HIGHWAY RESEARCH REPORT

FIELD TESTS ON TWO RAPID DRY TRAFFIC PAINTS

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STATE OF CALIFORNIA

TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

NO. M & R 645166

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STATE OF CALIFORNIA—TRANSPORTATION AGENCY

RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

June 29, 1967

Mr. J. C. Womack
State Highway Engineer
Sacramento, California

Dear Sir:

Submitted herewith is a report on two rapid dry traffic paints submitted by the industry for evaluation. The 3M LIS 3 liquid instant set paint tested had a "dry to no pick-up" of 6 to 15 seconds and was approximately as durable as our State Specification traffic paint. No operational spray equipment is available to apply this paint. The equipment used for the field tests was a prototype, suitable only for small applications. Completely different equipment would be needed to utilize this paint on a large scale. The cost of the paint is expected to be about $8.00 per gallon.

The Phillips Petroleum sulfur based paints tested had a "dry to no pick-up" of from 30 to 60 seconds but the yellowness index was much higher than permitted by our specifications for a white traffic paint. The three formulas tested gave similar durability over asphalt but varying durability over PC concrete. In no case was the durability as good as our State Specification paint.

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

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Division of Highways
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RESEARCH REPORT

FIELD TESTS ON TWO RAPID DRY TRAFFIC PAINTS

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Final Report on M. & R. Project 645166

June, 1967

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REFERENCE: H. A. Rooney and T. L. Shelly, "Field Tests on Two Rapid Dry Traffic Paints", State of California, Department of Public Works, Division of Highways, Materials and Research Department. Research Report 645166, June, 1967.

ABSTRACT: Two experimental rapid dry traffic marking materials which "dry to no pick up" under traffic in from 6 to 60 seconds were tested. The cross striping tests showed that the first paint tested, 3M Liquid Instant Set (LIS3) dried in 6 to 15 seconds and was approximately equivalent in durability to State Specification G-95 traffic paint which has a "dry to no pick up" time of 15 minutes. The second paint, a sulfur based material furnished by Phillips Petroleum, had a "dry to no pick up" time of about one minute. It was generally not satisfactory in durability compared to the State traffic paint, and had a distinct yellow color.

Centerline installations of the 3M Liquid Instant Set have been made in the San Francisco Bay Area and in the Los Angeles area with experimental prototype equipment. An operational spray rig to apply this paint has not yet been developed. This paint will cost about $8.00 per gallon. The current price of traffic paint for use in air pollution districts is about $2.30 per gallon. The 3M paint, however, has a thicker dry film when applied at equal wet film thickness because of the higher percentage of non-volatiles. If this paint is used, the extra cost probably would have to be justified by convenience to the public and safety to State personnel resulting from the elimination of the process of putting out and picking up cones to control traffic.

KEY WORDS: traffic marking materials, paints, traffic paints, setting time/rapid/, field tests.

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INTRODUCTION

In metropolitan areas it has been increasingly difficult and dangerous to do centerline striping without interfering with the flow of traffic. For several years we have been considering paint systems which would dry rapidly enough to eliminate the use of cones behind the striping machine. A paint which would "dry to no pick up" in one to three seconds was desired, but a 30 second "dry to no pick-up" time might be tolerated if one or two follow-up vehicles drove behind the striper to control traffic.

Two formulations of rapid dry traffic line paint have been tested to date. Both were formulated, furnished and applied by the industry. They were:

1. 3M brand Liquid Instant Set Traffic Paint.

2. Phillips Petroleum Sulfur Based Material.

Conventional solvent-based air dry traffic paints are applied to road surfaces at approximately 15 mils wet film thickness. Subsequent evaporation of the solvents result in a dried paint film of about 7 mils thickness. The durability of a 7 mil paint film is limited because of the constant abrasion of traffic. The useful life of the best solvent based traffic paint under the heavy traffic of metropolitan freeways is in the order of 8 - 12 months. Its life is mostly dependent upon its dry film thickness, other factors being equal. California Specification G-95 for a solvent based traffic paint requires a dry to no pick up time of 15 to 18 minutes at 77°F, and a 15 mil wet film thickness, which is equivalent to 7 mils dry film thickness. It is not presently possible to apply ordinary traffic paints containing solvents in greater than the 15 mil wet film thickness and still obtain satisfactory drying and durability.

The 3M brand Instant Set Traffic Paint has a higher percentage of solids compared to most solvent based systems and the dry film thickness would be about 8 to 10 mils with a 15 mil wet film thickness application. Thicker applications of this paint have not been tried.

The sulfur based paint exceeds the "dry to no pick up" value desired. It is placed at about 20 mils thickness. Its "dried" thickness is substantially the same as its applied thickness.

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DISCUSSION

The research on rapid traffic line paint has been restricted to date to the evaluation of materials formulated, furnished and applied by the industry.

During the past six years the following types of "rapid set" or "dry" traffic line materials have been examined by this Department:

1. Tapes
2. Extruded Thermoplastic
3. Minnesota Mining and Manufacturing (3M) LIS paints
4. Phillips Petroleum Company sulfur base material.

(The tape and extruded thermoplastic was covered under Interim Report, P.W.O. 645135, in March, 1967.)

3M Liquid Instant Set Paint

3M has demonstrated several liquid instant set formulations, at least one of which, Formula LIS 3, shows promise of being acceptable. LIS formulations contain approximately 80% total solids by weight, are heated to 240°F under ram pressure of 2400 psi and applied to the pavement hot, through an airless spray-gun at about 7 gallons per mile which results in a wet film thickness of 15 mils. The estimated price of the paint is $8.00 per gallon. "Dry to no pick-up" time has been from 6 to 15 seconds.

The first application by 3M was made March 10, 1966 on heavily traveled S.R. 160, North Sacramento Freeway, at Canterbury Road, northbound lanes, PCC pavement. Stripes approximately 4 inches wide were applied across the road at a right angle to traffic. Since there was relatively little rain (1) from then until November, a second application was scheduled and made November 9, 1966 at our test sites on U.S. 99, South Sacramento Freeway, southbound, just north of Florin Road on PCC pavement, and 3 miles further south just north of Duluth Avenue, on asphaltic pavement.

(1) See rainfall data at end of this report.

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Line Ratings* at age indicated:

	1st Application, 12 month period	2nd Application 5 month period	
	PC Concrete	PC Concrete	Asphaltic Concrete
State G-95 Control	3	8 1/2	7
LIS 3	5	8 1/2	6

*Only post-beaded lines were rated. Ratings were made in wheel track only; 10 = perfect.

Results were encouraging so that a third application was planned. A center line application of post-beaded LIS 3 formulation was made in San Francisco on PCC and AC, and in Los Angeles on PCC in late March and early April, 1967. In San Francisco, a 3M air pollution control formulation was applied. Control lines of State Specification G-95 traffic paint were applied for comparison.

The general procedure at each location was as follows:

The 3M paint was applied by a 3M crew of two. After the paint was brought up to temperature and pressure, one man drove the truck containing the heaters, compressor, generator, etc., while the other man walked immediately behind pushing the spray gun and compressed air-beader rig, all at a brisk walking speed of 3-4 mph. Some trouble was experienced occasionally during a stop with the circulation system of the hot paint. "Dry to no pick-up" time was as short as 6 seconds. All test sections have been applied at ambient temperatures of 50 to 75°F. The effect of ambient and road surface temperatures on the "dry to no pick-up" is not known at this time.

Sulfur Based Paint

Phillips Petroleum Company representatives applied their sulfur based traffic line material on February 14 and 16, 1967 at the U.S. 99, South Sacramento Freeway, PCC and asphalt pavement test areas. This material is virtually 100% solids. It was applied melted through an airless spray gun, and post-beaded from a self-contained rig with a single seat on which the operator rode. Two white and one yellow formulations were applied. Several lines tracked badly at 13 seconds, moderately at 18 seconds, and the "dry to no pick-up" was 30 to 60 seconds. Line thickness was approximately 20 mils. The white lines are yellow-white which do not meet our present yellowness index specifications. Durability has been considerably less than the control, especially their white formula #1 on concrete.

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Line Rating* at 3 months:

	PC Concrete	Asphaltic Concrete
State G-95 Control	8 1/2	8
Yellow	---	5
White Formula 1	2	5
White Formula 2	6	5

*Only post-beaded lines were rated. Ratings were made in wheel track only; 10 = perfect. Most failure of sulfur paint is in adhesion.

NOTE 1: Monthly rainfall data in Sacramento area.

March, 1966	0.22 inch
April	0.59
May	0.24
June	0.00
July	0.09
August	0.00
September	0.05
October	0.00
November	5.48
December	3.33
January, 1967	7.94
February	0.40
March	4.15
April	3.85

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