SOIL-AGGREGATE CUSHIONS FOR PREVENTION OF REFLECTION CRACKING OF RESURFACED PAVEMENTS

Second Progress Report

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This report describes the condition, after two years of performance, of a resurfaced pavement constructed with soil-aggregate cushion between the old and new surfaces. The construction phase of this work was described in detail in Research Report No. R-423, "Soil-Aggregate Cushions for Prevention of Reflection Cracking of Resurfaced Pavements" (May 1963). Final layout of the soil-aggregate cushion, constructed to a thickness of 4 in. and 2000 ft in length, is diagrammed in Fig. 1, which shows the five different materials used for the cushion:

23A gravel with sodium chloride admixture
22A gravel with sodium chloride admixture
22A gravel with calcium chloride admixture
23A gravel with calcium chloride admixture
"bank run" gravel with SC-5A asphalt admixture

An attempt was made to use sand for a sixth section of cushion on the east end of the job; however, the sand could not be stabilized and was removed before placement of the overlay. Parts of the 23A gravel cushion, located on the west end of the job, failed almost immediately after resurfacing and were removed as indicated in Fig. 1. All cushion materials except the sand proved satisfactory for carrying traffic in the interim before the bituminous overlay was constructed.

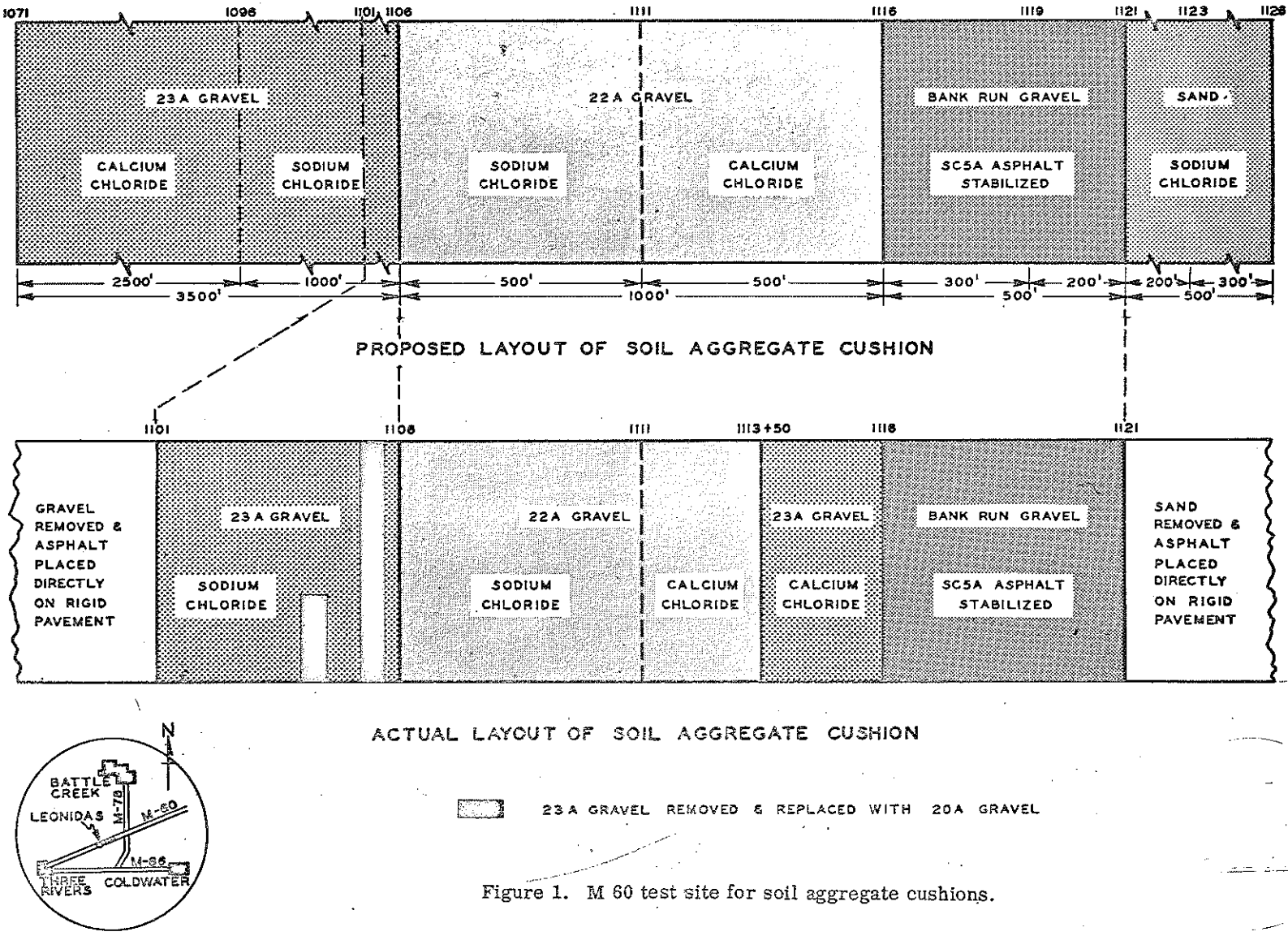

Figure 1. M 60 test site for soil aggregate cushions.

Pavement condition surveys were conducted over the old rigid pavement just before resurfacing and over the resurfaced pavement after one and two winters of service. Results of these surveys are shown in Fig. 2. Table 1 summarizes transverse cracking reflected through the pavement

TABLE 1
TRANSVERSE CRACKING OF
22A-23A GRAVEL CUSHION SECTIONS

Treatment	Location by Station	Original Pavement		After One Winter		After Two Winters	
		Number of Cracks	Cracks per Slab	Number of Cracks	Percent Reflected Through Overlay	Number of Cracks	Percent Reflected Through Overlay
23A Gravel with Sodium Chloride Admixture	1101+00 to 1106+00	29	5.8	2	6.9	3.5	12.1
22A Gravel with Sodium Chloride Admixture	1106+00 to 1111+00	23	4.6	4	17.4	4.25	18.4
22A Gravel with Calcium Chloride Admixture	1111+00 to 1113+50	7	2.8	3	42.9	3	42.9
23A Gravel with Calcium Chloride Admixture	1113+50 to 1116+00	15	6.0	0	0	0	0
Complete 22A-23A Gravel Section	1101+00 to 1116+00	74	4.9	9	12.1	10.75	14.5

over the 22A and 23A gravel cushions. Some difference appeared between pavements over the two gradations of gravel, with the 23A gravel more efficient in minimizing reflection cracking. However, since the test sections involved are so short, no significant difference can be proved at this time, and for the rest of this discussion the four 22A-23A cushions will be considered a single unit in comparisons with the asphalt-stabilized bank run gravel cushions and sections where resurfacing was applied directly over old pavement.

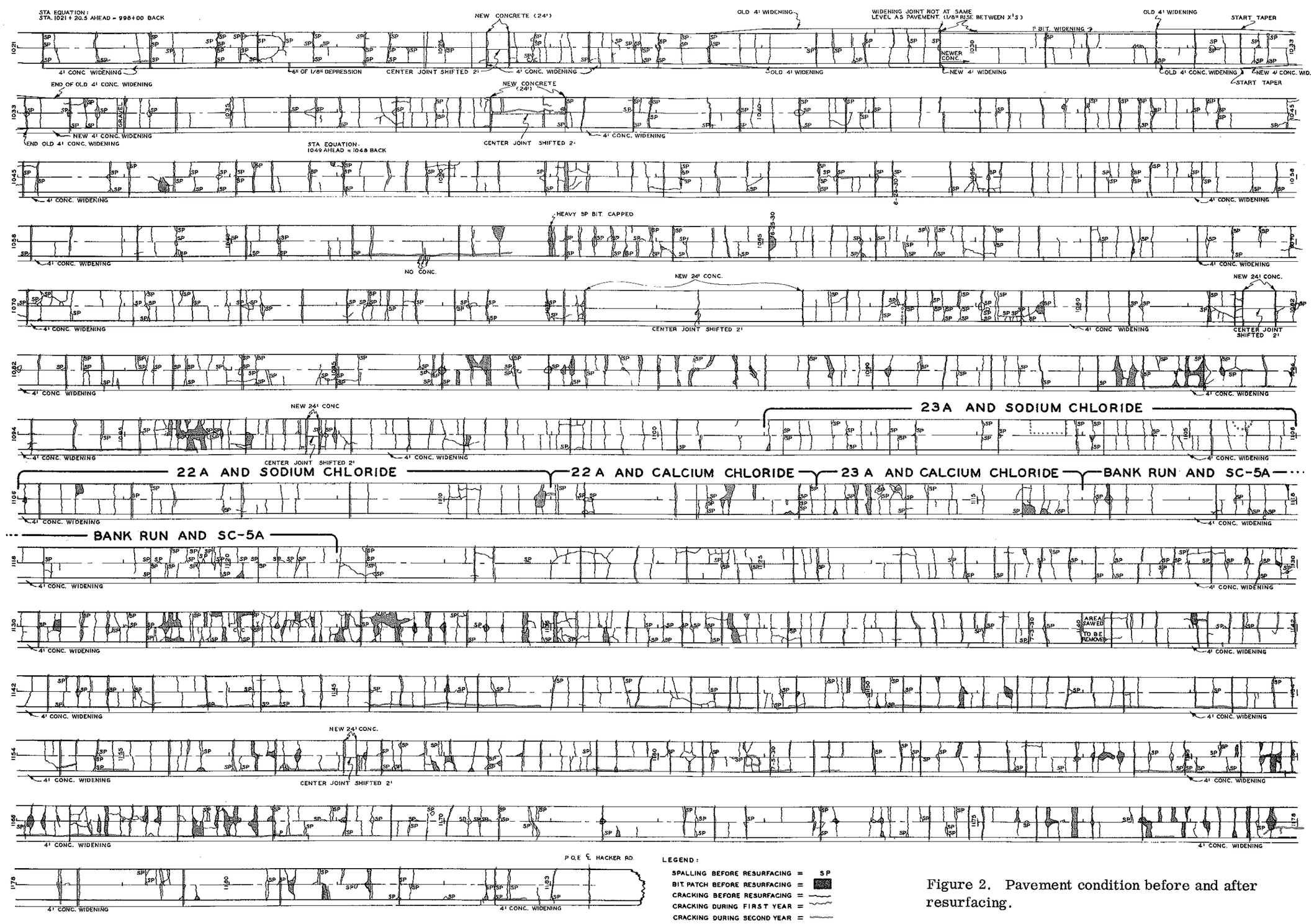

Figure 2. Pavement condition before and after resurfacing.

Table 2 indicates the relative efficiency of the soil aggregate cushions in minimizing transverse reflection cracking; all transverse discontinuities in the old rigid pavement, including both cracks and joints, are included as potential sites for reflection cracks. The old rigid pavement averaged about five transverse cracks or joints per 100-ft slab. The table shows that where no cushion was used, about 42 percent of the transverse cracks or joints reflected through the bituminous overlay after one winter, while only 12 percent reflected through in the 22A-23A cushion area and 9 percent in SC-5A asphalt-stabilized cushion. After two winters, about 47 percent of the transverse cracks or joints reflected through where no cushion was

TABLE 2
TRANSVERSE REFLECTION CRACKING
OF BITUMINOUS OVERLAY

Treatment	Location by Station	Total Transverse Cracks and Joints in Original Pavement	After One Winter		After Two Winters	
			Number of Cracks	Percent Reflected Through Overlay	Number of Cracks	Percent Reflected Through Overlay
Asphalt Surface Directly on Old Rigid Pavement	1022+00 to 1101+00	370	155	42	174	47
22A-23A Gravel with Chlorides	1101+00 to 1116+00	73	9	12	10.75	15
SC-5A Asphalt-Stabilized Bank Run Gravel	1116+00 to 1121+00	23	2	9	2	9
Asphalt Surface Directly on Old Rigid Pavement	1121+00 to 1183+00	329	137	42	151	46

used, and 15 percent through the 22A and 23A gravel cushion area, but no additional cracking had appeared in the surfacing supported by the asphalt-stabilized cushion.

Table 3 shows no longitudinal cracking reflected through the surface over the asphalt-stabilized cushion after two winters. After the second winter, however, significant lengths of longitudinal reflection cracking were observed in areas where no cushion was used. None were visible in the 22A-23A gravel-cushioned areas.

TABLE 3
LONGITUDINAL REFLECTION CRACKING
OF BITUMINOUS OVERLAY

Treatment	Location by Station	Original Rigid Pavement			After One Winter		After Two Winters	
		Longitudinal Cracking, ft	Length of Widening Strip, ft	Total Length of all Longitudinal Discontinuities, ft	Length, ft	Percent of Original Length	Length, ft	Percent
Asphalt Surface Directly on Old Rigid Pavement	1022+00 to 1101+00	838	7900	8738	54	0.6	488	5.6
22A-23A Gravel with Chlorides	1101+00 to 1116+00	56	1500	1556	0	0	0	0
SC-5A Asphalt Stabilized Bank Run Gravel	1116+00 to 1121+00	40	500	540	0	0	0	0
Asphalt Surface Directly on Old Rigid Pavement	1121+00 to 1183+00	646	6200	6846	30	0.4	1216	17.8

There were no noticeable joint blowups within the area involved.

The fine performance of the 23A gravel section is somewhat surprising. As Fig. 1 shows, a large section of this area failed immediately after construction, apparently due to excessive moisture, and was removed.

Summary

During the two-year period of service, the soil-aggregate cushions used in these tests have been of significant value in reducing reflection

cracking of the bituminous overlay. Where no cushion was used, 47 percent of the transverse cracks and joints in the original pavement reflected through the bituminous overlay, while only 15 percent reflected through the 22A-23A gravel cushion area and only 9 percent through the SC-5A asphalt-stabilized gravel cushion area. Annual pavement condition surveys will continue for determination of long range performance of the soil-aggregate cushion.