TRANSPORTATION SYSTEMS SECTION
COLLEGE OF ENGINEERING
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THE EFFECT OF STUDDED TIRES ON TRAFFIC STRIPING PAINTS

By
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ABSTRACT

Four different types of pavement marking materials were tested in Ring #6; three brands of striping paints and one thermoplastic striping tape. These striping materials were applied on two sections, the polymer cement concrete and the Class "G" asphalt concrete. The results were ranked on the basis of appearance, wear and whiteness.

The thermoplastic striping material consistently outperformed the three paints. The materials wore more rapidly on the polymer cement concrete than on the asphalt concrete and the ranking order for the paints was different for the two sections. The Type #3 stud seemed to have worn the paints more rapidly than either #4, #2, #1, GST, US and UST studs and tires in that order respectively. The superiority of the thermoplastic striping tape was due to its thickness and its construction.

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INTRODUCTION

Last year Kennametal, Inc. sent the Transportation Systems Section four different types of traffic paint and a thermoplastic striping tape. Time did not permit the testing of these materials in Ring #5, so these materials were tested in Ring #6.

This report presents only observations obtained during this test. The observations are visual and not measured. The results of other tests from Rings #5 and #6 are presented elsewhere (1,2,3,4).

Ring #6 was built in August, September and October 1972 and testing started on November 20, 1973. The principal purposes were to test different pavement overlays and their wear resistance to various stud types. The testing program presented an opportunity to test traffic striping paints as an added benefit without effecting the stud tire test.

STRIPING PAINTS

Kennametal, Inc. of Latrobe, Pennsylvania supplied the paints. The company does not manufacture paints but were interested in determining the effect of their tire studs on pavement traffic striping life.

Four different types of traffic paint and a roll of thermoplastic striping tape were sent. One of the cans of traffic paint was damaged in transit and eventually hardened so that it could not be used. Table 1 shows the brands of paint tested and their code number.

TIRE AND STUD TYPES

More information is supplied in reference 4. The types of tires

and studs are shown in Table 2.

PAINT APPLICATIONS

The paints were applied transversely in four stripes, coded 1 to 4, on two different pavements on November 14, 1972. The two pavements were the polymer cement concrete (021) and the Class "G" asphalt concrete with Petroset AT (100). The paints were applied as evenly as possible using a hand paint applicator as shown in Figure 1. Some difficulty was anticipated in applying heat to the thermoplastic striping tape. This was solved by using a Surfa-slick heating iron on the tape as shown in Figure 2. Although there was a tendency to scorch the white paint, the tape adhered successfully to the pavement most of the time.

The average measured thickness of the paints #1-3 were 22 mils and that of #4 was 95 mils. All were applied at the same time when the air temperature varied between 35-47°F, probably in the low forties. These conditions are far from ideal for laying down traffic stripes.

MEASUREMENTS

No measurements were made of the wear of the paints. Rather, visual observations were made and the paints were ranked according to wear, whiteness and appearance. The rankings were made on the paints relative to the different studs; e.g., each paint was ranked versus the stud or tire type. The question answered was which paint stood up better to one particular stud and not which stud caused the least wear on a particular paint. The rankings are more subjective than objective due to visual factors.

RESULTS

The results are presented in a series of ranking, Tables 3-10 for sections 021 and 100 and for wheel applications at 10,000, 25,000, 50,000 and 150,000+, respectively. A series of pictures were taken but only those taken at 50,000 wheel applications are included in Figures 3 and 4. These figures show the appearance of the paints. Rankings were based on such appearances.

DISCUSSION OF RESULTS

One can see from Tables 3-10, that striping material #4 was the outstanding performer with respect to wear and appearance. This material constantly showed less wear than the three paints.

The traffic striping materials performed differently on the polymer cement concrete than on the asphalt concrete. The paints wore more rapidly on the polymer cement concrete. As can be seen from Tables 3, 5, 7 and 9, No. 4 was superior to the three paints followed by #1, #2 and #3 in that order. After 50,000 wheel applications most of these paints were worn off. The type #3 stud seemed to have caused the most damage followed by #4, #1, #2, the GST, US and UST, respectively.

The traffic striping materials performed differently on the asphalt concrete section as shown in Tables 4,6,8 and 10. Here too, the No. 4 striping was the Number 1 in ranking. The rest of paints' rankings varied with wheel applications. Paints #1 and #3 consistently vied for the Number 2 ranking; paint #2 was almost always ranked third or fourth. Stud #3 seemed to wear the paints more rapidly than either the #4, #2, #1, GST, US and UST studs and

tires in following order, respectively.

After 150,000 wheel applications, almost all the paints were worn off in section 021 while some paint still remained in section 100. It seems that the hard polymer cement concrete pavement increases wear while the asphalt pavement is more flexible and hence bonds with the load. The paints do this too.

The reason for the phenomenal success of #4 striping tape to wear resistance is the thickness and its construction; it was four times as thick as the paints and it had an asphalt base. A disadvantage of this type of material is that its bond with the pavement may become loose, as happened; and also snow plows may tear it off because it is high off the pavement. One solution may be to apply this material into pre-recessed grooves to make it flush with the pavement.

It should be remembered that the results are valid for WSU conditions of testing and may not be valid elsewhere.

REFERENCES

1. Krukar, M. and J. C. Cook. "The Effects on Studded Tires on Different Pavement Materials and Surface Textures," Transportation Systems Section Publication H-36, Washington State University, Pullman, Washington, July 1972, 32 pages.

2. Krukar, M. and J. C. Cook. "The Effect of Studded Tires on Different Pavements and Surfaces," paper presented at 52nd Annual Meeting of the Highway Research Board, Washington, D.C., January 1973, 32 pages.

3. Krukar, M. and J. C. Cook. "Experimental Ring No. 5: Studded Tire Pavement Wear Reduction and Repair," Research Report No. 73/8-2, College of Engineering Research Division, Washington State University, Pullman, Washington, December 30, 1972, 160 pages.

4. Krukar, M. "Stud Tire Effects on Pavement Overlays," Research Report No. 73/8-24, College of Engineering Research Division, Washington State University, Pullman, Washington, March 30, 1973, 27 pages.

TABLE 1: TYPES OF TRAFFIC STRIPING PAINTS

BRAND OF PAINT	CODE NO.
Prismo Universal[1]	#1
Merkin Mastercraft Heavy Duty Traffic Paint-350 White[2]	#2
Gleem Zone Marking Paint - Instant Dry White[3]	#3
Thermoplastic Striping Tape - Prismo[1]	#4

[1] Manufactured by Prismo Corporation

[2] Merkin Paint Company,
A Division of Baltimore Paint & Chemical Corporation
2325 Hollins Ferry Road
Baltimore, Maryland

[3] Gleem Division
Baltimore Paint and Chemical Corporation

TABLE 2: TYPES OF TIRES AND STUDS

WHEEL PATH	TIRE TYPE	STUD TYPE	SYMBOL
1	Passenger Winter Tread G78 x 14	No studs	US
2	Passenger Winter Tread G78 x 14	Controlled Protrusion	#1
3	Truck 11 x 22.5	No studs	UST
4	Truck 11 x 22.5	No studs	UST
5	Passenger Winter Tread G78 x 14	Conventional Type	#3
6	Passenger Winter Tread G78 x 14	Perma-t-Gripper	#2
7	Passenger Winter Tread G78 x 14	Norfin	#4
8	Passenger Retread G78 x 14	Garnet Dust Retread, No studs	GST

TABLE 3: RANKING OF PAINTS ACCORDING TO WEAR - SECTION 021 - 10,000 W.A.[1]

PAINT NO.	WHEEL PATHS							
	1	2	3	4	5	6	7	8
	TYPE OF STUDS AND TIRES							
	US	#1	UST	UST	#3	#2	#4	GST
1	2	2	2	2	2	2	3	3
2	3	3	3	3	--	4	4	2
3	4	4	4	4	--	3	2	4
4	1	1	1	1	1	1	1	1

[1] Wheel Applications

TABLE 4: RANKING OF PAINTS ACCORDING TO WEAR - SECTION 100 - 10,000 W.A.[1]

PAINT NO.	WHEEL PATHS							
	1	2	3	4	5	6	7	8
	TYPE OF STUDS AND TIRES							
	US	#1	UST	UST	#3	#2	#4	GST
1	2	2	4	4	4	4	4	4
2	3	3	3	3	3	3	3	3
3	4	4	2	2	2	2	2	2
4	1	1	1	1	1	1	1	1

[1] Wheel Applications

TABLE 5: RANKING OF PAINTS ACCORDING TO WEAR - SECTION 021 - 25,000 W.A.[1]

PAINT NO.	WHEEL PATHS 1	2	3	4	5	6	7	8
	TYPE OF STUDS AND TIRES							
	US	#1	UST	UST	#3	#2	#4	GST
1	2	2	2	2	2	2	3	3
2	3	4	3	3	--	4	4	2
3	4	3	4	4	--	3	2	4
4	1	1	1	1	1	1	1	1

[1] Wheel Applications

TABLE 6: RANKING OF PAINTS ACCORDING TO WEAR - SECTION 100 - 25,000 W.A.[1]

PAINT NO.	WHEEL PATHS 1	2	3	4	5	6	7	8
	TYPE OF STUDS AND TIRES							
	US	#1	UST	UST	#3	#2	#4	GST
1	4	4	4	4	2	2	3	3
2	3	3	2	2	3	4	2	4
3	2	2	3	3	4	3	4	2
4	1	1	1	1	1	1	1	1

[1] Wheel Applications

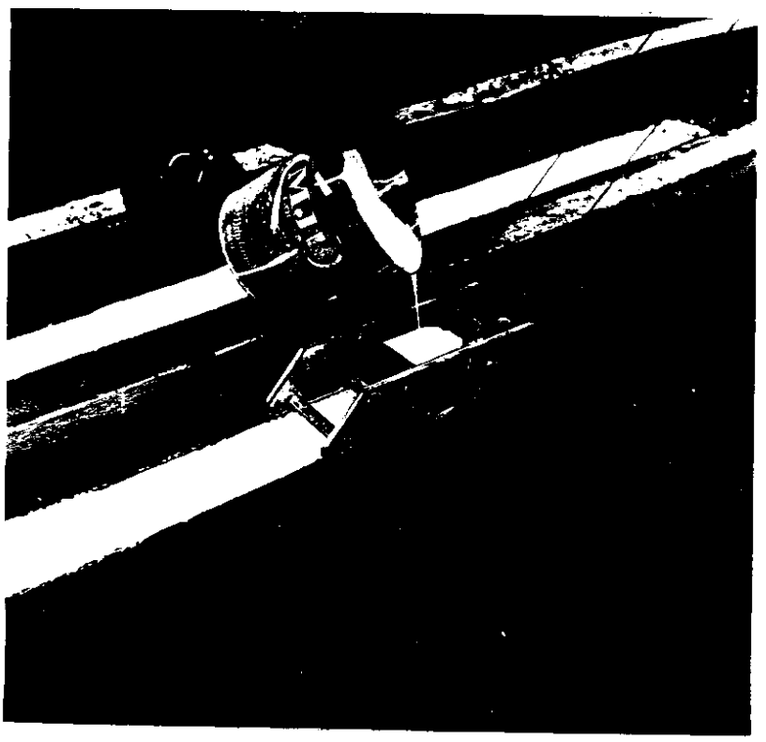


FIGURE 1: The application of striping paint on the pavement using the hand applicator.

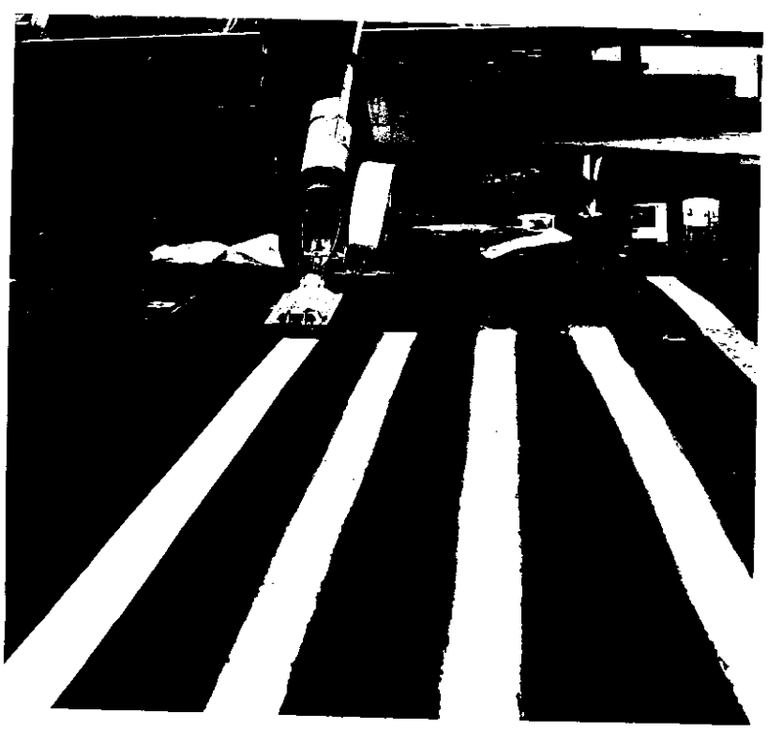
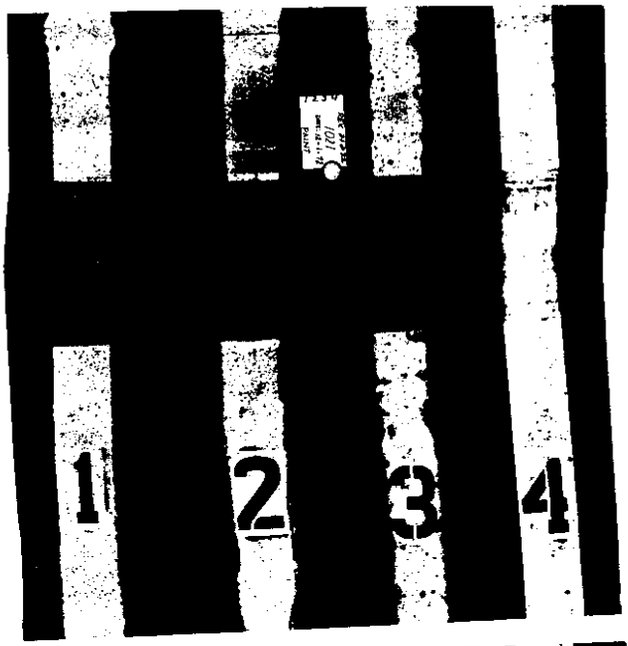
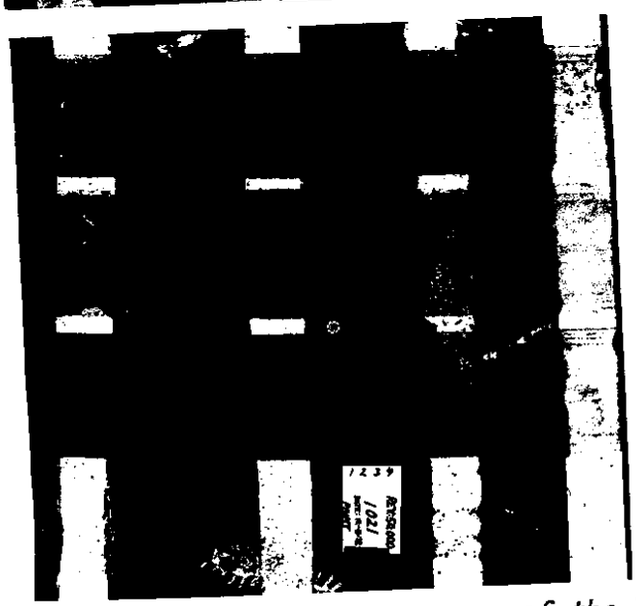


FIGURE 2: The application of heat using the Surfa-Slick on the thermoplastic striping tape.



(a) 1021 - wheel paths 1 and 2

(b) 2021 - wheel paths 3 and 4



(c) 3021 - wheel paths 5 to 8

FIGURE 3: The appearance of the Traffic paints in Section 021 after 50,000 wheel applications.

(a) 1100 - wheel paths 1 and 2

(b) 2100 - wheel paths 3 and 4

(c) 3100 - wheel paths 5 - 8

FIGURE 4: The appearance of the traffic paints in Section 100 after 50,000 wheel applications.