

1961 PERFORMANCE TESTS  
OF WHITE AND YELLOW TRAFFIC PAINTS

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

Research Laboratory Division  
Office of Testing and Research  
Research Project R-47 G-36(14)  
Report No. R-399

LAST COPY  
DO NOT REMOVE FROM LIBRARY

Michigan State Highway Department  
John C. Mackie, Commissioner  
Lansing, November 1962

## 1961 PERFORMANCE TESTS OF WHITE AND YELLOW TRAFFIC PAINTS

Each of eleven producers submitted one white and one yellow traffic paint for the 1961 tests. Experimental traffic paints in the tests included: (a) a white paint used by City of Detroit, (b) a white and a yellow paint used by Wayne County, (c) one white epoxy-amine and a white polyurethane, both two-component, and a white chlorinated rubber-alkyd paint, and (d) two yellows in continuation of the Laboratory's evaluation of alkyd resin based paints. Also under experimental evaluation were some special high-index, high-density, large beads on several stripes in the test areas.

The eleven producers asked to submit paints for the tests, all of whom complied, were the following:

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. Glidden Co. of Cleveland
6. Jaegle Paint & Varnish Co. of Philadelphia
7. O'Brien Corp. of South Bend
8. Plas-Chem Corp. of St. Louis
9. Prismo Safety Corp. of Huntingdon, Pa.
10. Stiles Paint Co. of Kalamazoo
11. Truscon Laboratories of Detroit

### Qualification Tests

Two of the producers had paints that did not meet some pre-stripping qualification requirements. These were deposited as stripes in fewer than the standard four areas, i.e., they were handled as experimental paints. All regular, non-experimental paints meeting the qualification requirements were deposited in the standard four areas.

Conformance to qualification requirements was determined in accord with governing specifications dated May 2, 1960, with an attachment of May 18, 1960. Laboratory qualification tests cover color, reflectivity,

consistency, bleeding, settling and vehicle stability, while the field qualification tests cover drying time of the traffic paints and applicability in regular highway striping equipment.

TABLE 1  
QUALIFICATION TEST RESULTS  
1961 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			
W H I T E	82	--	93.2	75	6.0	4.6	7.5	26	S
	84	--	82.4	72	5.7	4.3	7.5	24	S
	86	--	81.1	76	5.0	4.0	7.0	31	S
	88	--	81.0	74	5.7	4.2	8.5	23	S
	90	--	78.0	77	5.0	4.0	8.5	32	S
	92	--	81.6	81	5.7	3.6	6.0	27	S
	94	--	89.2	77	3.3	5.0	2.5	26	NS
	96	--	89.3	82	5.3	4.2	8.5	34	S
	98	--	88.5	76	5.3	4.8	8.0	34	S
	100	--	89.2	77	5.0	4.5	8.5	36	S
	102	--	87.2	72	5.3	5.0	8.5	22	S
	104	--	87.2	79	6.3	3.6	9.0	38	--
	106*	--	---	---	---	---	---	74	--
	108*	--	---	---	---	---	---	34	--
119	--	88.1	70	---	---	8.0	36	--	
121	--	87.3	66	---	---	8.0	36	--	
Y E L L O W	83	Po	59.4	68	5.3	5.3	7.0	28	S
	85	Po	53.3	71	7.0	4.8	8.0	24	S
	87	Pr	51.0	81	5.0	4.8	7.0	29	S
	89	Po	51.4	72	6.3	5.3	8.0	23	S
	91	Fg	59.2	63	7.0	4.3	8.5	32	NS
	93	Po	57.9	71	6.3	4.8	6.0	29	S
	95	Pr	60.0	72	3.3	8.0	2.0	33	NS
	97	Pg	59.5	80	8.3	5.3	9.0	30	S
	99	Pg	61.6	76	8.0	6.0	8.5	30	S
	101	Po	58.6	73	5.0	7.0	8.0	36	S
	103	Po	58.7	80	7.0	7.0	9.0	33	S
	105	Po	56.2	70	---	---	---	35	--
	107	Po	57.7	62	---	---	---	39	--
	120	Pg	59.7	77	---	---	9.0	32	--

\* 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  
NS = Not satisfactory } as determined by field crew

Results of the qualification tests are given in Table 1, which shows, as reported to the Committee by letter on March 30, 1962, that the following paints failed to meet one or more of the requirements:

White Paints

- No. 90 Excessively low reflectivity.
- No. 92 Excessive bleeding on tar base.
- No. 94 Excessive bleeding on asphalt base and excessively low settling index, about which field crew complained.

Yellow Paints

- No. 83 Borderline low viscosity.
- No. 91 Excessively low viscosity and did not match color standard, about which field crew complained.
- No. 95 Excessive bleeding on asphalt base and excessively low settling index, about which field crew complained.
- No. 97 Borderline in matching color standard.

Field Application

Paints submitted for the 1961 tests were deposited in field areas between August 15 and 22, 1962. Two of the field areas were moved from a site used for striping in the three previous years (US 127 south of Lansing) because of its proximity to the construction area of the I 96 interchange. The areas (Fig. 1), covering two lanes of four-lane roadways, were located as follows:

- No. 1 M 78, 3 miles east of East Lansing, concrete, south roadway.
- No. 2 M 78, 3 miles east of East Lansing, bituminous, north roadway.
- No. 3 US 27 - M 78, 0.5 mile south of Lansing, concrete, west roadway.
- No. 4 US 16, 2 miles east of East Lansing, bituminous, north roadway.

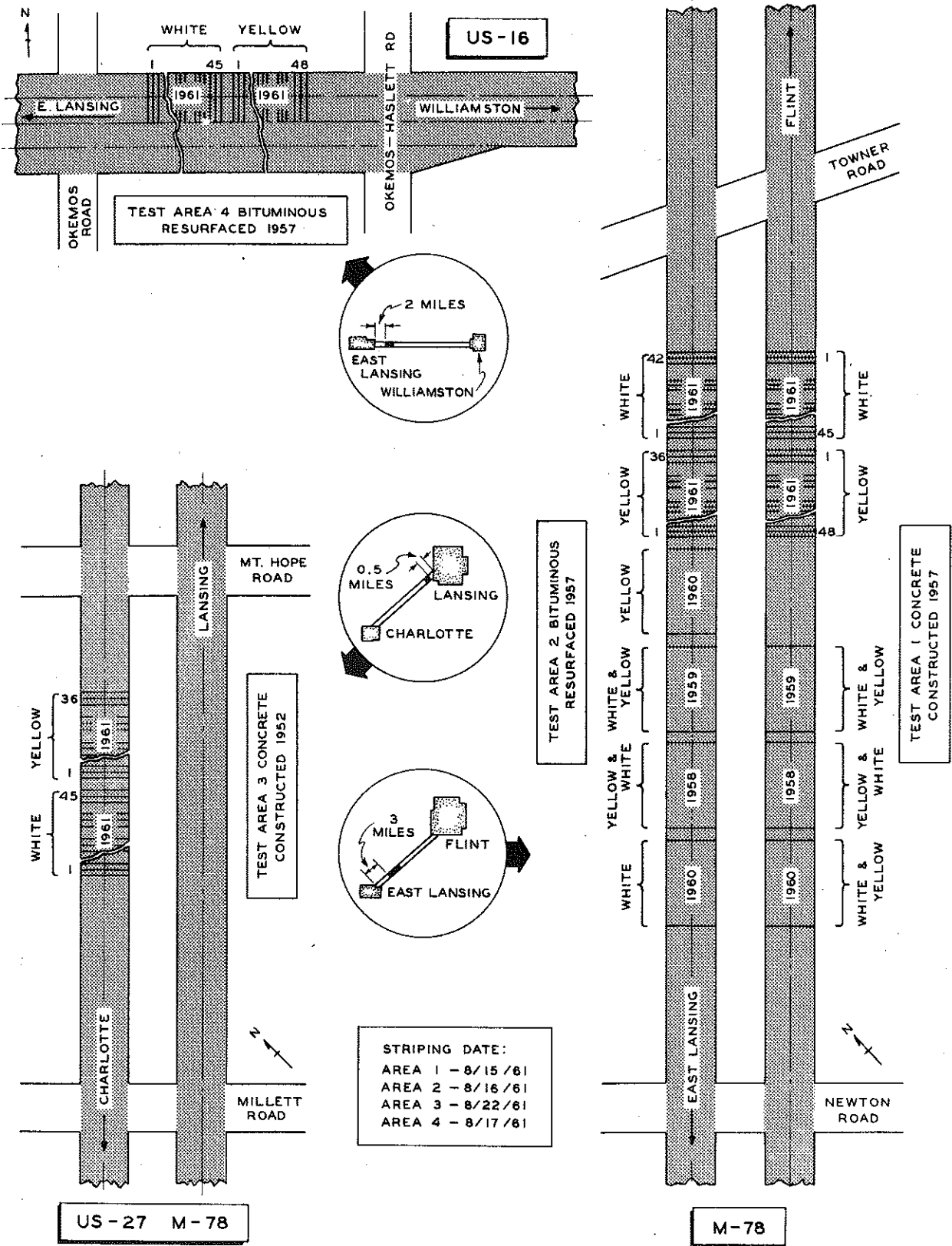


Figure 1. Location of 1961 traffic paint performance test areas.

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.

#### Field Performance Ratings

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

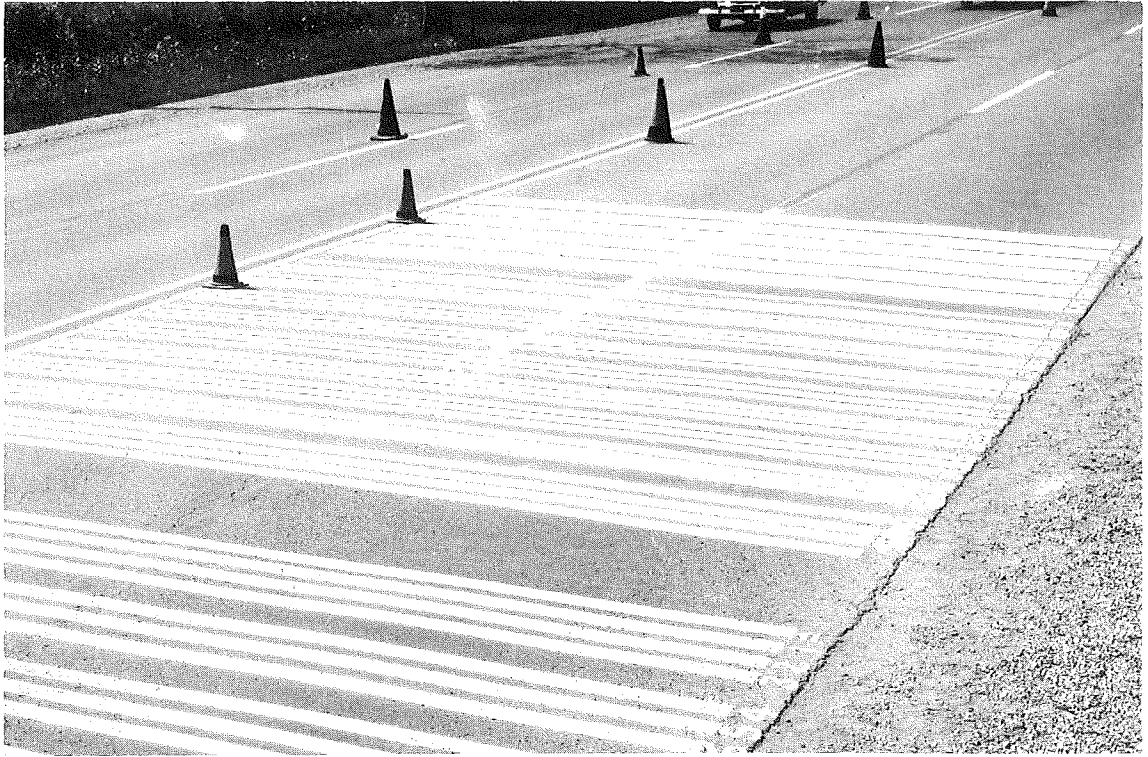
Quality ratings from the four test areas, averaged from the evaluations of the four observers, are tabulated for the tested paints in Table 2. These averaged quality values for the individual paints were then used to calculate the respective weighted ratings.

#### Field Test Results

Table 3 summarizes performance and evaluation values for all 1961 tested paints listed in descending order of terminal "Percent of Best" values. Half-year and one-year service factor values for the tested paints are listed in that 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 three white and two yellow paints, of the eleven submitted by producers, failed to meet all specification requirements, although a few others were borderline. This continues an improvement that began several years ago with the Committee's issuance of notices to producers receiving bid requests.

The Table 3 column listing the terminal service factor values of paints in the previous year's (1960) tests 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 1961 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 three points higher than did their prototypes submitted for the 1960 performance tests.



Appearance directly after application;  
yellow stripes foreground, white stripes background.



Appearance of whites after one year of exposure.

Figure 2. 1961 performance stripes; Test Area 4 (bituminous) on US 16,  
showing initial and terminal condition.

**TABLE 2**  
**PERFORMANCE RATING DATA**  
**1961 Tests**

Exposure Days	Factor Evaluated	White Paint Numbers																	
		82	84	86	88	90	92	94	96	98	100	102	104	106	108	119	121	134	
WHITE PAINTS	12	General Appearance	9.0	8.8	9.1	8.7	9.2	8.8	9.7	8.7	8.7	9.2	8.0	9.0	9.9	8.4	9.7	9.4	8.5
		Durability	9.5	9.8	10.0	9.7	9.9	9.8	9.8	10.0	10.0	10.0	9.0	10.0	10.0	10.0	9.9	10.0	10.0
		Night Visibility	7.3	8.8	8.1	8.9	5.8	8.2	8.4	9.4	9.4	8.7	8.0	8.1	4.3	10.0	7.4	7.4	9.4
		Weighted Rating	8.4	9.2	9.0	9.2	7.8	8.9	9.1	9.6	9.6	9.3	8.4	9.0	7.1	9.8	8.6	8.6	9.6
	91	General Appearance	7.5	8.3	8.5	8.0	8.4	7.8	8.4	8.1	8.1	8.9	6.5	8.1	3.4	8.2	8.2	8.5	7.7
		Durability	8.1	9.5	9.8	9.1	9.3	9.0	9.1	9.8	9.8	9.8	7.1	9.4	3.7	9.8	9.5	9.6	9.6
		Night Visibility	6.1	6.4	7.2	6.0	4.0	6.4	7.1	7.5	7.3	7.6	5.1	7.4	1.4	8.1	6.5	6.5	7.6
		Weighted Rating	7.0	7.8	8.4	7.4	6.6	7.6	8.0	8.5	8.4	8.6	6.0	8.3	2.5	8.8	7.9	7.9	8.4
	186	General Appearance	3.2	4.4	7.4	4.4	5.5	4.9	5.3	6.2	6.2	6.2	2.7	5.5	1.5	6.6	6.2	6.1	6.0
		Durability	3.6	4.9	7.7	4.8	6.3	5.5	5.6	7.0	6.9	6.5	3.0	6.3	2.0	7.4	6.6	6.1	6.9
		Night Visibility	2.9	3.2	5.9	3.0	4.8	4.0	5.0	4.3	4.8	5.5	2.3	5.2	1.4	4.3	5.8	5.8	4.4
		Weighted Rating	3.2	4.0	6.8	3.9	5.5	4.7	5.3	5.6	5.8	6.0	2.6	5.7	1.6	5.8	6.2	6.0	5.6
		Service Factor	68.3	71.9	81.0	69.6	65.8	71.6	75.8	80.1	80.1	81.0	57.4	77.7	34.0	82.8	76.2	76.1	79.6
	275	General Appearance	2.8	3.6	6.8	3.4	4.8	4.2	3.8	5.6	5.6	5.2	2.2	5.0	1.1	6.2	5.0	4.8	5.4
		Durability	3.4	4.3	7.4	3.9	5.6	4.6	4.4	6.4	6.5	5.8	2.6	6.0	1.4	7.1	5.8	5.4	6.2
		Night Visibility	1.4	1.6	4.3	1.2	3.6	2.4	3.1	2.2	3.0	4.1	1.3	3.2	0.8	2.4	3.7	3.6	2.4
		Weighted Rating	2.3	2.9	5.8	2.5	4.5	3.5	3.7	4.2	4.7	4.9	1.9	4.5	1.1	4.7	4.7	4.4	4.2
	373	General Appearance	2.2	3.0	6.1	2.7	4.0	3.1	2.8	4.7	4.7	4.4	1.8	4.7	1.2	5.5	4.0	3.9	4.6
		Durability	2.3	3.4	6.4	2.8	5.1	3.7	3.5	5.4	5.6	5.2	2.2	5.2	1.3	5.8	5.0	4.7	5.1
Night Visibility		1.1	1.0	3.5	0.9	3.3	1.9	2.1	2.0	2.4	3.4	0.9	2.5	0.7	1.4	3.3	3.2	1.9	
Weighted Rating		1.7	2.2	4.9	1.8	3.7	2.7	2.7	3.6	3.9	4.2	1.5	3.8	1.0	3.5	4.0	3.9	3.4	
Service Factor		43.7	50.7	69.5	48.0	55.5	53.6	56.9	62.0	63.6	65.3	38.5	61.8	22.9	64.5	62.4	61.2	61.4	
YELLOW PAINTS	12	General Appearance	9.1	8.7	9.3	8.8	8.7	8.8	9.4	9.3	9.2	9.3	8.8	9.4	9.4	8.9	9.3	8.9	
		Durability	9.3	9.7	10.0	9.1	9.5	9.4	10.0	10.0	9.8	10.0	9.5	9.9	10.0	9.5	9.8	9.4	
		Night Visibility	7.2	9.2	8.5	7.7	8.5	7.5	8.9	9.8	9.2	8.4	8.4	8.1	8.0	9.4	9.6	8.4	
		Weighted Rating	8.2	9.4	9.2	8.4	8.9	8.4	9.4	9.8	9.4	9.1	8.9	9.0	8.9	9.4	9.6	8.8	
	91	General Appearance	8.0	7.5	8.5	6.5	7.9	7.6	8.3	8.1	8.3	8.6	7.9	8.6	8.8	7.9	8.4	7.8	
		Durability	8.6	9.0	9.9	7.0	8.9	8.5	9.3	9.8	9.6	9.6	8.6	9.5	9.6	9.2	9.8	8.8	
		Night Visibility	6.1	6.4	7.8	4.4	6.6	5.9	7.2	7.9	7.9	6.4	6.3	6.8	6.8	7.6	7.9	3.8	
		Weighted Rating	7.3	7.6	8.7	5.6	7.6	7.1	8.2	8.7	8.6	7.9	7.4	8.1	8.1	8.3	8.7	6.2	
	186	General Appearance	3.8	4.2	7.8	2.5	5.5	4.2	4.8	7.2	7.2	7.1	5.5	6.0	5.8	6.3	6.6	5.3	
		Durability	3.7	4.4	8.6	2.4	5.6	4.5	5.0	7.4	7.4	7.5	5.8	6.3	6.1	6.6	7.0	5.4	
		Night Visibility	2.4	2.5	6.8	1.7	4.7	3.2	3.4	5.2	5.0	5.7	4.1	4.8	4.5	5.0	5.2	1.8	
		Weighted Rating	3.1	3.4	7.6	2.1	5.1	3.8	4.2	6.3	6.2	6.6	4.9	5.5	5.3	5.8	6.1	3.6	
		Service Factor	64.4	69.4	85.5	54.0	73.2	65.9	79.4	82.8	81.9	78.4	71.2	76.3	79.6	79.0	82.6	69.2	
	275	General Appearance	2.6	3.2	7.4	1.6	4.5	3.1	3.4	6.2	6.2	6.4	4.4	5.4	5.1	5.6	5.8	4.7	
		Durability	2.8	3.4	8.0	1.6	5.0	3.7	4.2	6.7	7.0	7.0	4.8	5.9	5.4	6.4	6.5	5.2	
		Night Visibility	1.2	1.1	5.2	0.8	2.8	1.5	2.0	3.0	2.7	3.9	2.9	3.2	2.7	3.4	3.3	1.2	
		Weighted Rating	2.0	2.2	6.5	1.2	3.8	2.5	3.0	4.8	4.8	5.4	3.8	4.5	4.0	4.8	4.8	3.2	
	373	General Appearance	2.2	2.7	7.2	1.4	3.8	2.6	2.4	5.6	5.5	5.6	3.6	5.3	4.1	4.9	5.3	4.0	
		Durability	2.5	2.6	7.7	0.8	4.3	2.8	2.8	6.0	6.0	6.0	3.8	4.3	4.4	5.4	5.6	4.6	
		Night Visibility	0.8	0.6	4.7	0.8	1.9	0.9	0.9	2.1	1.7	2.6	1.5	1.9	1.7	1.9	2.3	0.9	
Weighted Rating		1.6	1.6	6.2	0.9	3.0	1.8	1.8	4.0	3.8	4.3	2.6	3.2	3.0	3.6	3.9	2.7		
Service Factor		42.9	46.4	76.2	33.5	56.3	46.2	54.5	66.1	65.3	66.1	54.2	60.1	60.0	63.1	65.7	49.7		



**TABLE 3**  
**SERVICE FACTORS AND TERMINAL RATINGS**  
**1961 Performance Paints\***

	1960 Service Factor 373 days	Paint Number	1961 Service Factors		Terminal Percent of Best	Qualification Tests (1)
			186 days	373 days		
<b>WHITE PAINTS</b>	66.4	86	81.0	69.5	100.0	P
	----	100	81.0	65.3	94.0	P
	50.5	98	80.1	63.6	91.5	P
	53.7	96 (b)	80.1	62.0	89.2	{ P - Paint P - Beads
	51.7	94 (c)	75.8	56.9	81.9	NP
	62.8	90	65.8	55.5	79.9	NP
	34.8	92	71.6	53.6	77.1	NP
	50.1	84	71.9	50.7	72.9	P
	34.3	88	69.6	48.0	69.1	P
	42.3	82	68.3	43.7	62.9	P
	60.6	102	57.4	38.5	55.4	P
	----	104 Exp.	77.7	61.8	88.9	NP
	----	106 Exp. (c)	34.0	22.9	32.9	---- (d)
	----	108 Exp. (c)	82.8	64.5	92.8	---- (d)
	----	119 Exp. (c)	76.2	62.4	89.8	----
----	121 Exp. (c)	76.1	61.2	88.1	----	
59.8 (a)	1961 Acceptance	79.6	61.4	88.3	P	
<b>YELLOW PAINTS</b>	66.5	87	85.5	76.2	100.0	P
	63.9	97 (b)	82.8	66.1	86.7	{ P - Paint P - Beads
	----	101	78.4	66.1	86.7	P
	58.7	99	81.9	65.3	85.7	P
	66.5	91 (c)	73.2	56.3	73.9	NP
	39.3	95 (c)	79.4	54.5	71.5	NP
	66.2	103	71.2	54.2	71.1	P
	49.1	85	69.4	46.4	60.9	P
	49.3	93	65.9	46.2	60.6	P
	41.6	83	64.4	42.9	56.3	P
	24.3	89	54.0	33.5	44.0	P
	48.9	105 Exp.	76.3	60.1	78.9	----
	48.8	107 Exp.	79.6	60.0	78.7	----
	----	120 Exp. (c)	79.0	63.1	82.8	----
	62.3 (a)	1961 Acceptance	82.6	65.7	86.2	P
----	1961 Acceptance (c)	69.2	49.7	65.2	{ P - Paint NP - Beads (special)	

\* 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. Two field areas different than in 1960 tests.

- (1) P = passing; NP = not passing.
- (a) Values obtained in 1959 tests using two different areas than in 1961 tests.
- (b) Paints supplied with own beads, meeting Type III requirements.
- (c) Applied in fewer than four field areas.
- (d) Two-component.

These higher ratings, despite a cold and snowy 1961-62 winter, are believed due to transfer of two areas from US 127 to the comparatively milder ones on US 16 and US 27 - M 78.

Another reason for the generally higher ratings is that producers are apparently responding by submitting higher quality paints, which is in accord with special notices attached to the requests for bids stating that greater weight would be attached to quality of paint being evaluated, as authorized by the Committee at its meeting of May 9, 1960.

No recommendation is being made concerning regular performance paints to be selected for bids.

### Experimental Paints

Table 3 on white experimental paints shows that: (a) chlorinated rubber-alkyd paint received a good field rating, but did not meet all requirements, (b) the two-component polyurethane paint, because of poor adhesion, received a very poor field rating, (c) the two-component epoxy, formulated as a traffic paint, received a good field rating, and (d) paints representing purchases by City of Detroit and Wayne County, received good field ratings, but were not in the best grouping.

Table 3 data on yellow experimental paints show that the Laboratory's alkyd resin based paints received a good field rating, as did the paint representing purchase by Wayne County.

An examination of the last two entries in Table 3 shows the effect on field ratings of the special beads submitted for evaluation because of an alleged ability to impart night visibility to stripes in rainy weather. Observations show that test beads do improve this quality on new striping, but their large size induces early dislodgement which subsequently appreciably lowers service factor ratings. Laboratory data on test beads are presented in Table 4.

TABLE 4  
 LABORATORY DATA ON TEST BEADS  
 Identification No. 61 MR-137

MSHD Specification Requirements	Type III Beads	Test Beads
Color	Clear	Slight yellow tint
Gradation, percent passing		
Sieve Nos. 20	100	82.4
30	100	32.2
40	90-60	3.0
70	60-30	0.0
230	5-0	
Specific Intensity, cp/ft/sq ft		
Weight Ratio	min. 0.75	1.14
Volume Ratio	min. 0.75	1.49
Specific Gravity	ca. 2.5	4.24
Index of Refraction	min. 1.5	1.92
Moisture-Resistant Treatment	----	Slight