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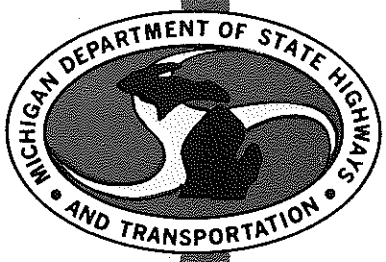
Final Report



TESTING AND RESEARCH DIVISION
RESEARCH LABORATORY SECTION

PERFORMANCE EVALUATION OF TRINIDAD ASPHALT CEMENT FOR BITUMINOUS CONCRETE RESURFACING

Final Report

C. A. Zapata

Research Laboratory Section
Testing and Research Division
Research Project 73 C-16
Research Report No. R-1150

Michigan Transportation Commission
Hannes Meyers, Jr., Chairman; Carl V. Pellonpaa,
Vice-Chairman; Weston E. Vivian, Rodger D. Young,
Lawrence C. Patrick, Jr., William C. Marshall
John P. Woodford, Director
Lansing, July 1980

The purpose of this study was to assess the service performance of the Trinidad asphalt cement blend (with respect to long-term durability in resisting surface cracking) compared with conventional 85-100 penetration grade asphalt in bituminous concrete overlays. The study was divided into three major phases: First, preconstruction condition surveys were conducted showing all surface defects in the existing pavement. Pavement friction measurements and riding quality of the test area were also recorded. Second, during construction, daily inspections of plant production and paving operations were conducted. Rolling temperature and nuclear density readings were also recorded at random locations in each test section. Third, post-construction seasonal surveys and field inspections were continued, keeping records of progressive cracking, friction resistance, and riding quality for comparative evaluation.

The selected test area lies in Roscommon County and consists of 4.9 miles of four-lane divided highway on US 27 from Snowbowl Rd, northerly to the M 55 crossover (Fig. 1). The resurfacing work in the test area began on June 13, 1974 and was completed August 2. Design characteristics, condition surveys, construction procedures, comparative costs, and results of initial field testing were presented in MDSHT Research Report R-962. Construction costs and subsequent analysis of field data can be found in MDOT Research Report R-1030 and in Project File 73 C-16. This final report summarizes all condition surveys (riding quality, pavement friction tests, and crack counts) taken to evaluate the performance of the test sections (Trinidad vs. Conventional) over the 5-1/2-year period following construction. The results discussed here indicate that after a 5-1/2-year service period under traffic and weather conditions, both Trinidad and conventional resurfacings are about equal in performance characteristics.

Riding Quality

Riding quality results over the last five years (1975-1980) are summarized in Table 1. The data indicate the following:

1. Over a 5-1/2-year service period, the experimental project has provided average to good riding quality levels with Riding Quality Indices ranging from 41 to 21, respectively.

2. On the basis of Departmental standards, no substantial differences in riding quality levels have been found between Trinidad and conventional resurfacings.

Pavement Friction Tests

Table 2 summarizes the wet sliding friction (wsf) values obtained annually from 1974 to 1980. The data indicate the following:

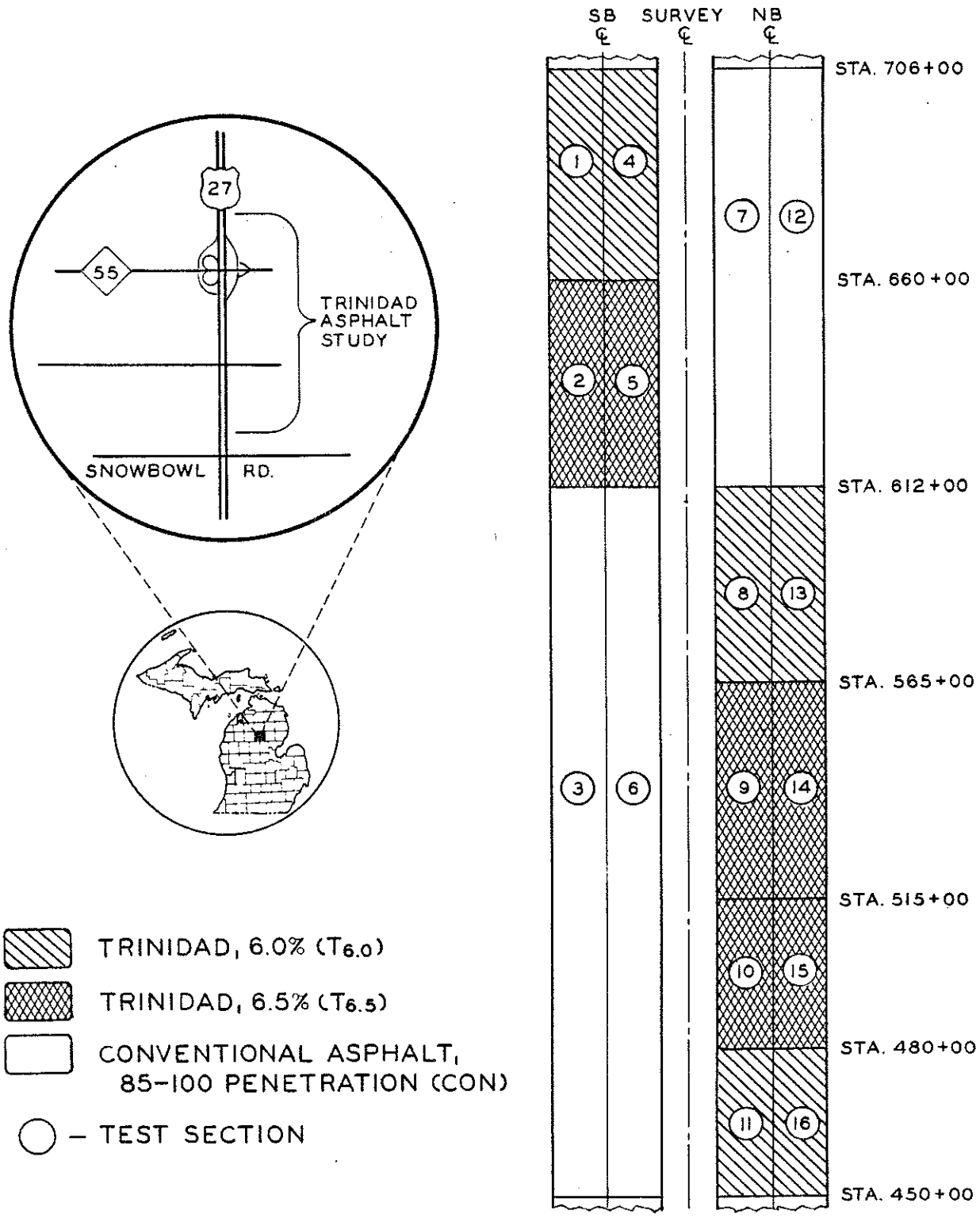


Figure 1. Experimental layout comparing Trinidad and conventional asphalt resurfacing over 4.9 miles of four-lane divided highway. The test area is divided into a total of 16 test sections.

1. Over a 5-1/2-year service period, the experimental project has provided adequate friction levels. No test section has average wsf values below 0.40.

2. After a 5-1/2-year service period, both Trinidad and conventional resurfacings have improved friction levels to an average wsf value of 0.75 which is categorized as satisfactory.

Progressive Cracking

In May 1980, the Research Laboratory formed a special group of four independent observers (P. M. Schafer, P. T. Luce, J. L. Anderson, and T. J. Hattis) to count surface cracks, keep records and report the field results. Table 3 shows the 1980 crack survey data and Figure 2 summarizes the crack growth curves of the experimental project after more than five years of service performance. The percentages of transverse cracks are based on the initial crack counts taken before resurfacing the experimental area. The field results indicate the following:

1. Crack counts for both conventional and Trinidad resurfacings continued increasing as expected. In fact, the crack growth curves for both resurfacing materials have not yet shown signs of tapering off with time.

2. For one-course overlay (160 lb/sq yd) and 6.0 percent asphalt content, visible transverse cracks for conventional resurfacing was greater than that for Trinidad (110 percent vs. 89 percent). By comparison, 160 lb/sq yd - 6.5 percent Trinidad developed surface cracking of 61 percent. For conventional overlay, 6.5 percent asphalt content was not used in this study.

3. For two-course overlays (250 lb/sq yd) and 6.0 percent asphalt content, both conventional and Trinidad resurfacings developed once again, about equal proportions of surface cracking, 63 and 66 percent, respectively. The 6.5 percent Trinidad asphalt, 250 lb/sq yd mixture showed the lowest proportion of cracking, 54 percent. On the other hand, both 250 lb/sq yd Trinidad and conventional resurfacings (curves 4, 5, and 6) continued increasing trends in crack formation, each averaging about 30 percent more than in 1979.

Conclusions and Recommendations

The 1980 findings are consistent with the conclusions reached in earlier reports that performance results do not show enough difference between Trinidad and conventional resurfacings to justify the higher cost of Trinidad

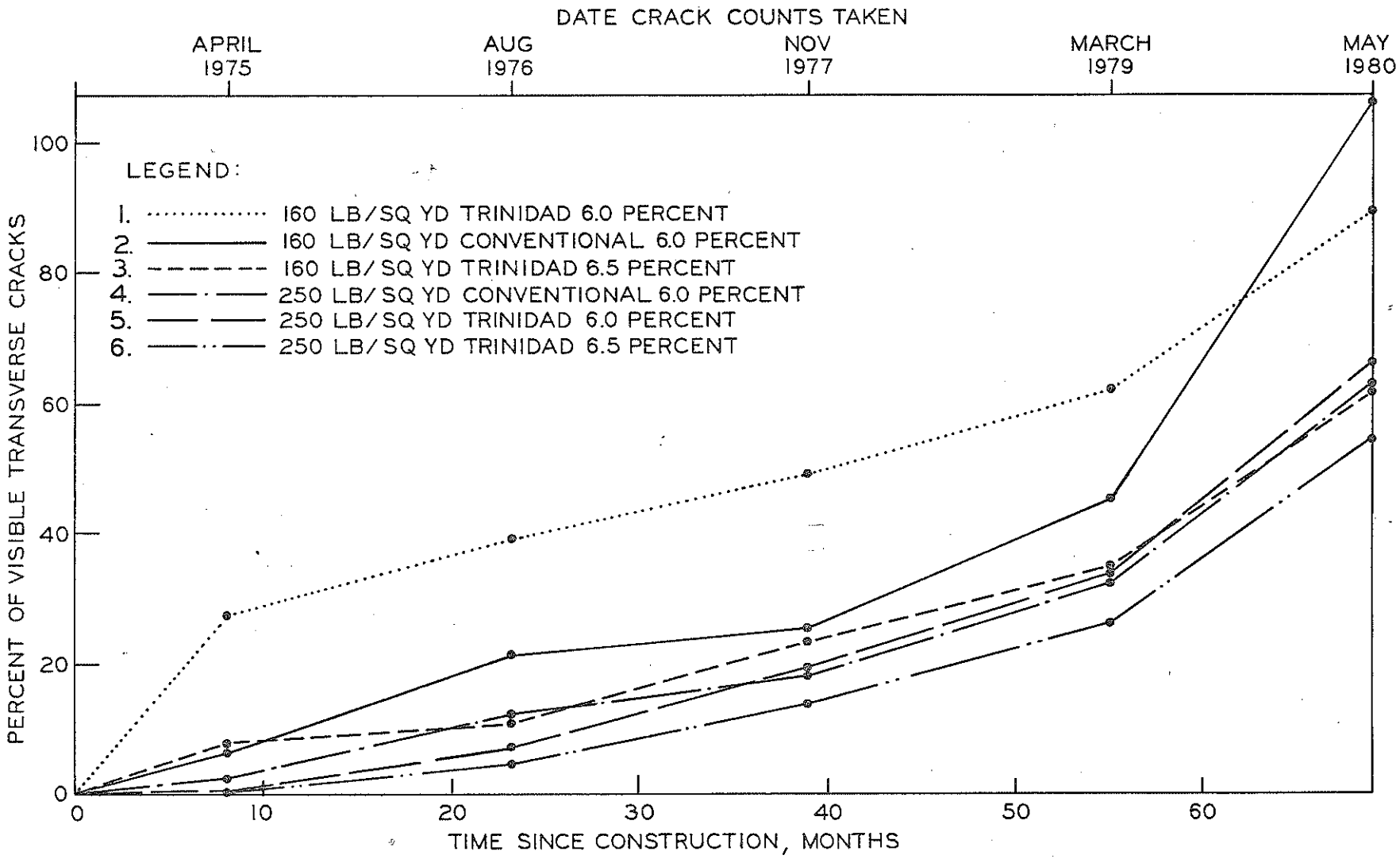


Figure 2. Rate of increase of visible transverse cracks through asphaltic concrete resurfacing after the sixth winter (Research Project 73 C-16, US 27 north of Snowbowl Rd to M 55).

construction. Since the Trinidad material does not seem to offer any practical benefit as crack resistant material in bituminous concrete overlays, it is recommended that Project 73 C-16 be closed.

TABLE 1
SUMMARY OF RIDING QUALITY INDEX
(US 27 North of Snowbowl Rd to M 55)

Material	Section No.	Riding Quality Index					
		9/4/75	3/24/76	9/1/76	9/11/78	9/26/79	4/23/80
250 lb/sq yd	4	35	29	30	31	30	34
Trinidad	1	39	41	38	39	38	39
6.0 percent	8	29	23	26	22	21	25
	13	32	30	31	24	28	28
	All	34	31	31	29	30	32
250 lb/sq yd	7	28	26	24	25	25	30
Conventional	12	39	38	38	35	35	37
6.0 percent	3(60%)	37	34	34	32	31	37
	6(60%)	32	26	27	25	23	29
		34	31	31	29	29	33
160 lb/sq yd	11	29	35	28	30	30	27
Trinidad	16	35	33	40	35	35	36
6.0 percent	All	32	34	34	33	33	32
160 lb/sq yd	6(40%)	32	26	27	25	23	26
Conventional	3(40%)	37	34	34	32	31	29
6.0 percent	All	35	30	31	29	27	28
160 lb/sq yd	10	36	28	27	23	22	26
Trinidad	15	40	33	38	34	34	35
6.5 percent	All	38	31	33	29	28	31
250 lb/sq yd	2	38	35	37	32	33	35
Trinidad	9	35	26	27	26	25	29
6.5 percent	14	36	34	35	33	30	31
	5	31	21	23	23	22	27
	All	35	29	31	29	28	31

Rating: Good = 0 - 30
Average = 31 - 70
Poor = 71 - 100

TABLE 2
SUMMARY OF COEFFICIENT OF WET SLIDING FRICTION
(US 27 North of Snowbowl Rd to M 55)

Material	Section No.	Coefficient of Wet Sliding Friction																				
		8/19/74			9/15/75			7/1/76			10/7/77			9/12/78			10/9/79			5/19/80		
		Low	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg
250 lb/sq yd	4	0.53	0.56	0.54	0.64	0.65	0.64	0.68	0.70	0.69	0.72	0.76	0.74	0.72	0.74	0.73	0.67	0.70	0.68	0.85	0.86	0.86
Trinidad	1	0.42	0.46	0.45	0.53	0.54	0.54	0.61	0.62	0.62	0.60	0.61	0.61	0.64	0.65	0.65	0.56	0.57	0.56	0.70	0.72	0.71
6.0 percent	13	0.51	0.53	0.52	0.59	0.60	0.59	0.60	0.61	0.61	0.64	0.65	0.65	0.65	0.67	0.66	0.57	0.58	0.57	0.67	0.72	0.70
	8	0.58	0.59	0.59	0.63	0.64	0.63	0.69	0.72	0.71	0.73	0.77	0.75	0.73	0.74	0.73	0.67	0.70	0.68	0.81	0.86	0.84
	All	0.51	0.54	0.53	0.60	0.61	0.60	0.65	0.66	0.66	0.67	0.70	0.69	0.69	0.70	0.69	0.62	0.64	0.62	0.76	0.79	0.78
250 lb/sq yd	7	0.58	0.59	0.59	0.64	0.66	0.65	0.69	0.71	0.70	0.77	0.78	0.77	0.72	0.78	0.75	0.68	0.70	0.69	0.82	0.87	0.85
Conventional	12	0.51	0.53	0.52	0.57	0.59	0.58	0.64	0.66	0.65	0.61	0.64	0.62	0.65	0.65	0.65	0.56	0.60	0.58	0.68	0.70	0.69
6.0 percent	3(60%)	0.51	0.55	0.53	0.55	0.55	0.55	0.61	0.62	0.61	0.58	0.60	0.59	0.62	0.64	0.63	0.55	0.57	0.56	0.68	0.70	0.69
	6(60%)	0.58	0.62	0.60	0.61	0.64	0.63	0.70	0.72	0.71	0.71	0.74	0.73	0.71	0.74	0.72	0.64	0.70	0.67	0.81	0.84	0.83
	All	0.55	0.57	0.56	0.59	0.61	0.60	0.66	0.68	0.67	0.67	0.69	0.68	0.68	0.70	0.69	0.61	0.64	0.63	0.75	0.78	0.77
160 lb/sq yd	16	0.48	0.50	0.49	0.57	0.59	0.58	0.62	0.66	0.64	0.67	0.70	0.69	0.65	0.66	0.65	0.57	0.61	0.58	0.68	0.70	0.69
Trinidad	11	0.56	0.59	0.58	0.61	0.63	0.62	0.67	0.71	0.69	0.73	0.74	0.73	0.71	0.73	0.72	0.66	0.68	0.67	0.79	0.81	0.80
6.0 percent	All	0.52	0.55	0.54	0.59	0.61	0.60	0.65	0.69	0.67	0.70	0.72	0.71	0.68	0.70	0.69	0.62	0.65	0.63	0.74	0.76	0.75
160 lb/sq yd	6(40%)	--	--	--	0.63	0.63	0.63	0.69	0.71	0.70	0.73	0.76	0.74	0.70	0.72	0.71	0.64	0.67	0.66	0.78	0.82	0.80
Conventional	3(40%)	--	--	--	0.58	0.59	0.58	0.64	0.66	0.65	0.62	0.65	0.64	0.64	0.65	0.64	0.58	0.60	0.59	0.69	0.72	0.70
6.0 percent	All	--	--	--	0.61	0.61	0.61	0.67	0.69	0.68	0.68	0.71	0.69	0.67	0.69	0.68	0.61	0.64	0.63	0.74	0.77	0.75
160 lb/sq yd	15	--	--	--	0.57	0.58	0.58	0.60	0.62	0.61	0.62	0.67	0.65	0.65	0.67	0.66	0.58	0.60	0.59	0.69	0.73	0.71
Trinidad	10	--	--	--	0.63	0.65	0.64	0.69	0.70	0.70	0.76	0.77	0.76	0.68	0.74	0.72	0.66	0.72	0.69	0.80	0.82	0.81
6.5 percent	All	--	--	--	0.60	0.62	0.61	0.65	0.66	0.66	0.69	0.72	0.71	0.67	0.71	0.69	0.62	0.66	0.64	0.75	0.78	0.76
250 lb/sq yd	2	0.50	0.52	0.51	0.55	0.55	0.55	0.59	0.62	0.60	0.61	0.61	0.61	0.61	0.64	0.62	0.56	0.56	0.56	0.64	0.67	0.66
Trinidad	5	0.58	0.63	0.60	0.60	0.64	0.62	0.71	0.71	0.71	0.73	0.77	0.75	0.73	0.76	0.74	0.66	0.70	0.68	0.74	0.80	0.77
6.5 percent	14	0.48	0.50	0.49	0.58	0.58	0.58	0.59	0.60	0.60	0.62	0.65	0.64	0.65	0.66	0.66	0.56	0.57	0.56	0.68	0.72	0.70
	9	0.54	0.57	0.56	0.63	0.64	0.64	0.68	0.71	0.69	0.72	0.74	0.73	0.73	0.74	0.73	0.67	0.68	0.68	0.82	0.86	0.85
	All	0.53	0.56	0.54	0.59	0.60	0.60	0.64	0.66	0.65	0.67	0.69	0.68	0.68	0.70	0.69	0.61	0.63	0.62	0.72	0.76	0.75

TABLE 3
SUMMARY OF TRANSVERSE CRACKS*
(May 1980)

Surface Type	Section No.	Transverse Cracks		Percent Reflection
		Prior to Resurfacing	May 1980 Survey	
250 lb/sq yd	1	636	638	100
Trinidad	4	581	388	67
6.0 percent	8	641	374	58
	13	775	336	43
	All	2,633	1,736	66
250 lb/sq yd	3(60%)	1,876	1,266	67
Conventional	6(60%)	1,581	735	46
6.0 percent	7	633	471	74
	12	1,224	894	73
	All	5,314	3,366	63
160 lb/sq yd	11	495	392	79
Trinidad	16	518	507	98
6.0 percent	All	1,013	899	89
160 lb/sq yd	3(40%)	1,009	952	94
Conventional	6(40%)	1,087	1,357	125
6.0 percent	All	2,096	2,309	110
160 lb/sq yd	10	492	327	66
Trinidad	15	761	442	58
6.5 percent	All	1,253	769	61
250 lb/sq yd	2	1,045	560	54
Trinidad	5	498	298	60
6.5 percent	9	552	385	70
	14	906	376	42
	All	3,001	1,619	54

* Transverse cracks visible under dry surface conditions to a man with normal vision standing on the outside shoulder of a two-lane pavement.