R-484

PERFORMANCE OF EXTRUDED NEOPRENE JOINT SEALER
I 96 from Waverly Road to M 99 (Construction Project EBACI 33083A, C1)

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Because of New York State's reported success in sealing joints with preformed neoprene, C. B. Laird initiated an experimental installation of this material in a Michigan road construction project in 1962. Preliminary arrangements were begun in July and a preformed neoprene sealer 1 in. wide and 1-1/2 in. deep was installed in both roadways of I 96 between Waverly Road and M 99 in September and October 1962. In all, 71 joints in the westbound roadway and 44 in the eastbound were sealed with neoprene. Specific locations and details of the installation were given in a memorandum report to E. A. Finney by A. J. Permoda dated July 17, 1963 and transmitted to R. L. Greenman on July 23.

General condition of the installation was observed by L. T. Oehler, J. E. Simonsen and C. C. Rhodes on November 2, 1964, and a detailed survey made by J. E. Simonsen and D. F. Simmons on November 3 and 4. In this detailed survey, every third contraction joint was observed carefully to determine depth of sealer below the pavement surface at four points across the two-lane roadway, total length of edge spalls, width of joint opening, and general effectiveness of the sealer. Results of this survey are listed in Table 1.

TABLE 1
CONDITION OF NEOPRENE SEALER
I 96 from Waverly Road to M 99 (November 3, 1964)
Air Temperature: 65 to 70 F

	Station	Sealer Depth, in. **				Groove Width, in.	Total Length of Spalls, in.	Sealer Condition
		3 ft	9 ft	15 ft	21 ft			
Westbound (71 Neoprene-Sealed Joints)	675+25*	1/8	1/16	0	3/16	0.51	20	Good seal, some dirt in folds
	670+30*	5/16	3/16	5/16	1/4	0.51	14	Good seal, dirt in surface fold
	666+35*	3/16	5/16	1/4	5/16	0.48	11	Good seal, very little dirt in surface folds
	662+45*	1/2	7/16	3/8	1/4	0.50	16	Good seal, very little dirt
	658+35*	1/16	1/8	1/4	5/16	0.48	0	Good seal, no dirt
	654+45*	7/16	7/16	3/16	1/4	0.45	4	Good seal, some dirt in folds
	650+70*	1/4	3/16	1/4	1/16	0.46	7	Good seal, some dirt in folds
	641+10	9/16	13/16	7/16	3/16	0.82	18	Loose seal, some wet sand infiltrated at sides, no dirt underneath
	638+15	1/4	1/4	1/4	1/4	0.72	12	Fairly tight seal, some sand down sides
	635+20	5/16	9/16	7/16	1/4	0.64	13	Fairly tight seal, some dirt down sides
	632+20	1/8	3/16	1/16	1/16	0.68	10	Fairly tight seal, a little fine sand down sides
	629+25	3/16	3/16	1/4	1/4	0.70	14	Good seal, some sand down sides
	626+15	1/2	5/16	3/16	5/16	0.82	20	Loose seal, very little infiltration, sealer jointed
	619+45	1/8	1/16	1/4	1/4	0.62	13	Good seal, some sand infiltrated
	616+50	3/16	1/4	1/4	3/8	0.63	15	Good seal, very little infiltration
	613+55	1/4	5/16	3/8	1/4	0.60	8	Good seal, very little infiltration, sealer jointed
	609+60	5/16	9/16	3/16	3/8	0.73	12	Good seal, little infiltration
	606+50	1/2	5/8	3/8	3/16	0.59	24	Good seal, some infiltration
	603+55	1/4	1/8	3/8	3/8	0.71	18	Good seal, some infiltration
	599+60	5/16	3/8	1/8	3/16	0.62	14	Good seal, some infiltration
	596+65	5/16	5/16	5/16	3/16	0.60	17	Good seal, some infiltration
	592+70	5/16	3/8	7/16	7/16	0.55	10	Good seal, little infiltration
	589+75	5/16	1/4	1/8	5/16	0.58	10	Good seal, little infiltration
Eastbound (44 Neoprene-Sealed Joints)	591+15	1/16	1/8	1/16	0	0.56	16	Good seal, some infiltration, sealant too high in joint, snow plow damage at shoulder, two tears
	596+15	1/4	0	0	1/16	0.60	18	Good seal, some infiltration, sealant high, two tears
	599+10	1/16	0	1/8	1/8	0.63	8	Good seal, some infiltration, sealant high, three tears (snow plow)
	603+05	1/8	1/16	0	3/16	0.61	12	Good seal, little infiltration, sealant too high, five tears (snow plow)
	607+10	9/16	3/16	1/8	3/16	0.65	18	Good seal, some infiltration, two tears (snow plow)
	610+00	1/8	3/8	3/16	1/8	0.62	8	Good seal, some infiltration
	614+00	1/4	3/16	1/4	3/16	0.64	9	Good seal, little infiltration
	616+95	1/4	3/16	5/16	1/8	0.62	17	Good seal, little infiltration sand
	620+90	3/16	1/4	3/16	1/8	0.78	9	Loose seal, moderate infiltration
	628+10	3/8	1/4	1/2	3/16	0.66	11	Good seal, slight infiltration, one tear
	631+00	1/2	1/2	7/16	1/4	0.64	13	Good seal, slight infiltration
	633+95	9/16	5/16	11/16	1/4	0.60	22	Good seal, slight infiltration
	636+90	7/16	7/16	5/16	3/16	0.65	21	Good seal, slight infiltration, one tear (snow plow)
	640+85	1/2	5/16	3/16	3/16	0.65	28	Good seal, some dirt and stones on top

* Joint groove formed with polystyrene plastic joint former 3/8 in. wide; all others listed were formed by styrofoam 1/2 in. wide.

** Sealer depth measured at four points along the joint, starting at the outer shoulder edge and proceeding across the traffic and passing lanes to the median edge.

In judging this particular installation it should be kept in mind that the preformed neoprene was only 1 in. wide and was placed in a joint that could be expected to open to just about 1 in. during the coldest part of the year. Current practice is to design the joint and sealer so that the sealer is under 20- to 25-percent compression at the joint's widest opening. For 99-ft slabs, this would require a contraction joint sealer 1-1/4 in. wide in a 1/2 in. groove as constructed. When the pavement is built in cool weather, as this one was, a slightly narrower sealer section can be tolerated since the joint will not open quite as wide in the winter. The reaction of the sealer against the joint face is depended upon to keep the sealer in place, rather than the bonding action of the lubricant-adhesive used for installation.

Most of the pavement joints in this project were formed in the standard way using 1/2- by 2-in. styrofoam strips as a temporary filler. At the end of the project, however, about 20 contraction joints were formed by means of a hollow polystyrene plastic filler a little less than 3/8 in. wide at the top, about 1-1/2 in. deep and tapering almost to a point at the bottom.

The first seven joints listed in Table 1 were formed with the 3/8-in. plastic filler and appear to be in generally better condition than the others. This is probably due to the fact that the plastic filler produced a smoother, straighter joint with less spalling along the edges and the narrower width resulted in a greater residual compression of the sealer at maximum opening of the joint. Groove width measurements revealed about 50-percent compression remaining on the day of the survey. The seal in all cases appeared tight and there was very little infiltration along the walls of the groove. Some sand and a few small pebbles were present in the surface folds, but no tearing of the sealer was found in this group. A typical joint in this area is shown in Fig. 1.

In the grooves formed by the 1/2-in. styrofoam temporary filler, width measurements indicated sealer compression of 18 to 45 percent on the survey date, resulting in a corresponding variation of sealer tightness. Some infiltration of fine sand or silt was apparent along joint walls, which probably occurred during cold periods when, it is suspected, little or no compression remained in the sealer. Small stones or sand were found folded in the sealer only at the pavement edges and centerline. A few small tears caused by snow plows on sealers installed too high in the joint were observed, mostly in the eastbound roadway. An example of styrofoam-formed joints is illustrated in Fig. 2. An excessively spalled joint is shown in Fig. 3. However, in spite of the fact that the sealer used in this project is now known to have been too narrow, examination of the grooves under the sealer in several joints selected at random revealed almost total absence of visible infiltration of stones and dirt to the bottom of the groove (Fig. 4).

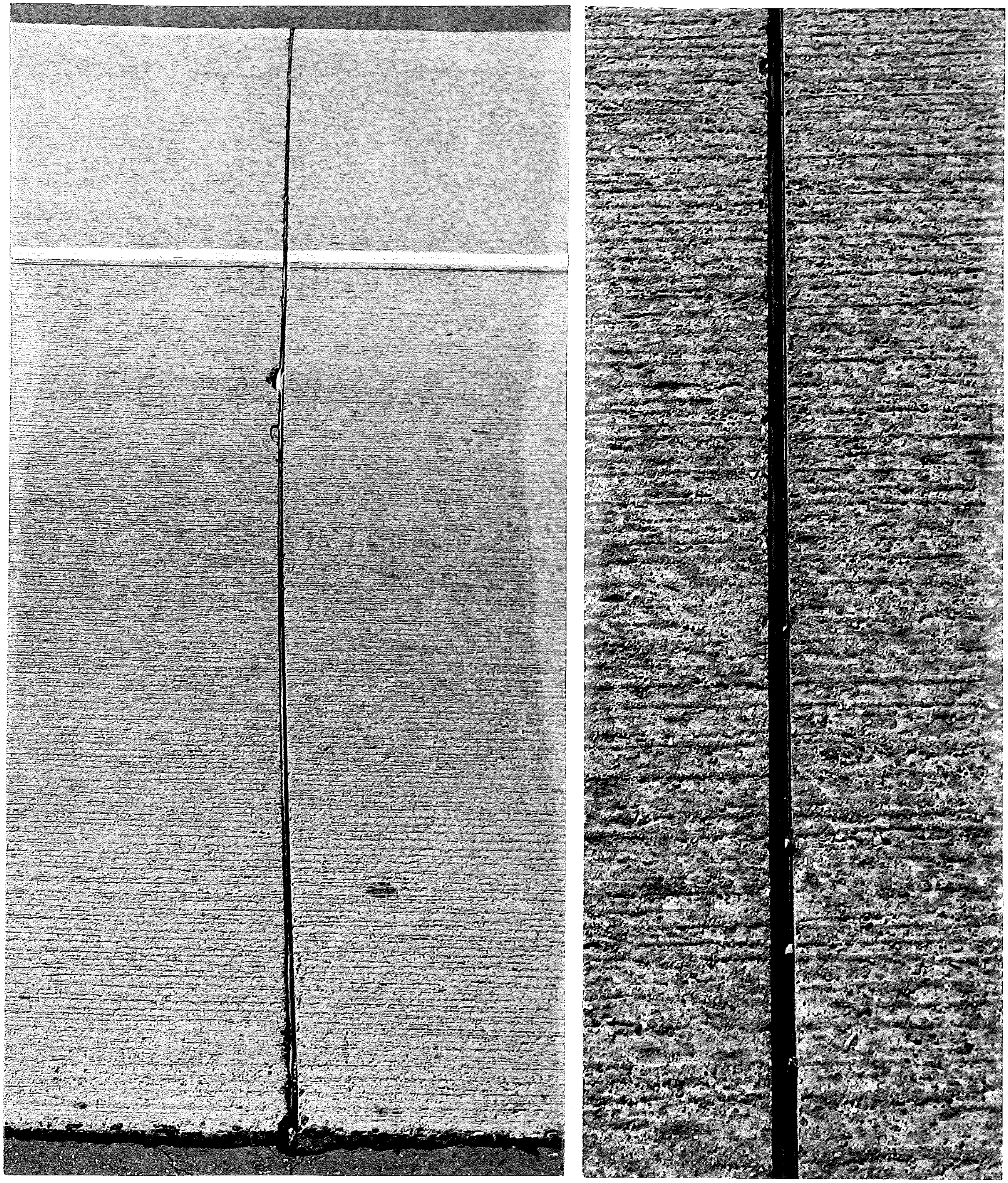

Figure 1. General view and close-up in center of traffic lane, showing preformed neoprene sealer in joint formed with 3/8-in. polystyrene filler (Sta. 666+35 WB, photo: 11-3-64).

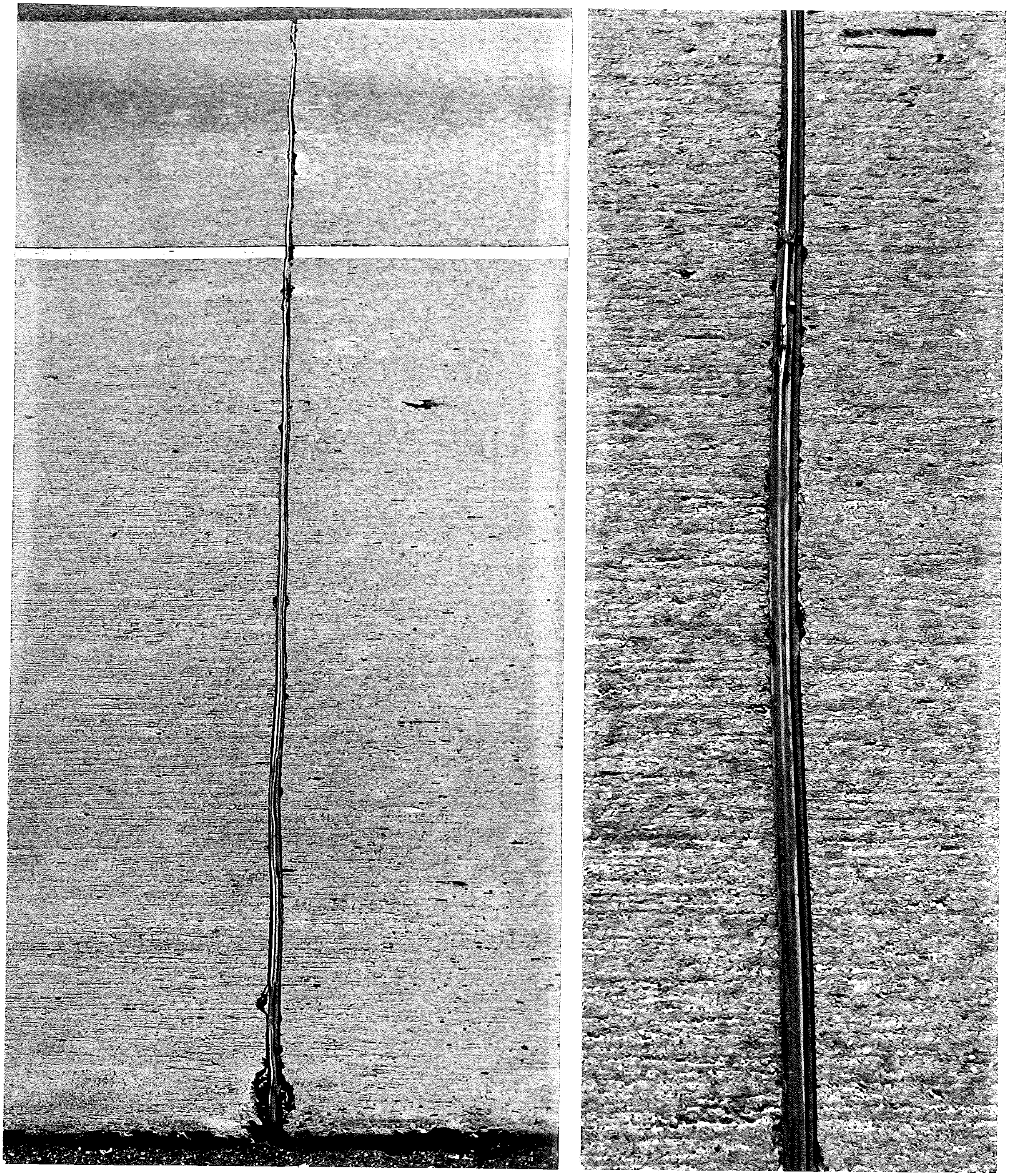

Figure 2. General view and close-up in center of passing lane, showing preformed neoprene sealer in joint formed with 1/2-in. styrofoam filler (Sta. 599+10 EB, photo: 11-3-64).

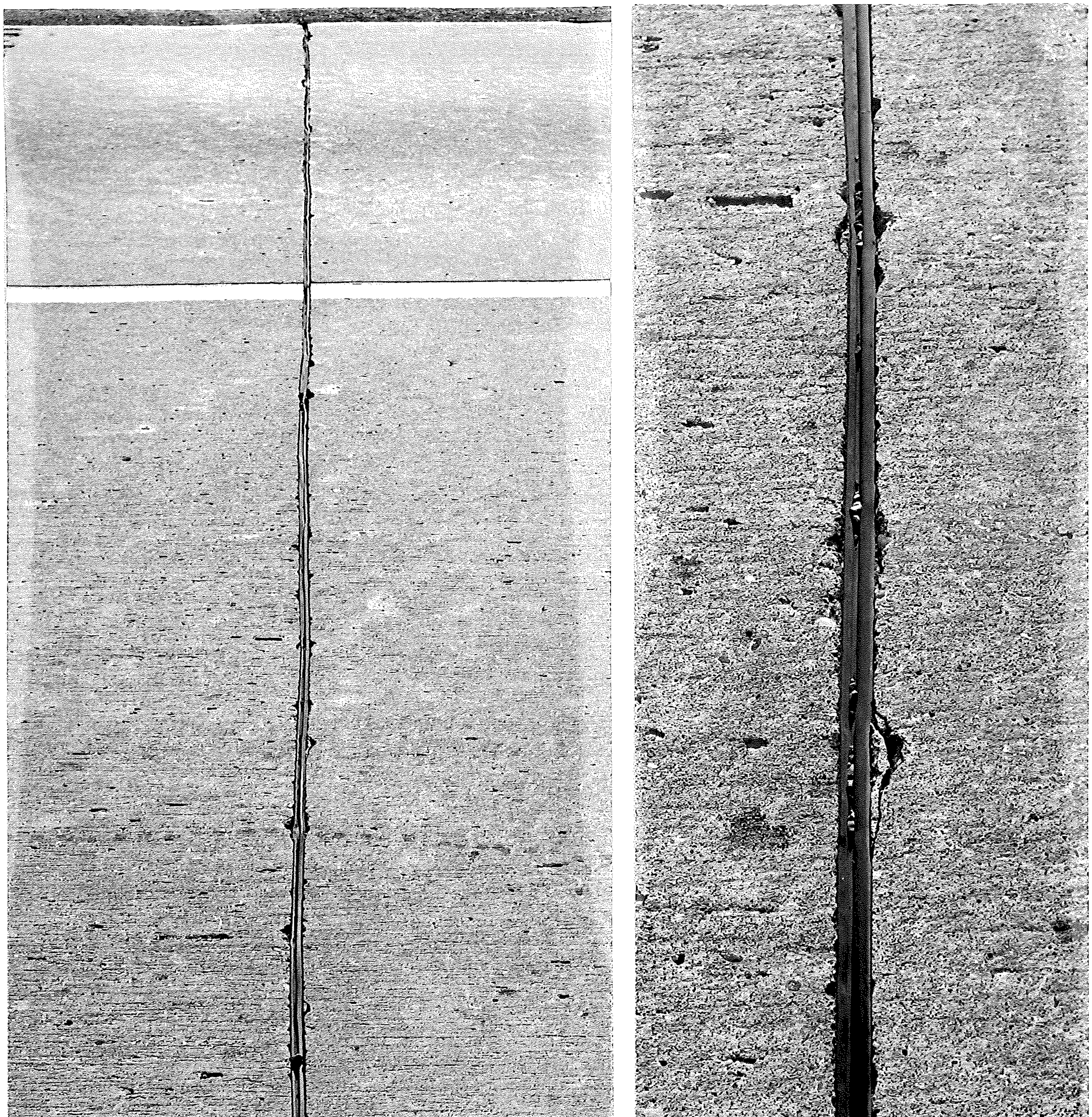

Figure 3. General view and close-up in center of passing lane, showing unusual amount of spalling and preformed neoprene sealer in joint formed with 1/2-in. styrofoam filler (Sta. 633+95 EB, photo: 11-5-64).

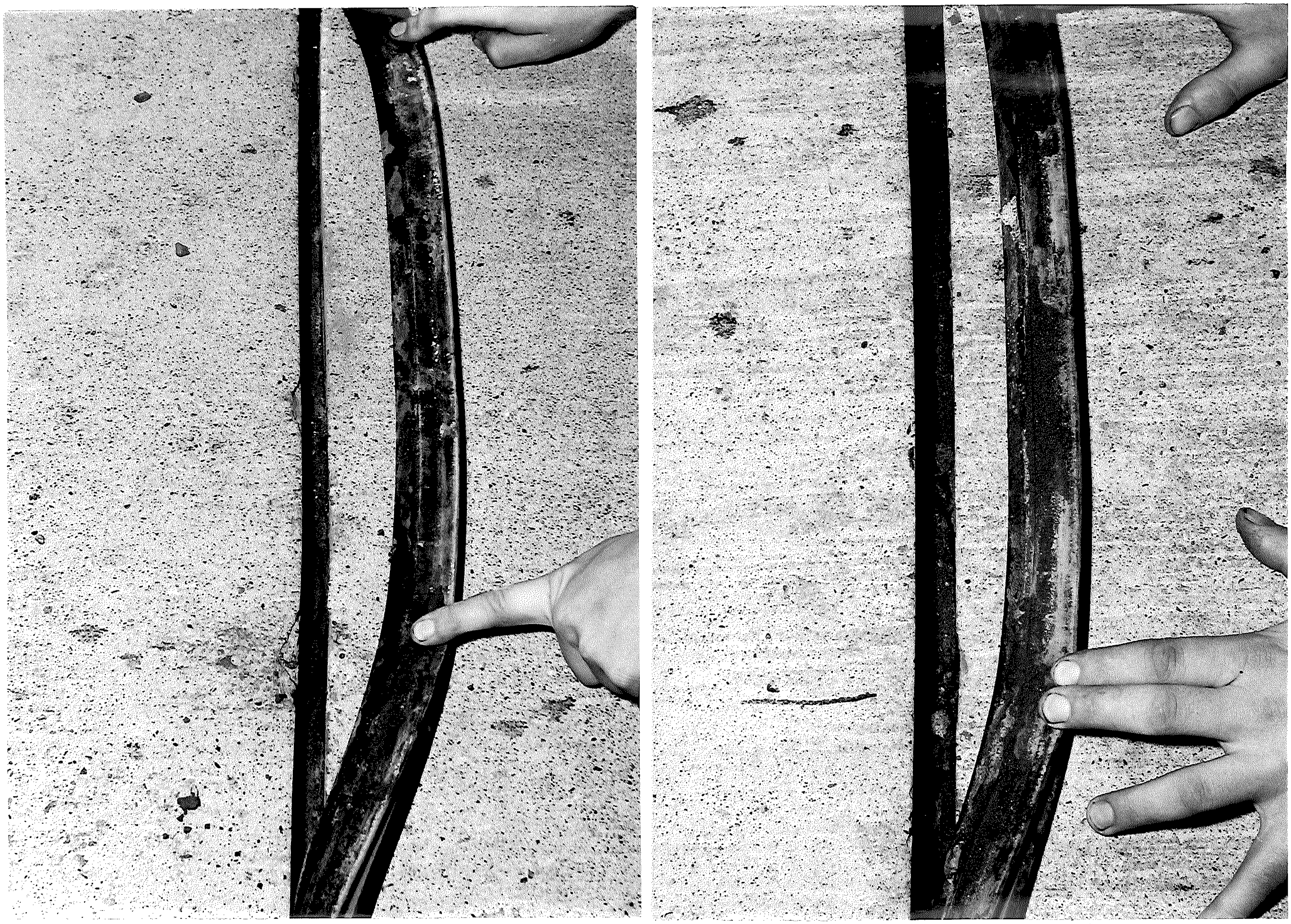

Figure 4. Views of two joints showing neoprene lifted out of groove, with almost total absence of infiltration (left: Sta. 606+50 WB, right: Sta. 641+10 WB; photos: 11-3-64).

For further information on condition of the material itself, a 6-ft length of sealer was removed from the pavement and tested in the laboratory. Results of the physical tests are listed in Table 2 along with the Department's most recent specification requirements, indicating that the neoprene has not deteriorated excessively and exhibits remarkly good resilience in all three compression tests. Tensile strength and elongation are down and Shore hardness is up slightly from specification values, as would be expected, but unfortunately not enough is known about the original physical properties of the material for quantitative evaluation of the change.

TABLE 2
PHYSICAL TEST RESULTS

Property	Sample Tested	Specification Requirements
Specific Gravity, 23/23 C	1.32	1.37 ± 0.03
Tensile Strength, psi	1807	2000 min.
Elongation at Break, percent	229	250 min.
Permanent Set at Break, percent	6	10 max.
Hardness, Shore type "A" durometer	72	60 ± 5
Heat Aged, 70 hr at 212 F		
Tensile Strength, change, percent	+16	-30 max.
Elongation, change, percent	-9	-40 max.
Hardness, change	+9	+10 max.
Oil Swell, 70 hr at 212 F, percent by volume	24	+80 max.
Recovery after Compression to 50 percent of Original Width, percent		
70 hr at 212 F	88	85 min.
70 hr at 14 F	88	80 min.
22 hr at -20 F	88	75 min.

Summary

This evaluation of the condition of the premolded neoprene compression seal in the experimental project on I 96 after two full years of service indicates that this material is unquestionably superior to all other joint sealing materials tried so far. This is true in spite of the fact that the sealer used was not of optimum dimensions for the width and spacing of contraction joints in the pavement, and no attempt was made to patch spalls along the joint edge before sealing. Present installations made under current specifications should surpass by a considerable margin the effectiveness and life of the I 96 installation.