

COMPARISON OF HIGHWAY STRIPING MATERIALS

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- Installation Report -

by

F. D. Shepard
Highway Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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ABSTRACT

This study has been undertaken to investigate problems relating to the durability of highway striping materials used by the Department. The research is limited to an evaluation of the durability and retroreflectance characteristics of selected paints, thermoplastics, and preformed tapes recommended by the Materials Division for use as centerline and edgeline striping. The report details the installation procedure only; a final report giving the results and conclusions will be submitted upon completion of the field tests.

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INTRODUCTION

As a result of a discussion of various problems relating to the durability of the traffic paint used by the Department at the May 31, 1978, meeting of the Traffic Research Advisory Committee, it was recommended that a task force be formed to study the problems. Upon meeting, the task force recommended that field tests of selected traffic striping materials be initiated. Also, it was thought that an investigation should be made into questions concerning paint specifications, drying times, and performance versus materials specifications. At subsequent meetings of the task force, it was established that the Materials Division would select the materials to be tested and the Research Council would perform the evaluation and prepare a final report.

PURPOSE

The state has used various highway striping materials with varying degrees of success; however, at no time have all the various materials been applied at the same time and place for comparisons. Therefore, the primary purpose of this investigation was to determine the durability characteristics of selected highway striping materials including paint, thermoplastics, and preformed tapes. Also, it was hoped that the investigation would provide a basis for evaluating the Department's specifications for the composition and purchasing of such materials and lead to improvements if warranted.

SCOPE

The study is limited to the testing of those highway striping materials recommended by the Materials Division as used for center-line and edgeline striping. The materials have been applied at one location on bituminous pavement and one on concrete pavement.

This report details the installation procedure only. A final report summarizing the results and conclusions will be submitted once the markings have failed or deteriorated sufficiently for their durability to become evident.

PROCEDURE

Site

The site chosen for placement of the materials is on Interstate 95, southbound, just south of the Route 301 exit in Richmond. The pavement in this area transitions from concrete to bituminous and thereby allowed placement of materials on both surface types under almost identical traffic conditions. This site has an average annual daily traffic of approximately 50,000 vehicles.

Selection of Marking Materials

Recommendations by the Materials Division and subsequent consideration by the task force led to the selection of 14 traffic paints, 6 thermoplastics, and 7 tapes. A list of these materials in the order they are placed on the road is given below.

Traffic Paints

1. A-702: Virginia's conventional white. A 20-30 minute conventional paint with a soya-tung oil vehicle.
2. TM-5368: New Jersey's type IV chlorinated rubber white. A cold applied paint.
3. TM-9216: Virginia's fast-drying white. Has a 50-second drying time and linseed oil vehicle.
4. TM-9216: Virginia's fast-drying white (thick). Same as #3, but with double thickness.
5. 284-270: Virginia's fast-drying white. Has soya oil rather than linseed oil in the alkyd. Same as #3 with soya-tung vehicle.
6. 284-272: High durability two-minute dry white. Same as #3, but with 2-minute drying time.
7. TM-9217: Virginia's fast-drying yellow. Same as #3, but in yellow.

8. TM-9217: Virginia's fast-drying yellow (thick). Same as #7, but with double thickness.
9. 284-271: Virginia's fast-drying yellow. Same as #5, but in yellow.
10. 284-273: High durability two-minute dry yellow. Same as #6, but in yellow.
11. A-701: Virginia's conventional yellow. Same as #1, but in yellow.
12. TM-5367: New Jersey's type IV chlorinated rubber yellow. Same as #2, but in yellow.
13. 284-275: Fast dry waterborne yellow. Water emulsion or latex acrylic.
14. 284-274: Fast dry waterborne white. Same as #13, but in white.

Thermoplastics. 2-component -- hard resin and color

15. 9HM31: Yellow conforming to the current Virginia specifications.
16. 9HM32: Same as #15, but in white.
17. 9HM33: High performance white. Supposedly a high performance thermoplastic.
18. 9HM30: Lower cost white. Lower than Virginia specification.
19. 9HM35: Polamide experimental. Different resin; not as thick. "Between a paint and a thermoplastic."
20. 9HM34: Federal Highway Administration's epoxy thermoplastic. A 2-component epoxy. Is pre-catalized, i.e., pre-coated and only when heat is applied do the components mix and react. It can be applied to damp roads. Also, it is basically the same type material as that applied around Williamsburg.

Tapes

21. 257: 3M Durable tape, yellow.
22. 5361: 3M Scotchlane tape, yellow.
23. 5731: 3M Sta-Mark tape, yellow.
24. 5730: 3M Sta-Mark tape, white.
25. 256: 3M Durable tape, white.
26. 5360: 3M Scotchlane tape, white.
27. 5730: 3M Sta-Mark tape (Va.), white.

Placement

Because of the variety of materials selected for test, coupled with the desired location, the uniform and controlled application of the materials presented a problem; especially if state forces were to be used. However, it was learned that the Baltimore Paint and Chemical Company had the equipment and expertise to apply all the desired materials, and they were contracted to install all the test sections with the exception of the pavement tapes. Since the tapes are preformed, no special apparatus was required for their placement.

The equipment used for application of the paint striping is shown in Figure 1 (all figures are attached). Calibration of the equipment for the desired paint coverage, paint film thickness and glass bead coverage is shown in Figures 2 and 3. After calibration of the equipment, paint stripes were applied to the pavement as shown in Figures 4 and 5. Figure 6 shows the equipment used for placement of the thermoplastic materials while Figure 7 shows the thermoplastic being applied. Figure 8 shows the preformed tapes being applied to the pavement.

As shown in Figure 9, two lines 12 inches apart were applied for each type material. Figures 10 and 11 show the test stripes placed on concrete and bituminous pavements, respectively. Close-ups of the lines are shown in Figures 12 and 13.

Evaluation

The lines are being inspected periodically to evaluate the performance of the materials. The characteristics being evaluated are

(1) general appearance, (2) durability, and (3) night visibility. The general appearance is judged by viewing the lines from the side of the road and takes into account such factors as fading, yellowing, darkening, and dirt collection. It will be rated on a scale of 0 (complete failure) to 10 (perfect).

The durability is being rated by estimating, from examination with the unaided eye, the percentage of line remaining in the wheel track areas. These ratings are on a scale of 0 (no line remaining) to 10 (no film loss). The type of film loss is recorded as "worn", "chipping" or both. The percentage of line remaining on the pavement is considered as the percentage of the wheel track area in which the pavement is not exposed. The term "wheel track" is defined as the area of greatest wear caused by the tire and the 9 inches to either side. Therefore, each line has two wheel tracks approximately 18 inches wide as shown in Figure 9.

The night visibility designates the brightness of the materials when examined at night under illumination from the side of the road. The eye and light source are separated by a distance which corresponds to a viewing angle of approximately 1/2 degree. This property is also rated in the wheel tracks and is reported as the percentage of beads retroreflecting or the current brightness compared to the original brightness. This rating is on a scale of 0 (no retroreflectivity) to 10 (100%, or initial, retroreflectivity).

In addition to the nighttime subjective evaluations of brightness, photometric readings will be made with a retroreflectance meter placed on each line. Results from this apparatus, as shown in Figure 14, will be compared with the visual observation to investigate the potential use of such instrumentation in determining brightness.

Also, close-up photographs of each line will be taken periodically to investigate the percentage of bead loss with time and possibly to correlate the loss of beads with the loss of brightness.

Ratings of the three characteristics discussed above can be combined to obtain an overall rating for each material. It is suggested that the following equation be used.

$$\text{Rating (R)} = 0.10 A + 0.40 D + 0.50 N,$$

where

- R = overall rating,
- A = appearance rating,
- D = durability rating, and
- N = night visibility rating.

RESULTS

As noted previously, periodic inspections are being made to accumulate data on the performance of the materials. Once the test stripes have failed or deteriorated sufficiently for results to become evident, a final report will be prepared. The report will summarize the results obtained on the installation and make recommendations based on these results and on the experience gained.

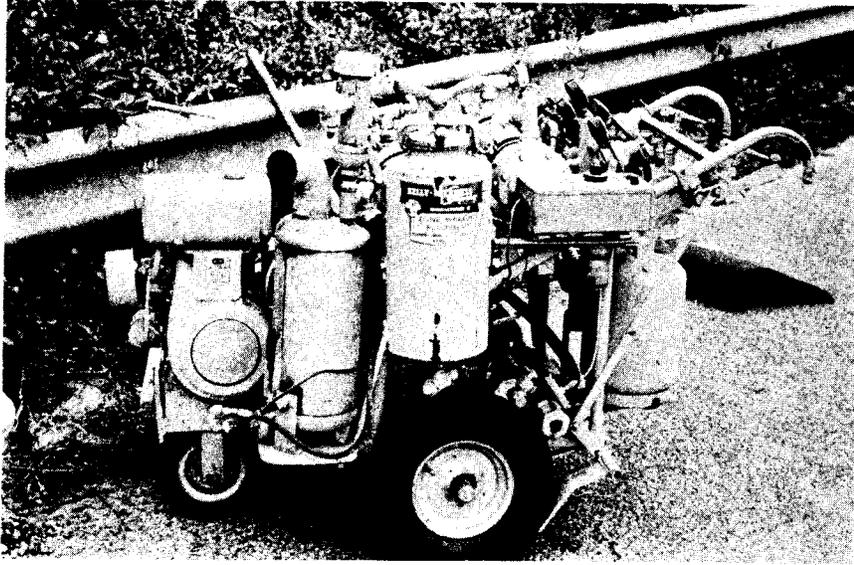


Figure 1. Paint striping machine.

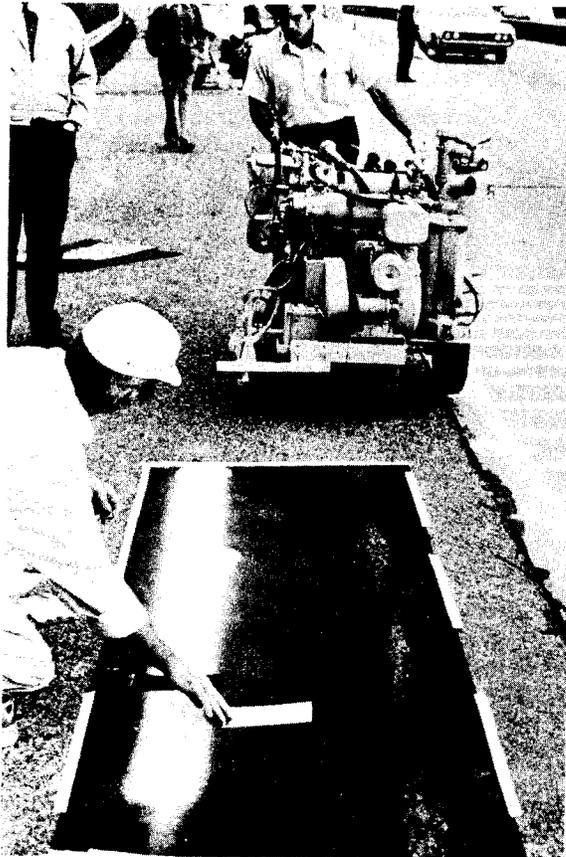


Figure 2. Calibrating for paint thickness.

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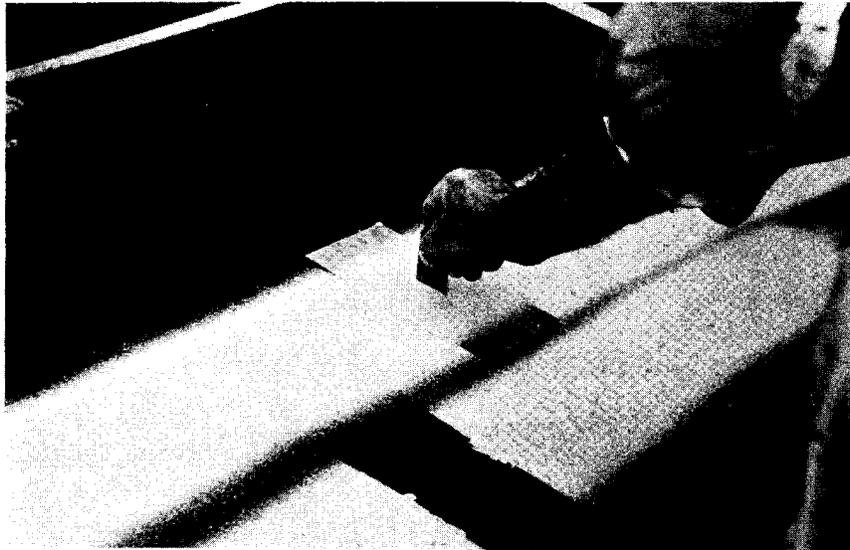


Figure 3. Checking test plate for paint thickness.

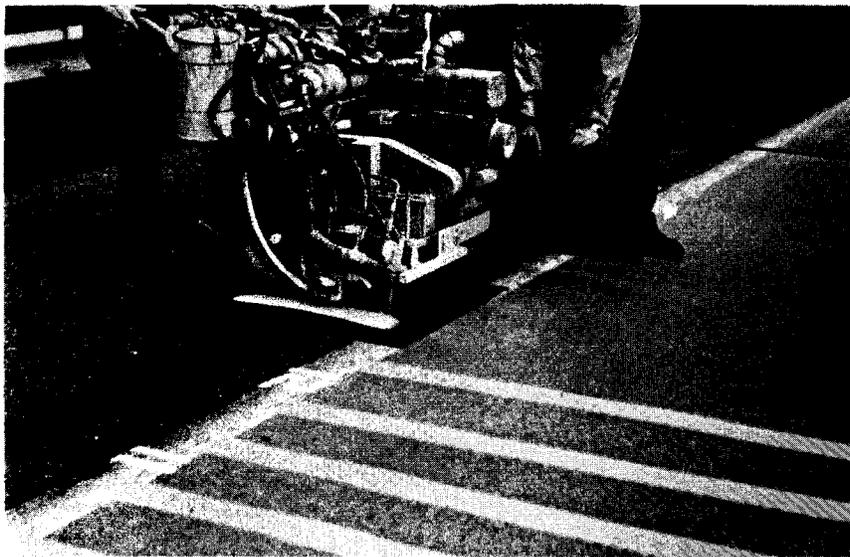


Figure 4. Beginning of test stripe application.

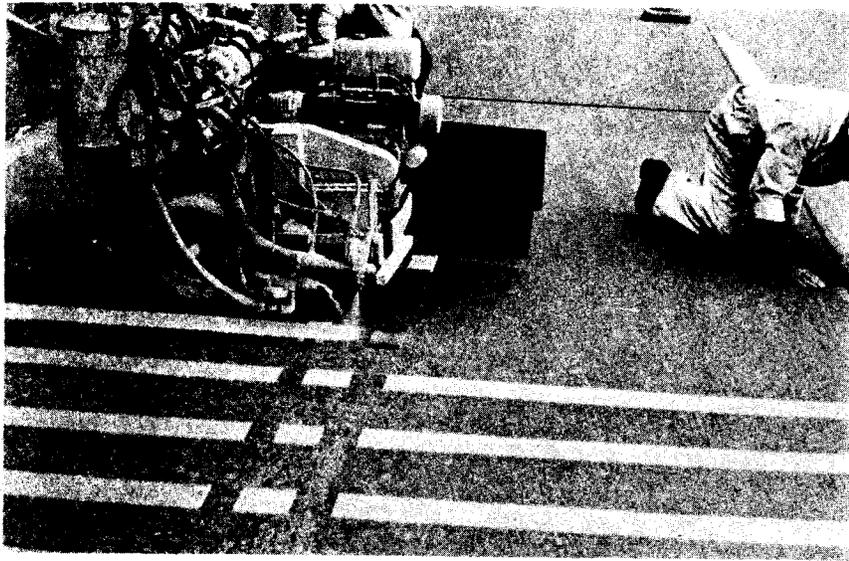


Figure 5. Applying test stripe on pavement and sample plates.

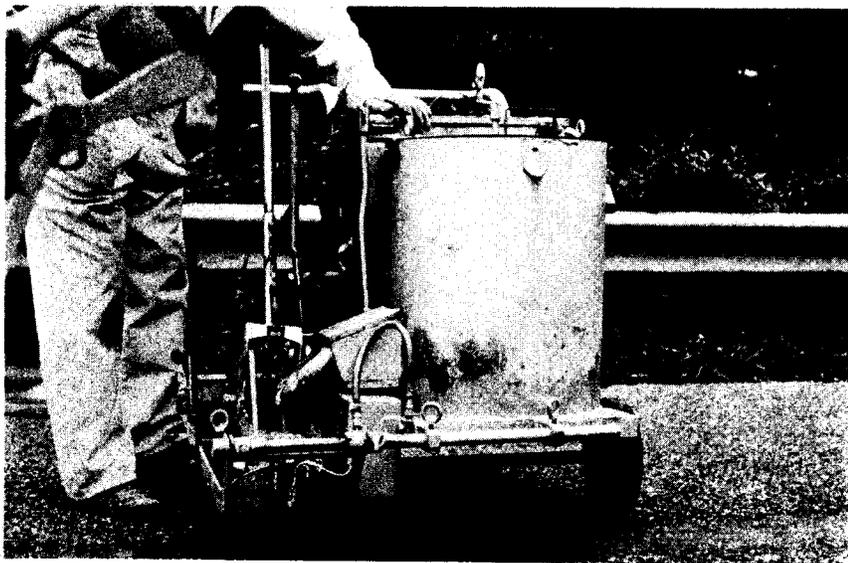


Figure 6. Machine for applying thermoplastic.

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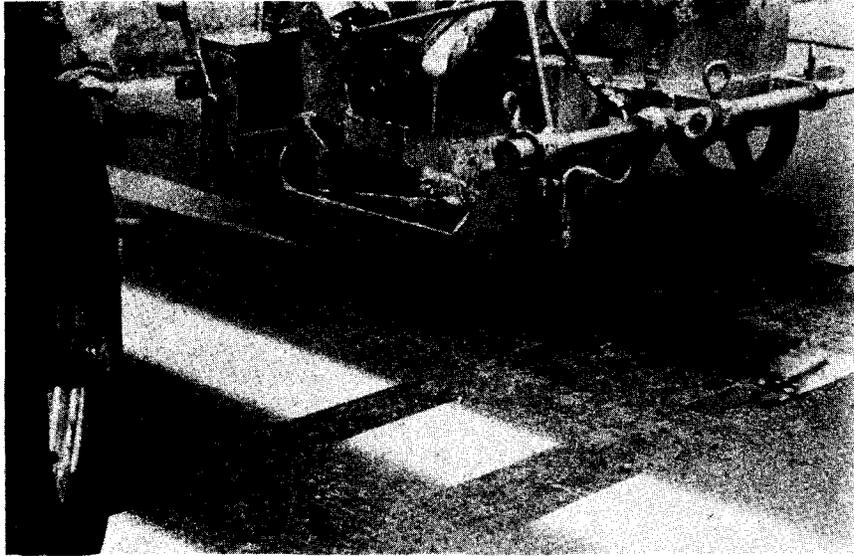


Figure 7. Applying thermoplastic material.



Figure 8. Applying preformed tapes.

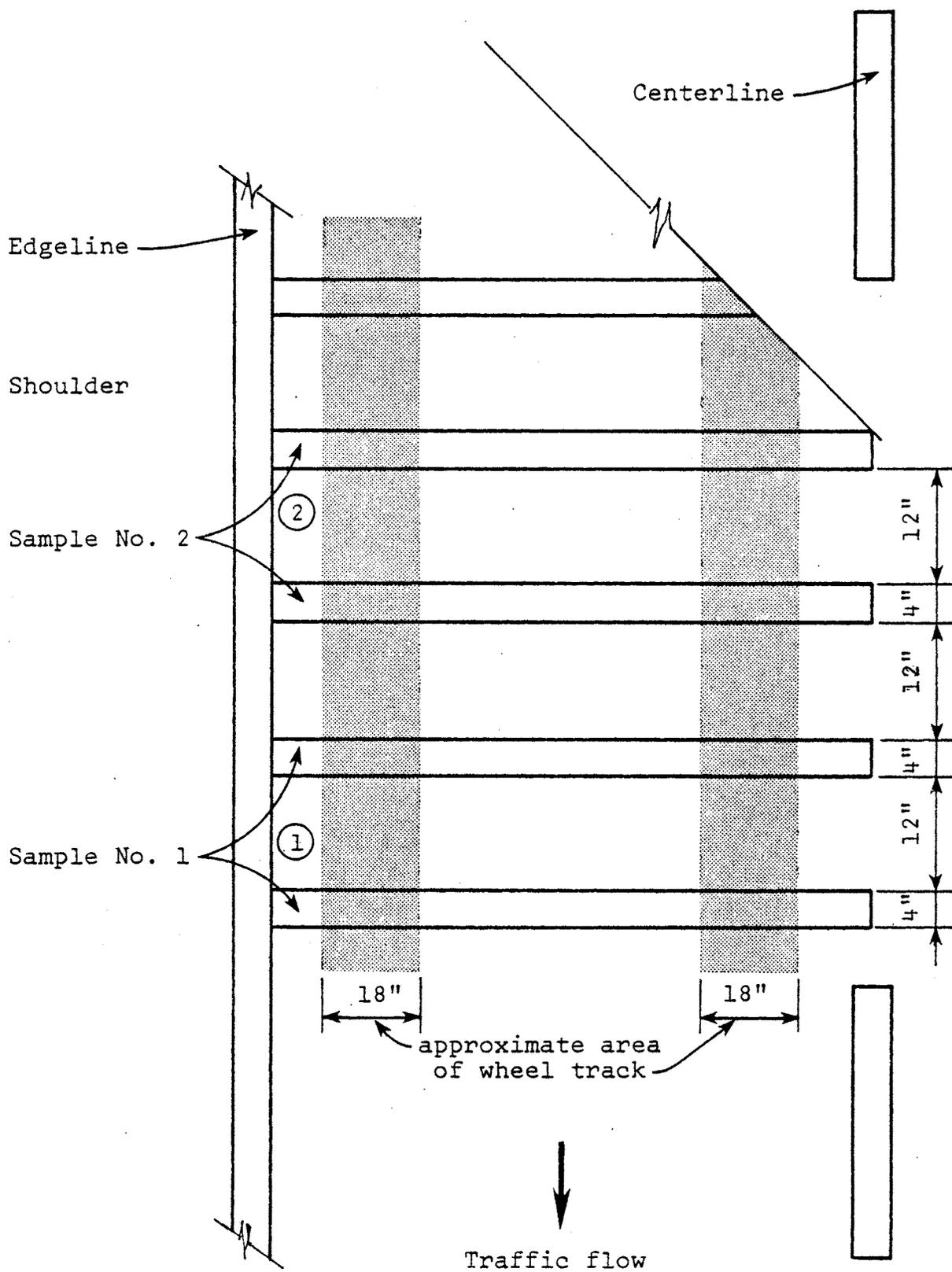


Figure 9. Placement of test materials.

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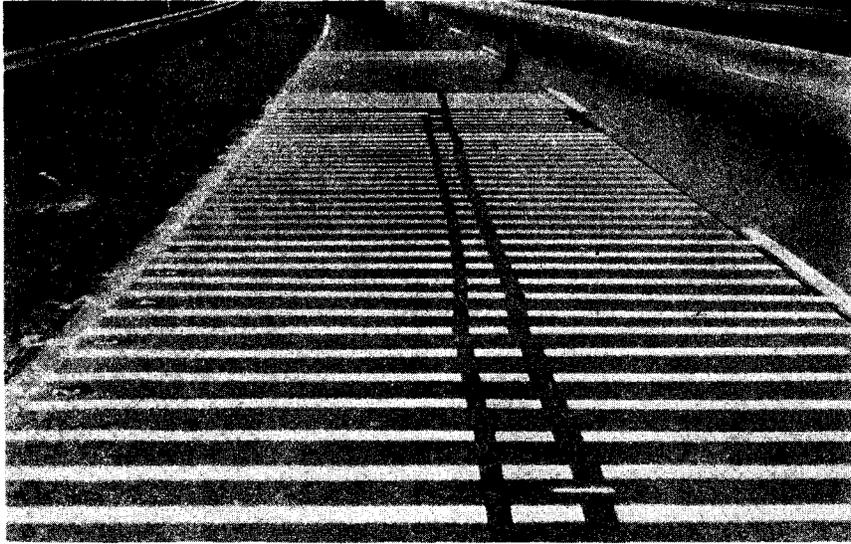


Figure 10. Test section on concrete pavement.



Figure 11. Test section on bituminous pavement.

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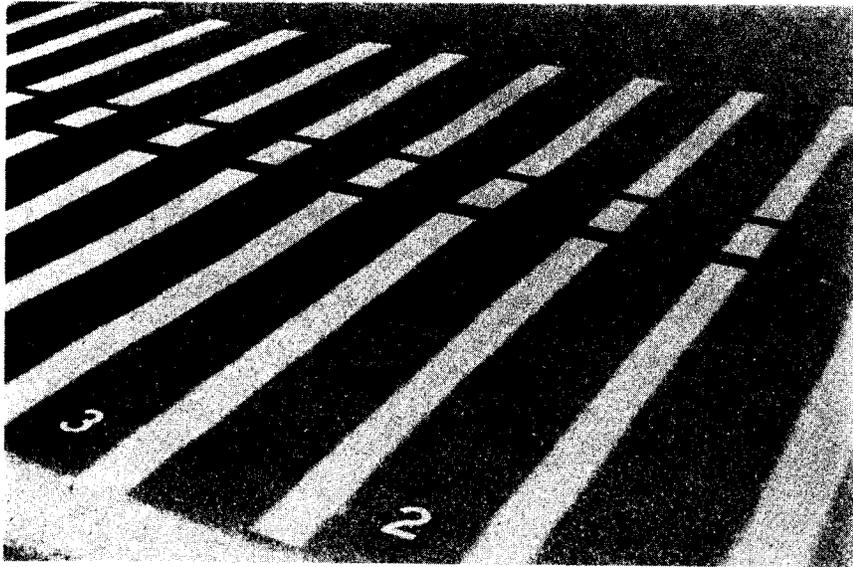


Figure 12. Typical test stripes.

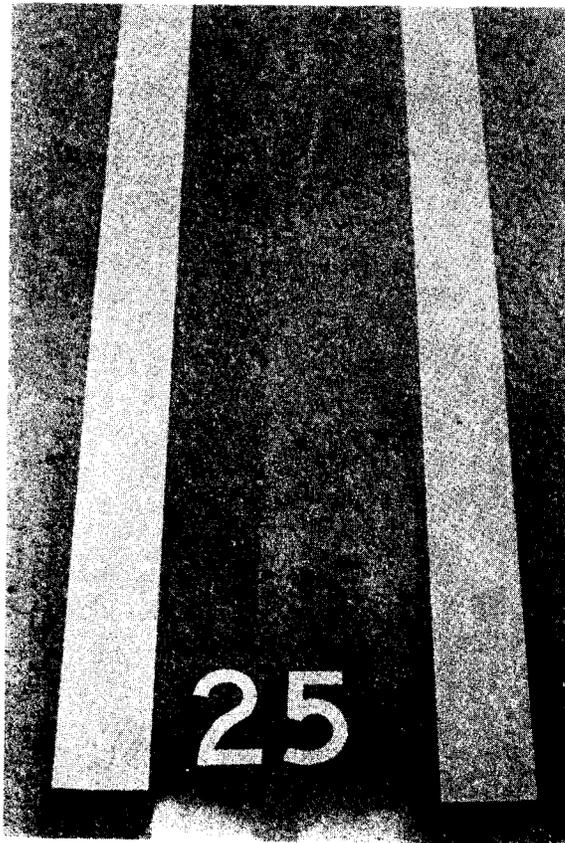


Figure 13. Close-up of test stripe.

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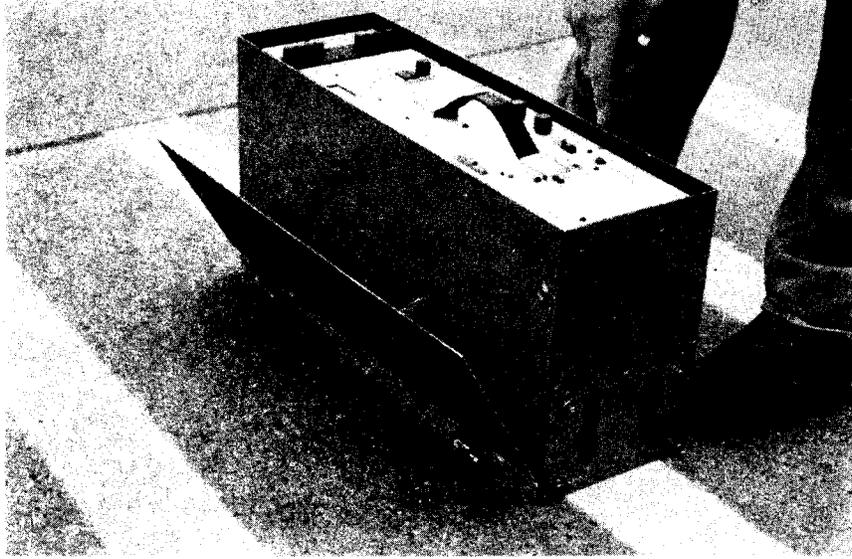


Figure 14. Retroreflectance meter.