

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

June 26, 1961

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To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Investigation of Three Spalled Joints on US 131 South of Grand Rapids.
Construction Projects F 41-88, C1RO and M 41-88, C2.
Research Project 39 F-7(14). Report No. 359.

Reported by O. L. Lindy

At the suggestion of R. L. Greenman, Assistant Testing and Research Engineer, in March 1961, the Research Laboratory Division has conducted condition and pictorial surveys of two 4-year-old projects on the US 131 freeway south of Grand Rapids. Particular attention was given to three joints exhibiting deterioration. The term "deterioration" is interpreted broadly in this report to include any form of spalling, breakage, or other failure of concrete.

The projects comprise 8.1 miles of divided highway. The southern project, M 41-88, C2, extends from 100th St. north to 76th St. The northern project, F 41-88, C1RO, runs from 76th St. north to 28th St (the US 16 bypass).

The recent surveys were done in March and April 1961. The projects were constructed in 1957, and the first Research Laboratory condition survey was conducted January 15, 1958. At that time, less than six months after construction and before the end of the first winter season, the three joints in question already showed evidence of deterioration. By the time of the 1961 surveys, an actual total of 30 contraction, expansion, and construction joints had deteriorated notably--out of 931 joints of all types in the two projects (Table 1).

The 1961 surveys also showed heavy transverse cracking in the south project, and lighter transverse cracking in the north one (Table 2).

Aside from the 30 deteriorated joints and the transverse cracking, the pavement could be described as in good condition.

Joint 1: Station 210+25 Southbound

Spalling at this joint is located in the traffic lane (Fig. 1). Considering the angle of the plan of cleavage at the pavement surface, the break is probably 3 to 4 in. down from the slab surface at the joint. The spall is on the "night" side of this construction joint and seems to be typical of deterioration being found at this type of joint.

Joint 2: Station 234+83 Northbound

This contraction joint has a large break in the traffic lane (Fig. 2), on the forward side of the joint--the unbroken slab was poured before the broken one. The crack formed by the break appears to be undergoing all the movement and pressure that normally would occur at the joint. This is demonstrated by the appearance of the joint seal; although it is separate and parted from the slab along most of the transverse joint, it is still adhering and undisturbed opposite the break.

Joint 3: Station 255+02 Northbound

Spalling at this construction joint is on the "night" side (Fig. 3). Concrete in this section is of a quality permitting bond failure between coarse aggregate and the slab surface mortar layer.

The more common causes of joint failure in pavements built under current specifications have been subjects of several recent reports from the Research Laboratory Division. One publication containing remarks particularly pertinent to the deteriorated joints on US 131 is Research Report No. 350.

While the causes for joint problems such as those illustrated here can be suggested on the basis of pavement surface examination, more complete information would certainly be available if these joints were opened.

The Research Laboratory Division has arranged with Kent County maintenance personnel at the District 7 garage for notification in case these joints or any of the 30 deteriorated joints are opened for repair. However, upon request and with the cooperation of the Office of Maintenance, the worst of the joints could be opened for repair and reported immediately.

OFFICE OF TESTING AND RESEARCH

E. A. Finney, Director
Research Laboratory Division

EAF:js

TABLE 1
SUMMARY OF JOINT DETERIORATION

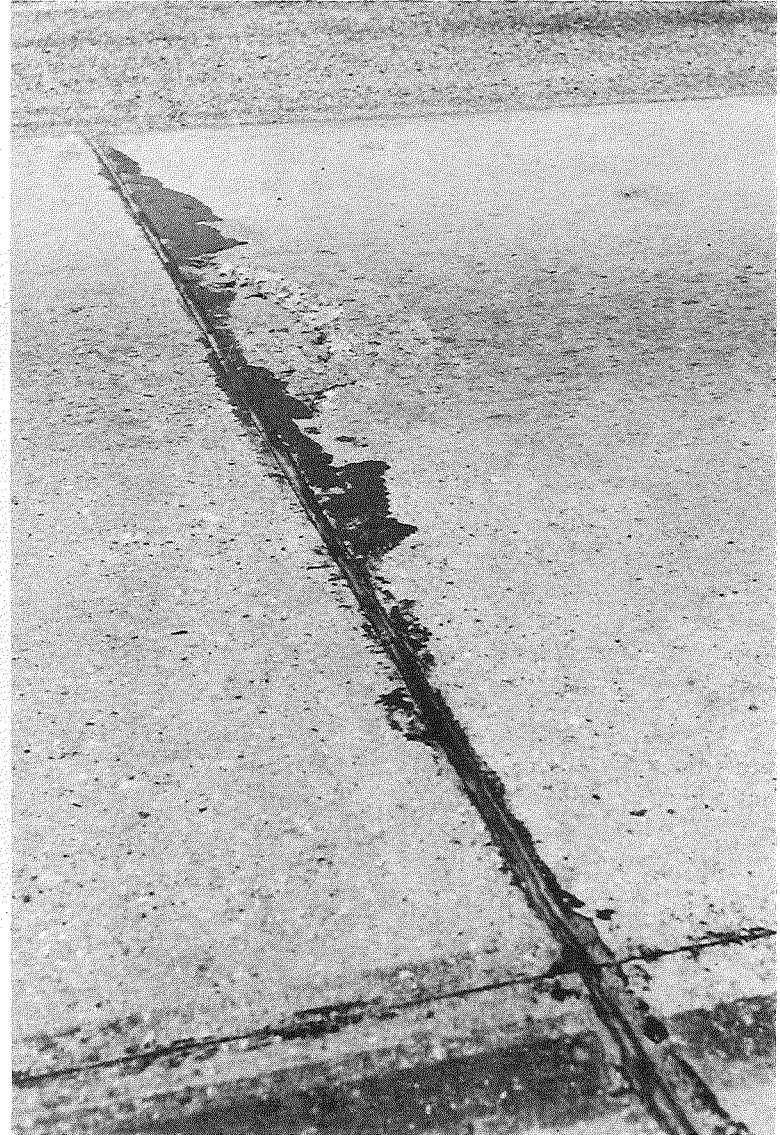
Project	Contraction Joints			Construction Joints			Expansion Joints		
	Total	Deteriorated		Total	Deteriorated		Total	Deteriorated	
		Number	Percent		Number	Percent		Number	Percent
M 41-88, C2									
Northbound	137	4	2.9	8	2	25.0	--	--	--
Southbound	135	4	3.0	9	2	22.2	--	--	--
F 41-88, C1RO									
Northbound	253	4	1.6	18	0	0.0	31	0	0.0
Southbound	273	12	4.4	23	1	4.4	44	1	2.3

TABLE 2
SUMMARY OF TRANSVERSE CRACKING

Project	Cracks		
	Total	Per Lane Mile	Per Slab
M 41-88, C2			
Northbound	429	160	3.0
Southbound	388	145	2.7
F 41-88, C1RO			
Northbound	176	32	0.6
Southbound	200	34	0.6

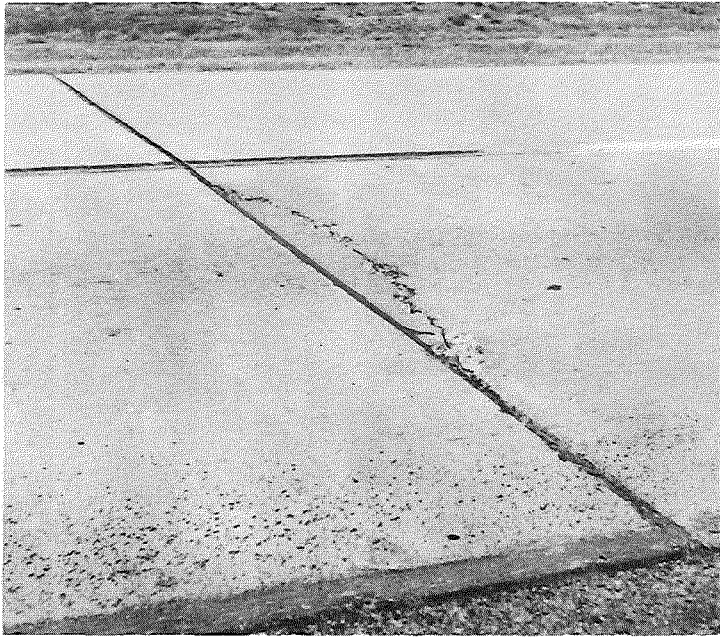


General View



Traffic Lane

Figure 1. "Joint 1" exhibits deterioration on the "night" side of the joint in the traffic lane. Station 210+25 Southbound.

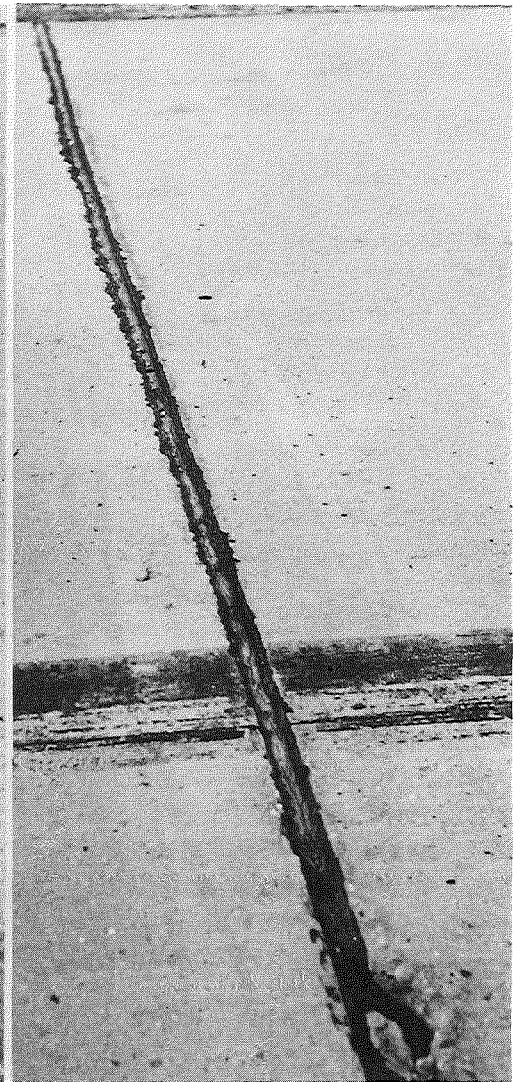


← General View

Figure 2. At "Joint 2" the sealing material is parted from the slab along most of the joint, but is intact and adhesive along the broken slab edge, where normal joint movement pressures appear to be occurring at the spall crack. Station 234+83 Northbound.



Traffic Lane

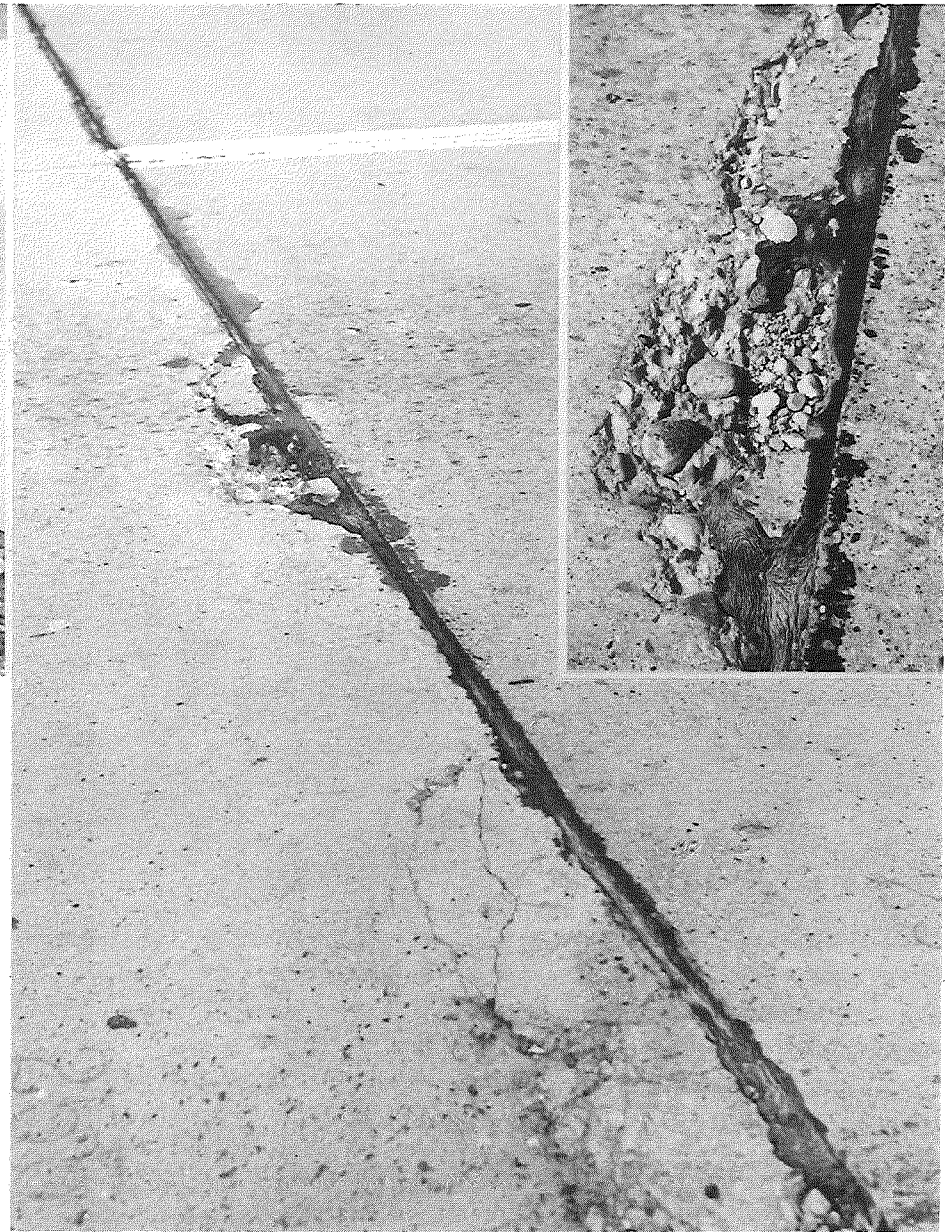


Passing Lane



General View

Figure 3. "Joint 3" has deteriorated concrete at two points in the traffic lane, on the "night" side of the joint. Note crumbling mortar and unbroken aggregate (right) indicating bond failure. Station 255+02 Northbound.



Traffic Lane With Enlarged Detail