PAVEMENT EVALUATION OF I-94 CONTROL SECTION 82021
Detroit Industrial Expressway from Rawsonville Road
(Washtenaw-Wayne County Line) to Hannan Road

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Prepared for the Pavement Selection Committee

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John C. Mackie, Commissioner
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In a memorandum to W. W. McLaughlin dated April 23, 1964, G. J. McCarthy requested a pavement condition survey and evaluation of I 94 Control Section 82021 for information of the Pavement Selection Committee in deciding whether to salvage the existing four-lane divided pavement as a base for a proposed six-lane pavement. Mr. McLaughlin referred the question to the Research Laboratory Division, and an inspection was completed June 4 by L. T. Oehler and F. Copple. Cores were taken from the pavement by the Field Testing Division on June 22, and Research Laboratory personnel conducted pavement roughness testing on July 7.

Project History

Control Section 82021 includes the following four construction projects, from the Washtenaw - Wayne County Line (Rawsonville Road) east approximately 6 miles to Hannan Road:

Project	Location	Roadway	Length, Mi	Slab Thickness, in.	Joint Spacing, ft	
					Expansion	Dummy
82-95, C1	Rawsonville Rd to Belleville Rd	WB	3.0	10	no record	no record
82-95, C2		EB	3.0	10	120	20
82-93, C1	Belleville Rd to Hannan Rd	WB	2.8	9	120	20
82-93, C3		EB	3.1	9	120	20

These four projects were all constructed in 1942 under wartime specifications omitting steel reinforcement and joint load transfer. The concrete was not air entrained. The two 22-ft roadways were divided by a 32-ft median strip. The subgrade is primarily a sandy soil, and drainage varies from good to poor; a high water table is reported to exist throughout the area, and the alignment is along or near the north shore of Belleville Lake for almost the entire control section length.

In 1956, a 2-ft concrete widening strip of 10-in. thickness was added to each roadway at the median edge on all four projects, and the resulting 24-ft pavement was surfaced with 2-1/2 in. of asphaltic concrete.

In 1958, 1600 ft of new reinforced concrete underpass pavement was poured to carry I-94 traffic under the new Belleville Road overpass structure. This Belleville Road interchange is approximately at the center of the control section.

Typical general views of the widened and resurfaced 1942 pavement and the 1958 underpass pavement are shown in Fig. 1.

Results of Condition Survey and Testing

In the inspection and survey of the I 94 projects, it was evident that the pavement was poorly drained; the road bed was at a lower elevation than most of the adjacent area (Fig. 2). Although there were no load transfer dowels in the 1942 pavement projects and the slabs were only 20-ft long, no slab rocking was evident even when loaded by very large trucks.

With regard to surface condition, all transverse joints had reflected through the asphaltic concrete, as had both the old longitudinal centerline joints and the longitudinal joints at the 1956 widening strip along their entire lengths (Fig. 3). On the other hand, there was little reflection cracking evident over transverse or longitudinal cracking of the old slabs. Transverse patches averaged approximately one per half-mile of pavement, and probably were constructed to repair joint blow-ups (Fig. 4). There was considerable alligator cracking adjacent to the reflection cracks (Fig. 5), and in some areas the entire surface course appeared to be disintegrating.

On the 1600 ft of 1958 concrete underpass pavement at the Belleville Road interchange, faulting of some transverse joints was noted, and one area of longitudinal joint was faulted (Fig. 6). Severe surface scaling and spalling were observed, particularly at the west end of this pavement, and the reinforcing steel was exposed in some areas (Fig. 7). On the average, there were about nine transverse cracks per 99-ft slab in the traffic lane of each roadway, and about five transverse cracks per slab in each passing lane (Fig. 8). Some spalling was in evidence at these transverse cracks.

The Michigan roughometer was used in all eight wheelpaths, over the whole length of all four lanes. Values measured were then averaged to give roughness readings of 280 in. per mi for both roadways west of Belleville Road (over 10-in. thick 1942 pavement) and 244 in. per mi east of Belleville Road (over 9-in. pavement). On the 1958 underpass pavement, the overall average was 237 in. per mi. These values may be compared with the riding quality scale developed using the Michigan roughometer on new concrete pavements: 0 to 130 in. per mi = "good" riding quality, 130 to 175 = "average," and over 175 = "poor."

Concrete cores taken in the 1942 projects had an average compressive strength of about 8300 psi. The 1942 concrete appeared to be in very good condition except in cores taken from areas where alligator cracking had developed in the overlay (Fig. 9). There, salt had apparently soaked through the asphaltic concrete and caused disintegration of the old concrete surface to a depth of 1/2 to 1 in. Compressive strengths of cores taken from the 1958 concrete underpass at Belleville Road averaged about 6500 psi, and no salt action was apparent at the core tops (Fig. 10).

Possible Alternatives in Salvaging the Existing Pavement

On the basis of experience elsewhere, it seems probable that in less than a year most cracks now in evidence would reflect through any new asphaltic concrete overlay placed directly upon the existing roadways. In addition, the old bituminous overlay is disintegrating in many areas and could not provide a good bond for a new surface. For these reasons, a new bituminous resurfacing placed directly over the old pavement would probably soon have rough riding qualities similar to those of the existing roadways.

Another possible solution would be construction of a thin gravel cushion (4 to 6 in. thick) over the existing pavement, with new rigid pavement placed over it. The existing pavement would provide an extremely firm foundation, and almost no settlement would occur in any structure of equal width placed directly over it. However, the proposed new roadways would both be three lanes wide, projecting transversely beyond the support provided by the old two-lane pavement, and unequal settlement could develop.

The most practical solution would appear to be construction of a thick gravel layer, probably at least 18 in. deep, over the existing pavement, followed by placement of the new roadways over this layer. With this volume of base material, there would probably be very little unequal settlement, and foundation drainage would be considerably improved.

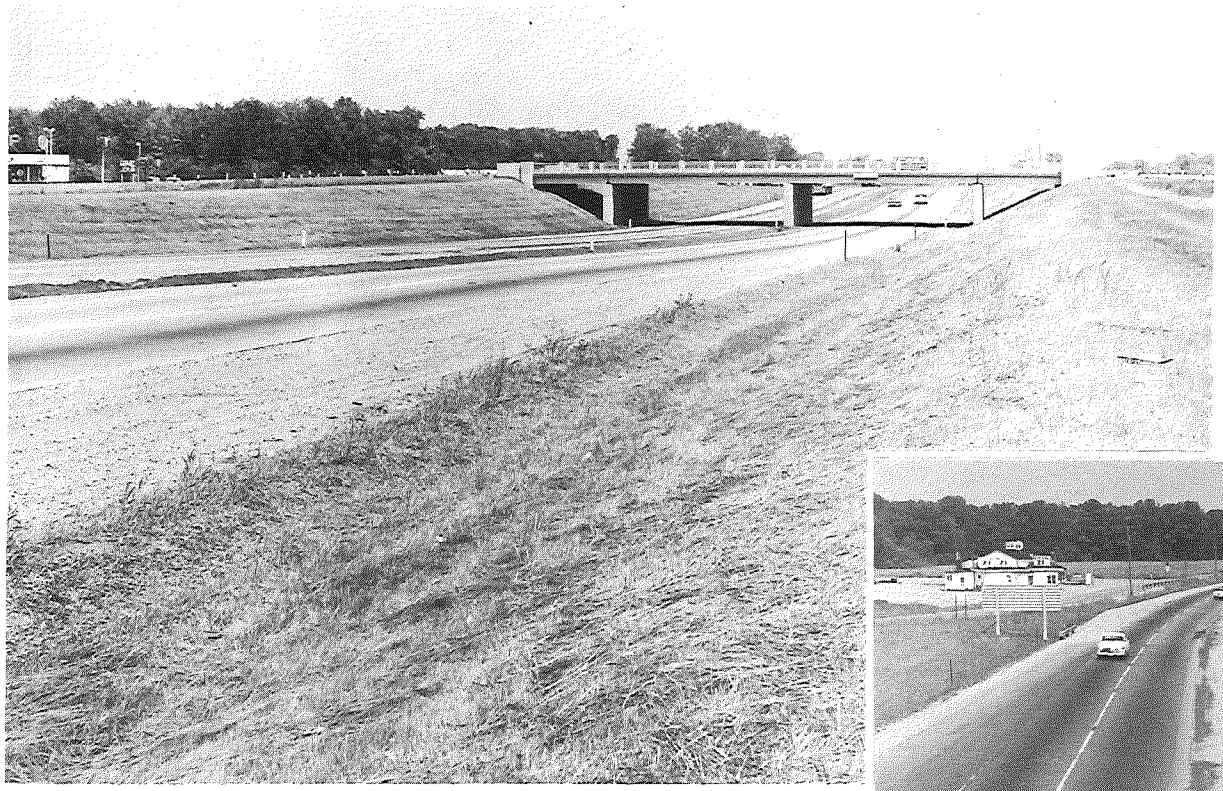
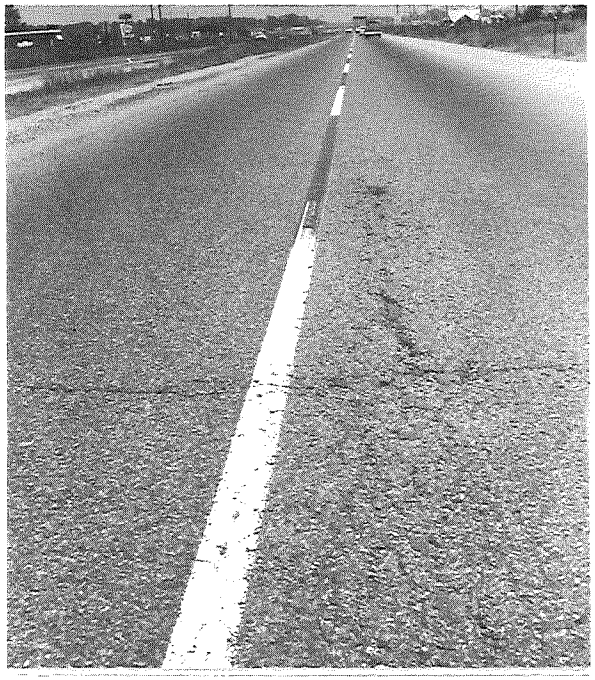
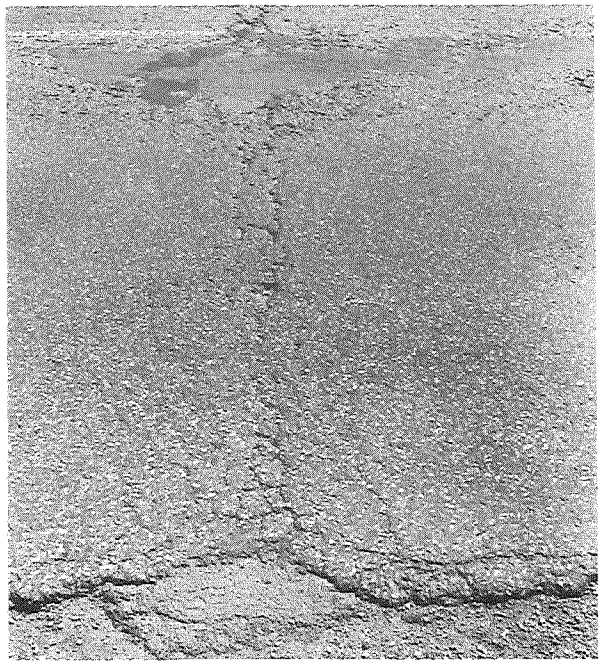


Figure 1. General views of the I 94 pavement looking east toward Belleville Road (above), and from Rawsonville Road (right).

Figure 2. Shoulder views illustrating poor drainage conditions.





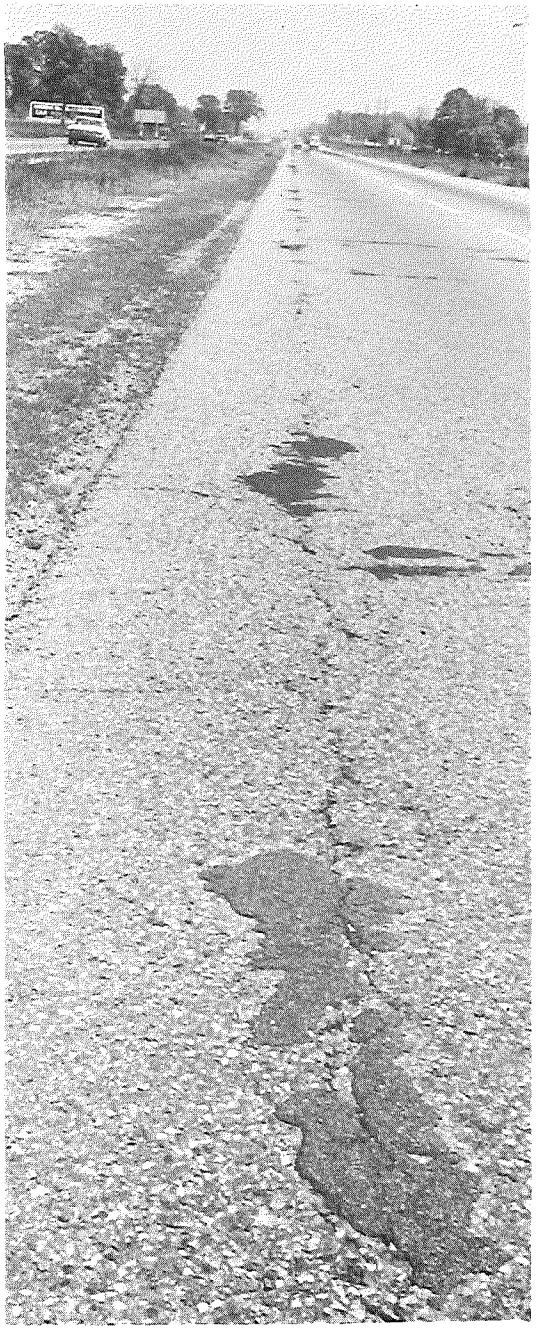


Figure 3. Reflection cracking over old centerline longitudinal joint (top left and bottom left), old transverse joint (bottom center), and joint widening strip (right).

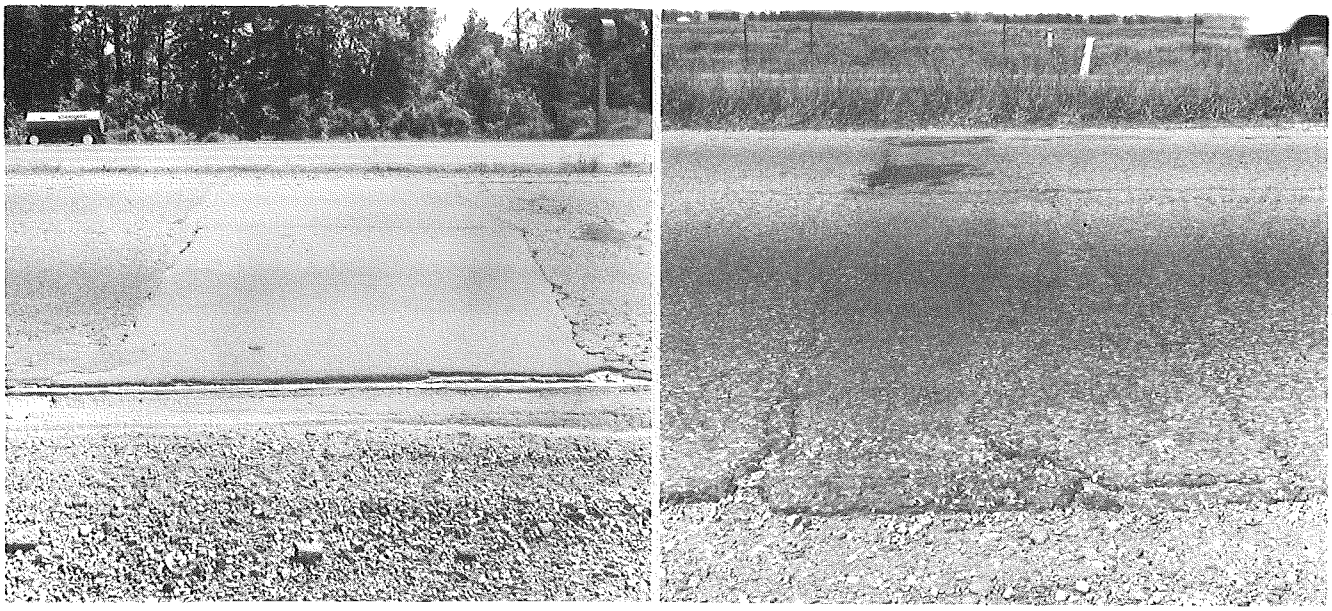


Figure 4. Typical transverse patches.

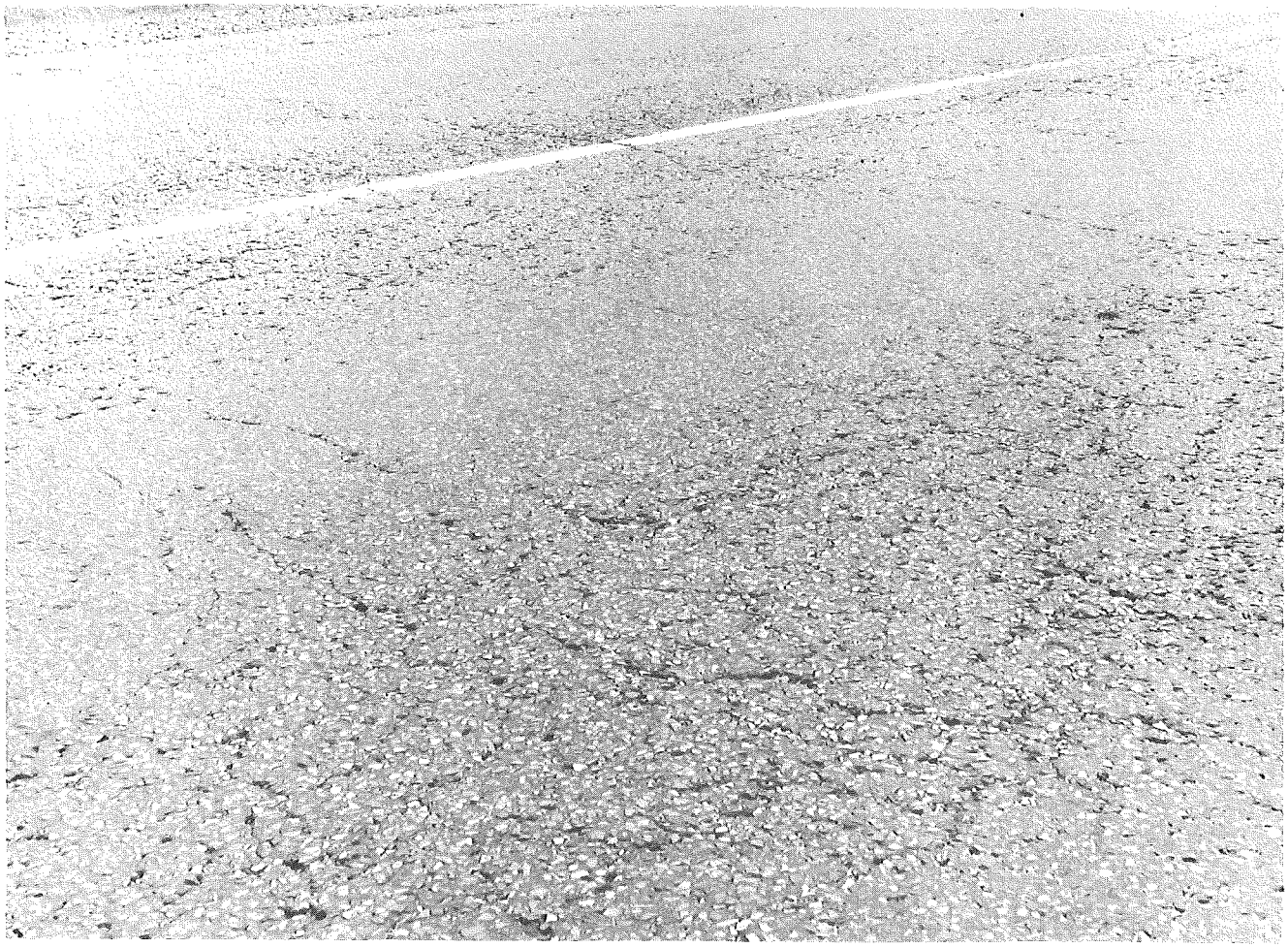


Figure 5. Typical alligator cracking.

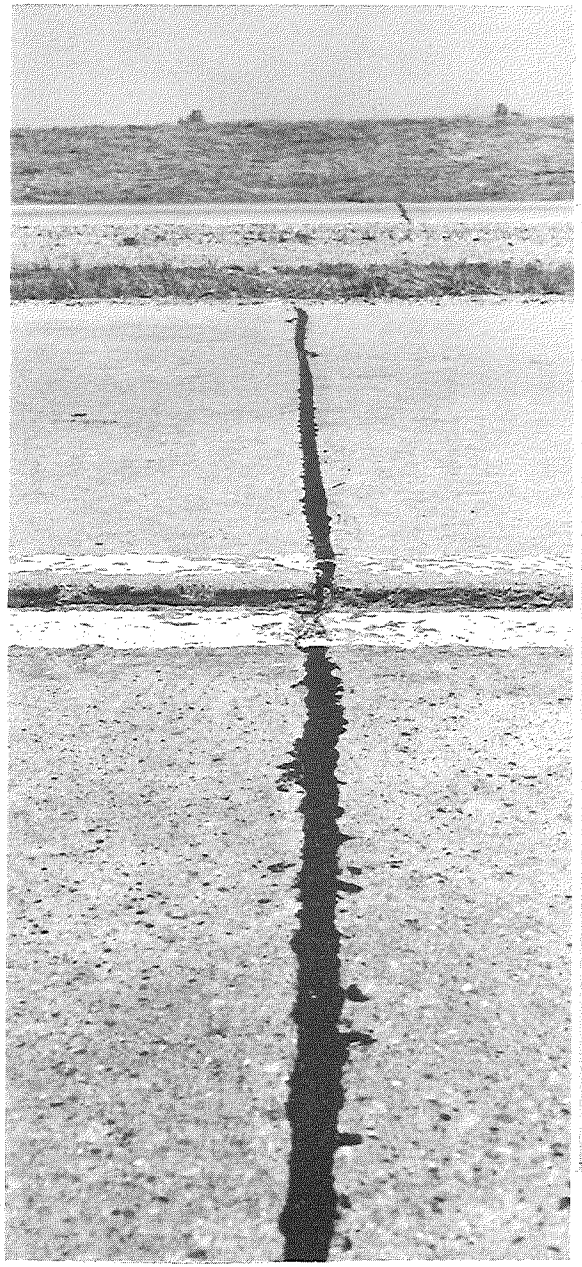


Figure 6. Faulting of longitudinal joint on Belleville Road underpass.

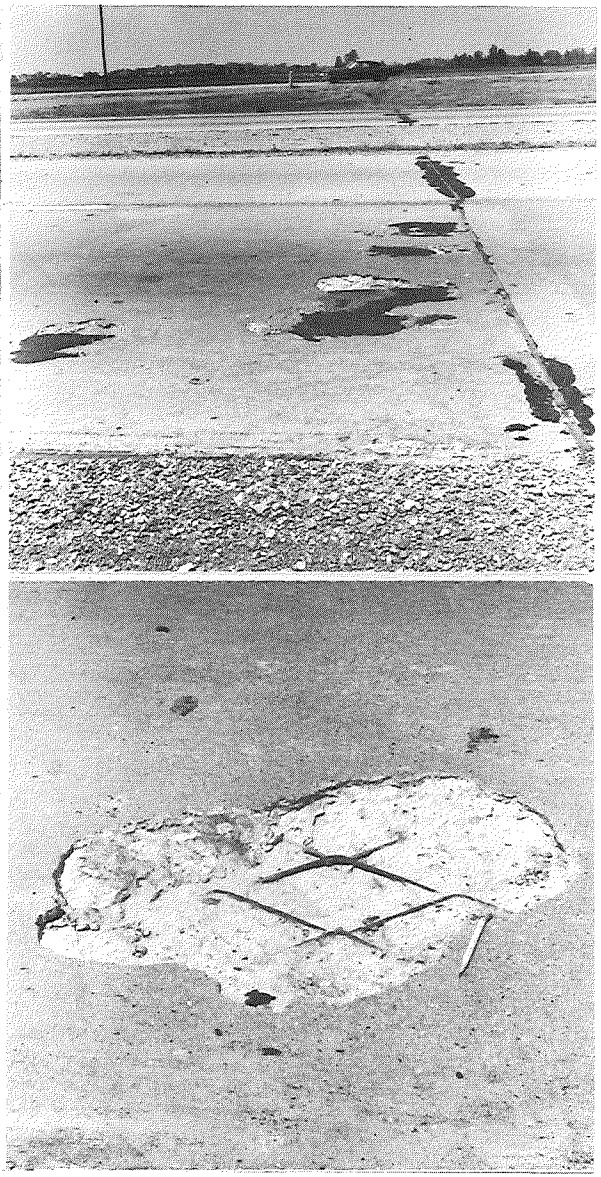


Figure 7. Surface deterioration and spalling (top), and exposure of reinforcing steel (bottom) on Belleville Road underpass; note proximity of steel to pavement surface.

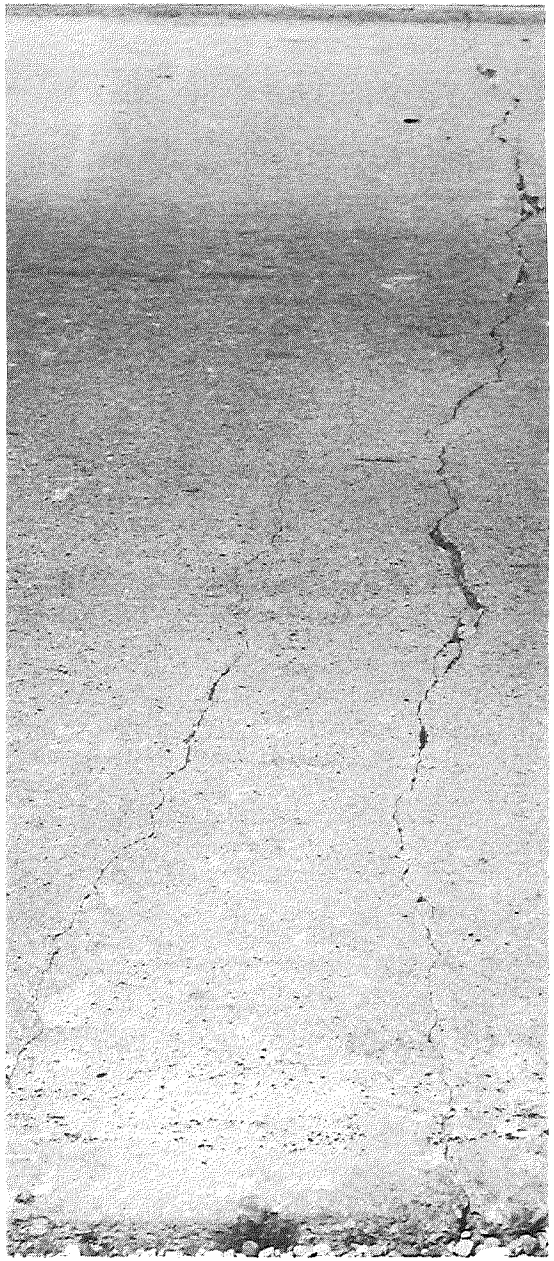


Figure 8. Typical transverse crack on Belleville Road underpass.

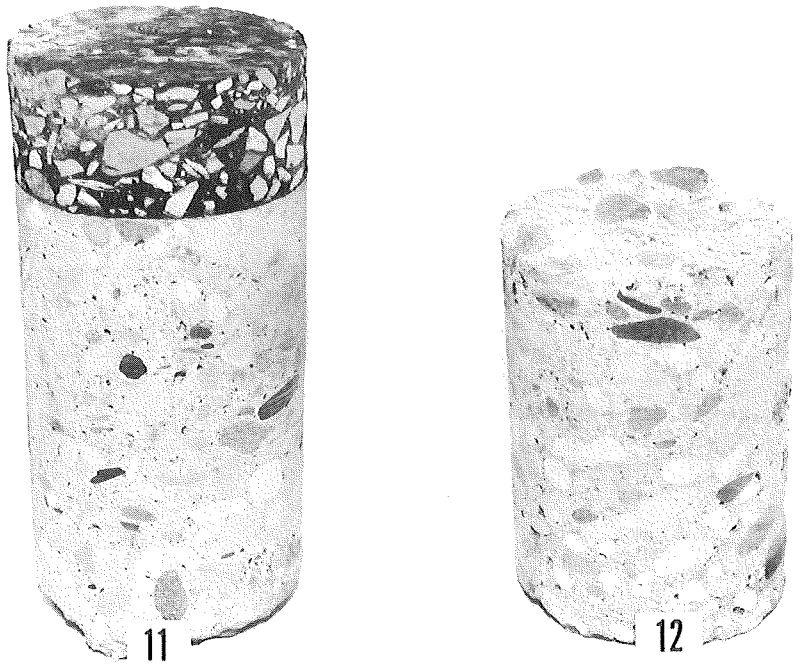


Figure 9. Cores from resurfaced 1942 plain concrete pavement; concrete is nominal 9-in. thickness and overlay is 2-1/2 in. Note good condition of concrete of Core 11 under sound bituminous cap, in contrast to Core 12 where concrete upper surface is disintegrated under alligator cracked bituminous which allowed deicing salts to soak through.

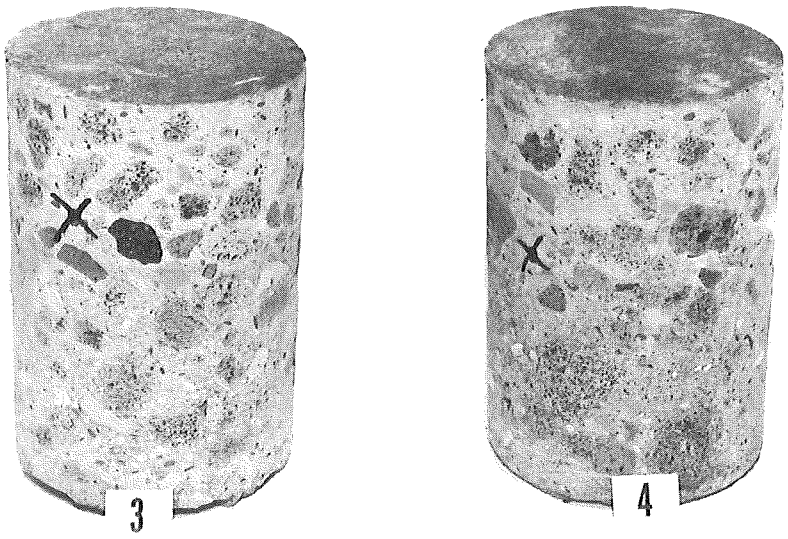


Figure 10. Cores from 1958 reinforced concrete underpass pavement on Belleville Road underpass, in which slag aggregate was used. Locations of reinforcing steel marked by X's.