

1968 PERFORMANCE TESTS
ON WHITE AND YELLOW TRAFFIC PAINTS
(INCLUDING COOPERATIVE TESTS
IN DETROIT AND WAYNE COUNTY)

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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ON WHITE AND YELLOW TRAFFIC PAINTS
(INCLUDING COOPERATIVE TESTS
IN DETROIT AND WAYNE COUNTY)

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1968 PERFORMANCE TESTS
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(INCLUDING COOPERATIVE TESTS
IN DETROIT AND WAYNE COUNTY)

The following ten producers submitted paints for the 1968 tests:

1. Baltimore Paint & Chemical Corp. of Baltimore
2. Devco Division of Celanese Coatings of Detroit
3. DeSantis Coatings, Inc. of Willoughby, Ohio
4. Forman Ford, Inc. of Minneapolis
5. Glidden - Durkee Division of Cleveland
6. Jaegle Paint & Varnish Co. of Camden, N. J
7. Perry & Derrick Co., Inc. of Cincinnati
8. Pittsburgh Plate Glass Co. of Pittsburgh
9. Prismo Safety Corp. of Huntingdon, Penna.
10. Standard Detroit Paint Co. of Detroit

Compared to the previous (1966) tests, the list has three additions--DeSantis, Perry and Derrick, and Pittsburgh Plate; and two deletions--Argo and Sherwin-Williams. This is in accordance with Committee review and action at its meeting of May 7, 1968.

In addition to the above 10 products, the Committee authorized: (a) the evaluation of two experimental traffic paints--Baltimore's white and yellow "Tyline" (quality paints) and Hercules' fast-dry white paint formulated per a Texas Highway Department specification, and (b) the exploratory evaluation of two new bead types--3M's Bisymmetric treated glass beads and Dow's plastic beads.

The 1968 tests, as well as the previous 1966 tests, are being conducted on a biennial basis, rather than the former annual bases, as the Committee authorized at its meeting of May 3, 1966.

Qualification Tests

Submitted paints were evaluated for conformance with qualification requirements given in the governing specifications dated May 7, 1968. Laboratory qualification tests covered bleeding, consistency, settling, color, reflectivity, and vehicle stability. Field qualification tests covered drying

TABLE 1
 QUALIFICATION TEST RESULTS
 1968 Performance Paints

Paint No.	Color ⁽¹⁾		Consistency, KU @ 77 F	Bleeding Index		Settling Index	Vehicle Stability	Avg. Field Drying Time, min	Applicability in Roadway Striper
	Dominant Wavelength, mμ	Reflectivity, percent		Asphalt	Tar				
White Paints									
90		83.7	84	5.3	4.7	7.3	satisfactory	28	All are presumed satisfactory, since striping crew did not keep and submit data.
92		86.4	83	5.3	4.7	6.7	satisfactory	24	
94		87.3	84	4.3	4.0	7.7	satisfactory	26	
96		86.3	80	4.7	4.0	6.3	satisfactory	26	
98		77.0	80	7.0	4.3	7.3	satisfactory	24	
100		89.5	90	4.3	3.0	8.0	satisfactory	28	
102		85.0	88	4.3	5.3	8.3	satisfactory	25	
104		86.6	88	5.0	4.3	8.3	satisfactory	28	
106		87.4	85	4.0	3.7	6.7	unsatisfactory	23	
108		90.9	90	6.7	4.7	7.0	satisfactory	27	
110		86.9	87	5.3	4.0	6.0	satisfactory	28	
112		87.6	76	4.3	3.0	6.3	satisfactory	21	
Control				6.0	4.3			22	
Yellow Paints									
89	582.6	45.1	88	5.7	5.7	6.3	satisfactory	27	
91	581.8	57.1	92	5.7	5.3	7.0	satisfactory	27	
93	581.6	60.2	90	6.7	5.7	8.0	satisfactory	25	
95	581.7	56.8	89	5.7	5.3	6.3	satisfactory	24	
97	582.7	48.3	99	6.7	4.7	7.3	satisfactory	24	
99	582.0	53.3	87	7.3	5.0	7.7	satisfactory	30	
101	582.4	55.9	88	6.3	5.7	8.0	satisfactory	25	
103	582.0	56.0	90	7.0	5.3	8.0	satisfactory	27	
105	581.5	55.8	86	6.0	4.3	7.0	unsatisfactory	23	
107	581.3	57.0	89	7.0	4.7	6.3	satisfactory	24	
109	581.3	52.3	87	4.3	5.3	6.3	satisfactory	26	
Control				7.7	5.7			23	

(1) Paints 96, 105, and 106 fluoresce.

time and applicability in regular highway-stripping equipment. Results of the qualification tests are given in Table 1, which shows that the following paints were borderline or failed to meet one or more of the requirements:

White Paints

- No. 94 - Borderline bleeding on tar base.
- No. 96 - Fluoresces, borderline low viscosity and bleeding index on tar base.
- No. 98 - Borderline low viscosity.
- No. 100 - Excessive bleeding on tar base.
- No. 106 - Fluoresces, borderline bleeding on asphalt and tar bases; fails vehicle stability test.
- No. 110 - Borderline bleeding index on tar base and borderline setting index.
- No. 112 - Low viscosity and bleeding on tar base.

Yellow Paints

- No. 89 - Does not meet color requirements.
- No. 97 - Does not meet color requirements and excessive high viscosity.
- No. 105 - Fluoresces, and fails vehicle stability test.

The above list shows a significant percentage of paints that fail or nearly fail to meet specification requirements. These deficiencies should be brought to the attention of the respective producers when paints are next ordered for performance testing in 1970.

Field Application

The submitted paints were applied for road performance tests between July 30 and August 8, 1968 in four areas, as usual. The road areas were the same as used in the previous 1966 tests, with the specific locations shown in Figure 1.

As in the past, road stripes used to evaluate performance extended transversally across two lanes of four-lane divided roadways. Application details for the test paints were standard, in that each was applied as a set of three 4-in. wide stripes at a 15-mil wet thickness, having glass beads "dropped on" in a ratio of 6 lb per gal of paint. Subsequently, 45-gal amounts of each paint purchased for the tests were applied as longitudinal striping by the Grand Rapids striping crew to evaluate handling and application characteristics in highway striping equipment. The crew's applicable comments are listed in Table 1.

Field Performance Ratings

Test stripes deposited in the four road areas were rated for performance, as usual, in the tire tracks of the traffic lane six days after application and 3-months after application, yielding normal values. Thereafter, unexpectedly, the stripes deteriorated at an abnormally high rate necessitating that the next rating be moved-up before the usual 6-month period. This was done at the 170-day service level and subsequently at 200 days; with all the quality ratings of the test stripes, averaged from the evaluations of the four observers, given in Table 2.

The standard ratings (traffic lane) were terminated prematurely at the latter level because, as the table shows, the stripes were about worn away and, incidentally, in much poorer condition than the 1966 stripes after 365 days in the previous tests (Figs. 2 and 3). This can be corroborated by averaging the durability values for the two tests--for the white paints it was 0.82 after 200 days of service in 1968, and 3.58 after 365 days of service in 1966. A graphical comparison is presented in Figure 4 for one white paint, the control paint purchased for 1968 roadway striping, which can be considered as typical of the better paints.

Vandalism damage was again encountered on the US 27 test sections as shown in Figure 5. Luckily, most of the damage was away from the tire-track rating areas.

Field Test Results

Table 3 presents performance ratings of all tested 1968 paints. The column headed, "1968 Traffic Lane Ratings" lists the paints in a descending order of performance, as determined on the given terminal "Percent of Best" scale. These ratings were determined from the customary traffic lane, but cover only 200 days of service, rather than the usual 365, as explained above.

TABLE 2
PERFORMANCE RATING DATA
1968 Tests

Exposure Days	Factor Evaluated	White Paint Identifications																
		90	92	94	96	98	100	102	104	106	108	110	112	(68) ¹	68PB ²	68TB ²	90PB ²	
White Paints	6	General Appearance	8.7	9.0	8.3	9.2	7.4	8.1	8.2	8.4	8.6	7.4	7.6	9.4	8.6	8.2	8.6	8.8
		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	10.0	10.0	10.0
		Night Visibility	6.8	6.4	6.8	6.2	5.3	8.0	8.1	8.4	8.1	7.4	6.4	7.9	7.6	8.3	8.3	6.4
		Weighted Rating	8.3	8.1	8.3	8.0	7.4	8.8	8.8	9.0	8.9	8.4	8.0	8.9	8.6	9.0	9.0	8.1
	97	General Appearance	7.9	7.6	7.4	7.6	7.2	7.1	7.8	7.2	7.8	6.2	7.2	7.2	7.6	6.6	7.5	8.0
		Durability	9.0	8.7	8.8	8.8	9.0	8.6	9.0	8.3	8.9	8.4	8.7	8.8	8.8	8.6	9.1	8.8
		Night Visibility	7.2	6.6	6.8	6.8	6.4	7.3	7.7	7.5	7.2	7.0	6.7	6.4	7.2	5.8	8.1	5.6
		Weighted Rating	8.0	7.6	7.6	7.7	7.6	7.8	8.2	7.8	8.0	7.5	7.6	7.5	7.9	7.0	8.2	7.1
	170	General Appearance	2.2	0.9	1.6	1.2	0.9	1.6	1.6	1.9	2.4	2.1	2.6	2.0	1.8	1.6	2.1	3.1
		Durability	2.5	1.0	1.8	1.3	1.0	1.8	1.4	2.3	2.5	2.3	2.7	2.0	2.1	1.7	2.3	3.4
		Night Visibility	1.5	0.4	1.0	0.8	0.5	1.0	0.8	1.2	1.4	1.6	1.8	1.2	1.1	0.9	1.4	2.2
		Weighted Rating	2.0	0.7	1.3	1.0	0.8	1.4	1.1	1.8	2.0	1.9	2.2	1.6	1.6	1.3	1.8	2.8
	200	General Appearance and Durability	1.1	0.2	0.7	0.4	0.3	0.8	0.5	0.9	1.1	1.4	1.8	0.4	0.8	0.3	1.1	2.0
		Night Visibility	0.6	0.2	0.4	0.2	0.1	0.5	0.2	0.5	0.6	0.9	1.1	0.2	0.4	0.2	0.3	1.6
		Weighted Rating	0.9	0.2	0.5	0.3	0.2	0.7	0.4	0.7	0.8	1.2	1.5	0.3	0.6	0.3	0.7	1.8
		256 ^a	General Appearance and Durability	4.6	1.8	2.7	2.4	2.1	2.1	2.0	2.9	3.2	3.1	3.5	3.8	3.1	4.1	2.3
Night Visibility	2.6		1.2	2.1	1.7	1.5	1.6	1.2	1.8	2.0	1.5	1.8	1.8	1.6	1.9	1.4	2.9	
Weighted Rating	3.6		1.5	2.4	2.0	1.8	1.9	1.6	2.4	2.6	2.3	2.7	2.8	2.3	3.0	1.8	3.8	
293 ^b	General Appearance and Durability		4.2	1.2	2.1	1.8	1.4	1.7	1.4	2.1	2.5	2.3	2.4	2.7	2.2	3.2	1.7	4.3
	Night Visibility	2.1	0.4	1.2	0.7	0.6	0.9	0.7	1.1	1.2	0.8	1.3	0.9	1.1	1.2	0.9	2.2	
	Weighted Rating	3.1	0.8	1.6	1.2	1.0	1.3	1.0	1.6	1.9	1.6	1.9	1.8	1.6	2.2	1.3	3.3	
	335 ^b	General Appearance and Durability	3.7	0.7	1.4	1.2	2.0	1.3	0.9	1.3	1.5	1.5	1.8	1.8	1.4	2.2	1.2	4.0
Night Visibility		1.8	0.3	0.9	0.6	0.4	0.6	0.4	0.7	0.9	0.6	1.1	0.8	0.7	0.9	0.7	2.0	
Weighted Rating		2.8	0.5	1.1	0.9	1.2	0.9	0.7	1.0	1.2	1.0	1.4	1.3	1.0	1.6	1.0	3.0	
Yellow Paints		6	Yellow Paint Identifications															
	89		91	93	95	97	99	101	103	105	107	109	(69) ¹	89TF ²				
	General Appearance		8.2	9.4	8.4	9.2	8.2	8.8	8.8	8.8	9.0	8.6	8.6	8.8	8.5			
	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			
	97	Night Visibility	6.5	6.2	9.0	6.4	6.2	7.7	7.4	8.8	7.8	7.8	7.8	8.1	8.6			
		Weighted Rating	8.1	8.1	9.3	8.1	7.9	8.7	8.6	9.3	8.8	8.7	8.7	8.9	9.2			
		General Appearance	7.0	8.4	7.6	7.6	7.4	7.4	8.1	7.6	8.0	6.6	8.2	7.8	6.9			
		Durability	9.1	9.1	9.0	8.9	9.0	9.1	9.0	9.0	9.0	8.7	9.2	9.2	9.2			
	170	Night Visibility	6.8	6.6	8.2	6.1	6.5	6.9	7.2	8.0	7.1	7.0	7.4	7.7	7.6			
		Weighted Rating	7.7	7.8	8.4	7.4	7.6	7.8	8.0	8.3	7.9	7.6	8.2	8.3	8.2			
		General Appearance	2.9	0.9	1.6	1.0	1.4	2.5	1.8	2.0	2.0	2.4	3.1	2.1	3.9			
		Durability	3.3	1.1	1.9	1.0	1.4	2.5	1.8	2.1	1.9	2.5	3.1	2.1	3.9			
	200	Night Visibility	1.6	0.6	1.3	0.6	1.0	1.7	1.1	1.3	0.9	1.6	1.7	1.2	2.0			
		Weighted Rating	2.4	0.8	1.6	0.8	1.2	2.1	1.4	1.7	1.4	2.0	2.4	1.6	2.9			
		General Appearance and Durability	1.1	0.3	0.8	0.2	0.6	1.1	0.8	1.0	0.7	1.1	1.3	1.0	1.2			
		Night Visibility	0.6	0.2	0.5	0.1	0.3	0.7	0.4	0.6	0.3	0.6	0.8	0.6	0.6			
256 ^a	Weighted Rating	0.8	0.2	0.7	0.2	0.4	0.9	0.6	0.8	0.5	0.8	1.1	0.8	0.9				
	General Appearance and Durability	5.8	2.4	3.4	2.0	2.2	3.6	3.0	3.4	2.6	4.1	4.2	2.9	6.1				
	Night Visibility	2.6	1.3	2.8	1.2	2.0	2.2	1.8	2.2	2.0	2.6	2.8	2.1	1.9				
	Weighted Rating	4.2	1.9	3.1	1.6	2.1	2.9	2.4	2.8	2.3	3.3	3.5	2.5	4.0				
293 ^a	General Appearance and Durability	5.1	1.5	2.8	1.4	1.8	2.8	2.0	2.7	2.3	4.0	3.5	2.2	5.7				
	Night Visibility	2.3	0.5	1.3	0.4	0.9	1.1	0.7	1.1	1.0	1.2	1.6	0.9	1.9				
	Weighted Rating	3.7	1.0	2.0	0.9	1.3	2.0	1.4	1.9	1.6	2.6	2.6	1.5	3.8				
	338 ^a	General Appearance and Durability	3.8	1.0	2.0	0.8	1.0	2.3	1.5	1.9	1.7	2.8	2.6	1.7	4.2			
Night Visibility		1.6	0.3	1.0	0.4	0.6	1.1	0.5	0.8	0.8	0.8	1.1	0.7	1.1				
Weighted Rating		2.7	0.7	1.5	0.6	0.8	1.7	1.0	1.4	1.3	1.8	1.9	1.2	2.7				

Notes: ¹ Control paint.
² Experimental lines put down in 2 areas only.
³ Ratings in passing lane.



Figure 2. 1968 paints are worn-out in tire-track rating area of traffic lane by March 1 (7 mo service) because of some abnormal deteriorating factor. (Area 1 concrete on M 78).



Figure 3. By comparison, 1966 paints show fair condition on August 1 (12 mo service) under normal wear. (Same area as above).

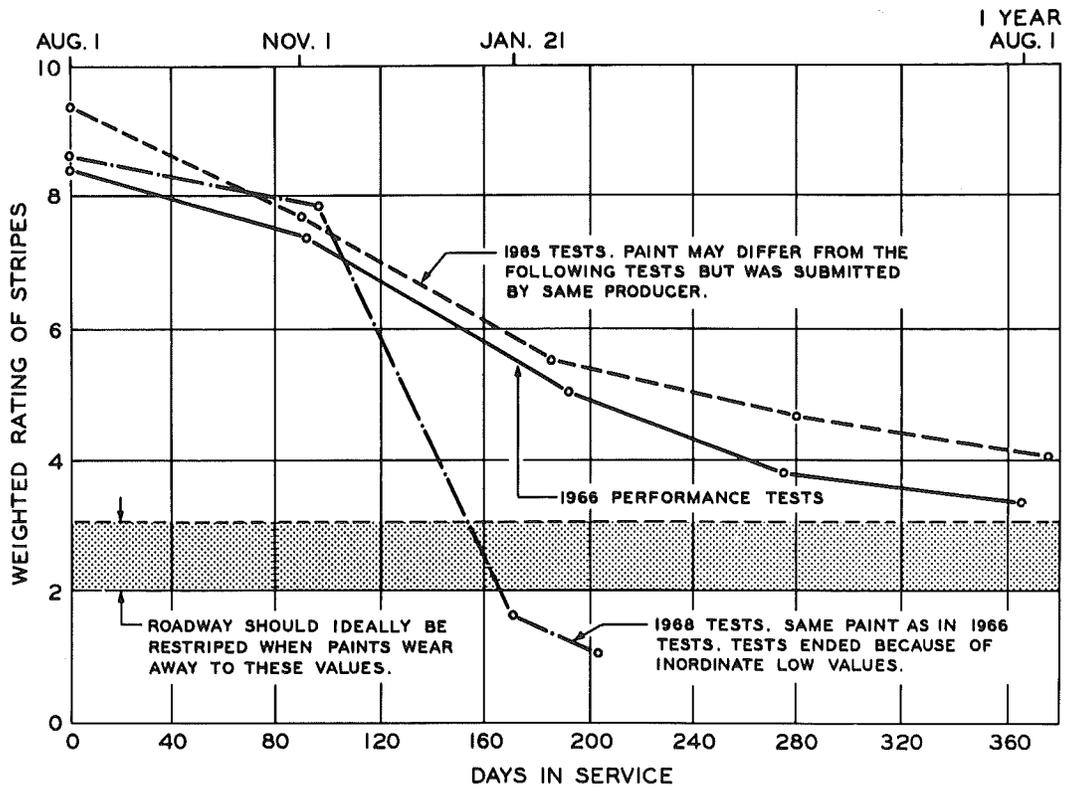


Figure 4. Performance of #68 (Control) white paints in department's performance tests.

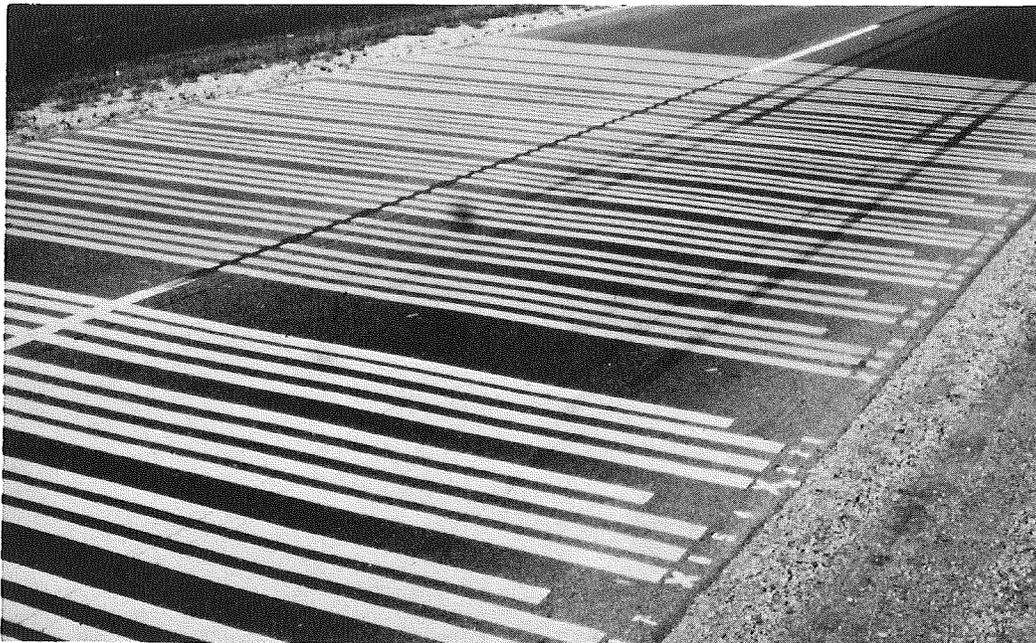


Figure 5. Dual-tire vandal damage again encountered on tests on US 27 S. of St. Johns. (Area 4 bituminous, taken 3 weeks after application). The damaging maneuver, braking of high-speed vehicle, was repeated on both US 27 areas.

TABLE 3
SERVICE FACTORS AND TERMINAL RATINGS
1968 Performance Paints⁽¹⁾

	Paint No.	1966 Service Factor 365 Days	1968 Traffic Lane Ratings		Qualification Tests	1968 Both Lane Ratings		
			Service Factor 200 Days	Terminal Percent of Best		Service Factor 338 Days	Terminal Percent of Best	No. Scale
White Paints	106	49.8	61.1	100.0	Failed	50.0	95.7	2
	104	56.4	60.0	98.2	Passed	48.5	93.0	3
	90	----	59.6	97.5	Passed	52.2	100.0	1
	102	----	59.6	97.4	Passed	46.7	89.5	5
	100	53.5	58.5	95.7	Failed	46.6	89.4	6
	108	----	58.2	95.2	Passed	47.1	90.2	4
	94	55.9	56.3	92.0	Passed	45.9	87.9	7
	96	----	55.0	90.0	Failed	44.1	84.4	8
	92	45.2	53.6	87.7	Passed	41.8	80.2	9
	98	45.0	52.2	85.3	Passed	41.7	79.9	10
	(68) (a)	55.9	58.9	96.3		47.7	91.4	
	(68)PB (b)	----	55.1	90.1		46.5	89.1	
(68)TB (b)	----	61.8	101.2		49.1	94.0		
90PB (b)	----	58.3	95.4		51.7	99.1		
110 (c)	----	58.4	95.5	Borderline	48.2	92.3		
112 (c)	----	57.6	94.2	Borderline	47.4	90.9		
Yellow Paints	93	60.5	63.1	100.0	Passed	52.1	98.2	2
	103	59.0	62.9	99.7	Passed	51.5	97.0	3
	99	59.0	60.4	95.8	Passed	49.9	94.0	5
	107	----	59.4	94.2	Passed	50.6	95.3	4
	89	----	59.3	94.0	Failed	53.1	100.0	1
	105	53.0	59.2	93.8	Failed	48.1	90.5	6
	101	----	59.1	93.7	Passed	46.9	88.3	7
	91	47.2	55.0	87.1	Passed	43.4	81.8	8
	97	54.1	54.7	86.7	Failed	43.4	81.8	9
	95	----	53.2	84.2	Passed	41.8	78.7	10
	(69) (a)	59.8	61.8	97.9		49.9	94.0	
	89TB (b)	----	65.2	103.3		57.4	108.0	
109 (c)	----	63.3	100.3	Passed	53.5	100.7		

(1) All paints applied at rate of 16.5 gals per mile of 4-in. stripe, with 6 lb of MDSH Type 3 beads dropped on per gallon, unless otherwise noted. Same road areas as in 1966 tests.

- (a) Paints purchased for 1968 roadway striping.
- (b) Experimental beads evaluated in indicated paints, in 2 areas only
PB = Plastic Beads, 68 GB-42 (68 NM-206) @ 2.5#/gal
TB = Treated Beads, 68 GB-43 (69 NM-243) preliminary, @ 4#/gal.
- (c) Experimental paints, applied in all 4 areas.

The "Qualification Tests" column in Table 3, summarizing data in Table 1, shows that three whites and three yellows failed to meet the required specification requirements, and hence become ineligible for bidding. Unfortunately, some better performing paints thereby become disqualified. However, this 30 percent ratio is an improvement over the one obtained in the previous 1966 tests.

The column headed, "1966 Service Factors - 365 days" is included by custom to ordinarily allow comparative performance of a producer's paint in the immediate previous tests, and the current tests. However, these values cannot be so used, in this report, since the "time" or x-axis of the performance curve (Fig. 4), are not the same, i. e., 200 days vs 365 days.

As mentioned previously, the current tests included some experimental paints and beads, whose performance is entered below the respective broken lines of Table 3. These will be commented on later in the report. Listed here, also, are the so-called control white and yellow paints purchased for 1968 roadway striping. They are identified as (68) white and (69) yellow. Both performed similarly to the other test paints, with the Service Factor curve for the white paint given in Figure 4.

The column headed, "1968 Both Lane Ratings" is new to paint performance reports. It covers a combination rating for each paint and includes the standard traffic lane Service Factor (discussed above) that was abnormally terminated at 200 days, plus an additional "Service Factor" determined on that paint's stripes in the passing lane. The latter was determined on "time" values from 200 days to termination of the ratings at 338 days, as presented in Table 2.

RECOMMENDATIONS

The standard Service Factors presented in Table 3, normally used by the Department to show a paint's comparative performance, are not very definitive because the stripes were much shorter lived this year than previously, due to the introduction of some new deteriorating factor. The factor was introduced after the November 1 ratings, which were normal. The factor was not expected, so as to suggest more frequent ratings to yield the desired performance discrimination.

Studded tires, which became legal in Michigan after November 1, are suspect as the new deteriorating force. They create problems in other

Northern areas as exemplified by the following account in an October 14, 1969 letter from Quebec:

Can you tell me if studded tires are used in Michigan? If yes, do they affect your paint lines? Do your test lines still last one year (this is impossible, here). In fact, I am wondering if it is worth all the trouble to make complicated performance tests, when the paints do not last more than a few weeks after the first snow storm, at least on our major highways.

Because the standard Service Factors are based on tests that were prematurely terminated, we recommend that the more definitive combination Both Lane Service Factors, presented in Table 3, be used in contracts for the Department's next striping requirements.

Cooperative Tests with Detroit and Wayne County

In accordance with previous arrangements, as in the past, we cooperated with the City of Detroit and with Wayne County in their performance tests, mainly by loaning striping equipment and operators.

Generally speaking, those stripes had only slightly poorer performance than the previous tests. This is ascribed as being due to wear from the annual increase of vehicular traffic. Because no abnormal deterioration was noted, it is assumed that studded tires are not generally used in the metropolitan area.

Experimental Paint and Beads

The plastic beads that were given initial screening evaluation in the tests, gave poorer performance than standard glass beads mainly due to a marked loss of night reflectivity, noticeable within two to three weeks after application. The reason is not known, but is presumably being checked by the producer.

The treated glass beads that were given initial screening evaluation in the tests, appear to give marginal improvement in performance, though values presented in Table 3 cannot be used in comparison without realizing that the experimental paint lines were tested in only two of the four test areas, not of the same severity. However, additional longer footage tests are now in progress for further confirmation. Because of the above and attached national publicity, we are exploring the possibility of revising the

Department's bead specifications to obtain a more preferred gradation, resembling that of the treated beads, for only a modest--if any--price premium.

The screening evaluation of the Texas-type fast-dry paint showed average to good durability and some improvement in drying, though not as great as alleged by the producer. However, this type paint may have some merit, if the Department feels that fast-drying is worth a price-premium.

The "Tyline" white experimental paint showed performance equal to the fourth, or fifth best in the tests, while the yellow paint was equal to the best paint in the tests. This is in accordance with previous screening tests conducted for the producer in this locality, which did not show any marked superiority over good paints in the Michigan environment. Both paints are premium priced by the producer.