# Application of Plain and Beaded Traffic Paints

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SYNOPSIS

TRAFFIC paint in Washington is applied by spraying. Glass beads, which improve the effective life as well as the visibility of traffic stripes, are mixed with the paint prior to spraying. The paint, in addition to being a good bead binder, must have the following properties for proper spray application: (1) viscosity between 75 and 85 Krebs units, (2) good nonsettling properties, (3) ability to wet moist surfaces, and (4) drying time not longer than 15 min.

Two types of spray machines are used. The first type is an independently steered push-cart machine which carries the spray guns and is pushed by a truck carrying the paint supply. The second type is a self-contained unit in which the paint is carried on the truck and the guns are suspended from a rear platform on the truck.

An average crew consists of three vehicles, including the spray machine, and a personnel complement of six men; 20 to 25 mi. of stripe per day can be applied if the paint dries in 15 min. or less.

Since 1949, field application has been supervised and coordinated by laboratory personnel. Equipment has been modified to enable spray machines to apply beaded mixtures efficiently at a spread rate of 21 to 22 gal. per mi. of 4-in. stripe. A rapid and reliable method of checking field application rate is described.

● A SUCCESSFUL striping program depends not only on the quality of the paint, but also on the satisfactory and economical application of the material in the field. The overall appearance of the stripe (including clean and sharp edges, accurate retracing over old lines, freedom from swirls and sharp angles, and to a certain extent, freedom from unsightly smearing by traffic before the paint is dry) is entirely dependent upon the men and machines that apply it. The general performance of the paint itself, on the other hand, is the responsibility of the formulator. In Washington, traffic paint is formulated in the laboratory and is applied by state forces using state-owned equipment.

Since 1949, field striping operations have been coordinated by laboratory personnel thoroughly familiar with all characteristics of the paint. Field and laboratory forces have cooperated in solving mutual problems. Equipment modifications or new painting procedures developed by any one crew have been acknowledged and the information passed on to other crews. In addition to more-efficient, and consequently more-economical, striping operations, this program has resulted in a stripe of uniformly high quality throughout the state.

## REQUIREMENTS OF TRAFFIC PAINT

This discussion will deal mainly with the field application of traffic paint. A successful striping program cannot be accomplished, however, with a basically sound striping material to use. Experience in Washington has indicated that traffic paint must meet the following general requirements if it is to be applied uniformly at an adequate rate of spread:

1. The viscosity of the material must be high enough to afford good handling characteristics in the equipment used. The rate of application of a low-viscosity material is difficult to adjust. The operation of the machine on the road when attempting to apply a low-viscosity material is quite inflexible. A viscosity at 70 F in the range of 75 to 85 Krebs units for paint and 90 to 105 Krebs units for beaded mixture has proved most satisfactory for our equipment.

2. The paint, when used as a premixed binder, must hold the beads in

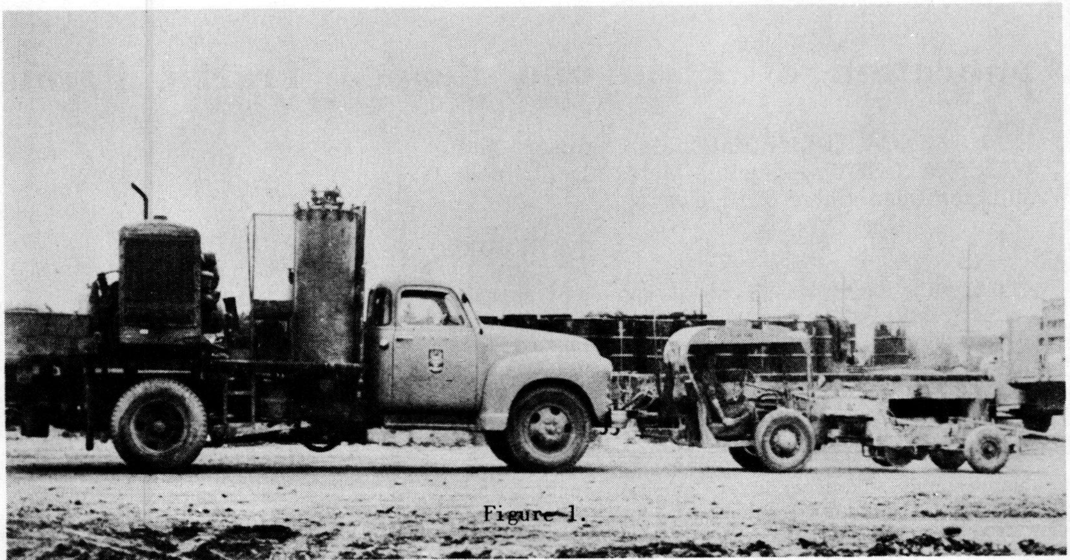

Figure 1.

suspension in the paint tanks and in the stripe after application. Each bead should retain its original position in the film and not settle through to form a layer next to the road surface during the drying period. Not only must the paint hold the beads in suspension in the containers and in the applied film during the drying period, but it must have sufficient suspending power to prevent the beads from being forced to the bottom of the paint film as they are ejected from the spray gun.

3. The paint must be able to wet moist surfaces. Many times, even during summer months, night fogs and heavy dews leave a film of moisture on roadways. The paint must wet through this moist and dirty surface and bond to the roadway itself. Glass beads often carry a residual moisture film which requires proper wetting action by the paint if the beads are to be completely dispersed in the tanks and uniformly applied to the roadway. A water-miscible solvent, such as acetone, alcohol, or methyl ethyl ketone, in the paint appears to be helpful in attaining thorough wetting of moist surfaces.

4. The paint must have rapid through-dry as well as rapid solvent release. A paint having quick surface-dry and slow through-dry will usually break under early traffic resulting in a smeared line, which is not only unsightly but also very hard on the morale of the paint crew. Our present specifications require a maximum dry-to-no-pick-up of 15 min. The paint we are using actually dries somewhat faster than that in the field under good drying conditions.

5. The problem of cleaning tanks and equipment is of major importance to the field crew. The cold-cut formulation we use is very helpful in that respect in that the hardened film can be redissolved in the solvents used in thinning the paint. This property may not be present in cooked-type vehicles which require catalytic driers.

## BEADED TRAFFIC STRIPES

The State of Washington uses beaded traffic stripe exclusively at the present time. The cost of glass beads has decreased sharply in the past few years. This reduction in bead cost has been accompanied by a rapid increase in the cost of most paint raw materials. The end result is that beads, on the basis of cost per solid gallon, are only slightly more expensive, or in some cases actually cheaper, than good-quality traffic paint. As was stated in an earlier publication (1), the use of glass beads results not only in vastly improved visibility, but also in appreciably longer effective service of traffic stripe.

We use premixed beads in all of our traffic stripe. On heavily traveled primary highways, in addition to premixing 4 lb. of small beads in each gallon of paint, we drop 3 lb. of larger beads on

each gallon of the applied beaded mixture. On all other roadways we omit the overlay beads and use 6 lb. of premixed beads in each gallon of paint.

The affinity of the glass beads for moisture often presents a problem in the application of overlay beads. In many cases the moisture film on the beads causes them to cling together and clog the hoppers and feed lines of the gravity dispensers. In normal summer weather dry, ventilated bead storage prevents this difficulty. In high-humidity areas, storage for 48 hr. in heated storerooms prior to using will assure free flow of the beads through the dispenser.

Since the premix beads are applied by spraying, there is a tendency, of course, for some of the beads to rebound and escape from the film. Experience has indicated that the application rate, rather than the line pressure, is the controlling factor in rebound loss. If the mixture is applied at a minimum rate of 18 gal. per mile of 4-in. stripe, the loss of beads through rebound will not exceed 10 percent. This maximum loss of 10 percent appears to be quite constant at line pressures of from 40 to 80 psi. and atomizing pressures of from 30 to 40 psi. These values represent the range of pressures normally used on our machines. Extensive field tests have indicated that rebound loss, even at low line pressures, may amount to as much as 50 percent if the application rate is reduced to 10 gal. per mi. of 4-in. stripe.

## EQUIPMENT USED FOR PAINT APPLICATION

The first traffic-striping machine used in Washington consisted of a motorcycle and side-car combination with a small compressor and tank. Next came a simple paint cart pushed by a truck, then more elaborate push carts, and finally a large self-contained unit. Two push-cart machines and four self-contained units are in use today. Both types of machines apply the paint through large spray guns.

### Push-Cart Machine

The push-cart machine (Fig. 1 and 2) is pushed by a $1^1/_2$-ton cargo truck. It is attached to the truck by a double-roll system, which permits free movement horizontally and vertically in a plane perpendicular to the line of travel. The truck carries the air compressor, paint tanks, and main feed controls. A pacing wheel mounted on the truck drives a "bitumeter" which records stripe footage and gives ground travel in feet per minute. A motor tachometer and hand throttle on the truck enable the driver to maintain a constant motor speed. If the truck is

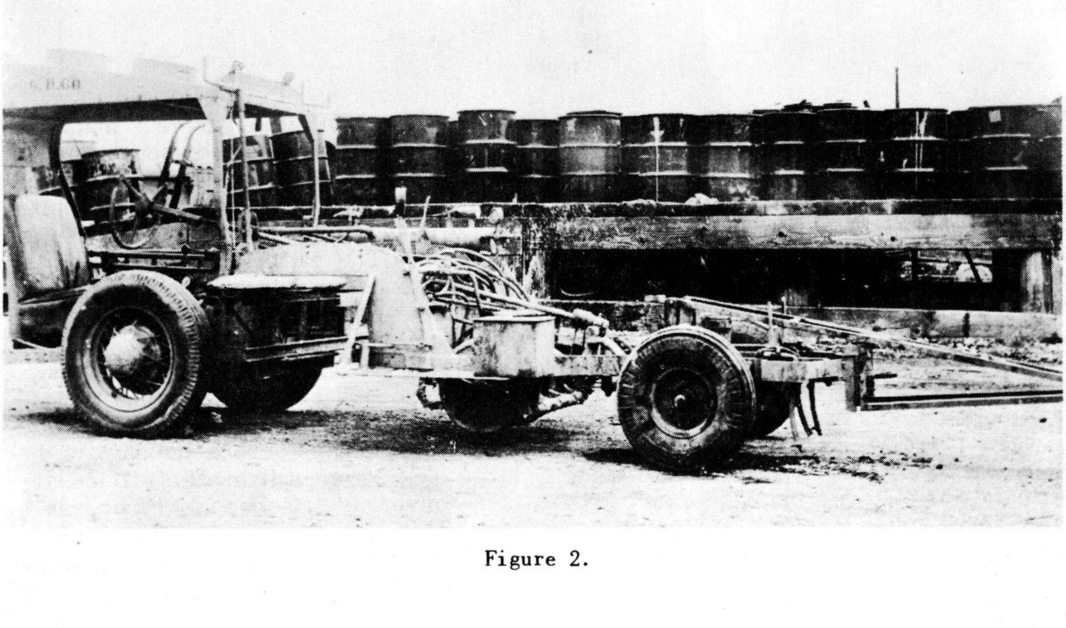

Figure 2.

properly powered and geared, the pacing wheel, hand throttle, and motor tachometer enable the driver to maintain a constant ground speed regardless of terrain. Feed lines from the paint tanks, which have capacities of 200 gal. and 60 gal., respectively, of main and barrier paint, are $1^1/_4$-in. galvanized pipe sloping from the tanks to the front bumper. The air and paint lines on the truck are connected to the lines on the cart by 1-in. neoprene pressure tubing. Feed lines on the cart are $^3/_4$-in. galvanized pipe. The cart, which is independently steered, carries three spray guns, bead dispensers for overlay bead application, and operating controls for the guns. Sharp stripe edges are secured by means of steel discs set 4 in. apart with the guns operating between them. The boom shown on the front of the cart carries a sight through which the cart driver looks to maintain a straight line of travel.

A gear-type pump is used for transferring the paint into the tanks on the truck. The beads for premixing are added after the paint is in the tanks. Paddles operated by an air motor are used to keep the paint and bead mixture stirred.

Figure 3.

## Self-Contained Machine

The self-contained unit (Fig. 3), which was built in 1950, is our newest machine. It has the guns and bead dispensers suspended from the rear platform It has a tank capacity of 400 gal. of main striping mixture and 100 gal. of barrier striping mixture. The tanks are provided with stirring paddles driven by a power take-off on the truck. All tank openings are gasketed to withstand pressures of more than 100 psi. The compressor has a capacity of 125 cu. ft. per min. It provides compressed air to the air manifold, visible in Figure 3 across the bank of the large tank, from which all air lines are fed. Solvent is provided from a pressure tank and is piped into the system so that all guns and lines may be flushed while on the

road. The three spray guns on this machine, as on all our other machines, are DeVilbiss WV-598 high-speed spray guns with Z-27 air cap. Air curtains provide sharp edge cuts on the stripe. A pacing wheel, motor tachometer, and hand throttle are also used on this machine to give positive speed control. The double-mirror system shown on the front of the truck places the driver's apparent point of vision about 6 in. above the ground, enabling him to maintain a straight line of travel. The mirrors are hydraulically operated and are controlled from the cab.

## VEHICLE AND PERSONNEL REQUIREMENTS OF STRIPING CREWS

The vehicle complement of an average striping crew consists of (1) a panel-type lead vehicle carrying small equipment and personal effects, and showing warning signs and blinker lights, (2) the striping machine, and (3) a light cargo-type follow-up truck carrying reserve paint, beads, and heavier items required for the day's operation. This truck carries rear warning signs and blinker lights and picks up the wet paint markers dropped from the striper.

An average personnel complement consists of six men, including a foreman, one man in the lead vehicle, a driver on the striping truck, a paint man, and two men in the rear truck. The foreman lays out the day's work, keeps the daily record of operation, and fills in where necessary. The entire crew works wherever required on loading, cleanup, and maintenance.

## AVERAGE GROUND SPEED OF STRIPING MACHINES

In order to meet adequate standards of stripe appearance, a ground speed of 4 to 5 mph. has been found most efficient for our present equipment. Experience has shown that about 1 mi. of wet paint behind the machine is all that can be protected against smears and traffic crossover. Difficulty is often encountered in congested traffic areas in keeping traffic under control with only 1 mi. of wet paint behind the machine. State police help is utilized as much as possible in those areas.

An average striping crew, particularly one using the large self-contained unit, can stripe 20 to 25 mi. per day if the paint dries in 15 min. or less. Some proprietary formulations we have used took as long as 45 min. to dry. In order to protect such material from smearing by traffic, the ground speed of the machine is cut to about $1\frac{1}{2}$ mph. Since the vehicle and personnel requirements are the same as for the faster-drying paint, it is apparent that the cost of application per mile of stripe is more than doubled when the slower-drying material is used.

## FIELD SUPERVISION OF PAINT APPLICATION

In the post-war years, the heavy increase in traffic throughout the state made it apparent that closer coordination of state-wide striping operations was imparative in order to achieve uniformity in operations. Since the striping material being supplied appeared to meet nearly all of the theoretical requirements set up by laboratory test methods and good formulating practices, the next step was to attempt to have it applied uniformly in the field. The first step was to eliminate mechanical defects in the equipment. These improvements included: (1) providing spray guns large enough to give adequate flow rates at an economical rate of travel, (2) reducing feed-line friction losses by increasing tubing sizes to the point where reasonable feed pressures would supply sufficient materials to the guns, and (3) increasing the size of the air compressor to the point where not only sufficient air was supplied for normal operation, but an emergency reserve was readily available. These three items have been attended to on all of our machines and the equipment is now capable of satisfactory operation.

Considerable time was lost by some of the crews in transferring the paint into the tanks on the spray machines, especially from 5-gal. cans. By substituting power stirrers for manual stirring, and by furnishing gear pumps to transfer the paint to the tanks, it was possible to supply the paint in 50-gal drums rather than 5-gal. cans. This not

only speeded up the loading operations but also saved from 5 to 10 cents per gal. on the purchase price of the paint.

The paint lines and guns often clog after short stops in the field. The time lost in cleaning the equipment on the road was reduced materially by providing a solvent line in the feed system such that the paint feed can be shut off and the lines and guns cleaned by blowing with solvent.

Coating the underside of the spray platform on the self-contained units with heavy grease prevented paint spatters from hardening. The coated platforms are now cleaned quickly and efficiently by merely spraying with solvent.

The external-mix spray guns require proper balance of line pressure and atomizing pressure for efficient operation. It was found that stripe appearance and uniformity were materially improved by instructing each crew on the proper adjustment and maintenance of the spray guns.

Laboratory tests and observations of carefully controlled, experimental field stripes indicated the premixed paint should be applied at a rate of not less than 21 gal. of mixture per mile of 4-in. stripe. The following method of checking field application rates has been developed and has proved rapid and reliable. It can be performed with a minimum of apparatus by nontechnical personnel and is actually used by the field crews to check their own applications:

An ordinary piece of glazed butcher paper, 24 in. long, previously weighed, is placed ahead of the machine and is coated as the machine passes over it. The paper is immediately rolled up and weighed on a 200-gram capacity triple-beam balance. The loss of solvent through evaporation is negligible. By knowing the unit weight of the mixture and referring to charts which have previously been prepared, the application rate in gallons per mile is determined. Pressures and ground speed, which were recorded previous to taking the test panel, are then adjusted until further test panels show that the proper application rate is obtained. The method, while admittedly subject to some error, is accurate enough for practical purposes and has been very helpful in maintaining uniform and adequate paint application.

We have been considering placing some type of metering device in the paint line ahead of the guns so that the gun operator, by reading his pacing disc and flow meter, may have a running check on the application rate. We have not as yet, however, actually installed such a device.

## CONCLUSIONS

The quality of a traffic stripe is judged primarily by the satisfaction that it gives the motoring public. Satisfactory service from any striping material is dependent to a great degree on the technical skill of the striping crew. The men must be able to operate the equipment properly, to register closely when retracing old stripes, and to apply new stripes neatly with a minimum of swirls and sharp angles. Cooperation between field crews and laboratory personnel has resulted in a more efficient striping program and a higher quality traffic stripe than was normally obtained before the field-supervision program was instituted.