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1956 PERFORMANCE TESTS ON FREE-FLOWING GLASS BEADS

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1956 PERFORMANCE TESTS
ON FREE-FLOWING GLASS BEADS

Glass beads, being hydrophilic, absorb moisture from the air, which condenses under a high ambient humidity, forming a watery film on the bead surface. Surface tension of the water films keeps the beads clumped together so that they do not flow freely through a distributor, but behave like untreated table salt in a shaker on a humid day. Many brands of table salt are now being treated to minimize this loss of free-flowing ability under high ambient humidities. At additional cost, beads now are being treated by manufacturers to yield a free-flowing product, by depositing a very thin coating of water-repellent on the bead surfaces.

In sampling untreated glass beads, it has been noted that early annual shipments are generally received in a damp or non-free-flowing condition. Paint application crews have mentioned difficulty in dispensing untreated beads under high humidity conditions, especially in cool weather.

A study of the merits of free-flowing surface treatments for glass beads should determine the treatments' effects on distribution and bonding of the beads in the paint matrix as deposited under both high humidity and normal humidity conditions. The study reported here was set up to determine whether proprietary surface treatments had any unusual effect on glass bead bonding in traffic paint stripes beaded under the second of these conditions, that of normal humidity. This project was assumed to be valuable for specification purposes.

Application

Glass beads having different surface treatments to provide free-flowing characteristics were obtained from several producers. Six samples of treated glass beads were field evaluated in the customary triplicate stripes as a supplement to the 1956 performance tests in Section 1 (Concrete), together with untreated glass beads purchased for highway striping in 1956, which served as controls.

All test beads were stored and applied to the stripes under atmospheric conditions which were not conducive to clustering of the spheres. All beads were applied by the drop-in method at the ratio of six pounds of beads per gallon of paint. The paint for all test stripes was the white paint used in 1956 highway striping, applied at the standard 15-mil thickness.

The evaluated glass beads are listed in Table 1, together with their characteristics, and with night visibility ratings made at the customary three-month intervals over a period of twelve months.

Results

The last column of Table 1 lists the sums of all night visibility ratings for the indicated beaded stripes. A comparison of the "total values" for Test Systems 1 and 8, which were identical and served as controls, shows good agreement in the ratings, and tends to confirm the validity of the rating system.

A comparison of Table 1's "total values" for beads of approximately the same gradation as represented by Test Systems 1, 4, 7, and 8, shows good agreement and suggests that under test conditions, surface treatment did not materially affect bead bonding or resultant night visibility ratings.

The lowest "total values" in Table 1 were obtained for Test Systems 2, 3, and 6, which had the largest beads, as indicated in the column listing percent of beads passing the 30 mesh sieve. The results are corroborated photographically in Figure 1; the pictures are of beaded test stripe surfaces containing standard (MSHD) and larger than standard beads, after four months of road exposure. The pictures indicate that the largest beads are very liable to early dislodgement as shown by the black craters left in the paint after beads were expelled.

Although the producer of the beads in Test System 2 did not describe his surface treatment, these beads clustered badly either because of an overabundance of the chemical water-repellent used in the treatment, or because of the nature of that chemical. A comparison of the total night visibility values of Systems 2 and 3, which had a similar gradation, shows that clustering reduced the night visibility of System 2 by approximately 50 percent.

The test glass beads had no noticeable effect on the durability ratings for the eight sets of test stripes, since the sums of the five ratings for those stripes fell within the narrow range of 46.9 to 47.8.

Conclusions

When glass beads of the same gradation were applied on paint stripes under atmospheric conditions not conducive to bead clustering, presence of a free-flowing type of surface treatment did not noticeably affect the cumulative night visibility or durability ratings for the paint stripes over one year's exposure, indicating that surface treatments did not affect bead bonding.

Treated glass beads having about 13 percent beads-retained on a 30 mesh sieve, yielded lower cumulative night visibility ratings than did beads of a MSHD Type III gradation, less than one percent of the latter being retained on a 30 mesh sieve, because of easy dislodgement of the larger beads from the paint stripes.

Bead clustering, inherent in one of the treated-bead test systems, lowered night visibility ratings of a beaded paint stripe by about 50 percent at the given gradation.

Recommendation

It is recommended that the Department consider specifying free-flowing glass beads of a Type III gradation for traffic striping applied in the Spring and Fall, when atmospheric conditions are conducive to clustering.

The approximate cost of such surface treatment is one cent per pound. In 1958, the delivered cost of MSHD Type III untreated beads was 10.14 cents per pound.

TABLE 1
EVALUATED GLASS BEADS
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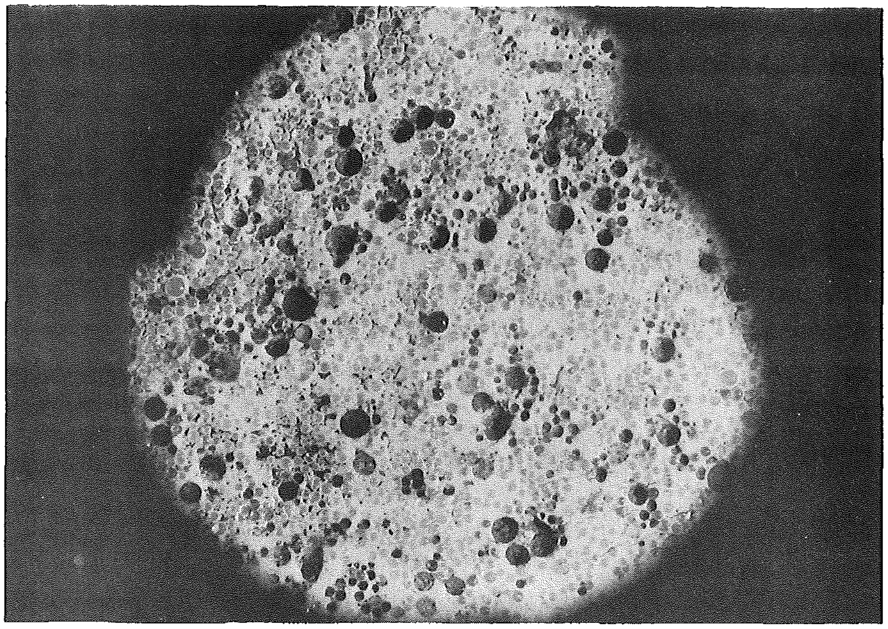
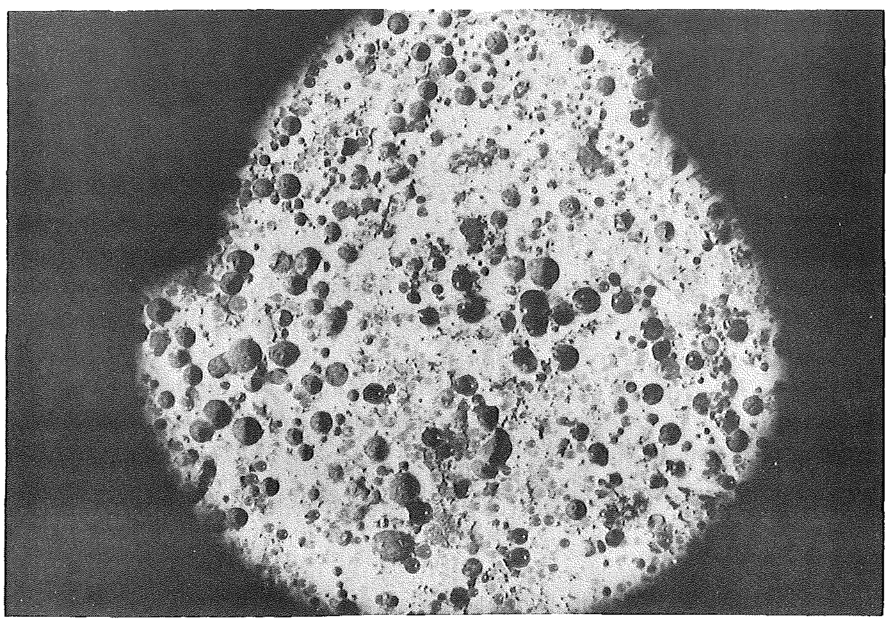
Test System	Identification	Gradation: Percent Passing Indicated Sieves				Behavior in Free-Flowing Tests		Test Stripe Numbers	Night Visibility Ratings					
									Months Exposed					Total Values
		30	40	70	230	94% Humidity Exposure	Water Immersion		0	3	6	9	12	
1	1956 - Type III, MSHD	99.6	77.0	40.8	0.3	Fail	Fail	1 - 3	7.5	8.5	5.6	3.6	2.3	27.5
2	Moisture-Resistant Type C: Flex-O-Lite Corporation*	86.4	66.9	30.3	0.3	Fail	Fail	4 - 6	3.6	3.3	1.5	0.8	1.3	10.5
3	Free-Flow: Flex-O-Lite Corporation	88.1	55.6	21.6	0.1	Pass	Fail	7 - 9	8.0	6.0	3.5	1.3	1.3	20.1
4	Moisture-Proofed: Micro Beads, Inc.	99.8	83.8	45.4	0.4	Pass	Pass	10 - 12	9.0	7.5	5.1	3.3	2.3	27.2
5	Moisture-Resistant: Potters Bros., Inc.	99.6	69.2	26.5	3.0	Pass	Pass	13 - 15	8.3	7.1	4.3	2.1	1.5	23.3
6	Duck Spheres: Prismo Safety Corporation	86.9	45.7	4.6	0.2	Pass	Pass	16 - 18	8.1	6.0	3.8	1.8	1.3	21.0
7	1955 - Type III Siliconized by Dow Corning	99.9	79.5	45.1	0.4	Pass	Pass	19 - 21	8.5	7.1	4.9	2.4	1.8	24.7
8	1956 - Type III, MSHD	99.6	77.0	40.8	0.3	Fail	Fail	22 - 24	7.5	7.4	5.8	3.8	2.3	26.8

*Beads clustered badly because of sticky bead surface.



A stripe beaded with standard size beads (MSHD Type III beads, of which less than one percent are retained on a 30 mesh sieve).



A stripe beaded with larger than standard size beads (Test System 3, of which 12 percent were retained on a 30 mesh sieve).

Figure 1. Photomicrographs of beaded paint stripes after four months of road exposure, showing a higher incidence of dislodgement for larger glass beads. Black areas are craters from which beads have been dislodged.