



MICHIGAN

DEPARTMENT OF STATE HIGHWAYS

February 7, 1969

To: R. L. Greenman
Testing and Research Engineer

From: L. T. Oehler

Subject: Joint Repairs on M 59 Near Howell. Research Project 39 F-7(14).
Research Report No. R- 693

In response to a letter from Paul J. Marek, Engineer of Maintenance, to R. L. Greenman concerning joint repairs on M 59 near Howell, an investigation was conducted during the month of September 1968, by R. L. Felter of this office.

Construction projects covered by these repairs are 47082, C1, C2; 47-26, C2; 47-26, C6; and 47-26, C8. Due to insufficient historical data, 47-26, C2 will be omitted from this report. (Construction characteristics of the subject projects are given in Table 1.)

The contract for concrete pavement patching was awarded to Edward R. White Company and called for 22-ft wide full- and half-width concrete pavement patches, six and nine feet long, at 141 locations along this 15.3 miles of state trunkline. The field investigation revealed many more joints that will require repair in the near future.

All surface deterioration was similar to that shown in Figures 1-5. The depth of deterioration was difficult to ascertain because of extensive bituminous patching. Condition surveys were taken on 47082, C1 & C2 at initial, six, and ten year levels. These surveys show deterioration on 0, 27, and 86 percent of the joints, respectively, at the time of the surveys. Project 47-26, C6 was surveyed at one, five, ten and nineteen year levels and showed 2, 52, 88, and 97 percent, respectively, of the joints had developed deterioration. Project 47-26, C8 was surveyed at initial, four, ten, and fifteen year levels and showed 4, 18, 81, and 90 percent, respectively, of the joints had developed deterioration. This indicates the deterioration began to develop early in the life of the pavement.

Two joints were investigated by removing shoulder material at the end of the joint. The first of these joints was a contraction joint which was scheduled to be repaired. Figures 6-8 show the condition of this joint. The concrete was found to be extensively deteriorated throughout its depth. Dowel bars were corroded (Fig. 9) and the wire mesh near the joint was rusted through. Condition surveys taken by this unit at the four-year stage note

"... failure of the joint seal and infiltration of dirt into almost all of the joints." This condition prevents normal joint action and places undue stress on the concrete near the joint. It also allows water to seep into the joint which becomes trapped by the base plates and accelerates deterioration of the concrete. The second joint investigated was an expansion joint which was not scheduled to be replaced (Fig. 10). This joint exhibited much sounder concrete as shown in Figure 11. It appears, therefore, that the surface deterioration is an end result of deterioration taking place in the lower confines of the joint which decrease the bearing surface and increase the stress on the concrete that remains near the top of the joint. This condition has been observed on numerous other pavements where joint deterioration is prevalent. Construction records reveal that all concrete met or exceeded the strength requirements for concrete pavement.

Construction records for 47-26, C8 note that a problem was encountered with the wire mesh sliding during the pouring of concrete. It was not stated how many joints were effected by this but steps were being taken to eliminate the problem. This left a length of mesh near the joint which was pulled up, cut off, and forced back into the concrete by hand. This process suggests the possibility of overworking the concrete near the joint and also the possibility of disturbing the alignment of the dowel bars. Either of these conditions would increase the susceptibility of the joint to damage. Due to the method used in removing the concrete in the area to be repaired, it was impossible to determine the alignment of the dowel bars. Hand forcing the wire mesh into the concrete also left the steel at random depths throughout the slab, with several locations where the steel is visible at the surface (Fig. 12).

The repair of these joints as prescribed by the Maintenance Division and Project Engineer P. W. Bergmann, has been completed. The process involved sawing to a five inch depth along each end of the area to be removed. The concrete was then broken-up using a drop hammer and removed (Fig. 13). This drop hammer technique of removal resulted in damage of the remaining concrete below the saw cut as shown in Figure 16. A form was placed at the outside edge of the pavement and the subbase was filled and compacted to allow a nine-inch pour of concrete. No ties were provided to the existing pavement. In cases where the entire 22 ft width was to be replaced, it was done in two 11 ft pours (Fig. 17), with tie bars placed transversly at the centerline joint. Measurements are presently being made on a similar repair job on US 127 south of Hudson to determine the effectiveness of this form of concrete patch.

The evidence available indicates the failure of the joint seal and subsequent infiltration of dirt and water to be the major cause for the deterioration.

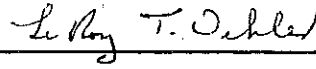
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The other factors such as overworking concrete near the joint and misalignment of the dowel bars, if present, would contribute to the degree of deterioration.

TESTING AND RESEARCH DIVISION



Director - Research Laboratory

LTO:sjt

cc: P. J. Marek

TABLE 1

CONSTRUCTION CHARACTERISTICS OF M 59 PROJECTS

Control Section	47082	47082	47082
Construction Project	47082, C1 & C2	47-26, C6	47-26, C8
Date of Construction	1957	1948	1952
Length of Project	2.671 mi	3.567 mi	5.313 mi
Pavement Thickness	8 in.	8 in.	8 in.
Pavement Width	22 ft	22 ft	22 ft
Pavement Reinforcement	Standard Wire Mesh		
Expansion Joint Spacing	None	None	396 ft (where required)
Expansion Joint Width	-----	-----	1 in.
Expansion Joint Load Transfer	-----	-----	Dowel Bars (1"x15"@12"C-C)
Contraction Joint Spacing	99 ft	99 ft	99 ft
Contraction Joint Load Transfer	Dowel Bars (1"x18"@12"C-C)	Dowel Bars (1"x15"@12"C-C)	Dowel Bars (1"x15"@12"C-C)
Base Plates	Sheet Metal	Asphalt Mastic Pressed Board	
Finisher	General	Lakewood Jaeger	Lakewood Jaeger
Curing	White Membrane	Clear Membrane	Paper
Cement	Peerless A. E.	Wyandotte Vinsol	Wyandotte Vinsol
Paving Aggregates	-----	Resin	Resin
Fine Aggregates	-----	American Aggregates Corporation	
Coarse Aggregates	-----	Green Oak Pit #47-03	
Contractor	-----	Green Oak Pit #47-03	
	Porath & Son	R. Sablain	Pierson



Figure 1. Typical joint condition showing extensive spalling. This joint is to be repaired. Project 47-26, C6.

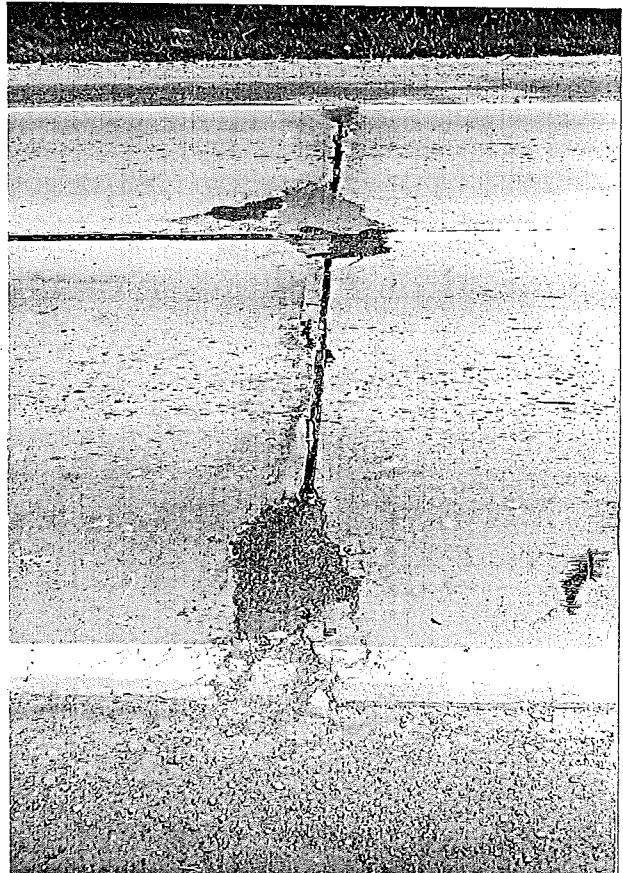


Figure 2. Typical joint condition. This joint is not to be repaired but will probably need attention in the near future. Project 47-26, C6.

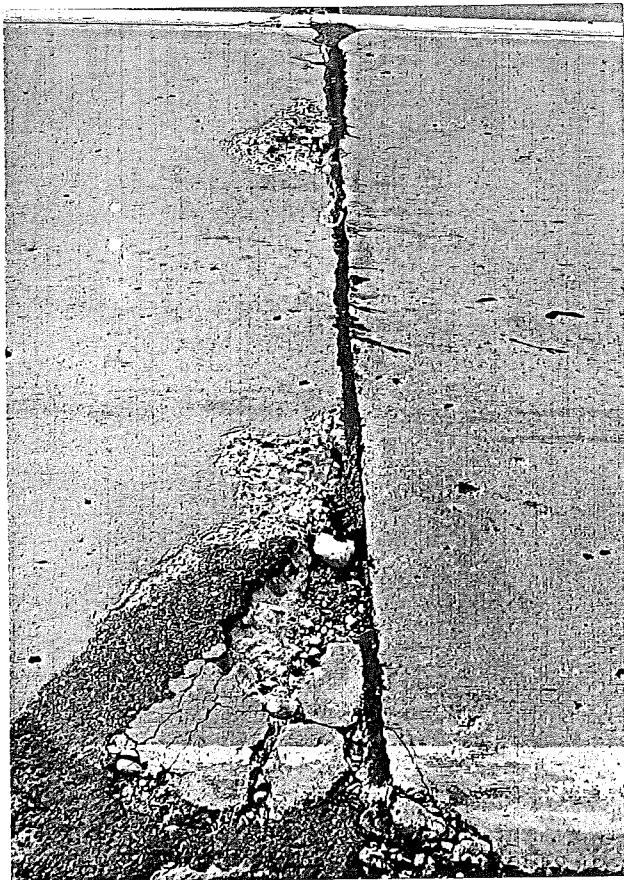


Figure 3. Typical joint condition. Note extensive deterioration and spalling of concrete. Project 47082, C2.



Figure 4. Typical failure indicating possible overfinishing of concrete near joint. Project 47082, C2.



Figure 5. Typical failure indicating possible overfinishing of concrete. Project 47082, C1.



Figure 6. Joint at 316+00. Note deteriorated concrete at bottom of joint. Project 47-26, C6.



Figure 8. Joint at 316+00. Note deteriorated concrete and corroded dowel bar. Project 47-26, C6.

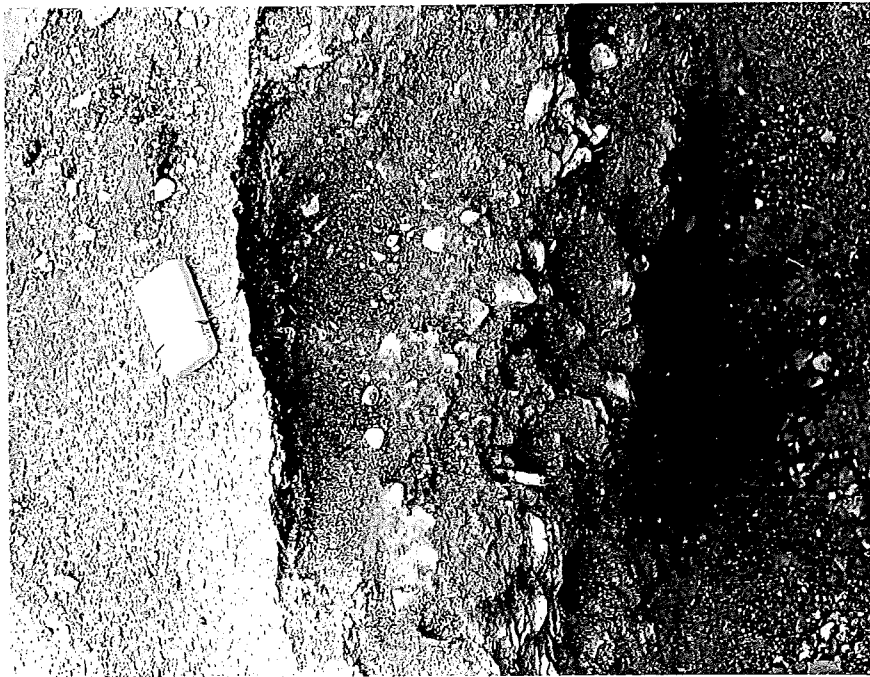


Figure 7. Joint at 316+00. Note deteriorated concrete and exposed wire mesh. Project 47-26, C6.

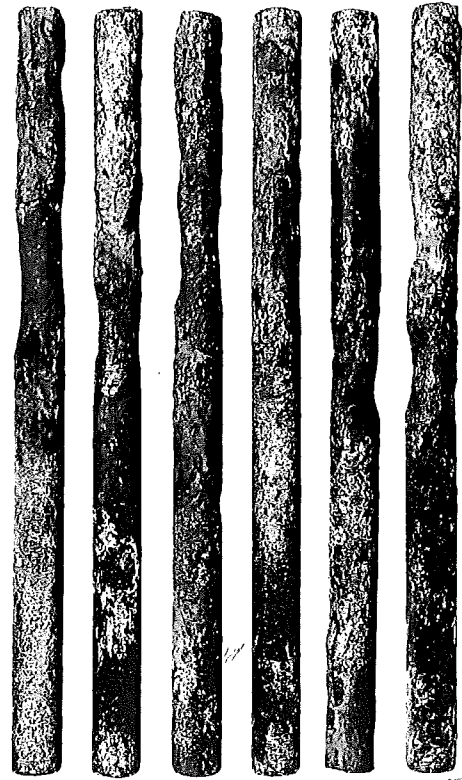


Figure 9. Typical condition of dowel bars showing extensive corrosion which has taken place. Taken from Project 47-26, C6.

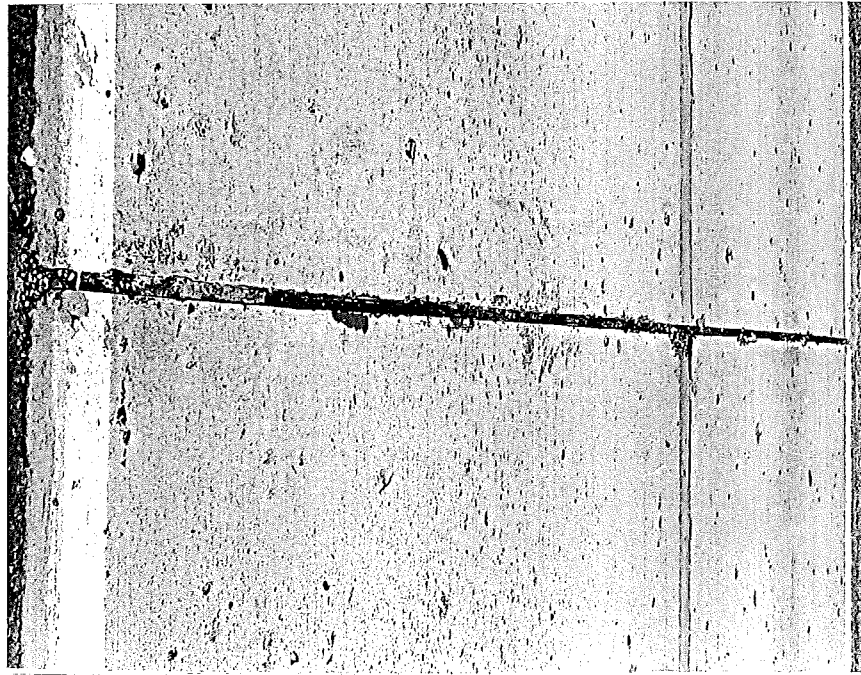


Figure 10. Expansion joint at 568+49. Note failure of joint material and the intrusion of foreign particles. Project 47-26, C8.

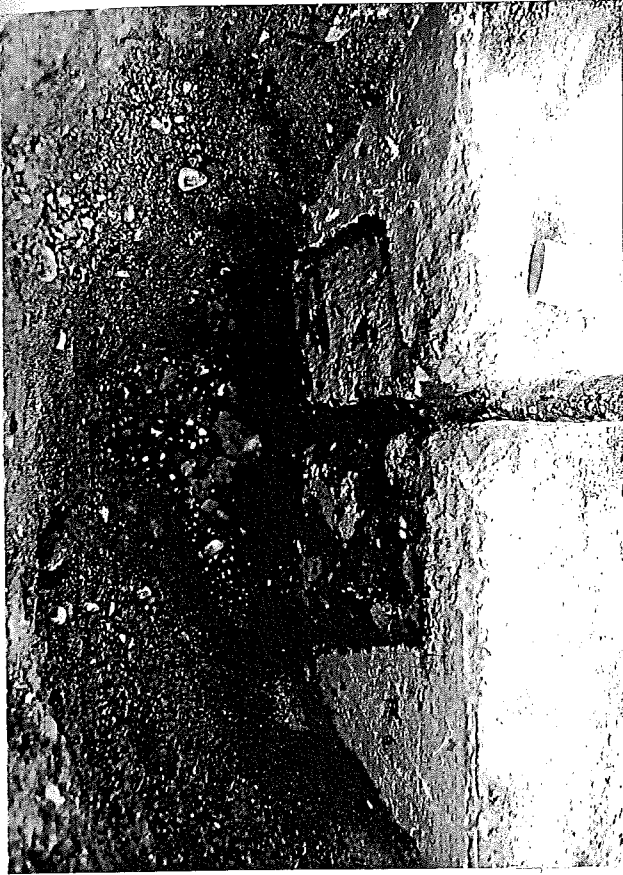


Figure 11. Joint at 568+49. Note presence of much sounder concrete and lack of surface deterioration. Project 47-26, C8.



Figure 12. Wire mesh exposed in concrete surface. Project 47-26, C2.



Figure 13. Joint repair in progress. Saw cuts have been made and concrete broken with drop hammer. Project 47-26, C6.



Figure 14. View after concrete has been removed. Project 47-26, C6.



Figure 15. Form in place and subbase filled, leveled, and compacted. Note tie bars to previously poured section. Project 47-26, C6.



Figure 16. View of damage to remaining pavement caused by breaking out the concrete to be removed. Project 47-26, C6.



Figure 17. Pavement repair with one 11 ft section complete. Project 47082, C2.