Thermoplastic Striping Compounds

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SYNOPSIS

IN 1949, the Texas Engineering Experiment Station inaugurated a research project to develop a compound for striping pavements which would produce stripes with longer service life than those now in general use.

The Road Research Laboratory in England during World War II developed a satisfactory striping compound of a mixture of rosin, mineral oil (a plasticizer for the rosin), pigment, filler, and sand. The mixture is heated to 135 C and placed, while hot, to a thickness of about 1/8 in. Stripes laid in Texas in accordance with the British formulation proved to be too soft, were subject to rather severe discoloration by the adhesion of road dust and tire film to the surface of the stripe, and showed poor adhesion to portland-cement concrete. But the results were sufficiently encouraging to warrant a decision to study modification of the British formulation.

The striping compound produced by adding alkyd resin to the rosin-plasticizer mixture has shown excellent characteristics. The stripe does show discoloration under traffic, and studies are currently under way in an attempt to improve this characteristic.

The rosin striping compound has been rated for service life by laying transverse stripes on asphaltic-concrete and portland-cement-concrete pavements. Glass beads have been incorporated in parts of the stripes.

Four of the rosin-base stripes have been in service for 12 to 14 months. Eight rosin-alkyd resin stripes have been in service for 6 to 8 months; and a large number of others have been in service for lesser periods of time.

Results to date indicate that the rosin-base stripes will have a service life of two to three times that of the comparative paint stripes. Ingredients in the rosin-base stripe are such that the cost of the materials compares favorably with the cost of paint.

● IN FEBRUARY 1949, the Texas Engineering Experiment Station (a part of the Texas A and M College System) initiated a research project to develop a semipermanent center stripe for highway use. Study of the striping problem in Texas and discussion with engineers of the Texas Highway Department indicated that a highway stripe with a service life of 3 to 6 years which could be placed at low cost was the desirable goal. Investigation of the literature and letter contacts established the fact that many individuals and concerns were working with paint stripes in order to improve durability. It was decided that the investigation would be directed primarily toward materials other than paint for striping.

The first possibility considered for producing a semipermanent stripe was the builtup or surface-dressed type, produced by laying a binder layer of asphalt cement and covering it with a layer of uniformly graded aggregate.

When this is constructed with limestone, a rather good white stripe is produced. This type of stripe has been used for a number of years by several highway departments and has proven to have a very long service life. The method of striping has two disadvantages: the night visibility of the stripes is quite poor and no naturally yellow stone is available for producing stripes in the standard yellow color. Therefore, it was decided to attempt to color limestone yellow in order to satisfy the second objection to the use of the builtup stripe. None of the attempts to do this was successful. The method which showed the most promising results was that of forming lead chromate, an insoluble yellow pigment, in the pores of the limestone by a chemical reaction. Good color was produced, but the penetra-

Figure 1. Laying rosin striping compound.

tion into the stone was not sufficient to give practical service life.

The second possibility investigated was the use of hot-melt plastic compounds which would harden upon cooling and thereby produce a permanent line on the pavement surface. The British had developed such a stripe by combining wood rosin, plasticizing oil, pigments, fillers, and sand. This mixture was heated to 135 C, thoroughly stirred, and laid by screeding it on the pavement with a small screed box having an adjustable gate. The thickness of the material as laid was about 1/8 in. The British reports indicated considerable success with this type of stripe. Their experience showed a service life of approximately two years and an initial cost of about twice that for paint stripes.

Since this was the only successful hot-melt plastic stripe which the study of the literature uncovered, the decision was made to begin the investigation by studying the British stripe.

INTERIM RECOMMENDATIONS FOR THE COMPOSITION OF PLASTIC WHITE LINE COMPOUNDS[1]

Gum rosin	15 percent by weight
Mineral oil (viscosity 1/2 to 2 poises at 25 C)	5 percent by weight
Titanium dioxide	10 to 5 percent by weight
Extender (whiting, etc.)	10 to 15 percent by weight
Aggregate (sand)	60 percent by weight

On July 28, 1950, a stripe was laid in accordance with this specification. It was found to be too soft for the hot Texas summer, since the traffic rolled it out, and the adhesion of road dust and tire film to the soft material soon changed the color to very nearly that of the pavement.

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TABLE 1

COMPOSITION OF ROSIN-OIL SERVICE TEST STRIPES INGREDIENTS

(Percent by Weight)

Stripe Number	Rosin	Mineral Oil	Titanium (TiCa)	Whiting	Chrome Yellow (Medium)	Calcium Chromate	Concrete Sand
B-2	23.0	1.0	15	5			56
B-3	22.0	2.0	15	5			56
B-4	23.5	0.5	5	5	10		56
B-5	23.0	1.0	15	5			56
				SILICA			(LIMESTONE)
R-1	22.5	1.5	5	5	5	5	56
R-2	22.0	2.0	5	5	5	5	56
R-3	21.5	2.5	5	5	5	5	56

MODIFICATIONS OF BRITISH COMPOUNDS

In order to produce a harder stripe, the amount of plasticizing oil in the compound was reduced. A number of oil-rosin combinations were tried in the laboratory with the hardness of each compound being measured with the standard penetration apparatus for asphalt and the brittleness being measured by means of a cold-bend test. The proper oil content was selected as 2 to 8 percent of the weight of the rosin-oil mixture, or an oil content of 0.5 to 2 percent of the weight of the total mixture. Laboratory tests in which the pigment, filler, and sand were varied indicated agreement with the British interim specifications with regard to proper proportions of pigment filler and sand. Yellow color was produced quite successfully by the use of chrome yellow alone or with calcium chromate as pigment.

Four test stripes using the composition selected as having desired hardness and brittleness characteristics on the basis of the laboratory work were laid in August and October of 1950. These test stripes were laid transversely across half of the roadway in order to get maximum traffic effect. The stripes were laid at the same

TABLE 2

APPLICATION DATE ON ROSIN-OIL TEST STRIPES

Stripe Number	Color	APPLICATION			Time Protected From Traffic	Condition When Opened to Traffic
		Date	Temperature F.	Thickness in.		
	Asphalt Surface Area 1				min.	
B-2	(W)	8/15/50	98	.125	45	Hard-High Gloss
B-3	(W)	8/15/50	98	.125	45	Hard-Slight Tack
B-4	(Y)	10/13/50	87	.180	10	Hard-High Gloss
P-4	(W)	7/25/50	96	.020- .030	75	Hard-Dry to Touch
P-5		7/25/50	96	.020- .030	45	Dry-Soft-Slight Tack
	Concrete Surface Area 2					
B-5	(W)	10/17/50	90	.125	10	Hard-High Gloss
P-8	(Y)	8/10/50	98	.020- .030	45	Soft-Slight Tack
R-1	(Y)	6/27/51	94	.180	30	Hard-Dry
R-2	(Y)	6/26/51	95	.180	10	Hard-Dry
R-3	(Y)	6/26/51	95	.180	10	Hard-Dry
*						

P-4 Chlorinated rubber traffic paint
P-5 Pliolite traffic paint
P-8 Pliolite traffic paint (Texas Highway Department Specification YP-3)
* Control paint stripes X-1, X-2, X-3, X-4 Table 9.
Concrete surface area 4
(Y) Yellow
(W) White

TABLE 3

MONTHLY RATING OF ROSIN-OIL TEST STRIPES

Location: Area 1 Pavement Surface: Asphalt

		August (1950)	September	October	November	December	January (1951)	February	March	April	May	June	July	August	September	October	October 15th
B-2 (W)	Plain		0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0
			N	M	M	S	MS	ES	MS	MS	S	ES	ES	ES	ES	MS	ES
	Beaded		0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0
			N	M	M	S	MS	ES	MS	MS	S	ES	ES	ES	ES	MS	ES
B-3 (W)	Plain		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			M	M	S	S	MS	ES	MS	MS	MS	ES	MS	S	ES	M	ES
	Beaded		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			M	M	S	S	MS	ES	MS	MS	MS	ES	MS	S	ES	M	ES
B-4 (Y)	Plain				0	0	0	0	0*	0	0	0	0	0	5	10	10
					N	N	M	M	M	M	MS	ES	MS	MS	S	MS	S
	Beaded				0	0	0	0	0*	0	0	0	0	0	5	10	10
					N	N	M	M	M	M	MS	ES	MS	MS	S	MS	S
P-4 (W)C	Plain	0	0	10	10	15	25	30	35	50	50	50*	60	60	75	85	85
		N	N	MS	MS	MS	MS	MS	MS	MS	MS	MS	MS	S	S	ES	ES
	Beaded	0	5	10	10	40	40	40	60	100							
		N	ES	ES	ES	ES	S	ES	ES								
P-5 (W)C	Plain	0	0	0	0	15	25	25	30	30	40	40*	50	50	60	65	75
		S	S	S	S	S	M	M	M	M	MS	MS	MS	S	S	ES	ES
	Beaded	10	10	10	10	20	20	20	30	30	30	40*	60	70	70	80	85
		S	S	S	S	S	M	ES	S	MS	S	ES	ES	ES	S	ES	ES

Location: Area 2 Pavement Surface: Portland Cement Concrete

B-5 (W)	Plain				0	10	30	100									
					N	M	MS										
	Beaded				0	10	20	100									
					M	S	S										
P-8 (Y)C	Plain		0	10	25	25	60	60	100								
			S	MS	MS	S	MS	S									
	Beaded		0	25	50	95	95	95	100								
			ES	ES	ES	ES	ES	ES									

Location: Area 4 Pavement Surface. Concrete

R-1 (Y)	Plain												0	0	0	0	5
													N	S	ES	MS	M
R-2 (Y)	Plain												0	0	0	0	10
													N	S	ES	MS	M
R-3 (Y)	Plain												0	0	0	0	0
													N	ES	ES	MS	M

* Noticeable cracking of film.

RATINGS: Film loss in percent.

Discoloration: (N) none; (M) moderate; (MS) moderately severe, (S) severe, (ES) extremely severe

(C) Control paint stripes

(Y) Yellow

(W) White

locations as two paint stripes which had been laid the latter part of July 1950. Glass reflectorizing beads were applied to a portion of each stripe. The stripes were rated the first of each month by visual examination on the basis of film loss and discoloration. The percentage of exposed pavement within the area originally covered by the stripe was estimated and recorded as film loss. The discoloration of

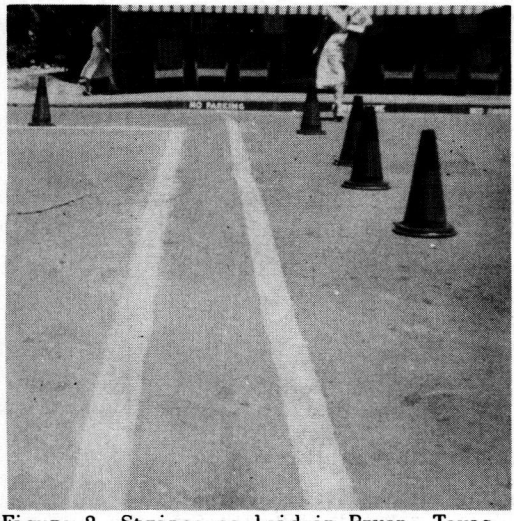

Figure 2. Stripes as laid in Bryan, Texas. Rosin stripe is at right and (Texas) standard YP-7 paint stripe is at left.

Figure 3. Stripes shown in Figure 2 after 5 months' service. Paint stripe was repainted twice.

TABLE 4

COMPOSITION OF ROSIN-ALKYD RESIN SERVICE TEST STRIPES

Ingredients (Percent by Weight)

Designation	Rosin	Alkyd Resin	Plasticizing Oil	Lead Drier (24%)*	Cobalt Drier (6%)*	Titanium (TiCa)	Whiting	Silica Filler	Chrome Yellow (Medium)	Calcium Chromate	Concrete Sand	Limestone Sand	Ottawa Sand	Crushed Limestone (-8 + 16)
BA-1	18.0	6.0				5		5	5	5	56			
BA-2	18.0	6.0				7	7	7			55			
BA-3	19.2	4.8				7	7	7			55			
BA-4	18.7	5.3				5		5	5	5	56			
BA-5	20.4	3.6				5		5	5	5		56		
BA-7	19.9	3.6	0.5			5		5	5	5			56	
BA-8	19.4	3.6	1.0			5		5	5	5		56		
BA-10	19.7	4.3				5		5	5	5		56		
BA-11	19.4	3.6	1.0			10		5				61		
BA-13	19.4	3.6	1.0			5		5	5	5				56
BA-14	19.4	3.6	1.0			10		10						56
BA-15	15	2.25				5		5	5	5			62.75	
BA-17	15.5	2.0	0.5		.34	5		5	2	8			62	
BA-18	19.4	3.6	1.0		1.0	5		5	5	5			56	
BA-19	15.5	2.0	1.0		0.1	5		5	5	5	56			

*Percent metal based on alkyd resin.

TABLE 5

APPLICATION DATA ON ROSIN-ALKYD RESIN TEST STRIPES

Location: Area 4 Pavement Surface Portland cement concrete

Stripe No.	Color	Date	Temp. F.	Thickness in.	Time Protected from Traffic min.	Condition When Opened to Traffic
BA-5	(Y)	6/27/51	94	0.18	15	Hard-Dry
BA-7	(Y)	6/27/51	94	0.18	10	Hard-Dry
BA-10	(Y)	6/18/51	95	0.08	10	Hard-Dry
BA-13	(Y)	7/10/51	98	0.20	15	Hard-Dry
BA-14	(W)	7/10/51	98	0.15	10	Hard-Dry
X-1(C)	(Y)	6/19/51	96	0.035	255	Dry
X-2(C)	(Y)	6/19/51	96	0.013	255	Dry
X-3(C)	(Y)	6/19/51	96	0.021	240	Dry
X-4(C)	(Y)	6/19/51	96	0.014	240	Dry
BA-15	(Y)	7/17/51	101	0.10	10	
BA-17	(Y)	7/26/51	98	0.18	10	Slight Tack
BA-18	(Y)	7/24/51	100	0.18	10	No Tack
BA-19	(Y)	7/24/51	100	0.18	10	Hard No Tack

X-1 Texas Highway Department YP-7 (Alkyd) Beaded
X-2 Texas Highway Department YP-7 (Alkyd) Plain
X-3 Texas Highway Department YP-3 (Pliolite) Beaded
X-4 Texas Highway Department YP-3 (Pliolite) Plain

TABLE 6

APPLICATION DATA ON ROSIN-ALKYD RESIN TEST STRIPES

Location Area 1 and 3 Pavement Surface Area 1 Asphaltic Concrete
Area 3 Portland Cement Concrete

Stripe No.	Color	Date	Temp. F.	Thickness in.	Time Protected from Traffic min.	Condition When Opened to Traffic
P-16	(W)	3/22/51	82	0.020	60	Dry to Touch
P-17	(Y)	3/22/51	82	0.020	45	Dry to Touch
BA-1	(Y)	4/27/51	85	0.100	2	Hard Surface
BA-2	(W)	5/5/51	86	0.125	5	Soft
BA-3	(W)	5/5/51	86	0.125	5	Soft
BA-4	(Y)	5/10/51	83	0.125	5	Hard Surface
BA-8	(Y)	6/28/51	97	0.180	2	Hard Surface
BA-11	(W)	7/6/51	98	0.150	None	Slightly Soft

P-16 Commercial traffic paint, beaded
P-17 Commercial traffic paint, beaded

the paint stripe was rated by comparing the color of the test stripe with that of a sample of the striping material placed on a block of similar pavement material. Discoloration was rated from "none" to "extremely severe" (indicating a color very nearly that of the pavement surface). Colored photographic prints, which were taken at the time of each rating, clearly record the extent of film loss and discoloration. Black and white prints record film loss but do not indicate discoloration.

Tables 1, 2, and 3, show the composition, application data, and monthly rating of the rosin stripes and paint stripes used for comparison.

In several instances, the stripes show an improvement in the discoloration rating. This improvement is due to the washing action of rainfall and the chalking action of the pigments.

ROSIN-OIL STRIPES AND CONTROL PAINT STRIPES

Asphalt Surface - Area 1

B-2 (Rosin-Oil Stripe). This stripe gave an excellent appearance for a few months. The discoloration by the adhesion of road dust and tire film was at times so severe that the stripe had a color very nearly that of the pavement surface.

Cracks appeared in January and became severe during the ice storms in February, during which a low temperature of 5 F was recorded. Even though these cracks extended completely through the stripe to the pavement, no film loss has been observed, and after 14 months of service, the stripe is still effective.

B-3 (Rosin-Oil Stripe). This softer stripe has shown intensive discoloration from the beginning but washes clean during rains to a color very nearly that of the original color. After 14 months of service, it shows no signs of cracking or noticeable wear.

B-4 (Rosin-Oil Stripe). This yellow stripe contained a harder binder than stripe B-2. Cracking was more severe, and these cracks widened to the extent that a film loss of 10 percent had occurred after approximately 12 months. Discoloration has not been as severe as for stripe B-2.

TABLE 7

MONTHLY RATING OF ROSIN-ALKYD RESIN TEST STRIPES

Area 1 Asphaltic Concrete Pavement

		April (1951)	May	June	July	August	September	October	October 15
P-16C (W)	Beaded	0 MS	0* S	10 ES	10 ES	10 ES	10 ES	10 ES	10 ES
P-17C (Y)	Beaded	5 MS	10* S	10 ES	20 ES	20 ES	20 ES	30 ES	30 ES
BA-1 (Y)	Plain		0 M	0 MS	0 S	0 MS	0 S	0 MS	0 S
	Beaded		0 M	0 MS	0* MS	0 S	0 S	0 MS	0 S
BA-2 (W)	Plain			0 MS	0 S	0 S	0 S	0 S	0 S
	Beaded			0* S	0 ES	0 ES	0 ES	0 ES	0 ES
BA-3 (W)	Plain			0 M	0 S	0 MS	0 ES	0 ES	0 ES
	Beaded			0* MS	0 ES	0 S	0 ES	0 ES	0 ES
BA-4 (Y)	Plain			0 M	0 M	0 MS	0 MS	0 MS	0 MS
	Beaded			0 MS	0 MS	0* S	0 S	0 S	0 MS
BA-8 (Y)	Beaded				0 N	0 M	0 MS	0 MS	0 S
BA-11 (W)	Beaded					0 MS	0 S	0 MS	0 ES

*40 percent loss of beads

Ratings: Film loss (percent)

Discoloration (N) none, (M) moderate, (MS) moderately severe, (S) severe, (ES) extremely severe.

(C) control paint stripes.

(Y) yellow.

(W) white.

TABLE 8

MONTHLY RATING OF ROSIN-ALKYD RESIN TEST STRIPES

Area 3 Portland-Cement-Concrete Pavement

		April (1951)	May	June	July	August	September	October	October 15
P-16C (W)	Beaded	0	0	0	0	10	10	15	15
		MS	S	ES	ES	ES	ES	MS	S
P-17C (Y)	Beaded	0	0	0	0	10	10	10	10
		MS	S	ES	ES	ES	ES	ES	ES
	Plain		0	0	0	0	0	0	0
BA-1 (Y)			N	M	M	MS	S	M	M
	Beaded		0	0	0*	0	0	0	0
			M	M	M	MS	S	M	M
	Plain			0	0	0	0	0	0
BA-2 (W)				M	ES	ES	S	MS	S
	Beaded			0	0*	0	0	0	0
				M	ES	ES	S	MS	S
	Plain			0	0	0	0	0	0
BA-3 (W)				MS	ES	ES	S	MS	ES
	Beaded			0	0*	0	0	0	0
				MS	ES	ES	S	MS	ES
	Plain			0	0	0	0	0	5
BA-4 (Y)				M	M	S	S	M	MS
	Beaded			0	0*	0	0	0	5
				M	MS	S	S	M	MS
BA-8 (Y)					0	0	0	0	0
					N	MS	S	M	MS
BA-11 (W)	Beaded					0	0	0	0
						MS	S	M	S

*Indicates approximately 40 percent of beads absorbed into stripe.
Ratings: Film loss (percent)
Discoloration: (N) none, (M) moderate; (MS) moderately severe, (S) severe, (ES)Extremely severe.
(C) Control paint stripes.
(Y) Yellow.
(W) White.

P-4 (Paint Stripe). Film loss became noticeable over smooth surfaces of protruding aggregate after only one month of service. The color of the stripe was good except in the areas where reflectorizing beads were applied. Film cracks were observed in the spring of 1951. The effective life of the stripe was considered to be 7 months.

P-5 (Paint Stripe). Discoloration was severe and film loss over protruding aggregate was noticeable at the time of the first rating. Film cracks were observed in the spring of 1951. The effective life of the stripe was considered to be 10 months.

Concrete Surface - Area 2

B-5 (Rosin-Oil Stripe). Loss of adhesion and resulting film loss was rapid. Failure of the stripe began during the first freezing weather in December and was complete in January. The stripe did not discolor as severely as the same composition on the asphalt surface.

P-8 (Paint Stripe). Discoloration was severe from the beginning, especially in the beaded portion of the stripe. Film loss in small evenly distributed spots was noticeable at the time of the first rating. The effective life of the stripe was considered to be 4 months.

R-1 (Rosin-Oil Stripe). After only a slight amount of rainfall, air bubbles or blisters appeared over the surface of the stripe. These bubbles were initially ironed out by traffic with only small surface deformations. During the cooler weather of September and October, these blisters were broken by traffic. This resulted in a pitted surface on the stripe. Small areas of the stripe have lost adhesion to the pavement and have flaked off.

R-2 (Rosin-Oil Stripe). The same general pattern of blistering has been observed as for R-1 above. Small areas of the stripe have flaked.

R-3 (Rosin-Oil Stripe). This softer stripe has shown some blistering and resulting blister holes, but blistering has not been as severe as for stripes R-1 and R-2.

The initial work with the rosin stripe indicated the following three major difficulties in its use: (1) The Rosin-oil stripe had poor adhesion to concrete. (2) The proper balance between hardness and brittleness in the striping compound was difficult to achieve; soft stripes were deformed and discolored by traffic, whereas hard stripes were too brittle and cracked severely in cold weather. (3) The stripes showed excessive discoloration due to the adhesion of road dust and tire film.

The experimental work performed in the period from September 1950 to the present time has been primarily directed toward producing a rosin stripe which would overcome the difficulties indicated. Tests were first conducted with twelve chemical and oil plasticizers to replace the mineral oil. The results, based on the performance of the stripes under traffic, indicate that chlorinated paraffin and chlorinated diphenyl oils are better plasticizers than mineral oil.

Attempts were made to incorporate both natural and synthetic rubber in the rosin-oil compound. Natural rubber was incorporated in the form of finely ground rubber crumbs. Examination of laboratory samples containing these crumbs showed the small rubber particles to be evenly divided throughout the mix, indicating that the rubber did not soften sufficiently to blend with the binder material. A uniform blend was obtained with synthetic rubber, but the resulting compounds were sticky and hard to spread. The surface of the spread material did not harden properly after the material had cooled.

The incorporation of alkyd resin in the rosin striping compound was found to materially improve adhesion, hardness, and flexibility of the stripe. This modification of the British composition has shown the most promise, and an extensive study of the rosin-alkyd resin compound was started in February of 1951.

ROSIN-ALKYD RESIN STRIPING COMPOUND

Laboratory tests on binder compounds containing alkyd resin indicated that satisfactory hardness and brittleness was obtained by the incorporation of from 10 to 16 percent alkyd resin and no plasticizer with rosin, or with 10 percent alkyd resin and from 1 to 4 percent of oil plasticizer.

Seven rosin-alkyd resin compounds containing no plasticizing oils have been laid as test stripes on various streets of the A and M College of Texas campus. These stripes are designated BA-1 through BA-5, 10, and BA-15. A number of stripes have also been laid which contain rosin-alkyd resin-oil plasticizer binders. Of these, five have been in service long enough to be reported at this time. These stripes are numbered BA-7, 8, 11, 13, and 14.

A cobalt-metal drier was added to the rosin-alkyd resin striping compound in order to harden the surface of the stripe and thus prevent discoloration due to the adhesion of foreign matter. Three of these stripes have been in service almost three months. They are stripes BA-17, 18, and 19.

The composition of the rosin-alkyd resin, rosin-alkyd resin-oil, and rosin-alkyd resin-oil-drier stripes is shown in Table 4.

Rosin-alkyd resin service test stripes were applied to the pavements in three locations. The application data and monthly ratings of these stripes and the paint control stripes used with them are shown in Tables 5, 6, 7, 8, and 9.

TABLE 9

MONTHLY RATING OF ROSIN-ALKYD RESIN TEST STRIPES

Area 4 Portland-Cement-Concrete Pavement

		July 1951	August	September	October	October 15	Remarks on final ratings
BA-5	Plain	0 N	0 S	0 ES	0 MS	5 MS	Blister holes
BA-7	Plain	0 S	0 S	0 MS	5 MS	5 S	
BA-10	Beaded	0 MS	0 ES	0 ES	5 MS	5 S	
BA-13	Plain		0 S	0 ES	0 MS	0 MS	No blisters
BA-14	Plain		0 S	0 ES	0 ES	0 S	
X-1	Beaded	0 MS	0 ES	0 ES	0 ES	0 ES	Black
X-2	Plain	0 MS	0 MS	0 M	0 M	2 MS	
X-3	Beaded	0 MS	0 ES	0 ES	0 ES	10 ES	
X-4	Plain	0 MS	0 S	0 MS	0 MS	0 M	
BA-15	Plain	0 M	0 M	0 MS	5 MS	5 MS	
BA-17	Plain		0 M	0 ES	0 M	0 S	Some Blisters
BA-18	Plain		0 MS	0 ES	0 MS	0 MS	
BA-19			0 M	0 ES	0 MS	15 S	Blister Holes Some Flaking Greenish color

RATINGS Film Loss (Percent)
Discoloration (N) none, (M) moderate, (MS) moderately severe, (S) severe, (ES) extremely severe.
(Y) Yellow
(W) White

ROSIN-ALKYD RESIN STRIPES AND CONTROL PAINT STRIPES

At the time of this report, the oldest of the rosin-alkyd resin stripes have been in service for only 5 1/2 months. The weather during this period of time has been generally hot, and there has been only a small amount of rainfall.

All of the rosin-alkyd resin and rosin-alkyd resin-plasticizing oil stripes have shown good adhesion to both portland-cement-concrete and asphaltic-concrete pavements. These stripes have all been subject to discoloration by the adhesion of road dust and tire film.

Discoloration of these stripes has been about the same as for the rosin-oil stripes discussed earlier. The incorporation of metallic driers has only slightly reduced discoloration.

In the use of paint stripes for com-

parison with rosin striping compounds, the following points have been observed: (1) Failure of paint stripe films has occurred because of loss of bond or adhesion to the pavement. (2) Discoloration of paint stripes in some cases has been very nearly as severe as for the rosin compound stripes. (3) Discoloration of the portion of each paint stripe beaded with glass reflectorizing beads has been more severe than for unbeaded sections; this discoloration has materially reduced day visibility of the stripe.

Several paint stripes, not reported in this paper, have been beaded in alternate 6-in. sections. This method of bead application greatly improves day visibility without materially reducing night visibility.

CONCLUSIONS

Although some of the striping compounds reported in this paper have been service tested for a relatively brief period of time, the following general conclusions appear to be justified:

1. Yellow and white stripes compounded according to the specifications for the British "Plastic White Line," modified by the reduction of oil content, have shown good service life on asphalt pavement. Comparison with standard paint stripes indicates a relative service life of more than 3 times that of the paint stripes. The undesirable characteristics of this material are (1) poor adhesion to concrete pavement and (2) discoloration by the adhesion of foreign matter.

2. The incorporation of alkyd resin in the rosin compound materially improved adhesion of the striping material to portland-cement concrete but did not materially reduce discoloration. The rosin striping compound modified by the addition of alkyd resin has very definite possibilities as a striping material. The short drying time of from 5 to 10 min. is a definite advantage in its use.

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