

R-355

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

May 25, 1961

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To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Longitudinal Cracking on I 75 - US 23, Genesee County.
Research Project 39 F-7(14). Report No. 355.

Reported by O. L. Lindy

In May 1960, unusually heavy longitudinal cracking was observed on three 3-year-old projects on I 75 - US 23 between M 21 west of Flint and the Genesee-Saginaw county line. At that time these projects were condition surveyed and photographed. In April 1961, these projects were again surveyed to ascertain if any new longitudinal cracks had developed or if the old ones had enlarged.

A summary by project of the comparative quantities and lengths of cracks in relation to overall project length is given for both the 1960 and 1961 surveys in Table 1. More specific information on individual cracks is given in the appendix, which shows stationing at the point of beginning of each crack, as well as length, lane, and maximum distance from centerline.

Standard specifications under which these projects were built called for a minimum depth of 2 in. for the saw-cut forming the weakened plane at the longitudinal joint. Checks on the actual saw-cut depth in random areas where longitudinal cracking had formed are shown in the appendix; similar saw-cuts were found in uncracked areas. The depths measured indicate that the saw-cut was generally close to the specified 2-in. minimum. Nevertheless, considerable longitudinal cracking has developed.

Although no record seems to be available of when longitudinal cracking began to develop, comparison of the 1960 and 1961 data in Table 1 and the appendix indicates that this cracking is a progressive phenomenon. There are increases both in the total number of cracks and in the lengths of some older cracks.

The photographs illustrate typical patterns of longitudinal cracking on these projects. It should be noted that light spalling develops readily along these irregular cracks. Such spalling is generally only the first stage in more serious deterioration.

At this time no attempt has been made to determine the specific cause of this pavement failure. Longitudinal cracking such as that observed on these projects might be caused by one or more of the following:

1. Traffic loads on the pavement prior to establishing the weakened plane longitudinal joint by sawing.
2. Heavy loads during early life of the pavement, such as earthmoving equipment or other heavy contractor's equipment.
3. Non-uniformity of subgrade support, particularly in the transverse direction.

In the course of the Laboratory's regular program of pavement condition surveys, cracking on these projects will be under continuing observation.

OFFICE OF TESTING AND RESEARCH

E. A. Finney, Director
Research Laboratory Division

EAF:LTO:js

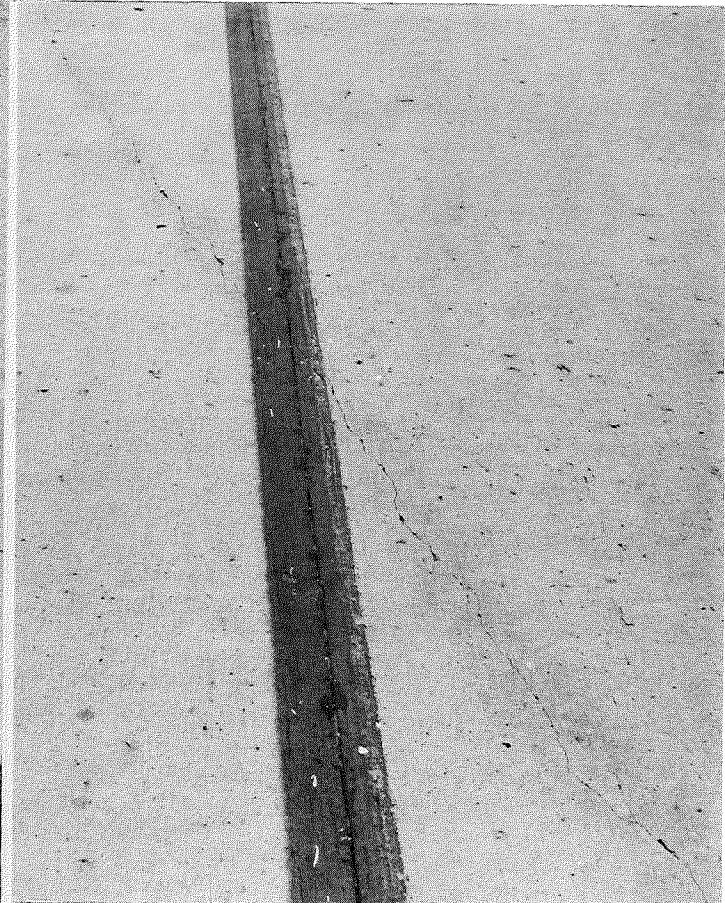
TABLE 1
SUMMARY OF LONGITUDINAL CRACKING

Project	Longitudinal Cracks											
	Northbound						Southbound					
	Number		Length, ft		Percent of Roadway Length		Number		Length, ft		Percent of Roadway Length	
	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
25032, C1	9	10	319	338	5.1	5.4	5	5	168	168	2.7	2.7
25032, C2	24	29	1030	1111	7.8	8.4	18	20	607	653	4.6	5.0
25-54, C1	34	43	1099	1333	3.3	4.0	95	116	2886	3272	8.7	9.9



◀ Figure 1. Crack from centerline to pavement edge.

Figure 2. Crack extending across centerline saw-cut.
▼



◀ Figure 3. Crack extending across transverse joint.

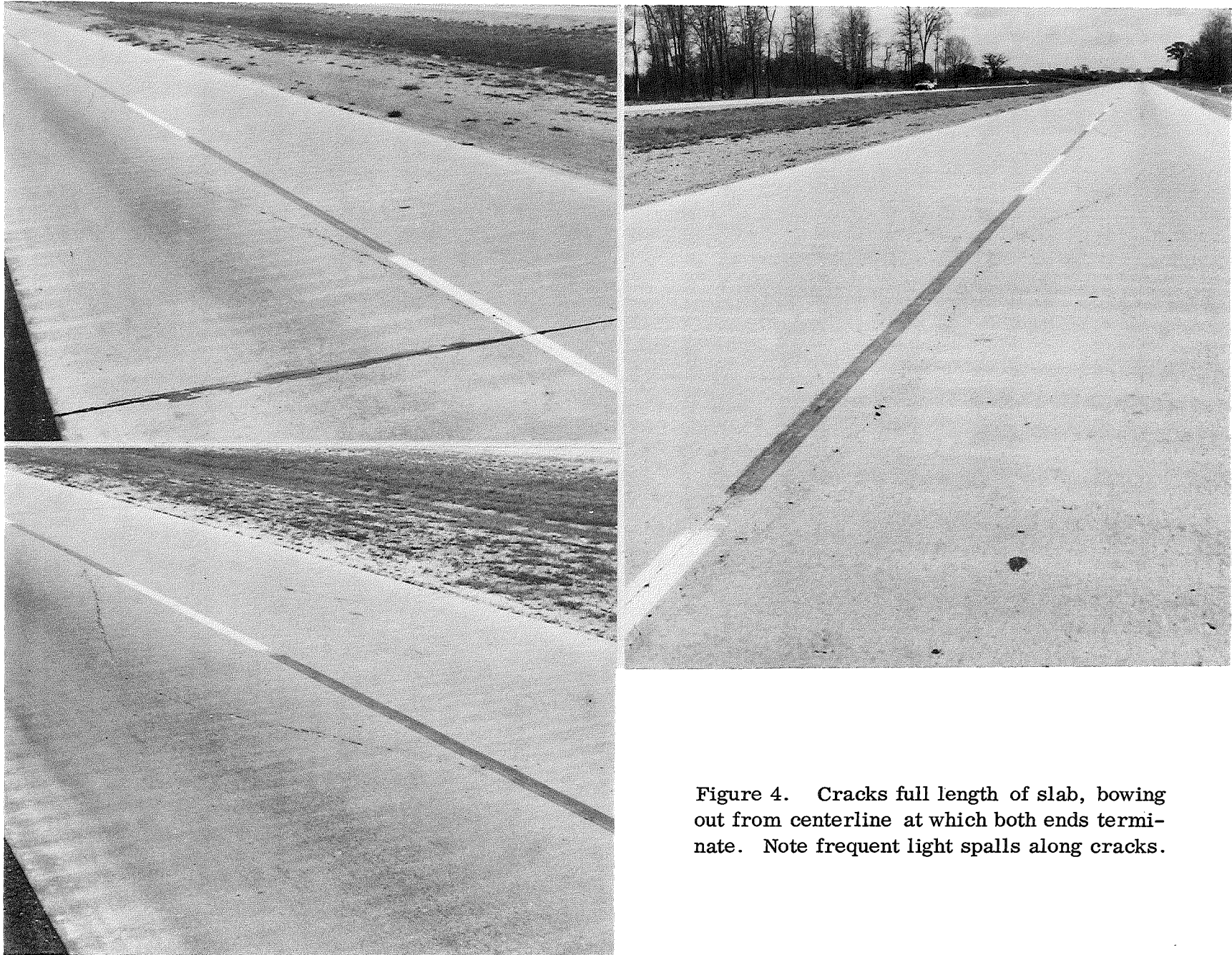


Figure 4. Cracks full length of slab, bowing out from centerline at which both ends terminate. Note frequent light spalls along cracks.

APPENDIX
SUMMARY OF LONGITUDINAL CRACKING

POB Station	Cracks			Longitudinal Saw-Cut	
	Total Length, ft		Max Distance from ζ , ft*	Avg Depth, in.	Min Depth, in.
	1960	1961			
25032, C1RO (STA. 830+85 TO 893+00)					
NORTHBOUND					
842+91	15	15	6P		
842+91	15	15	3T		
843+93	19	19	12T		
844+39	39	39	6T		
857+72	38	38	3P		
858+56	47	47	2T		
859+19	28	28	3P		
866+90	85	85	6T		
869+31	--	19	1P		
887+82	33	33	12P		
SOUTHBOUND					
847+45	75	75	3T 2P		
870+40	25	25	12P		
871+61	22	22	12T		
880+38	21	21	4P		
882+38	25	25	12T		
25032, C2 (STATION 893+00 TO 1025+00)					
NORTHBOUND					
912+72	18	18	4T		
912+74	10	10	2T		
916+20	--	35	12P		
916+46	--	12	12P		
918+38	31	31	1P		
920+80	86	86	2P		
921+72	23	23	10T		
921+80	9	9	3T		
926+69	18	18	1T		
951+57	142	142	12T 1P		
953+08	51	51	12T	1 7/8	1 3/4
953+90	50	50	12T	1 7/8	1 3/4
955+28	57	57	12T		
957+23	15	15	4T		
964+92	88	88	4T	1 3/4	1 3/4
967+20	46	46	6T	2 3/8	2 1/4
980+23	--	12	1P		
982+57	13	13	2T	2	2
999+00	15	15	2T	2	2
1000+12	9	9	2T		
1000+83	29	29	9T		
1001+12	20	20	9T	2	1 7/8
1002+58	122	122	2P 2T	2	1 7/8
1004+66	63	63	4T	2	2
1005+78	23	23	11T		
1006+22	67	67	12T 2P	2	2
1008+07	25	25	12T		
1009+10	--	15	1P		
1009+10	--	7	12T		

* P = Passing Lane; T = Traffic Lane

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POB Station	Cracks			Longitudinal Saw-Cut	
	Total Length, ft		Max Distance from C , ft*	Avg Depth, in.	Min. Depth, in.
	1960	1961			
SOUTHBOUND					
898+24	14	14	12T		
898+32	11	11	12T		
898+88	57	57	4T		
910+10	27	27	12T		
915+20	23	23	12T		
915+80	40	40	12T		
919+61	33	33	9T		
933+05	19	19	12T 2P		
960+35	--	9	2P		
964+00	32	32	12T		
965+40	100	100	2P		
971+11	33	33	6T		
974+52	--	37	12T		
999+19	25	25	12T		
1004+13	12	12	6T		
1008+65	20	20	12T		
1009+25	21	21	12T		
1009+35	25	25	12P 12T		
1009+61	26	26	2T		
1012+22	89	89	12T		
NORTHBOUND					
1071+55	20	20	12T		
1074+17	12	12	1P	1 7/8	1 7/8
1074+80	12	12	3P	1 7/8	1 7/8
1075+79	27	60	1T 1P		
1076+90	15	15	6T		
1076+90	15	47	2P		
1079+69	31	31	3T	1 7/8	1 7/8
1079+82	--	18	2T		
1108+92	20	20	2T	2	1 7/8
1113+66	--	14	2P		
1115+15	--	17	12P		
1116+70	25	25	11T	2	2
1117+54	14	14	1T	2	2
1119+67	20	20	1P		
1123+33	--	15	1T		
1125+85	15	15	1P	1 7/8	1 7/8
1126+08	22	22	2T	2	2
1131+38	--	6	1/2P		
1133+72	56	56	6T		
1139+83	29	29	12P		
1139+99	65	65	6P 4T		
1151+90	--	25	2P		
1152+56	44	44	12T		
1153+60	100	100	2T	1 3/4	1 3/4
1166+13	45	45	12P		

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POB Station	Cracks			Longitudinal Saw-Cut	
	Total Length, ft		Max Distance from C , ft*	Avg Depth, in.	Min. Depth, in.
	1960	1961			
NORTHBOUND					
1167+06	46	46	12P		
1180+80	76	76	4T		
1184+24	27	27	12T		
1184+95	15	15	12T		
1189+63	12	12	1P		
1191+18	72	72	12T		
1191+20	--	20	12P		
1218+60	31	31	2T		
1222+75	--	12	1T		
1223+80	28	28	2T		
1257+27	44	47	12T		
1257+72	64	64	12T		
1265+53	40	40	2T 2P		
1267+20	15	15	2T		
1267+55	12	12	2T		
1267+05	--	18	12T		
1269+25	11	11	2T		
1293+85	19	40	2T		
SOUTHBOUND					
1044+78	45	53	2T 12P		
1049+27	25	25	1P		
1050+61	--	29	2P		
1060+33	--	9	2P		
1068+10	25	25	12P		
1068+26	16	16	1T		
1068+66	50	50	12T		
1069+70	22	22	12P		
1072+05	55	55	12P		
1077+10	36	36	6T		
1077+45	11	11	6P		
1081+16	31	31	12T		
1085+54	25	25	3P		
1086+40	30	30	12P		
1088+49	17	17	2P		
1088+75	14	14	3T		
1089+90	43	43	2T		
1090+31	139	139	9T 1P		
1096+73	17	17	12P		
1100+65	90	90	4T		
1102+00	60	60	4T		
1103+02	15	15	1T		
1103+51	9	9	1/2T		
1104+13	27	27	1P		
1104+47	--	12	1/2P		
1105+26	63	63	5T	2	1 7/8

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POB Station	Cracks			Longitudinal Saw-Cut	
	Total Length, ft		Max Distance from ϕ , ft*	Avg Depth, in.	Min Depth, in.
	1960	1961			
1116+65	25	25	12P		
1116+88	47	47	12T		
1119+71	9	9	1P		
1119+96	13	13	12P		
1121+61	43	43	12T		
1129+16	--	15	1T		
1129+45	25	25	12T		
1129+69	14	14	12T		
1130+95	25	25	12T		
1132+00	20	20	1/2P		
1133+31	17	17	4P		
1136+16	14	14	1/2P		
1138+75	45	45	12P 3T		
1138+75	10	10	12T		
1139+75	6	6	1/2T		
1140+84	41	41	2T		
1144+50	22	22	12T		
1144+63	27	27	4T		
1145+20	--	6	1/2P		
1145+30	--	13	1T		
1153+00	--	10	1P		
1154+05	55	55	3P 3T		
1155+44	36	36	12T		
1155+46	17	17	12P		
1156+13	22	22	2P		
1157+11	23	23	1T		
1159+08	12	12	1/2T		
1159+25	23	23	10T		
1160+00	13	13	10T		
1162+62	37	37	1P 12T		
1162+81	8	8	12P		
1163+15	40	40	10T		
1163+61	24	24	3P		
1164+78	24	24	12P		
1170+60	17	20	1P		
1176+15	18	18	2P		
1189+18	22	22	2T		
1192+62	10	10	1/2P		
1197+73	59	59	2T		
1198+47	35	35	1P		
1198+76	44	44	1/2T 1P		
1200+53	--	14	1T		
1201+44	78	78	2T	1 7/8	1 3/4
1202+29	--	8	1T		
1206+08	32	32	6P		

25-54, C I (STATION 1025+00 TO 1355+00)

SOUTHBOUND

* P = Passing Lane; T = Traffic Lane

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SUMMARY OF LONGITUDINAL CRACKING

POB Station	Cracks			Longitudinal Saw-Cut	
	Total Length, ft		Max Distance from ϵ , ft*	Avg Depth, in.	Min Depth, in.
	1960	1961			
1207+08	17	17	2P		
1208+55	14	14	1P	2	2
1208+72	49	49	2T 3P		
1210+00	22	22	7T	1 7/8	1 7/8
1210+42	74	74	3T 2P	1 7/8	1 7/8
1211+32	18	27	1/2P		
1212+22	44	44	1T	2	1 7/8
1214+55	70	70	6T		
1215+69	34	34	1T	1 7/8	1 7/8
1216+28	25	25	1P		
1217+65	13	13	4T		
1218+64	--	17	1/2P		
1219+33	36	36	1/2P		
1220+14	7	11	1P		
1220+43	--	8	1/2T		
1220+64	--	17	1/2P		
1221+80	29	29	2T		
1222+21	49	49	3P 12T		
1222+51	20	20	12P		
1223+11	22	22	10T		
1223+40	25	25	12P		
1224+30	25	25	12T		
1226+00	--	47	12T		
1227+50	30	30	1P		
1233+78	--	22	2T		
1234+84	49	49	6T	1 3/4	1 3/4
1236+08	--	30	4T		
1236+88	22	22	4P		
1237+08	17	17	3P		
1237+89	11	11	2P		
1237+91	19	19	6P		
1240+42	--	18	1T		
1240+79	22	22	1T		
1241+21	47	47	4T	2	2
1245+25	17	17	10P		
1246+90	16	16	2T		
1256+86	--	6	1T		
1257+11	--	28	3T		
1258+12	20	20	2P		
1259+91	--	27	1P		
1261+30	--	16	1T		
1262+60	30	30	2P		
1267+23	47	47	2T		
1268+28	--	10	1T		
1270+96	29	29	3T		

25-54, CI (STATION 1025 +00 TO 1355 +00)

SOUTHBOUND

* P = Passing Lane; T = Traffic Lane.