R-424

OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

May 6, 1963

To: L. T. Oehler, Supervisor
Physical Research Section

From: J. E. Simonsen

Subject: Repair of Continuously Reinforced Experimental Pavement: I 96 from Portland Rd. to M 66. Research Project R-57 F-46. Research Report No. R-424.

The regular quarterly inspection performed February 7, 1963, revealed three new failures--one at Sta. 1045+40 on the westbound roadway in the continuously reinforced wire mesh section and two in the conventional pavement section at Sta. 976+87 and 990+82 on the eastbound roadway. In addition, the existing patches in the traffic lane at Sta. 1071+90 westbound and 1044+66 eastbound had deteriorated in the vicinity of the failure crack to such an extent as to require repair. Conditions at these five locations are shown in Figs. 1 through 5, with diagrams of proposed repairs.

In order to determine the lap location and the cause of failure of th new locations, test cores were taken in the immediate area of the failures on March 28, 1963.

Station 1045+40, Westbound Roadway (Continuously Reinforced)

Two cores through the failure crack (one each in the center of each lane) showed that the failure had occurred at a lap in the reinforcement. The steel reinforcement through the crack was badly rusted. A third core taken at the crosswire location of the lap in the passing lane revealed that the lap was sufficient, but that the weld between crosswire and longitudinal wire had failed. Thus, it is believed that a Type II failure had occurred, as defined in Research Report No. R-397 "Failure of Continuously Reinforced Pavement."

Station 976+87, Eastbound Roadway (Conventional Pavement)

A core through the failure crack in the center of the passing lane showed that the reinforcement had failed by rusting. The failure crack is located approximately at the third point of a 99-ft slab, and 20 ft east of a strain gage installation in the center of the slab, where a plane of weakness was formed by inserting a crack former during construction in the Fall of 1958. Yet, the failure crack originated in April 1959, three months prior to the formation of a crack at the intentionally formed plane of weakness. In addition, joint width measurements show that joints

adjacent on either side of the failure are performing satisfactorily. The failure crack, however, is located 4 ft west of a 15-in. culvert and extends through the sealed shoulders on both sides of the slab. Although the slab profile as determined by level rod readings showed only a 1/8-in. dip at the failure location, the facts indicate that loss of subgrade support rather than induced temperature stress and shrinkage was the probable cause of failure.

Station 990+82, Eastbound Roadway (Conventional Pavement)

At this location a core through the failure crack showed that the reinforcement had failed by rusting. It was noted that the crack had occurred at the approximate midpoint of a slab of an unusual length--136 ft 9 in. The crack originated in April 1959, and subsequent settlement of the subgrade required mud-jacking of the east 45 ft of the slab in the late summer of 1962. Level readings of the failed slab profile indicate settlement of the adjacent 50 ft west of the mud-jacked area. A maximum settlement of 5/8-in. was recorded at the failure crack. The crack was initially formed by volume restraint and the resulting failure may be attributed to a loss of subgrade support.

Patch Cracking

The cause of the failure cracks in the patches in the traffic lanes at Sta. 1071+90 westbound and 1044+66 eastbound apparently resulted from excessive slippage at the center splice due to bond failure when a 30^{o} temperature drop occurred during the first 24 hr after pouring. These failures are discussed in detail in Research Report No. R-409, "Repair of Continuously Reinforced Pavement."

Recommendations

It is recommended that these five locations be repaired as soon as possible to prevent further deterioration of the pavement. The proposed areas for repair are shown in Figs. 1 through 5, and the quantities needed for repair are given in Table 1.

It is suggested that repair of the three locations in the continuously reinforced pavement be done according to the procedure and recommendations in Research Report No. R-409. However, performance observations of the patches repaired in May 1962, indicate that a 3-ft lap of the reinforcement at the end limits of the patches is sufficient to re-establish the continuity, providing the failure is confined to only one lane. Thus, in this case, welding of the reinforcement would be required only in the first repaired lane of the patch at Sta. 1045+40 westbound.

The limits of the two conventional pavement areas where replacement is proposed are based on placing a contraction joint assembly transversely in the center of the patches. The probable cause of failure indicates that providing a plane of weakness with load

transfer capability would minimize the probability of a new failure at these locations. A standard reinforcement mat 10-ft long and 11 ft 6 in. wide should be cut in four pieces, each 2 ft 6 in. long, for use as replacement steel. It is suggested that the existing pavement grade be checked at these two locations prior to repair to determine if mud-jacking in the vicinity of the failures would be required before replacing the pavement.

It would be desirable that Laboratory representatives be present during the repair work to obtain supplemental information in ascertaining the exact causes of failure.

OFFICE OF TESTING AND RESEARCH

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TABLE 1
REPAIR QUANTITIES

Repair Items	Repair Quantities					
	Sta 1045+40 WB	Sta 976+87 WB	Sta 990+82 EB	Sta 1044+66 EB	Sta 1071+90 WB	Totals
Removing old pavement, sq yd						
8-in. uniform	29.3	----	----	35.3	24.0	88.6
9-in. uniform	----	14.7	14.7	----	----	29.4
Patching pavement, sq yd						
8-in. uniform	29.3	----	----	35.3	24.0	88.6
9-in. uniform	----	14.7	14.7	----	----	29.4
Deformed bars, total (and length)						
No. 5	----	----	----	22 (26.5-ft)	----	----
No. 4	92 (11-ft)	----	----	----	46 (18-ft)	----
No. 3	8 (11.5-ft)	----	----	10 (11.5-ft)	6 (11.5-ft)	----
Conventional reinforcing mats	----	1	1	----	----	----
Steel reinforcement, lb	710	86	86	651	579	2122

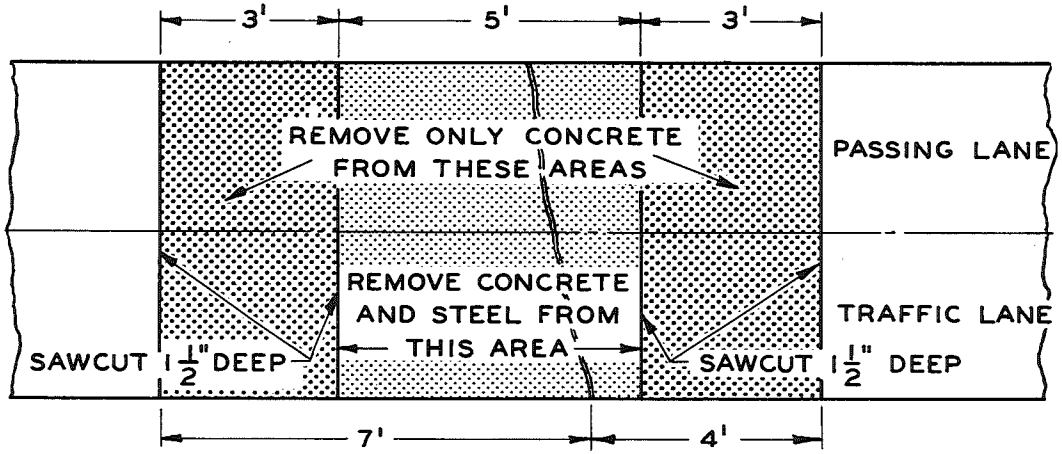
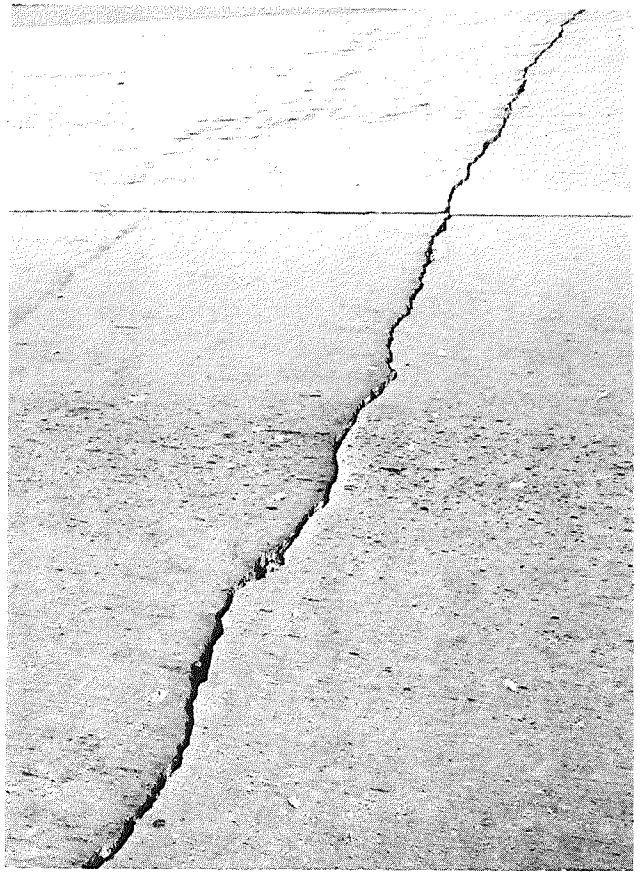
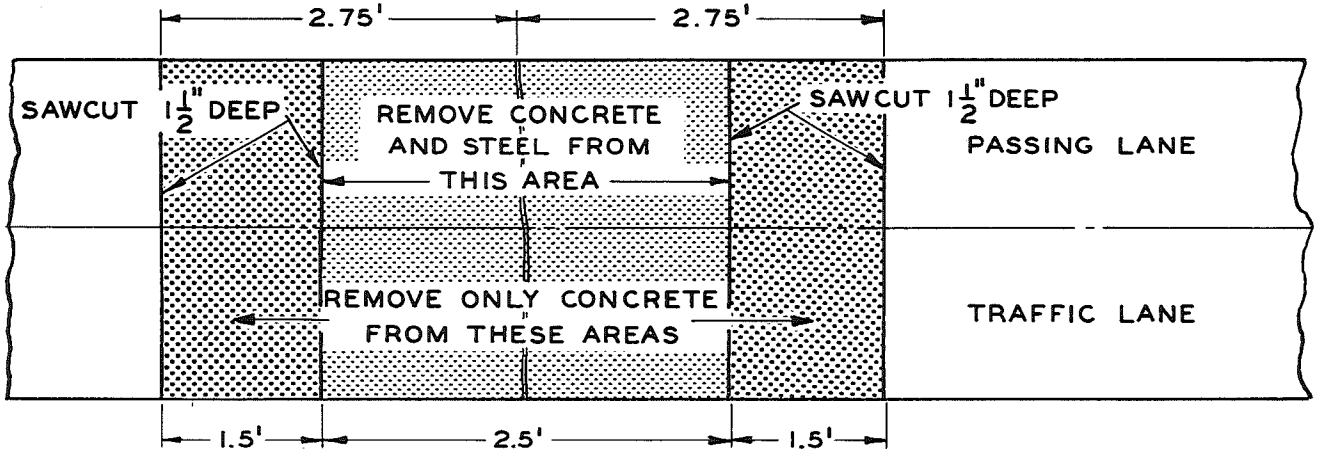


Figure 1. Failure and proposed repair at Sta 1045+40 westbound, in continuously reinforced wire mesh pavement. Photographed from traffic lane shoulder.

Figure 2. Failure and proposed repair at Sta 976+87 eastbound, in conventional concrete pavement. Photographed from traffic lane shoulder.





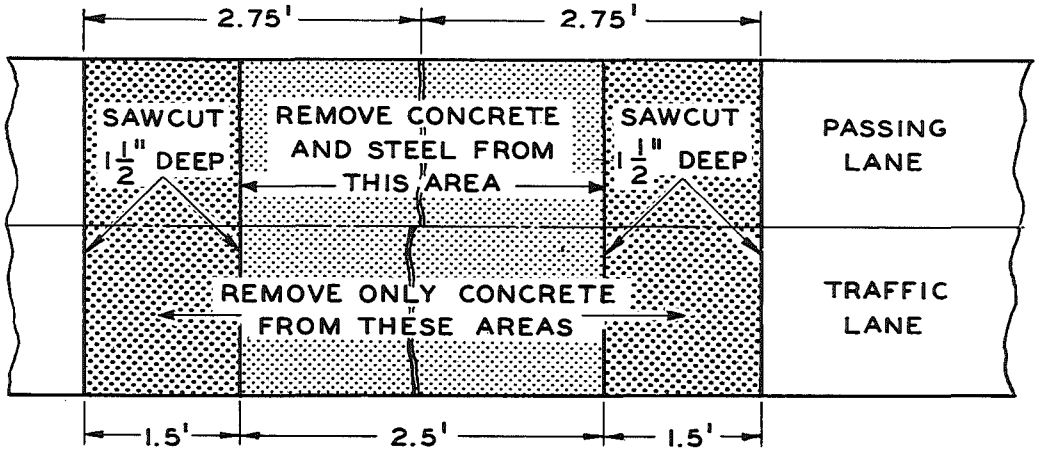
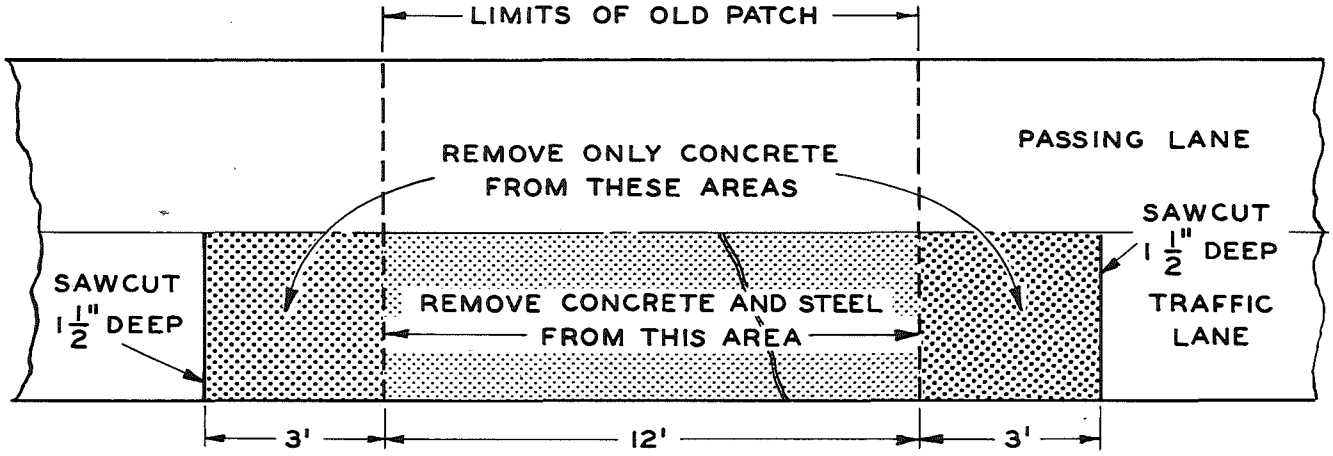


Figure 3. Failure and proposed repair at Sta 990+82 eastbound, in conventional concrete pavement. Photographed from traffic lane shoulder.

Figure 4. Failure and proposed repair at Sta 1071+90 westbound, in existing patch of continuously reinforced pavement. Photographed from traffic lane shoulder.



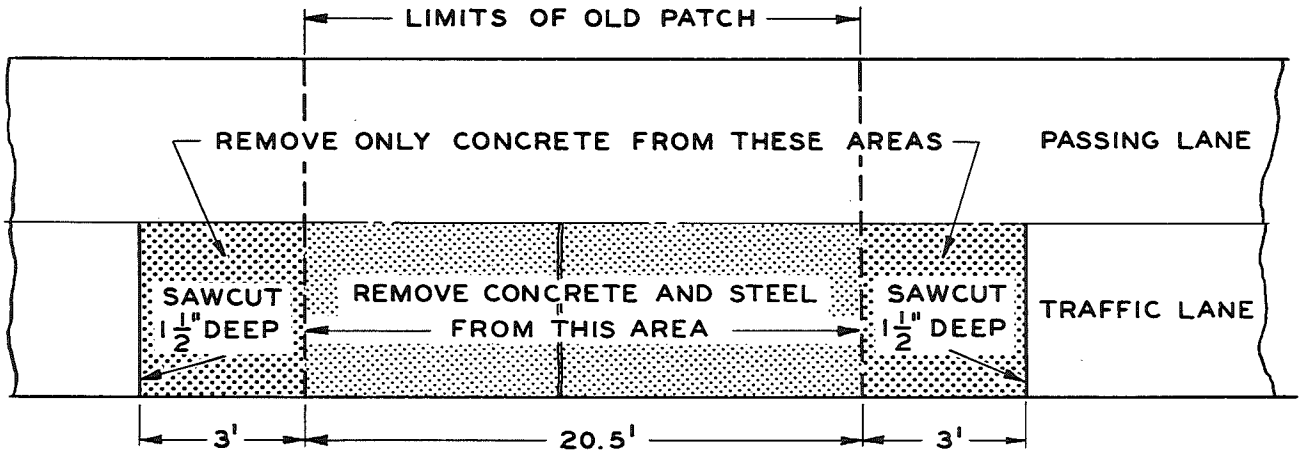


Figure 5. Failure and proposed repair at Sta 1044+66 eastbound in existing patch of continuously reinforced pavement. Photographed from traffic lane shoulder.