R-334

OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

June 3, 1960

To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Study of Premolded Rubber and Polyvinyl Chloride Base Plate for Joints. Research Project 53 G-70. Report No. 334.

Reported by D. F. Simmons and C. C. Rhodes

Late in 1953, a black vulcanized rubber stock from the Servicised Products Corporation was evaluated by the Research Laboratory Division as a possible substitute for metal in base plates for transverse joints. The material was physically suitable and soil burial tests for a full year indicated no serious deterioration from the action of soil micro-organisms. The work was reported in Research Laboratory Report 231, which recommended trying the material in a field test to learn practical details of handling and installation.

Several trial installations were made, but before specifications could be written, two new products, a gray and a black polyvinyl chloride plastic, were submitted in 1958 for similar tests to determine their suitability for use as base plate material. The gray plastic was furnished by Servicised Products; the black was produced by the Detroit Macoid Company and submitted by W. R. Meadows.

These two materials along with a new sample of the Servicised rubber material were tested in the same way as described in Report No. 231. In these tests, which again were carried on for 1 year, tensile strength, elongation, stress at 100-percent elongation, permanent set, and Shore hardness were measured on sets of samples removed at 1-month intervals from burial in rich garden soil, and also on samples heat-aged in an oven at 158 F for 70 hr, 7 days and 14 days respectively.

The results of these tests are shown in Table 1, and values for specific gravity and absorption in Table 2. A statistical analysis of the data in Table 1 showed no significant correlation between burial time and physical properties, except Shore hardness, where both polyvinyls exhibited a very slight increase and the rubber a small decrease during the period of exposure. It can be concluded, therefore, that all three materials were not appreciably affected by soil micro-organisms.

Specifications to cover both rubber and polyvinyl chloride plastic as materials for non-metallic base plate were written in April 1958, and revised in accordance with manufacturers' suggestions in January 1959. Apparently these specifications are adequately serving their purpose, and no further laboratory work is contemplated at this time.

It is pertinent, however, to call attention to some of the construction difficulties associated with the use of this material, as revealed by an examination of several joints on the US 12 Kalamazoo Bypass (IN 39-40, C7 & 8), built in the fall of 1956. The attached photographs (Figs. 1 through 4) were taken in April 1958, of joints selected at random for inspection of the end plates. Three of the four showed various defects in positioning of the end plate (Figs. 1 through 3). The fourth (Fig. 4) showed good end plate positioning, but the surface groove was not centered over the base plate. Evidently considerable care must be taken to position the turned-up ends properly and to avoid displacement of these ends by the fresh concrete during pouring operations.

OFFICE OF TESTING AND RESEARCH

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Table 1
Soil Burial and Aging Tests of Nonmetallic Base Plate Materials

Designation	Servicised Polyvinyl Chloride (Gray)					Servicised "Baseal" GR-S Rubber (Black)					Meadows Polyvinyl Chloride (Black)				
	Tensile Strength, psi	Elongation % at break	Tensile Stress 100% Elongation psi	Permanent Set %	Durometer Hardness	Tensile Strength, psi	Elongation % at break	Tensile Stress 100% Elongation psi	Permanent Set %	Durometer Hardness	Tensile Strength, psi	Elongation % at break	Tensile Stress 100% Elongation psi	Permanent Set %	Durometer Hardness
Original[1]	1503	360	667	68	82	1143	108	1140	14	98	2310	303	1363	60	88
1st month[1]	1675	325	820	65	84	1137	78	----[2]	15	98	2813	280	1792	55	88
2nd month[1]	1660	307	973	60	82	1168	83	----	14	96	2690	280	1938	44	88
3rd month[1]	1549	280	985	50	84	1108	68	----	3	96	2623	263	1828	35	88
4th month	1424	240	1081	56	87	1178	62	----	7	98	2414	260	2104	38	92
5th month	1597	333	972	57	87	1121	67	----	6	97	2632	297	1586	48	94
6th month	1550	337	926	48	88	1106	73	----	6	97	2536	253	1563	43	98
7th month	1493	303	972	39	88	1215	87	----	8	96	2535	343	1437	41	98
8th month	1556	377	865	52	92	1036	87	----	8	94	2577	380	1385	43	97
9th month	1448	317	926	58	88	1058	97	----	7	97	2581	363	1459	44	96
10th month	1181	280	934	59	88	1000	90	----	10	94	2241	380	1448	45	92
11th month	1556	340	1050	60	86	1124	90	----	11	91	2552	360	1690	46	94
12th month	1600	297	1205	59	89	1021	90	----	11	94	2640	377	1700	47	94
70 hr. heat aging[1]	1718	358	845	58	77	1447	98	----	12	94	2657	283	1885	45	92
7 day heat aging[1]	1683	373	840	61	77	1607	77	----	7	92	2624	283	1780	53	92
14 day heat aging[1]	1675	365	822	60	76	1615	63	----	2	90	2538	268	1623	42	92
12 months Natural Aging	1900	470	900	61	75	1224	88	----	11	89	2700	417	1890	45	94

(1) Tests made by Detroit Testing Laboratory, Inc. prior to acquisition of Scott Tester by the Research Laboratory
(2) Specimen failed before reaching 100-percent elongation

TABLE 2
SPECIFIC GRAVITY AND ABSORPTION
OF NONMETALLIC BASE PLATE MATERIALS

Material	Water Absorption, percent	Specific Gravity 23/23C
Servicised PVC	0.02	1.42
Servicised GR-S	0.04	1.44
Meadows PVC	0.02	1.32

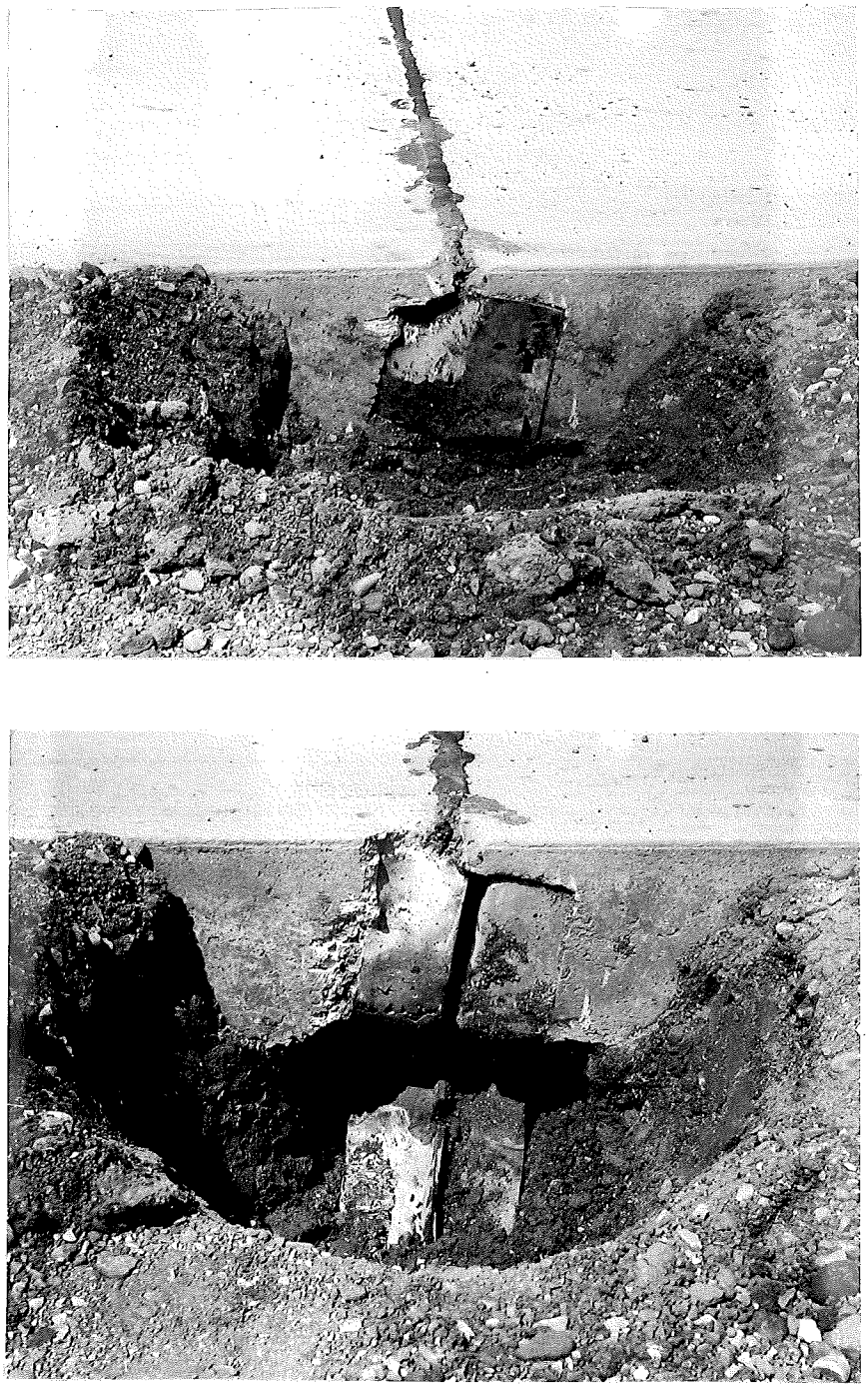


Figure 1. End plate twisted laterally; before (above) and after (below) bending down end plate. Sta 817+57

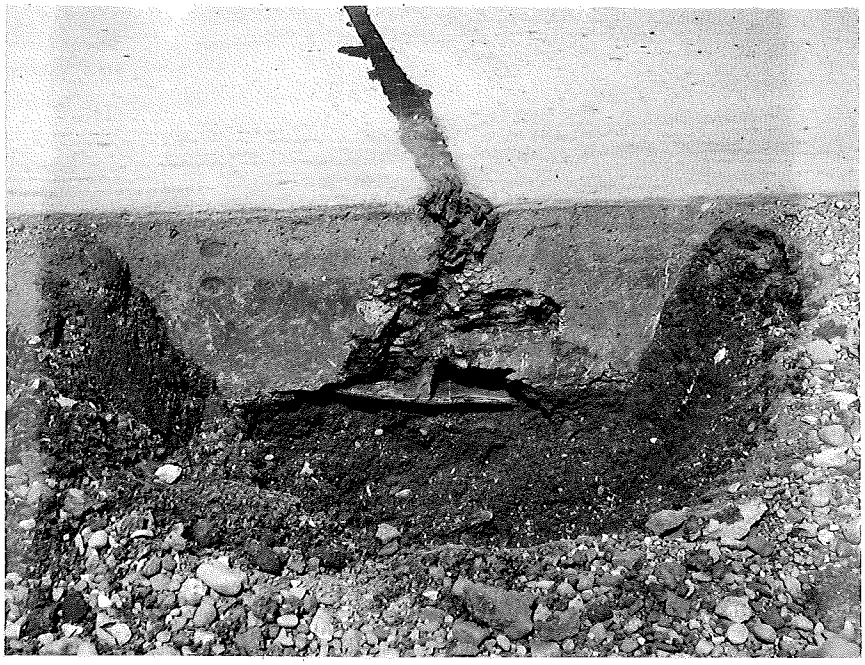


Figure 2. Base plate too short--no material remained for end plate. Sta 858+25

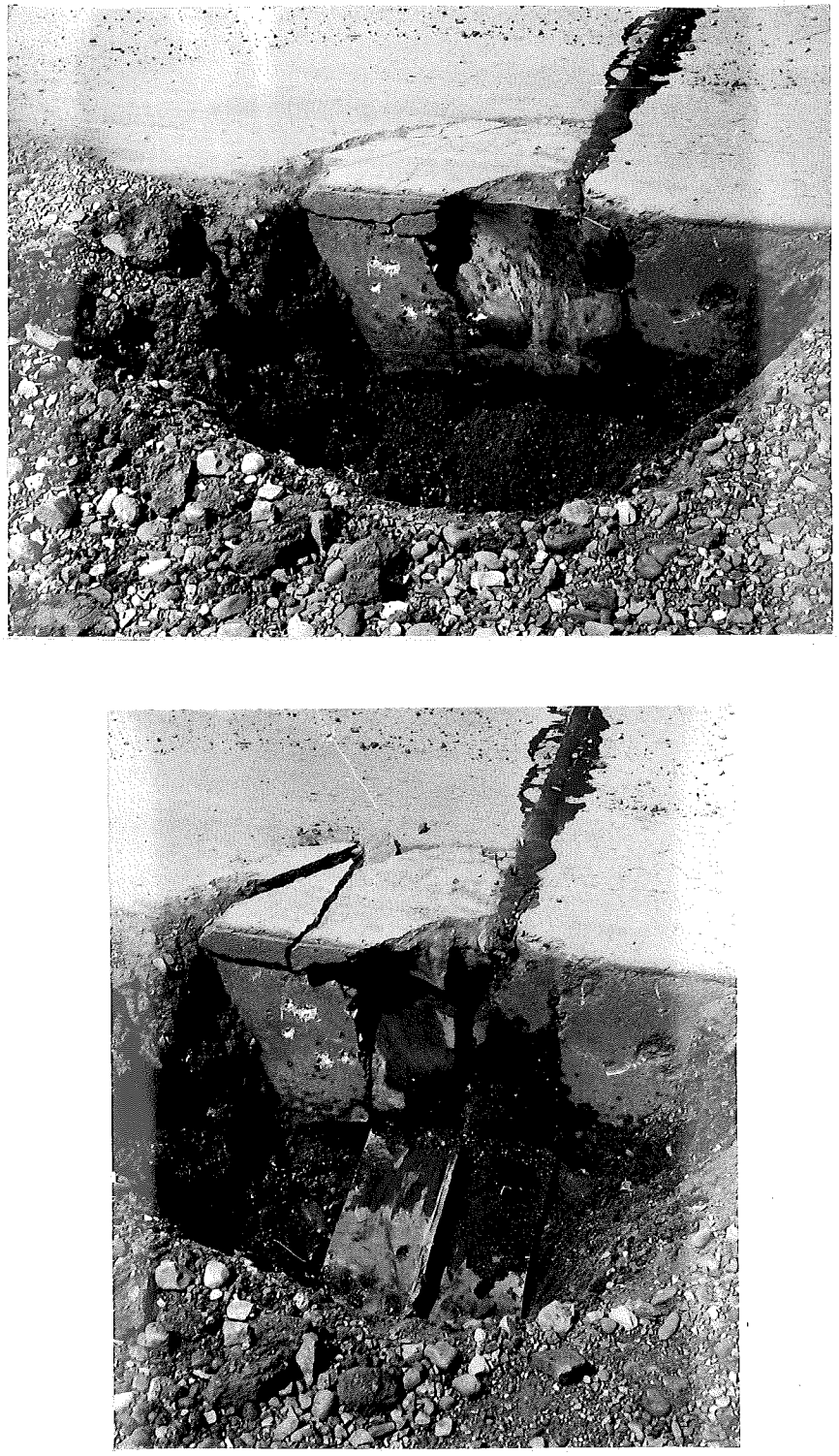
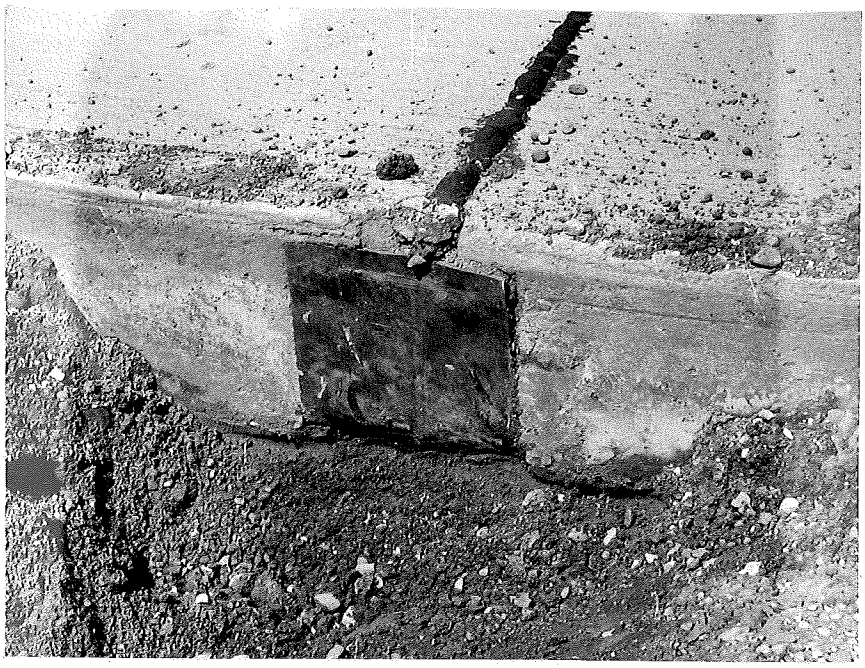


Figure 3. End plate distorted, with one corner embedded in concrete, resulting in edge break; before (above) and after (below) bending down end plate. Sta 874+10



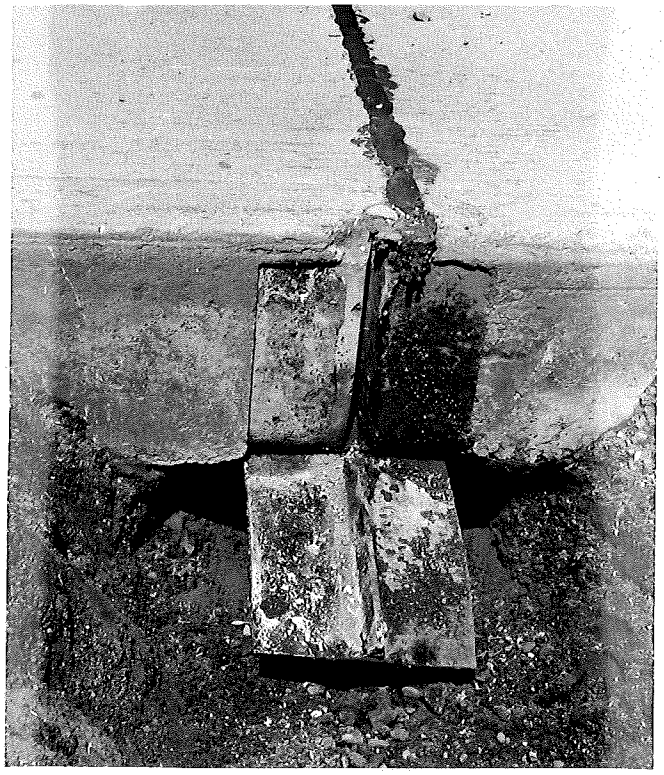


Figure 4. End plate properly positioned, but joint groove not centered over base plate; before (above) and after (below) bending down end plate. Sta 805+72