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1963 PERFORMANCE TESTS
OF WHITE AND YELLOW TRAFFIC PAINT
(Including Cooperative Tests in Detroit and Wayne County)

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Michigan State Highway Department
John C. Mackie, Commissioner
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1963 PERFORMANCE TESTS
OF WHITE AND YELLOW TRAFFIC PAINT
(Including Cooperative Tests in Detroit and Wayne County)

The following twelve producers, the same ones as in the previous year, were asked to submit paints for the 1963 tests, and all complied:

1. Acme Quality Paints, Inc. of Detroit
2. Argo Paint and Chemical Co. of Detroit
3. Baltimore Paint and Chemical Co. of Baltimore
4. Boydell Brothers Co. of Detroit
5. DeSoto Chemical Coatings Inc. of Chicago
6. Glidden Co. of Cleveland
7. Jaegle Paint and Varnish Co. of Philadelphia
8. Prismo Safety Corp. of Huntingdon, Pa.
9. Standard Detroit Paint Co. of Detroit
10. Stiles Paint Co. of Kalamazoo
11. Wm. Armstrong Smith Co. of East Point, Georgia
12. Truscon Division of Devoe and Raynolds of Detroit

In addition to paints from these producers, the following experimental traffic paints were evaluated: a) a white and a yellow used by the City of Detroit, b) two two-component white epoxies, c) a white with a mildew-inhibiting extender pigment and its control paint, and d) special beads in blue and yellow traffic paints. These were all field evaluated in fewer than the standard four areas.

Qualification Tests

All regular, non-experimental paints were evaluated for conformance with qualification requirements given in the governing specifications dated April 23, 1963. Laboratory qualification tests covered color, reflectivity, consistency, bleeding, settling, and vehicle stability, while field qualification tests covered drying time and applicability in regular highway striping equipment. Results of the qualification tests are given in Table 1, which shows (as reported to the Committee in Research Report No. R-457,

TABLE 1
 QUALIFICATION TEST RESULTS
 1963 Performance Paints

	Paint No.	Color Quality**	Reflectivity, percent	Consistency, KU - 77 F	Bleeding Index		Settling Index	Avg. Field Drying Time, Minutes	Applicability in Striping Equipment***
					Asphalt	Tar			
WHITE PAINTS	90	P	86.9	76	5.9	4.8	7	22	S
	92	P	86.5	78	5.6	5.0	7	22	S
	94	P	81.1	70	5.4	3.7	8	36	S
	96	P	90.6	72	5.1	4.3	7	27	S
	98	P	86.1	78	7.4	4.3	9	36	S
	100	P	82.7	71	4.4	3.2	6	24	S
	102	P	84.4	76	5.5	3.3	9	21	S
	104	F	78.1	78	4.6	5.2	5	29	S
	106	P	82.6	86	5.0	4.3	7	17	S
	108	P	89.4	73	7.6	5.0	7	19	S
	110	P	81.2	92	5.5	5.2	3	16	S
	112	P	84.0	77	6.5	4.3	8	17	S
	113*	--	--	--	--	--	--	47	--
	114A	--	--	--	--	--	--	25	--
	114B	--	--	--	--	--	--	22	--
116	--	--	--	--	--	--	26	--	
121*	--	--	--	--	--	--	49	--	
YELLOW PAINTS	89	Po	60.0	76	9.0	5.5	7	31	S
	91	Pr	52.9	72	8.3	5.0	7	32	S
	93	Po	50.5	79	9.0	3.8	8	24	S
	95	Po	59.2	75	6.9	5.2	7	24	S
	97	F	47.4	73	9.0	4.8	7	30	S
	99	Po	58.1	66	6.0	3.5	6	25	S
	101	Pr	53.8	77	8.9	6.0	9	25	S
	103	Po	55.6	80	7.5	5.5	5	43	S
	105	Pr	50.2	85	4.3	6.0	6	15	S
	107	Po	57.1	71	8.1	8.2	6	26	S
	109	F	48.0	75	5.3	4.2	6	13	S
	111	Pr	49.6	77	6.5	4.3	9	18	S
	115	--	--	--	--	--	--	24	--

* Two Component paint

** P = passes color requirements
 F = fails color requirements
 o = exact color match with standard
 r = red side of standard
 g = green side of standard

*** S = Satisfactory as determined by field crew.

dated April 9, 1963) that the following paints failed to meet one or more of the requirements:

White Paints

- No. 94 - Excessive bleeding on tar base
- No. 100 - Excessive bleeding on tar base
- No. 102 - Excessive bleeding on tar base
- No. 104 - Excessive low settling index and low reflectivity
- No. 110 - Excessively high viscosity and low settling index

Yellow Paints

- No. 97 - Did not meet color requirements
- No. 99 - Excessively low viscosity and bleeding on tar base
- No. 103 - Excessive low settling index, plus borderline drying
- No. 105 - Borderline high viscosity, low settling index, long drying
- No. 109 - Did not meet color requirements

Field Application

All paints submitted for the 1963 tests were deposited in the four field areas between August 7 to 13, 1963. The test stripes, covering two lanes of four-lane roadways, were applied in the same general areas used in 1962, as shown in Fig. 1. Deposition details for the test paints in the performance areas were standard, in that each was applied as a set of three 4-in. wide stripes at a 15-mil thickness, having beads "drop-ped-on" in ratio of 6 lb per gal of paint. Subsequently, 45-gal amounts of each paint purchased for tests were applied as longitudinal striping by the Grand Rapids crew, for evaluation of handling and application characteristics of the paints in highway striping equipment.

Field Performance Ratings

Test stripes deposited in the four performance areas (Fig. 2) were rated four days after application and at three-month intervals thereafter over a period of one year. Quality ratings of the test paints in the four test areas, averaged from evaluations of the four observers, are given in Table 2. These averaged quality values for the individual paints were then used to calculate the respective weighted ratings, also listed in that table.

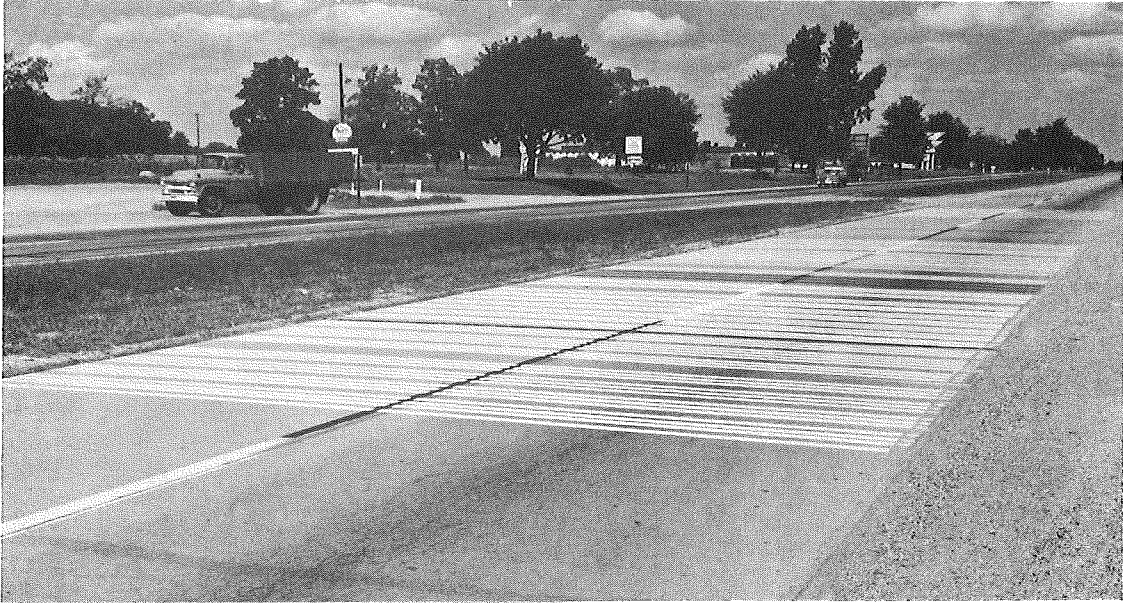


Figure 2. Initial appearance of stripes at Test Area 1 (concrete) on M 78; whites in foreground, yellows in background, blues in center.



Figure 3. Terminal appearance of white stripes after eight months of service in Detroit; MSHD control stripes in triplicate in foreground, Detroit's quadruplicate stripes in background.

TABLE 2
PERFORMANCE RATING DATA
1963 Tests

Exposure Days	Factor Evaluated	White Paint Numbers																				
		90	92	94	96	98	100	102	104	106	108	110	112	113	114A	114B	116	121	98			
WHITE PAINTS	4	General Appearance	9.1	9.0	9.1	9.3	8.7	8.9	9.4	8.3	8.8	9.7	7.2	9.4	7.4	9.2	9.0	9.7	8.9	8.9		
		Durability	10.0	10.0	9.9	10.0	10.0	10.0	10.0	9.2	9.8	10.0	8.1	10.0	9.9	10.0	10.0	10.0	10.0	10.0		
		Night Visibility	7.7	8.2	6.2	6.1	6.2	6.6	7.0	5.9	5.5	6.5	5.3	7.0	5.7	6.4	6.3	6.2	6.6	7.1		
		Weighted Rating	8.8	9.0	8.0	8.0	8.0	8.2	8.4	7.5	7.6	8.2	6.6	8.4	7.6	8.1	8.0	8.1	8.2	8.4		
	85	General Appearance	7.9	7.5	7.8	7.6	6.9	7.5	7.9	7.3	7.0	8.6	4.6	7.9	7.4	7.9	7.7	8.4	6.7	7.4		
		Durability	9.4	9.5	9.1	8.8	9.1	8.3	9.4	8.7	7.7	9.5	6.0	9.3	9.2	9.6	9.3	9.5	8.9	9.5		
		Night Visibility	7.2	7.2	6.3	6.4	6.5	5.7	7.0	5.9	5.8	6.8	4.4	7.1	5.8	6.4	6.2	6.6	6.3	6.6		
		Weighted Rating	8.2	8.2	7.6	7.5	7.6	6.9	8.0	7.2	6.7	8.1	5.1	8.1	7.3	7.8	7.6	7.9	7.4	7.8		
	180	General Appearance	6.5	6.3	6.2	5.8	5.9	5.1	6.6	4.0	5.5	7.6	2.2	6.7	6.6	5.7	5.7	7.0	5.8	6.0		
		Durability	8.1	7.8	7.3	6.7	6.9	5.9	7.8	4.5	6.5	8.0	2.5	7.6	7.8	7.4	7.8	7.8	6.7	7.7		
		Night Visibility	5.8	5.2	5.1	4.8	5.7	2.5	6.2	2.1	4.8	6.4	1.1	5.8	5.2	5.5	5.8	6.3	5.1	5.5		
		Weighted Rating	6.8	6.4	6.1	5.7	6.2	4.1	6.9	3.2	5.6	7.2	1.8	6.6	6.4	6.3	6.6	7.0	5.8	6.4		
		Service Factor	79.4	78.8	72.8	71.2	73.1	64.8	78.4	62.0	65.9	78.6	45.6	77.7	71.3	75.0	74.4	77.2	71.6	76.1		
	277	General Appearance	5.8	5.4	5.2	4.9	4.8	2.6	5.8	1.7	4.6	6.8	0.5	5.5	5.2	5.3	5.5	6.5	4.3	5.4		
		Durability	7.0	6.5	5.9	5.5	5.8	3.0	7.0	1.9	5.4	7.5	0.5	6.1	6.5	6.5	6.2	7.0	5.0	6.7		
		Night Visibility	5.1	3.7	4.1	4.0	4.3	1.1	5.4	0.5	3.5	5.4	0.3	4.8	4.5	4.8	4.3	5.4	4.0	5.0		
Weighted Rating		5.9	5.0	4.9	4.7	5.0	2.0	6.1	1.2	4.4	6.4	0.4	5.4	5.5	5.5	5.2	6.2	4.4	5.7			
372	General Appearance	4.8	4.7	4.3	4.2	4.3	2.1	4.4	1.4	3.9	5.6	0.3	4.2	4.0	4.0	4.2	4.9	3.3	4.3			
	Durability	6.2	5.6	5.3	4.8	5.2	2.5	5.6	1.6	4.5	6.2	0.5	4.9	6.0	5.5	5.3	5.9	4.0	5.7			
	Night Visibility	2.8	2.2	2.0	2.0	2.2	0.7	2.8	0.5	2.0	3.1	0.2	2.8	2.2	2.7	2.2	3.0	2.0	2.7			
	Weighted Rating	4.4	3.8	3.6	3.3	3.6	1.6	4.1	1.0	3.2	4.6	0.3	3.8	3.9	4.0	3.6	4.4	2.9	4.1			
	Service Factor	68.3	64.3	60.5	58.3	61.0	43.9	67.9	38.7	54.6	69.9	25.9	65.1	61.8	63.9	62.7	68.0	57.5	65.3			
YELLOW AND BLUE PAINTS	4	Yellow Paint Numbers																Blue Paint Numbers				
		89*				91	93	95	97	99	101	103	105	107	109	111	115	87	83**			
		CY	3 MY	3 MW	III														3 MB	3 MW	III	
	General Appearance	8.8	7.9	9.0	9.3	9.1	9.2	9.6	8.9	9.7	9.2	8.9	8.5	9.7	8.1	8.9	9.7	9.2	8.5	9.3	9.5	
	Durability	10.0	10.0	10.0	10.0	9.9	9.8	10.0	9.9	9.8	10.0	9.6	9.0	10.0	8.6	10.0	10.0	10.0	10.0	10.0	10.0	
	Night Visibility	8.0	8.8	9.3	7.0	6.5	6.4	5.9	5.4	5.3	7.6	6.2	4.9	5.9	4.7	5.8	5.8	6.7	8.0	9.0	4.5	
	Weighted Rating	8.9	9.2	9.6	8.4	8.1	8.0	7.9	7.6	7.5	8.7	7.8	6.9	7.9	6.6	7.8	7.9	8.3	9.0	9.4	7.2	
	85	General Appearance	8.3	7.3	8.3	8.5	7.7	8.0	8.5	7.4	8.5	8.1	7.9	7.2	8.8	6.3	7.9	8.8	8.0	7.5	7.5	8.3
		Durability	10.0	9.8	9.8	9.5	9.5	9.0	9.1	9.1	9.2	9.5	9.2	7.8	9.6	7.0	9.5	9.4	9.6	8.8	8.8	9.3
		Night Visibility	7.8	7.4	8.6	7.0	6.4	6.5	6.7	6.0	6.2	7.2	6.6	5.7	6.6	4.7	6.5	6.4	7.1	6.8	7.5	4.3
		Weighted Rating	8.7	8.4	9.0	8.2	7.8	7.6	7.8	7.4	7.6	8.2	7.8	6.7	8.0	5.8	7.8	7.8	8.2	7.7	8.0	6.7
	180	General Appearance	6.8	5.8	7.0	6.6	5.8	6.6	7.0	5.8	6.5	6.8	6.3	5.5	7.7	1.8	6.3	7.6	6.6	7.8	7.8	8.0
		Durability	8.3	8.1	8.3	7.5	7.7	7.5	7.7	7.4	7.1	8.1	7.4	6.5	8.3	2.3	7.8	8.2	8.3	9.0	9.0	9.0
		Night Visibility	6.1	5.0	6.4	5.8	5.7	5.8	5.9	5.6	5.1	6.5	4.3	3.6	6.3	0.8	5.6	5.9	5.8	7.0	7.0	6.3
		Weighted Rating	7.0	6.3	7.2	6.6	6.5	6.5	6.7	6.3	6.0	7.2	5.7	5.0	7.2	1.5	6.6	7.0	6.9	7.9	7.9	7.6
		Service Factor	83.3	80.2	87.0	78.0	75.2	74.4	75.7	71.5	72.0	80.6	72.5	62.8	77.9	48.5	74.9	76.3	78.6	80.3	83.2	70.4
277	General Appearance	6.3	5.5	6.6	5.9	5.8	5.9	6.2	5.4	5.4	6.2	4.8	3.8	6.9	0.2	5.6	6.9	6.3	7.0	7.0	7.3	
	Durability	7.6	7.3	7.4	6.5	6.9	6.7	6.6	6.3	5.8	7.2	5.2	4.2	7.4	0.2	6.5	7.3	7.3	8.0	7.8	7.5	
	Night Visibility	4.4	3.6	5.6	4.9	5.2	5.0	4.5	4.8	3.8	6.1	2.6	1.9	5.4	0.1	4.8	5.6	5.5	5.5	5.9	5.0	
	Weighted Rating	5.9	5.3	6.4	5.8	5.9	5.8	5.5	5.5	4.8	6.6	3.9	3.0	6.4	0.2	5.6	6.4	6.3	6.6	6.8	6.2	
372	General Appearance	6.0	4.6	6.5	4.9	4.0	4.7	4.7	4.5	4.0	5.2	3.5	2.8	5.6	0.2	4.6	5.3	5.5	6.1	6.0	6.6	
	Durability	6.9	7.4	7.1	5.6	5.7	5.4	5.2	5.4	4.7	6.4	4.3	3.5	6.4	0.3	5.6	6.2	6.3	7.5	7.5	7.5	
	Night Visibility	2.6	3.0	3.8	3.2	2.8	2.7	2.6	2.8	2.2	3.9	1.8	1.4	3.2	0.8	2.6	2.9	3.2	3.7	4.1	3.0	
	Weighted Rating	4.7	4.9	5.4	4.3	4.1	4.0	3.8	4.0	3.4	5.0	3.0	2.4	4.7	0.5	4.0	4.5	4.7	5.5	5.6	5.2	
	Service Factor	70.7	67.1	75.1	66.5	65.6	64.5	64.7	62.2	59.4	71.8	50.4	47.8	69.7	26.5	64.4	68.4	69.4	73.5	75.4	66.8	

* Special Bead Tests
 CY = Cataphote Yellow appear deep yellow at night
 3 MY = Scotchrock Yellow appear deep yellow at night
 3 MW = Scotchrock White appear yellow-white at night
 III = MSHD beads appear light yellow at night

** Special Bead Tests
 3 MB = Scotchrock Blue appear deep blue at night
 3 MW = Scotchrock White appear blue white at night
 III = MSHD beads appear light blue at night

Field Test Results

Table 3 summarizes performance indicators expressed as calculated service factor values, listed in descending order of terminal "Percent of Best" values for all tested 1963 paints. Half-year and one-year service factor values for the paints are given in the table, which also contains a column tabulating results of the previously mentioned qualification tests.

The "Qualification Tests" column in Table 3 shows that five white and five yellow paints, of the twelve regulars submitted by producers, failed to meet all specification requirements; a few additional were borderline. This is a poorer average than usual. It is fortunate that these failures, which automatically disqualify a producer from bidding on striping requirements, generally did not occur in the better performing paints.

The Table 3 column listing the terminal service factor values of paints in the previous year's tests (1962) is given for comparison of performance of various products in two successive test years. As before, the current tests included stripes of samples of the white and yellow paints purchased for Departmental 1963 roadway striping, for information on reproducibility of ratings and for a check on analytical methods employed in acceptance testing. A comparison of data shows that these two paints received 1963 service factor ratings within 2.0 points of their prototypes in the 1961 tests, which is a gratifying check on raters' evaluations and Laboratory testing procedures.

As is customary, no recommendation is being made concerning regular performance paints to be selected for bids.

Experimental Paints and Beads

For white experimental paints Table 3 shows: a) that the City of Detroit white had a terminal rating between the second and third best performance paints, b) that the mildew-inhibiting extender pigmentation did not improve performance of its control paint, which rated with or without pigmentation a little poorer than the fifth best performance paint, and c) that the two two-component epoxy paints, requiring 50 minutes to dry, rated about equivalent to the eighth best performance paint.

For yellow experimental paints Table 3 shows: a) that the City of Detroit yellow had a terminal rating between second and third best performance paints. The special-bead stripes show that white Scotchrock

TABLE 3
SERVICE FACTORS AND TERMINAL RATINGS
1963 Performance Paints*

	Paint Number	1962 Service Factor (364 Days)	1963 Service Factors		Terminal Percent of Best	Qualification Tests (a)
			180 days	372 days		
WHITE PAINTS	108	63.5	78.6	69.9	100.0	P
	90	66.2	79.4	68.3	97.7	P
	102	65.2	78.4	67.9	97.1	NP
	112	67.7	77.7	65.1	93.1	P
	92 (b)	64.4	78.8	64.3	92.0	{ P - Paint P - Beads
	98	64.9	73.1	61.0	87.3	
	94	59.2	72.8	60.5	86.6	NP
	96	48.7	71.2	58.3	83.4	P
	106	42.5	65.9	54.6	78.1	P
	100	57.0	64.8	43.9	62.8	NP
	104	42.8	62.0	38.7	55.4	NP
	110	39.1	45.6	25.9	37.1	NP
	116	62.9	77.2	68.0	97.3	--
	114A (c)	--	75.0	63.9	91.4	--
	114B (c)	--	74.4	62.7	89.7	--
113 (c) (d)	77.1	71.3	61.8	88.4	NP	
121 (c) (d)	--	71.6	57.5	82.3	NP	
98	63.6 (f)	76.1	65.3	93.4	P	
YELLOW PAINTS	101	69.5	80.6	71.8	100.0	P
	107	67.8	77.9	69.7	97.1	P
	89	69.9	78.0	66.5	92.6	P
	91 (b)	69.2	75.2	65.6	91.4	{ P - Paint P - Beads
	95	60.0	75.7	64.7	90.1	
	93	55.4	74.4	64.5	89.8	P
	111	62.9	74.9	64.4	89.7	P
	97	63.4	71.5	62.2	86.6	NP
	99	63.5	72.0	59.4	82.7	NP
	103	60.0	72.5	56.4	78.6	NP
	105	58.3	62.8	47.8	66.6	NP
	109	37.9	48.5	26.5	36.9	NP
	115	64.5	74.9	68.4	95.3	--
89 (c) (e)	{ 3 MW 3 CY 3 MY	87.0	75.1	104.6	P	
		83.3	70.7	98.5	P	
		80.2	67.1	93.5	P	
87	71.2 (f)	78.6	69.4	96.7	P	
BLUE PAINTS	83 (c) (e)	{ 3 MW 3 MB III	83.2	75.4	102.6	--
			80.3	73.5	100.0	--
			70.4	66.8	90.9	--

* All paints applied at rate of 16.5 gal per mile of 4-in. stripe; 6 lb of MSHD Type III beads dropped-on per gallon, except where noted. Field areas same as in 1962 tests.

- (a) P = passing; NP = non-passing.
- (b) Paints supplied with own beads.
- (c) Applied in fewer than four field areas.
- (d) Two-component paint.
- (e) Special beads applied.
- (f) Values obtained in 1961 tests using same areas as in 1963.

beads improved night visibility but had poor color fidelity, since returned light was whitish. The Cataphote yellow beads gave some improvement in performance, with good color fidelity in night viewing. The yellow Scotchrock gave less improvement over Type III beads than did the Cataphote beads; they had good color fidelity, as footnoted in Table 2.

Regarding special bead application on blue striping, Table 3 shows that Type III beads gave fair to good color fidelity with only fair night visibility. The Scotchrock beads behaved about the same as in the yellow stripes.

Cooperative Tests with Detroit and Wayne County

In accord with previous arrangements, and as in the past, the Department cooperated with Detroit and Wayne County in performance striping.

For Wayne County this involved considerably less than last year, and consisted of assistance in application of their paint samples with the Laboratory striper plus subsequent observation of their performance at the six-month level. Fifteen whites and thirteen yellows, plus MSHD controls, were applied as triplicate, beaded stripes, in two test areas comprising one concrete and one bituminous roadway.

For Detroit the cooperation consisted of the following:

1. Detroit submitted its 1963 roadway paints for evaluation in Department tests. The performance of these two paints was indicated earlier in this report.

2. Laboratory equipment and operators assisted in application of Detroit performance paints. Due to poor planning on Detroit's part, leading to a delay in starting test striping, resulting haste in the application contributed to poor bead dispersion in the whites. These were re-applied by request at a later date. Twenty-one whites and twenty yellows, plus MSHD controls, were applied in quadruplicate, with two stripes beaded and two unbeaded. Stripes were applied in the customary single area, the sheet asphalt roadway on Oakland Ave.

3. The Department's rating crew of two assisted in making only the final rating, at the eight-month service level. On the average these stripes looked acceptably good and about half had a durability rating of 5 or above after eight months of road service (Fig. 3). Also on the average, beaded whites rated 4.1 points better than unbeaded, while beaded yellows rated 2.8 points better than unbeaded.