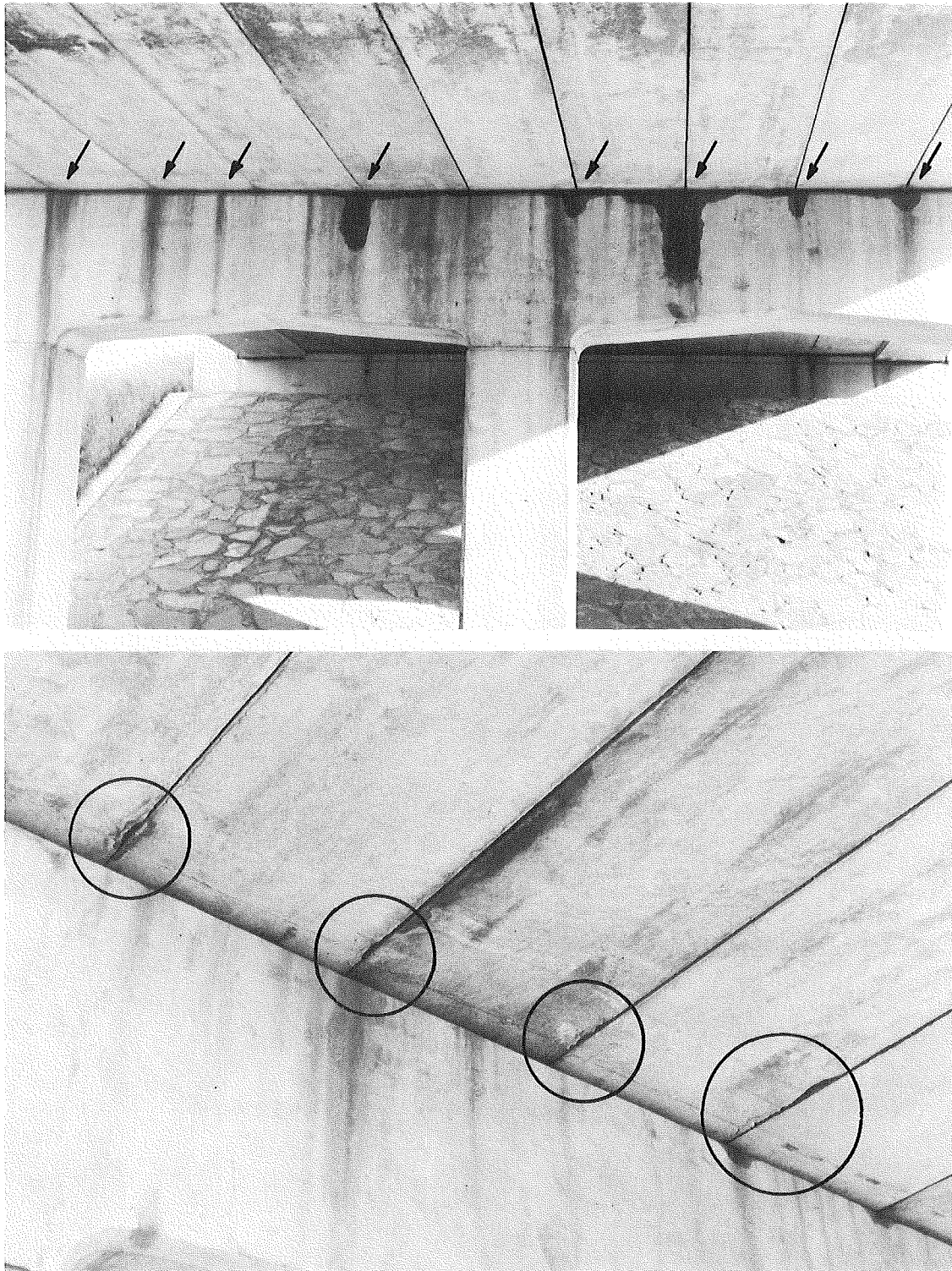


Figure 10. Condition of underside of beams after several days without rain, showing water draining from within the beam structure (top) and deterioration at beam corners (bottom) (9-27-60).