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RESEARCH FILE

State of California
Department of Public Works
Division of Highways
Materials and Research Department

July 10, 1959

Laboratory Project
Authorization 84-R-6148

Mr. F. E. Baxter
Maintenance Department
1120 N Street
Sacramento 14, California

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Dear Sir:

Submitted for your consideration is:

A PROGRESS REPORT ON

APPLICATIONS OF GLASS BEADS ON GUARD RAILS

AND VARIOUS HIGHWAY DELINEATORS

Study made by. . . . . Structural Materials Section
Under general direction of . . . . . J. L. Beaton
Work supervised by . . . . . R. N. Field
Report prepared by . . . . . R. O. Watkins

Very truly yours,

F. N. Hveem
Materials and Research Engineer

By John L. Beaton
J. L. Beaton
Supervising Highway Engineer

cc: JWTrask
GMWebb
RJIsrael
BTremper
RNField
JLBeaton

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The following is a progress report of work done during the past year in investigating the effectiveness of reflective glassbead coatings on highway guard rail, in accordance with the request from the Maintenance and Traffic Departments. (See Figure I, letter of June 16, 1958, from F. E. Baxter to F. N. Hveem).

Location of Test and Material Tested

Three guard rail installations in the Sacramento area have been coated with various reflective glass beads and paint-binder combinations.

The first installation to be coated was a tangent section located 16 miles east of Sacramento on Highway 50, where the highway crosses Alder Creek. Prismo, Flex-O-Lite, and Potter Brothers (Traffic-Line) beads were applied on September 12, 1958 to three sections of rail each, using Prismo paint, white Traffic-Line paint and Service and Supply's white guard rail enamel (52-G-10). This allowed nine combinations of beads and paint.

A 100 foot installation of curved Tuthill rail located in Broderick on State Sign Route 24 was reflectorized October 9, 1958, utilizing two combinations of beads and binders. Prismo beads were bonded with both Prismo and guard rail enamel. 3 M's reflective liquid Codit was also tested on this section of rail.

On June 18, 1959, a coating of wide angle Cataphote beads was applied to 480 feet of a 600 foot section of Tuthill type guard rail located on the outside shoulder of the west-bound lanes of U.S. Highway 40, 200 feet east of the Marconi Avenue Overcrossing. These beads are manufactured with a silicon coating which the manufacturer claims improves the wet weather reflectance. Standard white guard rail enamel, obtained from Service and Supply, was used as a binder.

The physical properties of the beads tested in this investigation are tabulated below:

Bead	Diameter	Index of Refraction	Color
Potter Bros.	8 to 35 mils	1.50	Clear
Flex-O-Lite	10 to 40 mils	1.78	Clear
Prismo	5 to 8 mils	1.91	Yellow
Cataphote	7 to 10 mils	1.92	Light Yellow

No Physical Properties were given for the Codit.

Procedure

All the experimental beaded coatings except 3 M's Codit, were applied to the fresh paint with a spray gun

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fitted with a special nozzle.

Much difficulty was encountered on the first two applications in obtaining an even coating of beads. An acceptable coating was produced on the last rail installation by using 2 men with spray guns. One man spraying a thin coat of paint was followed about 30 seconds later by another man spraying the beads. The air pressure to the bead gun was reduced to the operational minimum so the beads just fell on the fresh paint and were not blasted on.

The first application of Codit (micro beads suspended in paint) was sprayed on the rail. This method of application resulted in no reflectance, because the beads did not stay suspended in the binder. A second application of Codit was later brushed on the rails, this procedure resulted in a highly reflective coating.

Results

During this investigation, only the three above mentioned paint binders were tested. The Traffic-Line paint was the most difficult binder to work with, due to its fast drying characteristics. The drying time of Service and Supply's Guard Rail Enamel and the Prismo paint were found to be satisfactory for bead application. To date no difference in the service life of the test binders has been determined.

The delineating effectiveness of the various coatings has been observed at night. The Cataphote and Codit coatings are judged to have a higher reflectance than the other products tested. No attempt was made to obtain a numerical reflectance reading in the field, but Laboratory readings on special samples indicate the Cataphote beads and Codit have a reflectance of about 13 candles per foot per candle per square foot. The other coatings read about 7 and less.

The following is an analysis of the delineation value of the various products:

Potter Bros. Beads (Traffic-Line)

These beads have too low a reflectance for this application and do not warrant further investigation.

Codit

Codit has a very slight gray daytime appearance, and is highly reflective at night. After nine months exposure, the Codit coated rail in Broderick is still a good delineator. 3 M's representative insists that this material can be successfully sprayed by use of the right type of spray gun. So far, this has not been witnessed.

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Prismo

When special samples were measured in the Laboratory, the Prismo beads were found to have approximately half the reflectance value of the Codit. When applied, the Prismo had a light yellow appearance both day and night. After almost one year, these beads have turned brown resulting in a dirty daytime appearance. The night-time reflectance has dropped to about one-half the initial value.

Flex-O-Lite

The reflectance of these beads was judged to be slightly greater than that of the Prismo beads. The beads are ungraded in size and contain the largest beads tested. Though the large beads can be readily rubbed off the rail with the hand, nearly all are still in place after one year of weathering. The non-uniformity in size results in a lower coverage per pound than can be obtained with micro-beads.

To date these has been no change in color of the beads and only a slight loss of reflectance.

Cataphote Beads

The recently applied coating of Cataphote beads is the most promising of all the products tested. The last 120 feet of the test rail are not reflectorized, and at night the rail appears to terminate where the coating ends. There is a slight uneven appearance resulting from manual application of beads and binder that could be eliminated on future products by using an automatic spray machine designed by a Los Angeles firm.

Future Work

Periodic inspections of these test sections will be continued to observe the weathering affects and possible loss of reflectance under field conditions, and a final report will be prepared.

If, after viewing the rail on Highway 40, the Maintenance Department feels that this project warrants further investigation, we will have a similar section coated in District VII by machine method.

Cost

The cost of coating rails with Codit on a large scale would be about $25.00 to $28.00 per 100 feet of rail.

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Cataphote or similar micro-beads would cost approximately $26.00 per 100 feet of rail when applied manually on a small scale. Machine application and large quantity purchasing should cut the cost to approximately $15.00 per 100 feet.

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FORM WH-38

Figure I

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

INTRA-DIVISION CORRESPONDENCE

DATE June 16, 1958

To: Mr. F. N. Hveem

Attention of J. Beaton

File Reference

From: Mr. F. E. Baxter ~~Dist.~~ Hdqrs.

This will confirm telephone conversation between Mr. Field of your office, and Mr. O'Brien of this Department, regarding the request from the Traffic Engineer, to apply a beaded surface to a short section of guard rail.

It is our recommendation that a number of sections be painted within the same area, using:

a. Prismo Binder and Sign Beads

b. White Traffic Paint and Road Spheres

c. White Traffic Paint and Flex-o-lite Beads

d. White Guard Rail Enamel and Road Spheres

e. White Guard Rail Enamel and Flex-o-lite Beads

This office will furnish you with a sufficient quantity of the Flex-o-lite Beads and also a paint spray gun, which may be used to apply all sizes of beads to a vertical surface.

When you have secured all the necessary materials to make the test, we shall appreciate being informed, in order that we can arrange with District III, to wash the guard rail section prior to painting.

It is suggested that the guard rail area selected be on a tangent, and in the vicinity of Sacramento, so that it may be observed by personnel from both the Maintenance and Traffic Departments.

F. E. Baxter

F. E. BAXTER
Maintenance Engineer

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