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1962 PERFORMANCE TESTS OF WHITE AND YELLOW TRAFFIC PAINT (Including Cooperative Tests in Detroit and Wayne County)

A. J. Permoda
R. L. Snider
M. H. Janson

Research Laboratory Division
Office of Testing and Research
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John C. Mackie, Commissioner
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1962 PERFORMANCE TESTS
OF WHITE AND YELLOW TRAFFIC PAINT
(Including Cooperative Tests in Detroit and Wayne County)

Twelve producers were asked to submit paints for the tests, all of whom complied:

1. Acme Quality Paints, Inc. of Detroit.
2. Argo Paint & Chemical Co. of Detroit.
3. Baltimore Paint & 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 & Varnish Co. of Philadelphia.
8. Prismo Safety Corporation 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 Laboratories of Detroit.

In addition to these producers, the following experimental traffic paints were evaluated in the 1962 tests: a) a white and a yellow used by the City of Detroit, b) a white and a yellow used by Wayne County, c) a white and a yellow two-component epoxy, d) a white and a yellow based on a chlorinated rubber-aklyd vehicle, and e) a white submitted by the Pennsylvania Highway Department on an exchange basis. Some of these paints were field evaluated in fewer than the standard four areas.

Qualification Tests

Prior to stripe application, it was determined that several of the twelve producers submitted paints not meeting some qualification requirements. These paints were deposited as stripes in fewer than the standard four areas (i.e., they were handled as experimental paints). The performance paints meeting the "Specific Requirements" of the specifications were deposited in four areas as is customary.

Conformance to these requirements was determined in accord with governing specifications dated May 2, 1960, with attachments of 5-18-60 and 4-24-62. Laboratory qualification tests cover requirements for color, consistency, bleeding, settling, and vehicle stability, while field qualification tests cover drying time of the traffic paints and applicability by regular highway striping equipment.

Results of the qualification tests are given in Table 1, which shows (as reported to the Committee by Report No. R-420 dated April 17, 1963) that the following paints failed to meet one or more of the requirements:

White Paints

No. 164	Excessive bleeding on both asphalt and tar bases.
No. 170	Excessive low reflectivity and borderline settling.
No. 172	Excessive bleeding on asphalt base.
No. 180	Excessive bleeding on asphalt, high viscosity, and low settling index.
No. 186	Excessive high viscosity.

Yellow Paints

No. 171	Did not match color standard, and had low settling index.
No. 181	Excessive bleeding on asphalt base and low settling index.
No. 187	Excessive low viscosity.

Field Application

Paints submitted for the 1962 tests were deposited in the four field areas between August 13 and 17, 1962. These areas, covering two lanes of four-lane roadways, were located adjoining last year's 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 wet thickness having beads "dropped-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 to evaluate handling and application characteristics of the paints in highway striping equipment.

TABLE 1
QUALIFICATION TEST RESULTS
1962 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	164	P	83.5	77	3.7	3.3	9	35	S
	166	P	91.5	81	6.0	6.3	6	18	S
	168	P	93.1	81	4.0	5.0	9	23	S
	170	F	74.8	81	4.7	5.0	6	14	S
	172	P	81.8	72	3.6	5.0	9	24	S
	174	P	90.3	73	4.8	5.2	8	27	S
	176	P	84.7	75	4.0	4.7	8	27	S
	178	P	81.8	71	5.3	5.0	7	28	S
	180	P	82.2	86	3.0	4.0	4	22	S
	182	P	85.2	72	5.0	5.7	6	29	S
	184	P	86.4	74	4.5	4.3	8	25	S
	186	P	81.4	97	5.5	7.2	7	25	S
	188*	--	--	--	--	--	-	200	--
	196	--	--	--	--	--	-	30	--
	198	--	--	--	--	--	8	34	--
	200	--	--	--	--	--	8	30	--
	202	--	--	--	--	--	8	23	--
YELLOW PAINTS	165	Pr	55.9	79	4.8	5.2	9	40	S
	167	Po	57.8	82	8.2	8.7	6	27	S
	169	Po	58.6	77	4.8	5.3	6	40	S
	171	Fo	50.4	78	4.3	5.0	5	27	S
	173	Pr	51.1	74	5.2	7.3	8	20	S
	175	Pr	58.4	77	6.2	5.2	6	27	S
	177	Po	53.6	72	5.2	4.7	8	47	S
	179	Pg	58.4	73	6.3	6.0	6	34	S
	181	Po	56.7	85	3.8	4.2	5	29	S
	183	Pg	57.2	72	6.3	5.5	7	39	S
	185	Pr	50.3	77	5.0	4.5	8	25	S
	187	Po	53.4	68	9.2	9.7	6	25	S
	189*	--	--	--	--	--	-	150	--
	195	--	--	--	--	--	8	34	--
	197	--	--	--	--	--	-	16	--
	199	--	--	--	--	--	5	32	--
	201	--	--	--	--	--	-	37	--

* Two Component paint

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

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

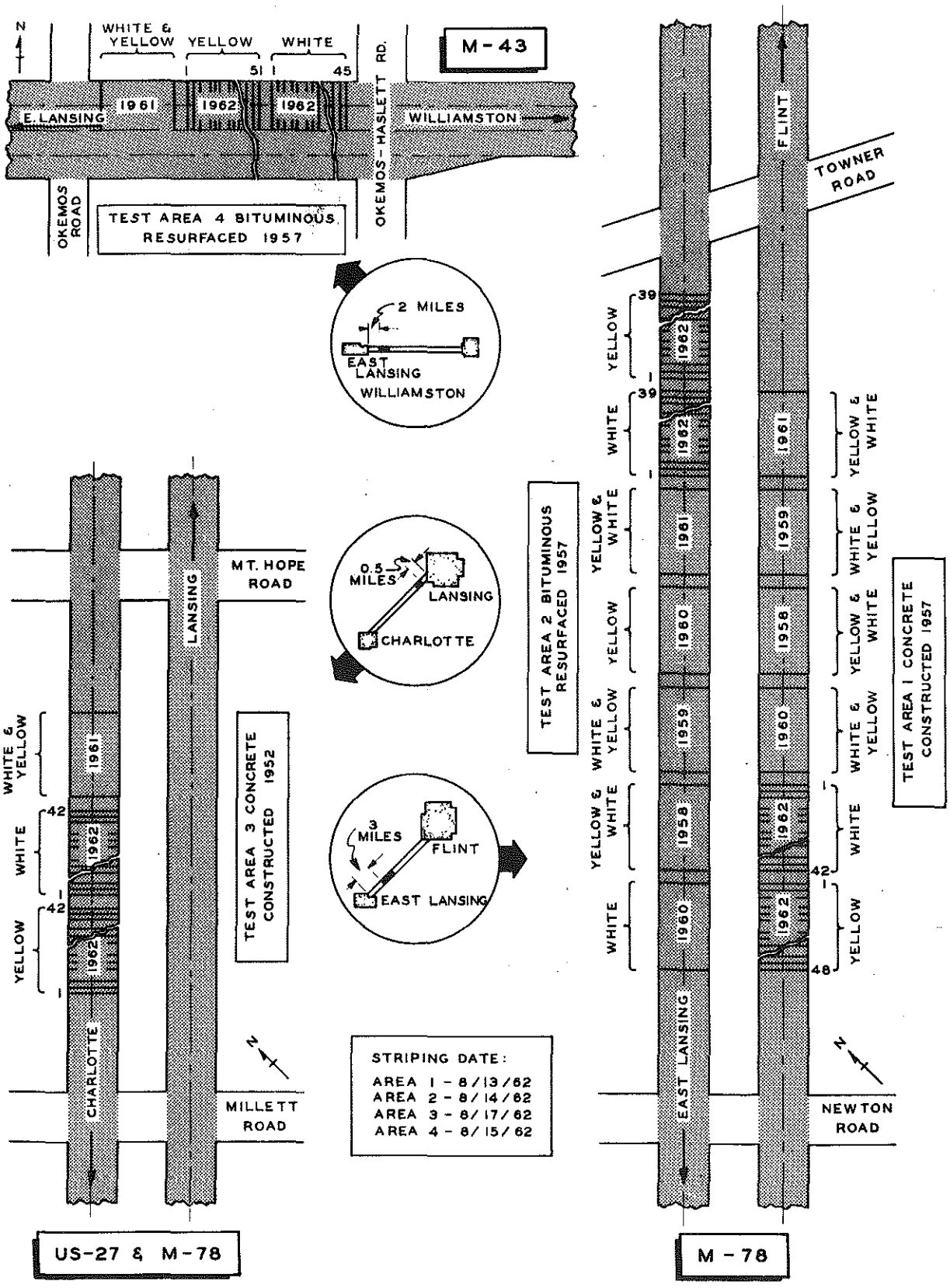


Figure 1. Location of 1962 Traffic Paint Performance Test Areas.

Field Performance Ratings

Test stripes deposited in the four performance areas, one of which is shown in Fig. 2a, were rated thirteen days after application and at three-month intervals thereafter over a period of one year.

Quality ratings from the four test areas, averaged from evaluations of four observers, are tabulated for the test paints in Table 2. These averaged quality values for the individual paints were then used to calculate the respective weighted ratings. Fig. 2b shows appearance of some stripes after one year of exposure; it may be noted that in this test area, a tire track has undergone maintenance resealing in the traffic lane, or rating zone. Such occurrences are another reason and justification for the use of multiple test areas.

Field Test Results

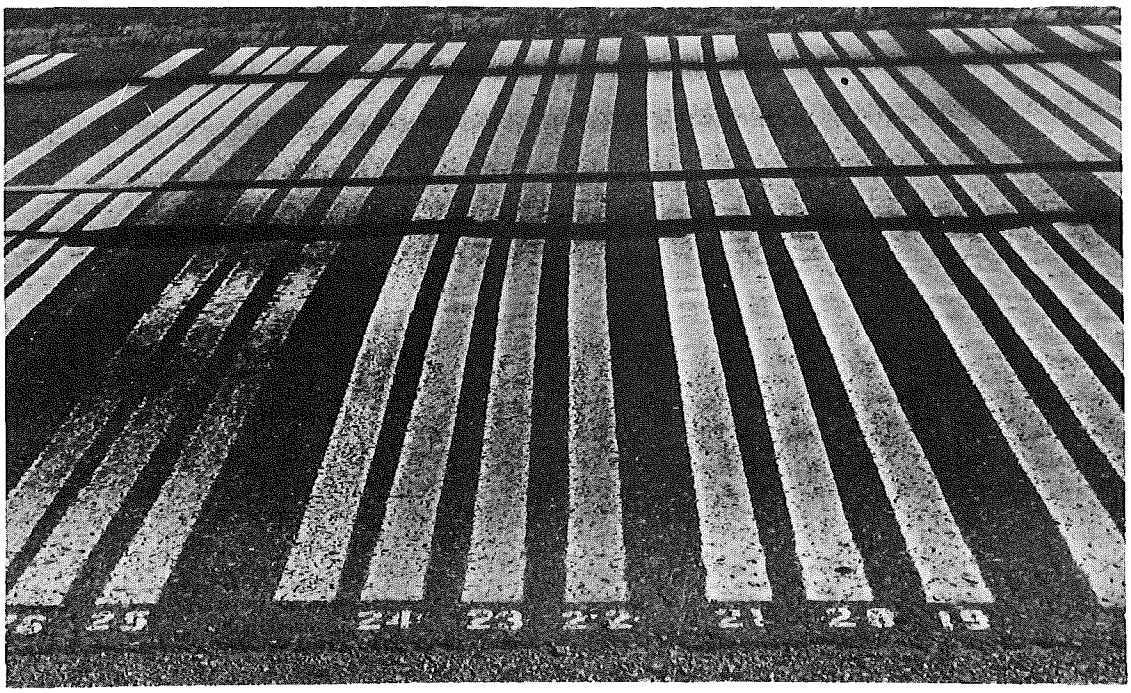
Table 3 summarizes performance indicators expressed as calculated service factor values listed in descending order of terminal "Percent of Best" values for all tested 1962 paints. Half-year and one-year service factor values for the paints are given in this table, which also contains a column tabulating results of the previously mentioned qualification tests.

A review of the "Qualification Tests" column in Table 3 shows that five white and three yellow paints, of the twelve regulars submitted by producers, failed to meet all specification requirements, although a few others were borderline. This is a somewhat poorer average than usual. It is fortunate that these failures, automatically disqualifying a producer from bidding for striping requirements, generally do not occur in the best performing paints.

The Table 3 column listing the terminal service factor values of paints in the previous year's tests (1961) is given to permit evaluation of comparative performance by the separate producers. As previously, the current tests included stripes of samples of the white and yellow paints purchased for Departmental 1962 roadway striping. This is done 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 service factor ratings about five points higher than did their prototypes in the 1960 tests. These higher ratings are believed partially due to transfer of two areas from US 127 to the comparatively milder ones on M 43 and US 27 - M 78.

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

A. Initial appearance at Test Area 4 (bituminous) on M 43; whites in foreground, yellows in background.



B. Appearance after one year of exposure of some whites in Test Area 2 (bituminous) on M 78, showing longitudinal joint resealing in tire track.

Figure 2. 1962 performance stripes.

TABLE 2
PERFORMANCE RATING DATA
1962 Tests

	Exposure Days	Factor Evaluated	White Paint Numbers																
			164	166	168	170	172	174	176	178	180	182	184	186	188	196	198	200	202	106
WHITE PAINTS	13	General Appearance	9.0	8.9	9.2	7.4	9.1	9.6	8.6	9.0	8.8	8.7	9.2	8.0	9.2	9.1	9.0	9.6	8.3	8.2
		Durability	9.8	10.0	9.8	8.6	10.0	10.0	10.0	9.8	10.0	9.9	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
		Night Visibility	5.2	9.0	5.7	4.6	5.4	5.1	6.3	5.6	7.2	6.7	6.2	9.2	7.2	5.5	5.6	5.9	8.8	8.9
		Weighted Rating	7.4	9.4	7.7	6.5	7.6	7.5	8.0	7.6	8.5	8.2	8.0	9.4	8.5	7.6	7.7	7.9	9.2	9.3
	81	General Appearance	7.0	6.8	6.6	5.1	7.4	8.2	7.0	7.4	6.9	7.1	7.1	6.7	7.5	7.2	7.2	7.7	6.4	6.5
		Durability	9.0	8.9	7.7	6.8	8.6	9.2	9.2	9.2	8.8	9.5	9.6	9.3	9.8	9.2	9.2	9.4	9.0	9.2
		Night Visibility	7.8	7.0	6.8	5.7	7.4	6.8	7.2	6.8	7.2	7.3	7.6	4.4	6.1	7.0	6.9	6.5	7.6	8.0
		Weighted Rating	8.2	7.7	7.1	6.1	7.9	7.9	8.0	7.8	7.8	8.2	8.4	6.6	7.7	7.9	7.8	7.8	8.0	8.3
	181	General Appearance	6.2	3.6	4.5	3.3	5.7	6.5	5.7	5.8	5.1	6.0	6.2	4.5	7.5	5.9	5.9	6.4	5.2	5.8
		Durability	7.1	4.0	4.9	4.2	6.5	6.8	6.8	6.9	6.1	7.2	7.3	4.6	9.0	6.6	6.8	7.5	7.2	7.4
		Night Visibility	6.6	3.0	4.6	3.6	5.8	6.2	6.2	5.8	4.9	6.4	6.5	1.8	5.8	5.4	6.3	6.8	5.7	5.4
		Weighted Rating	6.8	3.5	4.7	3.8	6.1	6.5	6.4	6.2	5.4	6.7	6.8	3.2	7.2	5.9	6.5	7.0	6.2	6.2
		Service Factor	76.3	69.2	66.0	55.5	73.2	74.2	75.5	73.4	72.9	77.6	78.5	62.8	77.7	73.0	74.4	76.0	78.1	79.6
	272	General Appearance	4.6	1.4	2.9	2.1	4.7	5.3	5.4	5.1	4.2	5.1	5.4	2.6	8.0	5.0	5.1	5.8	4.6	5.5
		Durability	6.1	1.6	3.5	2.4	5.2	5.8	6.6	6.6	5.2	6.5	6.6	3.0	8.8	5.8	5.8	6.5	6.1	6.6
		Night Visibility	5.2	0.6	2.6	1.5	4.0	5.2	4.9	5.2	3.1	4.6	5.0	1.4	7.6	4.3	4.6	5.4	3.9	3.1
		Weighted Rating	5.5	1.1	3.0	1.9	4.6	5.4	5.6	5.8	4.0	5.4	5.7	2.2	8.1	5.0	5.1	5.9	4.8	4.7
	364	General Appearance	4.0	1.4	2.3	2.2	3.4	4.0	4.2	4.3	3.1	4.5	4.8	1.7	7.0	3.9	4.0	5.0	3.7	4.5
		Durability	4.8	1.4	2.3	1.8	3.7	4.3	5.1	5.2	3.7	5.6	5.4	1.8	8.6	4.5	4.7	5.9	4.7	5.4
		Night Visibility	3.0	0.7	1.7	1.2	2.5	3.5	3.9	4.1	2.5	3.7	4.2	1.2	6.3	3.1	3.5	4.4	2.7	2.2
		Weighted Rating	3.8	1.0	2.0	1.5	3.1	3.9	4.4	4.6	3.0	4.5	4.7	1.5	7.3	3.7	4.0	5.1	3.6	3.7
		Service Factor	64.9	42.8	48.7	39.1	59.2	63.5	65.2	64.4	57.0	66.2	67.7	42.5	77.1	60.9	62.9	67.6	63.3	63.9

			Yellow Paint Numbers																
			165	167	169	171	173	175	177	179	181	183	185	187	189	195	197	199	201	107
YELLOW PAINTS	13	General Appearance	9.1	9.0	9.4	7.6	9.2	9.5	8.8	9.5	9.4	9.2	8.2	9.2	9.8	6.4	8.9	9.2	9.6	8.6
		Durability	10.0	10.0	10.0	9.7	10.0	10.0	10.0	10.0	9.9	10.0	10.0	10.0	10.0	8.9	9.6	10.0	10.0	10.0
		Night Visibility	6.4	8.6	6.0	5.6	5.4	5.4	6.0	6.1	6.5	5.8	5.8	7.9	4.5	4.8	5.0	6.4	4.8	8.4
		Weighted Rating	8.1	9.2	7.9	7.4	7.6	7.6	7.9	8.0	8.2	7.8	7.7	8.9	7.2	6.6	7.2	8.1	7.4	9.1
	81	General Appearance	7.8	7.8	7.7	5.5	7.9	7.9	7.8	8.2	7.5	7.9	7.0	8.0	7.0	4.2	7.0	7.4	8.4	7.4
		Durability	9.4	9.4	9.0	6.9	8.9	9.3	9.7	9.6	9.0	9.6	9.4	9.2	9.2	6.0	7.9	9.2	9.4	9.4
		Night Visibility	7.8	7.8	7.1	6.4	6.7	7.2	7.2	7.4	7.3	7.4	7.1	7.4	3.2	4.8	6.6	7.5	7.3	8.4
		Weight Rating	8.4	8.4	7.9	6.5	7.7	8.1	8.3	8.4	8.0	8.3	8.0	8.2	6.0	5.2	7.2	8.2	8.2	8.7
	181	General Appearance	6.3	6.2	5.8	2.5	5.6	6.7	6.7	6.6	6.4	6.9	6.0	6.0	6.3	3.4	4.9	6.4	7.7	6.8
		Durability	6.9	6.8	6.7	3.1	6.2	7.7	7.6	7.8	6.3	7.7	7.2	6.9	8.3	4.0	5.6	7.2	8.1	8.0
		Night Visibility	5.4	4.5	5.4	2.7	4.9	6.5	6.3	6.7	5.7	6.6	5.6	4.2	2.8	3.4	4.9	5.8	7.1	6.6
		Weighted Rating	6.1	5.6	6.0	2.8	5.5	7.0	6.9	7.1	6.0	7.1	6.3	5.5	5.4	3.6	5.2	6.4	7.6	7.2
		Service Factor	77.2	78.3	73.8	57.1	70.7	77.0	77.9	79.4	74.9	78.7	74.7	75.8	60.9	50.9	66.3	76.8	78.6	83.6
	272	General Appearance	5.2	4.9	4.7	1.6	4.1	6.3	6.3	5.9	5.4	6.0	5.1	4.8	5.5	1.8	4.4	5.7	6.9	6.4
		Durability	5.7	5.3	5.5	2.1	4.9	6.8	6.9	6.6	6.2	7.2	6.4	5.2	7.0	1.9	4.9	6.1	7.3	7.3
		Night Visibility	4.1	2.6	3.8	1.2	3.3	5.1	5.5	5.1	4.6	5.4	3.7	2.8	1.0	2.1	3.7	4.5	6.1	5.5
		Weighted Rating	4.8	3.9	4.6	1.6	4.0	5.9	6.1	5.8	5.3	6.2	4.9	4.0	3.8	2.0	4.2	5.3	6.7	6.3
	364	General Appearance	4.4	4.1	3.8	2.8	3.3	5.4	5.6	5.0	4.8	5.2	4.4	4.3	4.5	1.3	3.9	4.3	6.6	5.4
		Durability	4.9	4.2	4.3	2.0	3.3	5.6	6.3	5.8	5.3	6.1	5.2	4.1	6.0	1.6	4.0	4.9	7.4	6.4
		Night Visibility	3.5	1.9	2.9	1.0	2.0	3.9	4.7	4.5	3.6	4.4	3.5	2.1	1.6	1.3	2.5	3.4	5.5	4.7
		Weighted Rating	4.2	3.0	3.6	1.6	2.6	4.7	5.4	5.1	4.4	5.2	4.3	3.1	3.6	1.4	3.2	4.1	6.4	5.4
		Service Factor	63.4	59.5	60.0	37.9	55.4	67.8	69.5	69.2	63.5	69.9	62.7	58.3	51.2	36.6	54.1	64.5	72.0	73.1

TABLE 3
SERVICE FACTORS AND TERMINAL RATINGS
1962 Performance Paints*

	1961 Service Factor 373 Days	Paint Number	1962 Service Factors		Terminal Percent of Best	Qualification Tests (1)
			181 days	364 days		
WHITE PAINTS	69.5	184	78.5	67.7	100.0	P
	63.6	182	77.6	66.2	97.8	P
	38.5	176	75.5	65.2	96.3	P
	--	164 (c)	76.3	64.9	95.9	NP
	62.0	178	73.4	64.4	95.1	P
	65.3	174	74.2	63.5	93.8	P
	50.7	172 (c)	73.2	59.2	87.4	NP
	53.6	180 (c)	72.9	57.0	84.2	NP
	43.7	168	66.0	48.7	71.9	P
	--	166 (b)	69.2	42.8	63.2	P - Paint P - Beads
	--	186 (c)	62.8	42.5	62.8	NP
	55.5	170 (c)	55.5	39.1	57.8	NP
	--	188 Exp. (c)(d)	77.7	77.1	113.9	NP
	61.8	200 Exp. (c)	76.0	67.6	99.8	--
	--	202 Exp. (c)	78.1	63.3	93.5	--
	61.2	198 Exp.	74.4	62.9	92.9	--
	62.4	196 Exp.	73.0	60.9	89.9	--
	60.6 (a)	1962 Acceptance	79.6	63.9	94.4	P
YELLOW PAINTS	65.3	183	78.7	69.9	100.0	P
	54.2	177	77.9	69.5	99.4	P
	66.1	179	79.4	69.2	99.0	P
	66.1	175	77.0	67.8	97.0	P
	46.2	181 (c)	74.9	63.5	90.8	NP
	--	165	77.2	63.4	90.7	P
	76.2	185	74.7	62.9	89.7	P
	42.9	169	73.8	60.0	85.8	P
	--	167 (b)	78.3	60.0	85.8	P - Paint P - Beads
	--	187	75.8	58.3	83.4	NP
	46.4	173	70.7	55.4	79.3	P
	56.3	171 (c)	57.1	37.9	54.2	NP
	--	201 Exp. (c)	78.6	72.0	103.0	--
	--	199 Exp.	76.8	64.5	92.3	--
	63.1	197 Exp. (c)	66.3	54.1	77.4	--
	--	189 Exp. (c)(d)	60.9	51.2	73.2	--
	60.1	195 Exp. (c)	50.9	36.6	52.4	--
	66.2 (a)	1962 Acceptance	83.6	73.1	104.6	P

* All paints applied at rate of 16.5 gal per mile of 4-in. stripe; 6 lb of MSHD Type 3 beads dropped-on per gallon. Field areas same as in 1961 tests.

(1) P = passing: NP = not passing.
(a) Values obtained in 1960 tests using two different areas than in 1962 tests.
(b) Paints supplied with own beads.
(c) Applied in fewer than four field areas.
(d) Two-component paint.

Experimental Paints

Table 3 on white experimental paints shows that: a) the two-component epoxy paint having a 3-hour drying time had a very good rating, b) the chlorinated rubber-aklyd vehicle paint had a good rating, c) the Pennsylvania white had a good to fair rating, and d) whites, representing purchases by City of Detroit and Wayne County, had good to fair ratings, but were not in the best grouping.

Table 3 on yellow experimental paints shows that: a) the chlorinated rubber-aklyd vehicle paint had a very good rating, b) the Detroit yellow had a good rating, c) the Wayne County yellow had a fair rating, d) the two-component epoxy had a fair to poor rating, and e) the one-component epoxy had a poor rating because of application problems from poor sprayability.

Cooperative Tests with Detroit and Wayne County

The Traffic Control Devices Committee met with representatives of City of Detroit and Wayne County in Lansing on January 15, 1962, to review contract arrangements for striping of highways in Detroit and Wayne County. By Committee request, the Traffic Paint Subcommittee subsequently met in Detroit on January 30, 1962, with Detroit and Wayne County representatives and worked out details of the Committee-approved cooperative tests (Research Project R-47 G-36(15a)), as follows:

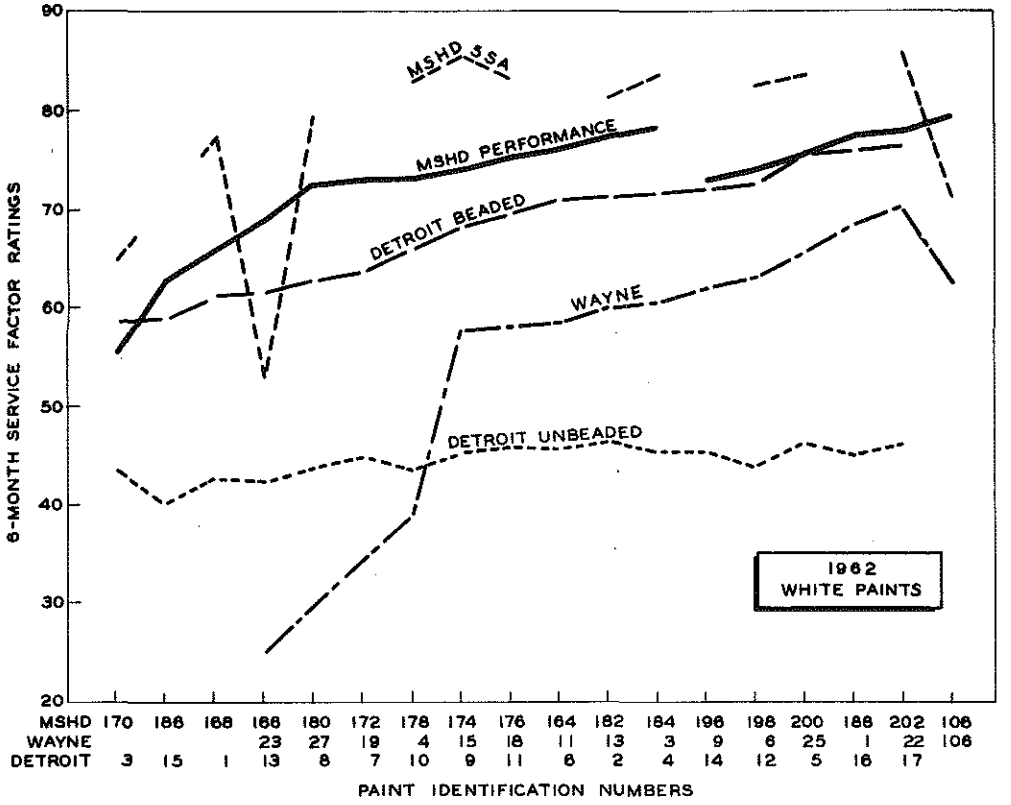
1. The Department would deposit its 1962 performance paints in the sheet-asphalt-surfaced Detroit test area on Oakland Ave.

2. Departmental equipment and operators would assist in depositing Detroit's paints in the same test area.

3. Departmental equipment and operators would assist in depositing Wayne County's paints in two test areas, one on concrete and one on a bituminous surface.

4. A Departmental rating team would make periodic evaluations of the cooperative striping.

5. Detroit and Wayne County would submit samples of paints purchased for their 1962 striping for application in the Department's 1962 road tests. Performance results are reported in Table 3. Results for Departmental, Detroit, and Wayne County tests are plotted graphically for six months of service in Fig. 3, and for Departmental and Detroit tests after twelve months in Fig. 4.



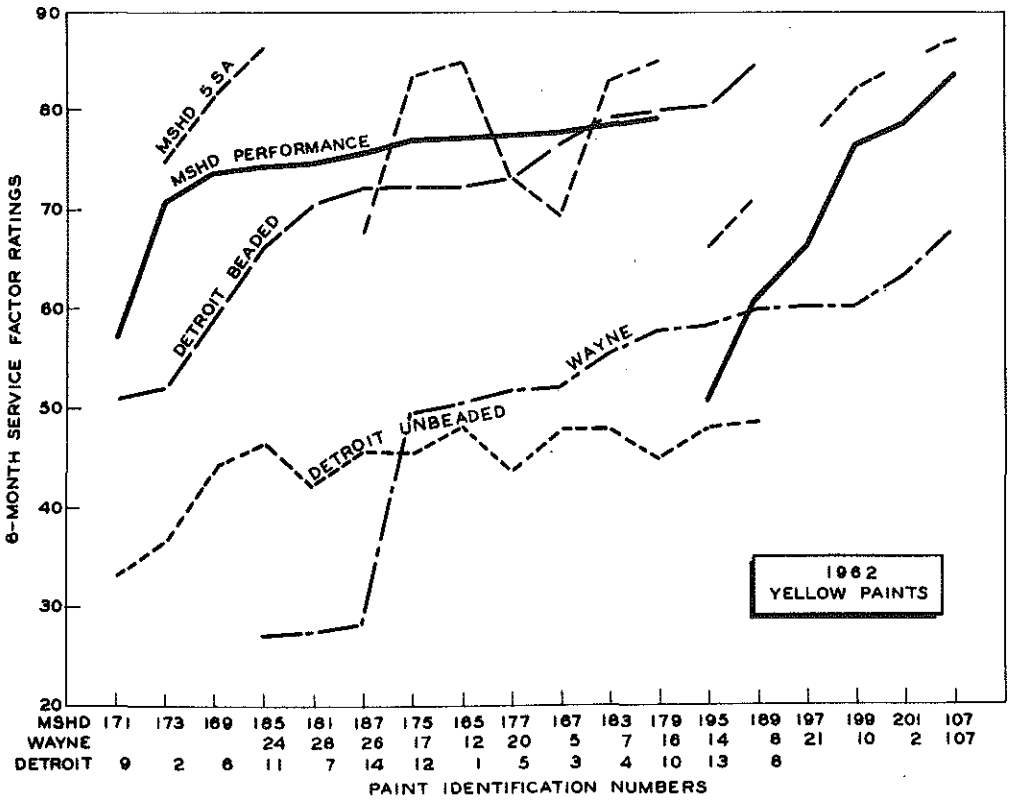
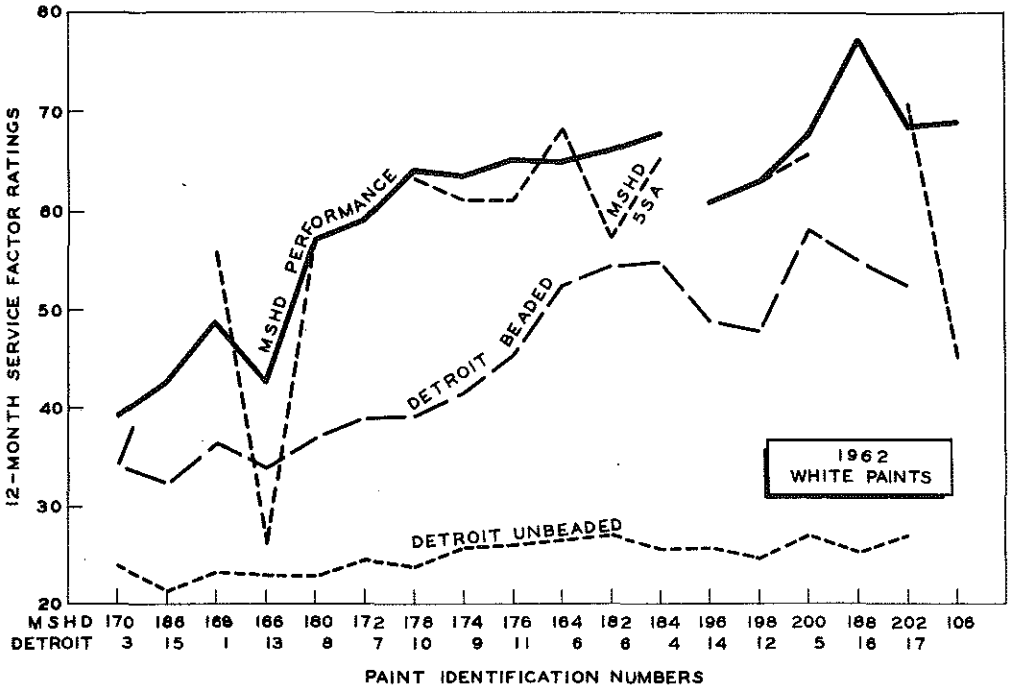


Figure 3. 1962 performance test ratings after six months, including cooperative striping with Detroit and Wayne County.



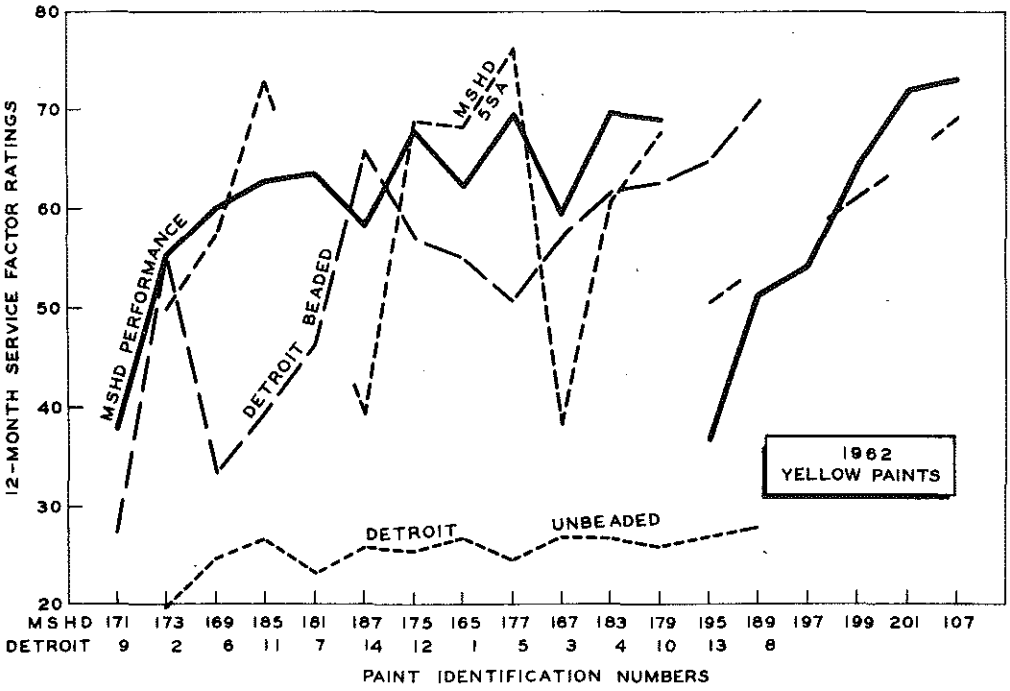


Figure 4. 1962 performance test ratings after one year, including cooperative striping with Detroit.

In drawing conclusions from Figs. 3 and 4, one should realize that results from metropolitan area tests are likely to be less reliable than from Department's standard tests because fewer areas were involved and generally only two or three raters made the urban stripe evaluations. In addition, it is difficult to make night visibility evaluations in Detroit where the test area is on a street illuminated with city lighting. However, the graphs do indicate the following results, which are similar to those for 1957 cooperative tests, given in Research Report R-299A:

1. Fig. 3 shows that on the average Wayne County white and yellow stripes had significantly poorer service factor ratings at the six-month level than Department stripes a) in standard performance areas and b) in test section 5SA in Detroit, and also poorer ratings than Detroit's beaded test stripes. Selection of tough roadway areas for the tests partially explains Wayne's lower ratings. The extreme right hand point on Wayne County's graphs represents the Department's control paints, which in the whites rated about equal to fourth best, and in yellows was best in the tests. As customary, Wayne County tests and ratings were terminated at this six-month level.

2. The remainder of Fig. 3 shows comparative performance at the six-month level for other paints in the 1962 tests.

3. Fig. 4, based on twelve-month ratings, shows that:

(a) Departmental test paints, on the average, performed about as well in Detroit as in standard rural performance areas, despite a higher traffic volume in Detroit.

(b) Individual Department test paints generally did not have the same relative ratings in rural performance areas as in Detroit. The Department's white control paint had a poor rating in Detroit.

(c) On the average, Detroit's beaded stripes received lower ratings than the Department's in the same Detroit test area.

(d) Beading of Detroit test paints significantly improved performance ratings.