1960 PERFORMANCE TESTS ON WHITE AND YELLOW TRAFFIC PAINTS

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Each of ten producers submitted one white and one yellow traffic paint for the 1960 performance tests. Experimental traffic paints in the tests included: a) two white epoxy-amine (two-component) paints, and b) four yellows, in continuation of the Research Laboratory Division's evaluation of alkyd resin based traffic paints.

The producers of the test paints were:

1. Acme Quality Paints, Inc. of Detroit
2. Baltimore Paint & Chemical Corp. of Baltimore
3. Boydell Brothers Co. of Detroit
4. Glidden Co. of Cleveland
5. Jaegle Paint & Varnish Co. of Philadelphia
6. O'Brien Corp. of South Bend
7. Plas-Chem Corp. of St. Louis
8. Prismo Safety Corp. of Huntingdon, Pa.
9. Stiles Paint Co. of Kalamazoo
10. Truscon Laboratories of Detroit

Producers who failed to return submitted bid forms, and therefore to supply paint for these tests were:

1. Berry Brothers Co. of Detroit
2. Silver Lead Paint Co. of Lansing

Qualification Tests

This year all the submitted paints were deposited in field areas for performance evaluation. Subsequently all regular, non-experimental paints were evaluated for conformance with qualification requirements given in the governing specifications dated May 2, 1960, with attachment of May 18, 1960. Laboratory qualification tests cover color, reflectivity, consistency, bleeding, settling, and vehicle stability (specification attachment), while the field qualification tests cover drying time of the traffic paints and applicability in regular highway striping equipment.

Results of the qualification tests are given in Table 1, which shows, as reported to Committee by letter of March 2, 1961, that the following paints failed to meet one or more of the requirements as indicated:

White Paints

No. 96 Excessive bleeding on tar base; low settling index about which field crew complained.

TABLE 1
QUALIFICATION TEST RESULTS
1960 Performance Paints

	Paint No.	Color Quality*	Reflectivity, percent	Consistency, K. U. - 77 F	Bleeding Index		Settling Index	Drying Time Field - Avg. Minutes	Applicability in Striping Equipment***
					Asphalt	Tar			
WHITE	90	--	81.3	79	6.3	4.8	8	33	S
	92	--	83.1	75	7.0	4.0	8	32	S
	94	--	83.8	74	4.3	4.0	9	23	S
	96	--	80.2	77	6.0	3.0	5	33	NS
	98	--	81.5	76	5.0	4.3	8	27	S
	100	--	89.4	82	6.0	4.7	7	28	S
	102	--	79.2	86	5.7	5.0	9	32	NS
	104	--	79.2	79	6.0	4.3	8	35	S
	106	--	85.8	78	5.7	4.0	9	35	S
	108	--	94.0	82	7.0	5.0	9**	27	S
	117	--	----	--	---	---	-	300	-
	118	--	----	--	---	---	-	130	-
YELLOW	91	Pg	56.2	85	5.3	7.0	8	37	S
	93	Po	52.9	82	9.3	5.0	9	38	S
	95	Po	53.3	70	3.7	6.0	6	24	NS
	97	Pg	57.1	78	8.7	5.3	7	34	S
	99	Pg	59.9	76	7.0	7.7	9	31	S
	101	Pg	59.9	77	9.7	7.3	8	33	S
	103	Pg	53.3	67	8.7	6.7	8	42	NS
	105	Po	54.6	65	7.7	5.7	7	41	NS
	107	Po	56.7	75	8.7	5.7	9	37	S
	109	Pg	59.0	73	8.0	6.7	9	39	S
	110	Po	57.7	--	6.7	6.7	-	42	-
	111	Pg	57.0	--	2.3	5.7	-	39	-
	114	Pg	56.0	--	5.0	7.0	-	37	-
	115	Pg	56.9	--	2.7	7.7	-	37	-

* P = passes color requirements
o = exact color match with standard
g = green side of standard

** Fails vehicle stability test

*** S = satisfactory
NS = not satisfactory as determined by field crew

No. 98 Beads submitted with paint were slightly coarser on Nos. 30 and 70 sieves than MSHD requirements; also were treated to be "Free-Flow."

No. 102 Borderline low reflectivity and borderline high viscosity.

No. 108 Failed to pass vehicle stability test.

Yellow Paints

No. 95 Excessive bleeding on asphalt base and borderline low viscosity about which field crew complained.

No. 99 Beads submitted with paint were slightly coarser on Nos. 30 and 70 sieves than MSHD requirements; also were treated to be "Free-Flow."

No. 103 Excessive low viscosity and borderline field drying time about which field crew complained.

No. 105 Excessive low viscosity, about which field crew complained.

Field Application

Paints submitted for the 1960 tests were deposited in field areas between August 17 and 24, 1960. The field areas, including concrete and bituminous roadways, were the same as in 1958 and 1959, with specific locations shown in Fig. 1. The areas, covering two lanes of divided four-lane roadways, were located as follows:

No. 1 M 78, three miles east of East Lansing, concrete, south roadway.

No. 2 M 78, three miles east of East Lansing, bituminous, north roadway.

No. 3 US 127, between Miller Rd and Pennsylvania Ave extention, concrete, east roadway.

No. 4 US 127, between Miller Rd and Pennsylvania Ave extention, bituminous, west roadway.

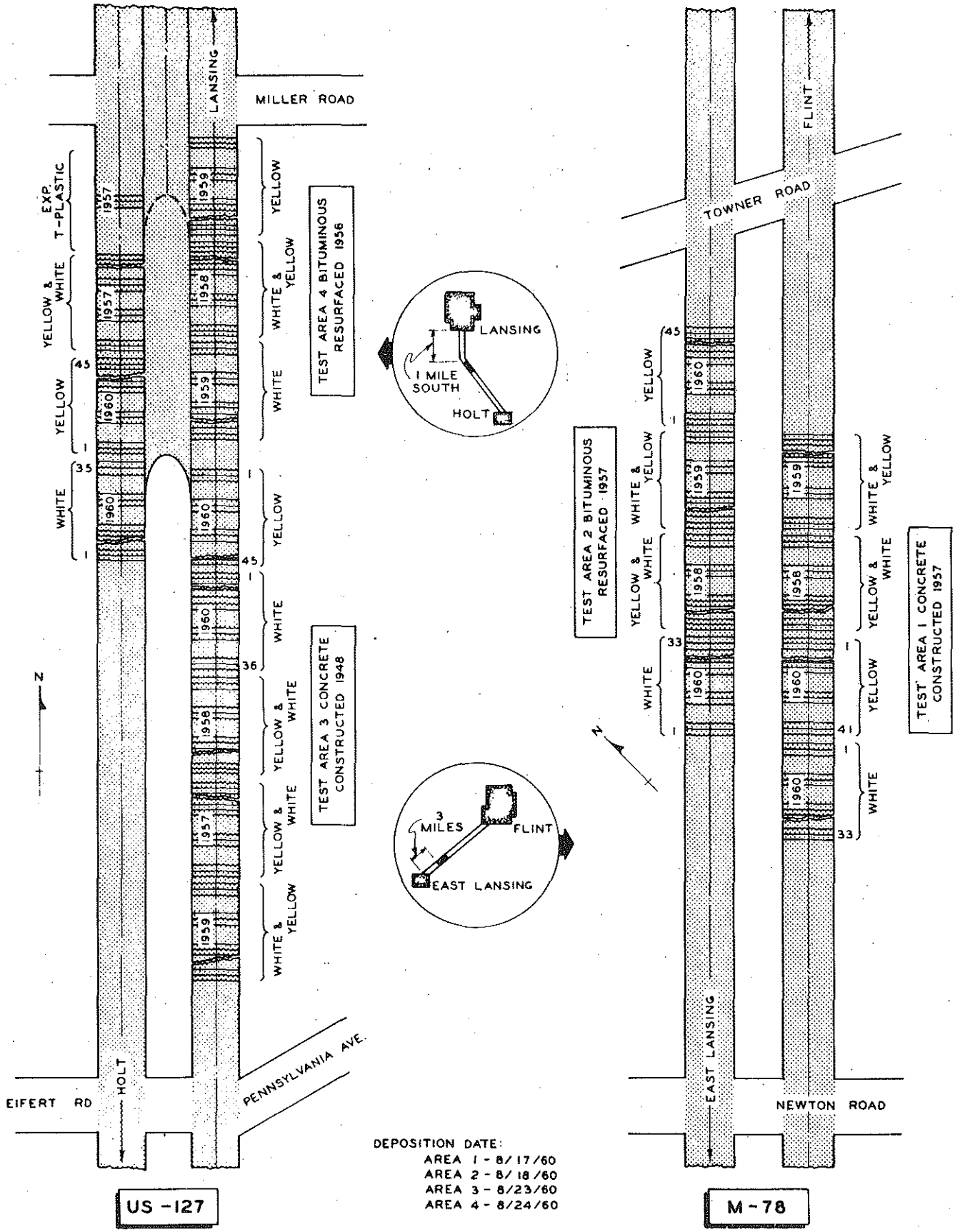


Figure 1. Location of 1960 traffic paint performance test areas.

Each test paint was deposited as a series of three transverse stripes; the standard paints in all four areas, the experimental paints usually in fewer areas.

All paints were applied as stripes of 15-mil wet thickness, which is equivalent to a paint application rate of 16.5 gal per mi of 4-in. stripe, since no other stripe thickness recommendations were received from any of the producers. In accordance with governing specifications, reflectorizing beads were added to all stripes by the "drop-on" method in the ratio of 6 lb per gal of paint, with glass beads conforming to MSHD Type III Specifications, except for Prismo paints which received beads furnished as a complement. Latter beads were somewhat coarser than Type III and were treated to be "Free-Flow."

All paints were applied across two highway lanes, traffic and passing, as 4-in. transverse stripes. The order of application of test paints was again rotated in the four areas to compensate for any inequalities arising from differences in the time or order of application. The stripes were identified only by numbers which increased consecutively in any area in order of application.

Detailed observations again were made by Laboratory personnel during application of test paints, including air temperature, relative humidity, and weather conditions.

No difficulty was experienced in depositing any of the standard paints. The two white, experimental, two-component epoxy paints that were each applied in one test section, dried slowly, and in that process completely overcoated the "drop-on" bead complement. Both of these had additional beads broadcast over the stripes to assure that they would not track over the adjoining test stripes under traffic. Under the circumstances both paints, apparently formulated as gloss enamels and not traffic paints, received somewhat more than the standard ratio of beads.

Forty-five gallon amounts of each standard paint purchased for the tests were applied as longitudinal stripes by the Grand Rapids striping crew to evaluate handling and application characteristics of the paints in highway striping equipment. The crew commented that they encountered some trouble, as cited in Table 1, in applying white paints from Boydell (excessive settling) and Plas-Chem (gray-white); and yellow paints from Glidden (low viscosity), O'Brien (borderline viscosity), and Plas-Chem (low viscosity).

Field Performance Ratings

Test stripes deposited in the four performance areas, two of which are shown in Fig. 2, were rated seven 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 findings of the 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.

Field Test Results

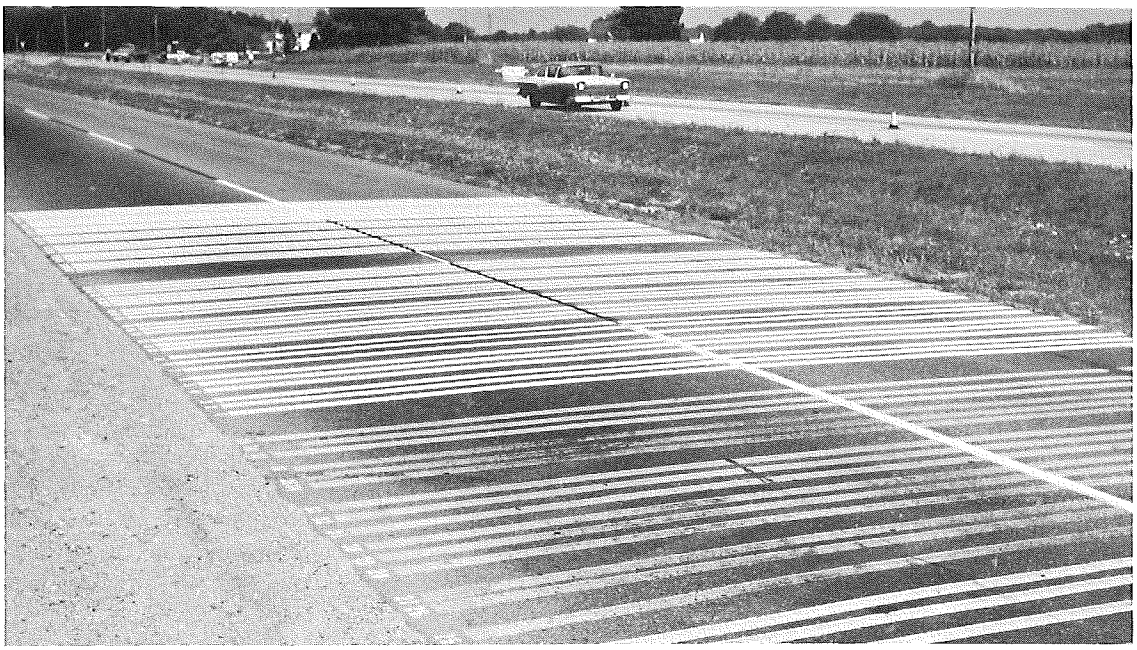
As in previous years there were considerable differences in the quality ratings of the evaluated paints in the four test sections. As before, test paints deteriorated considerably faster in test areas on US 127 than in the other two sections located on M 78, which had about half the traffic density of the former, with the majority of the paints showing fastest deterioration in the concrete test area on US 127.

Table 3 summarizes evaluation values for all 1960 tested paints listed in descending order of terminal "Percent of Best" values. Half-year and one-year service factor values for all test paints are tabulated in that table, which also contains a column tabulating results of the previously mentioned qualification tests.

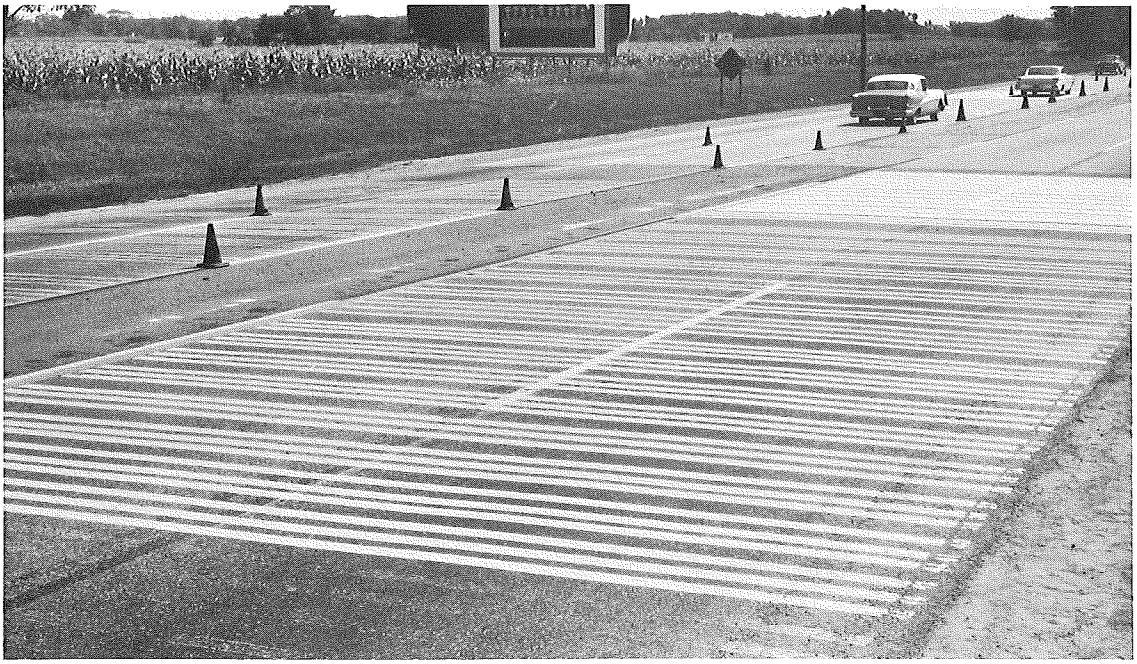
The "Qualification Tests" column in Table 3 shows that three of ten, for both the white and yellow paints, failed to meet all specification requirements. In addition, one producer's paints, submitted as a package of paint and beads, had beads which failed to meet Department specifications, since they were coarser, as shown in Table 4. A review of this column in Table 3 shows that 30 percent of submitted paints are liable to disapproval for bid requests because of failure to meet all specification requirements, in this respect a somewhat better average than usual.

The Table 3 column listing the terminal service factor values of paints for the previous 1959 tests, by the same producers supplying paints for the 1960 tests, is given to permit evaluation of comparative performance of a producer's paints.

As previously, the current tests included stripes of samples of the white and yellow paints purchased for Departmental 1960 roadway striping. This is done for information on reproducibility of ratings, and for a check on analytical methods employed in the laboratory. A comparison of data



Area 2, bituminous; yellow 1960 stripes center and 1959 yellow in foreground.



Area 4, bituminous; white 1960 stripes in background and yellows in foreground.

Figure 2. Performance areas shortly after deposition of 1960 striping

TABLE 2
PERFORMANCE RATINGS DATA
1960 Tests

	Exposure Days	Factor Evaluated	White Paint Numbers												
			90	92	94	96	98	100	102	104	106	108	117	118	128
WHITE PAINTS	7	General Appearance	9.2	9.5	9.4	8.8	8.8	9.0	8.9	9.0	9.0	9.7	9.8	9.5	8.9
		Durability	10.0	10.0	10.0	10.0	10.0	10.0	10:0	10.0	10.0	10.0	10.0	10.0	10.0
		Night Visibility	8.9	6.0	5.8	6.3	9.1	9.8	7.8	7.5	8.1	6.2	4.3	5.2	8.2
		Weighted Rating	9.4	8.0	7.8	8.0	4.4	9.8	8.8	8.7	9.0	8.1	7.1	7.6	9.0
	86	General Appearance	5.9	6.9	5.2	4.6	5.6	6.0	5.7	6.9	6.2	6.3	7.5	6.8	5.9
		Durability	8.8	8.6	6.5	6.3	8.8	8.4	8.8	8.6	8.8	7.5	8.3	8.1	8.8
		Night Visibility	7.7	4.9	4.4	4.7	6.2	6.1	6.8	6.5	7.2	6.7	3.5	3.4	6.8
		Weighted Rating	8.0	6.6	5.3	5.3	7.2	7.0	7.5	7.4	7.7	7.0	5.8	5.6	7.5
	171	General Appearance	5.5	5.9	3.0	2.6	4.8	6.0	4.4	4.8	5.3	3.7	7.8	5.0	5.3
		Durability	7.9	7.8	4.2	3.9	7.0	7.1	6.5	6.2	7.5	4.8	8.8	5.9	8.0
		Night Visibility	5.2	5.2	2.2	2.2	3.3	2.2	4.0	3.6	5.3	3.4	4.8	3.4	5.4
		Weighted Rating	6.3	6.3	3.1	2.9	4.9	4.5	5.0	4.8	6.2	4.0	6.7	4.6	6.4
		Service Factor	79.1	68.6	54.0	54.1	71.9	71.0	72.1	70.5	76.6	65.1	63.7	58.4	76.1
	269	General Appearance	6.1	5.6	1.5	1.7	4.2	4.2	3.6	3.5	5.2	2.2	6.3	4.0	5.3
		Durability	6.8	6.5	1.8	2.0	4.5	4.3	3.9	4.0	5.2	2.3	5.6	4.4	6.1
		Night Visibility	4.4	5.4	1.0	1.2	2.6	1.8	2.6	2.2	3.6	1.5	3.5	2.8	3.9
		Weighted Rating	5.5	5.9	1.4	1.6	3.5	3.0	3.2	3.1	4.5	1.9	4.6	3.6	4.9
	373	General Appearance	5.7	5.4	1.5	1.6	3.9	3.9	2.9	3.2	4.4	1.8	3.3	4.0	5.2
		Durability	6.3	6.4	1.7	1.9	4.6	4.0	3.4	3.4	5.1	2.0	3.8	4.8	5.8
		Night Visibility	3.7	4.4	0.9	0.9	2.2	1.4	1.6	1.4	2.5	1.1	3.6	4.3	3.0
		Weighted Rating	4.9	5.3	1.3	1.4	3.3	2.7	2.5	2.4	3.8	1.5	3.7	4.5	4.3
		Service Factor	66.4	62.8	34.3	34.8	53.6	50.5	51.7	50.1	60.6	42.3	55.5	48.6	62.6

	Exposure Days	Factor Evaluated	Yellow Paint Numbers														
			91	93	95	97	99	101	103	105	107	109	110	111	114	115	129
YELLOW PAINTS	7	General Appearance	9.8	9.3	9.3	9.5	9.4	9.5	9.4	9.4	9.4	9.6	9.6	9.7	9.5	9.8	9.5
		Durability	10.0	10.0	9.4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
		Night Visibility	8.2	7.5	5.3	5.9	9.2	9.9	7.9	6.1	7.4	5.1	5.3	4.8	5.2	4.7	7.5
		Weighted Rating	9.1	8.7	7.3	7.9	9.5	9.9	8.9	8.0	8.6	7.5	7.6	7.4	7.6	7.3	8.7
	86	General Appearance	7.1	6.8	5.2	6.9	6.9	6.5	6.7	6.8	7.0	6.9	6.9	7.1	6.6	6.7	6.9
		Durability	8.7	8.6	5.8	8.3	8.8	8.4	7.9	8.0	8.7	7.7	8.2	8.1	7.9	7.8	8.7
		Night Visibility	7.3	6.8	3.5	5.8	7.3	7.1	5.4	6.0	6.6	5.2	6.1	5.8	5.3	4.9	7.1
		Weighted Rating	7.8	7.5	4.6	6.9	7.9	7.6	6.5	6.9	7.5	6.4	7.0	6.9	6.5	6.2	7.7
	171	General Appearance	5.6	6.2	2.2	4.4	6.5	6.3	3.6	4.4	6.5	3.8	4.7	4.9	4.7	4.4	5.6
		Durability	7.4	8.0	2.7	5.9	8.0	7.6	4.7	6.0	8.0	4.8	6.2	6.3	5.8	5.4	7.7
		Night Visibility	5.0	6.0	0.6	3.7	4.6	3.6	1.9	3.8	6.0	2.8	3.8	4.0	3.6	3.3	5.5
		Weighted Rating	6.0	6.8	1.6	4.7	6.2	5.5	3.2	4.7	6.9	3.7	4.9	5.0	4.6	4.3	6.4
		Service Factor	77.0	78.4	45.4	66.0	78.5	76.3	62.9	66.3	76.1	60.0	66.3	65.2	62.7	60.2	76.4
	269	General Appearance	6.2	6.1	0.5	3.7	6.3	6.0	2.3	3.7	6.1	3.0	3.8	3.9	3.2	2.3	5.6
		Durability	6.5	6.7	0.6	4.0	6.8	6.2	2.6	4.1	6.6	3.1	4.1	4.2	3.5	3.8	6.2
		Night Visibility	4.4	4.7	0.2	2.5	3.2	2.0	0.8	2.4	4.7	1.7	2.2	2.2	2.0	1.9	4.1
		Weighted Rating	5.4	5.6	0.4	3.2	5.0	4.1	1.7	3.2	5.6	2.4	3.1	3.2	2.7	2.8	5.1
	373	General Appearance	6.1	6.1	0.5	3.6	6.1	5.9	1.9	3.3	5.6	2.7	3.2	3.3	2.6	3.2	5.7
		Durability	6.4	6.8	0.4	4.3	6.6	6.1	2.0	3.6	6.3	2.7	3.8	4.0	3.0	3.7	6.0
		Night Visibility	4.3	4.0	0.0	2.0	2.9	1.9	0.5	2.0	4.3	1.4	1.6	1.6	1.5	2.0	3.7
		Weighted Rating	5.3	5.3	0.2	3.1	4.7	4.0	1.2	2.8	5.2	2.1	2.6	2.7	2.2	2.8	4.8
		Service Factor	65.2	66.5	24.3	49.3	63.9	58.7	39.3	49.1	66.2	41.6	48.9	48.8	45.2	44.6	63.8

TABLE 3
SERVICE FACTORS AND TERMINAL RATINGS
1960 Performance Paints*

	1959 Service Factor 379 days	Paint Number	1960 Service Factor 171 days	1960 Service Factor 373 days	Percent of Best	Qualification Tests (1)
WHITE PAINTS	28.5	90	79.1	66.4	100.0	P
	52.1	92	68.6	62.8	94.6	P
	53.0	106	76.6	60.6	91.2	P
	53.7	98 (b)	71.9	53.6	80.6	P - Paint NP - Beads
	----	102	72.1	51.7	77.9	NP
	59.8	100	71.0	50.5	75.8	P
	36.9	104	70.5	50.1	75.4	P
	35.9	108	65.1	42.3	63.7	NP
	45.9	96	54.1	34.9	52.3	NP
	37.9	94	54.0	34.3	51.6	P
	----	117 Exp. (c)	63.7	55.5	83.6	NP
	----	118 Exp. (c)	58.4	48.6	73.4	NP
	59.8 (a)	1960 Acceptance	76.1	62.6	94.2	P
YELLOW PAINTS	61.6	93	76.4	66.5	100.0	P
	46.3	107	76.1	66.2	99.6	P
	27.3	91	77.0	65.2	97.9	P
	59.2	99 (b)	78.5	63.9	96.1	P - Paint NP - Beads
	62.3	101	76.3	58.7	88.2	P
	27.5	97	66.0	49.3	74.1	P
	30.3	105	66.3	49.1	73.8	NP
	39.6	109	60.0	41.6	62.6	P
	----	103	62.9	39.3	59.0	NP
	32.6	95	45.4	24.3	36.5	NP
	48.8	110 Exp.	----	48.9	73.4	P
	48.8	111 Exp.	----	48.8	73.3	NP
	48.8	114 Exp.	----	45.2	67.9	NP
	48.8	115 Exp. (c)	----	44.6	67.0	NP
	58.3 (a)	1960 Acceptance	76.4	63.8	95.9	P

* 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 as noted. Same field areas as in 1959 tests.

1) P = passing; NP = not passing.

a) Values obtained in 1958 tests, using same areas as in 1960.

b) Paints supplied with own beads, coarser than MSHD Type III.

c) Applied in fewer than four field areas.

in Table 3 shows that these two paints received 3 to 5 points higher service factor ratings than did their prototypes submitted for the 1958 performance tests. These higher ratings are believed to be due to the milder weather during the past 1960-61 winter, which also is believed to be a partial explanation for the generally higher ratings of the paints submitted for the 1960 tests. Fig. 3 gives typical initial and final conditions of some stripes.

TABLE 4
TEST RESULTS FOR GLASS BEADS
Submitted with White Paint No. 98 and Yellow Paint No. 99

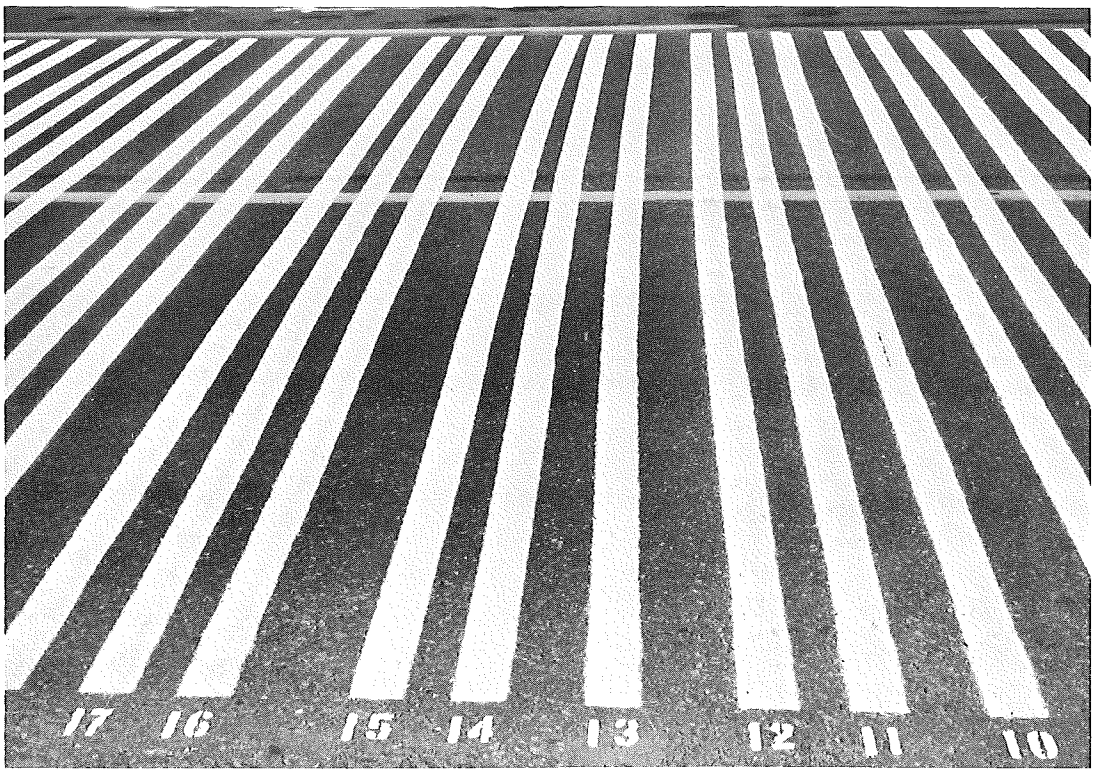
MSHD Specification Requirements		Type III Beads	Test Beads
Gradation, Weight Percent Passing:			
Sieve Nos.	30	100	93.5
	40	60-90	61.7
	70	30-60	9.8
	230	0-5	2.1
Index of Refraction		1.50 min.	1.53
Moisture-Resistant Treatment		---	Yes

Note: Beads do not meet specification gradation requirement. They were considerably coarser. They were treated to be moisture-resistant.

Another reason for the generally higher ratings is that producers responded by submitting higher quality paints for the 1960 tests, in accordance with special notices that were attached to the request for bids stating that greater weight would be attached to quality of paint being tested, as authorized by the Committee at its meeting of May 9, 1960.

Examination of data in Table 3 on experimental paints shows that: a) white paint No. 117, a two-package epoxy, which required about 5 hr to dry and in the process received a high complement of beads, had an excellent rating considering it was evaluated only in the toughest section, the concrete area on US 127, and b) laboratory experimental yellow paints need improvement.

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



Appearance just after deposition

Terminal appearance

Figure 3. Typical 1960 performance striping on US 127 (bituminous).