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RESEARCH UPDATE U95-15

METROMARK COPOLYMER TRAFFIC STRIPING PAINT

Reference:

Work Plan 95-R-10

Introduction:

MetroMark is a multi-component copolymer system, catalyzed by a 2% component of methyl ethyl ketone peroxide (MEKP) and comprised of polyester, epoxy and thermoplastic. The manufacturer's claims for the product include the following:

- Low profile - The MetroMark application varies between 8 and 15 mils thickness as compared to an average 90 to 120 mil application for thermoplastic. This should translate to less snowplow damage.
- No requirement for special application equipment - Standard paint rigs can be converted for use with MetroMark, usually in less than a day.
- Not solvent based - It is anticipated that, for the foreseeable future, this product will satisfy the EPA requirements for low volatile organic compounds. Current levels of VOC's contained in the product are less than those in waterborne paints.
- Fast no-track time - Metromark will reach a no-track condition in 60 seconds or less when ambient temperature is 24°C (75°F).
- Functional flexibility - MetroMark can be used on new asphaltic or Portland Cement pavements and is compatible with thermoplastic or standard paints for repair purposes.
- Durable - MetroMark lasts as much as 3 years when applied at 12 mils and two years when applied at 8 mils.

The reported properties of MetroMark suggested that it would be a viable option in our pavement marking maintenance program. Arrangements were made for an evaluation of the material during the 1995 construction season.

THE EVALUATION:

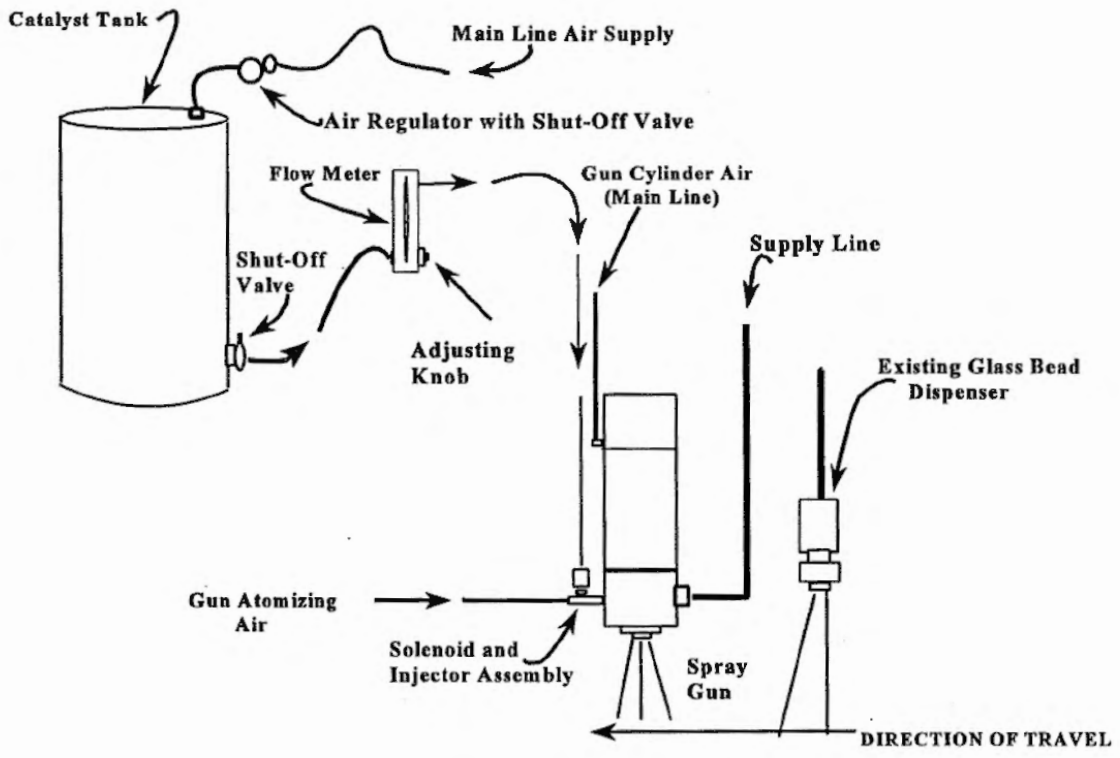
The short term evaluation was to validate the manufacturer's claims related to equipment conversion and cost competetiveness. Also evaluated were product effectiveness in marking new pavements and in the repair of thermoplastic and standard paints. The long term evaluation was to determine the durability of the material relative to various application thicknesses and its ability to retain satisfactory levels of retroreflectivity.

TRUCK CONVERSION:

The truck conversion, utilizing one of the Agency's standard paint trucks, T-90, took place on 10/16/95 at the Mendon garage. The entire conversion was completed in approximately two hours and required a minimum of additional hardware. The standard conversion kit consists of a catalyst tank (for the MEKP), a flow meter to control the addition of the catalyst, a solenoid, and injector assembly which integrates the spray gun for the dual application of the MetroMark striping material and the catalyst. Also included were lengths of plastic hose to connect this new equipment to the existing system. A diagram showing the configuration of the conversion is shown on the following page.

THE STRIPING OPERATION:

The first attempt to apply the MetroMark material with the converted paint truck occurred on 10/17/95. The test site was I 91 MM 46.7 - MM 41.7 in Springfield where existing standard marking paint was being repaired. The weather for the trial was not ideal since ambient temperature was 10°C (50°F) and the average pavement temperature was 15°C (59°F). The first striping attempted was the white skip lines. The marking truck lead the operation, followed by two smaller trucks, equipped with flashing arrow signs, directing traffic to the adjacent lane. Spaced approximately 0.37 km (1200 ft) apart, the trailing trucks were traveling at around 8km/hr (5 mi/hr), providing approximately 5½ minutes of traffic-free drying time.



FLOW DIAGRAM-CONVERTED HOT PAINT RIG

Although observed dry time was approximately 10 minutes due to the cold temperature, it was noted that after only a minute and in spite of the traffic control, some passenger cars passed over the skiplines, but did not track the paint. The MetroMark representative explained that this phenomenon is related to the polymerization reaction in which cross-linking begins immediately, causing the formation of large molecular chains. As this occurs, the material still appears wet, but is cohesive and less likely to track. The speed with which this cross-linking reaction takes place is temperature related, but when properly catalyzed and applied, results in a rapid "no track" condition, even in cold weather.

The project was revisited on the following day and the MetroMark representative reported some problems with the application of the material which prevented him from getting consistent coverage or the desired thicknesses. Aside from these problems, the operation continued to go smoothly.

Although work continued on I91 in Springfield and VT 155 in Weston and Wallingford (new pavement on project STP 9446) through the remainder of the week (until 10/20/95), observation did not resume until the following Monday (10/23/95). At that time the crew was applying the MetroMark product over existing SG-70 thermoplastic on I91 southbound from MM 68.00 to MM 69.00. By that me the weather had warmed considerably and pavement temperatures rose from the

low forties which had been recorded at arrival at the site, to the mid sixties an hour later. The MetroMark representative reported that application rates were still inconsistent but that these problems could be resolved easily with some slight modifications of the conversion process. He attributed the problems to two factors:

a) Old paint buildup in the supply tanks and hoses which curtailed the effectiveness of the heat exchanger. This could be corrected with a more thorough flushing of the system prior to use with the MetroMark.

b) The nozzles were designed for delivery of solvent based paints and were too small for application of the MetroMark at the desired thicknesses. The correction here would be to install larger and specifically designed nozzles.

When interviewed regarding opinions of the MetroMark product, the paint truck foreman stated that he was favorably impressed by the lay-down characteristics of the product, but had some adverse feelings relative to its odor. He said that both he and his assistant had been ill on the previous evening (after the first day of evaluation) with burning eyes and nausea. His summation comment was that he didn't mind working with the material through the evaluation, but would be reluctant to handle it through an entire summer. If the MetroMark material is to be used in Vermont, this problem will need to be resolved.

RETROREFLECTIVITY:

Retroreflectivity values were recorded at three locations: Hartford I 91 SB, MM 68.91 +/-, and two sites on Vt 155, MM 0.60 and MM 0.98 in Mount Holly.

The average retroreflectivity on repaired thermoplastic white lines was 358 with a range which varied from a low of 306 to a high of 411.

The retroreflectivity of the white lines on new pavement in Mount Holly was very disappointing, with an average of 120, ranging from a low of 95 to a high of 130. The apparent cause of the poor retroreflectivity here was excessive paint application relative to bead flow. According to the MetroMark representative, this situation could be corrected by using floatable beads.

The yellow lines on new pavement had much better retroreflectivity, averaging 131, from a low of 95 to a high of 156.

COST:

The quoted price for the MetroMark material was $9.11/liter ($34.50/gal). The price included the conversion labor and equipment. The cost for the beads used was $0.42/kg ($0.19/lb). The painting crew foreman recorded the quantities of paint usage and coverage shown in the table on the following page. The material costs shown are somewhat greater than anticipated for this evaluation. It should be mentioned here, however, that these prices would be significantly reduced if the MetroMark material was bought in truck load quantity. Manufacturer's quoted price under these conditions would be $6.24/liter

($23.60/gal.), assuming current material costs.

MetroMark Coverage For Six and Four Inch Line Widths					
Line Width And Color	m (lf) Covered	l (gal) Used	kg (lbs) Beads	m/l (ft/gal)	**Cost/m (Cost/lf)**
6" White	22088 (72464)	833 (220)	1045 (2300)	27 (329)	$0.357 ($0.111)
6" Yellow	16154 (53000)	681 (180)	818 (1800)	24 (294)	$0.401 ($0.123)
Total 6"	38241 (125464)	1514 (400)	1864 (4100)	25 (314)	$0.385 ($0.116)
4" White	9656 (31680)	435 (115)	909 (2000)	22 (275)	$0.453 ($0.137)
4" Yellow	7403 (24288)	397 (105)	455 (1000)	19 (231)	$0.504 ($0.157)
Total 4"	17059 (55968)	833 (220)	1364 (3000)	20 (254)	$0.489 ($0.146)

The mean coverage for the 6" line suggests that the material was applied at an average thickness of 9.4 mils while the average 4" application thickness exceeded 12 mils.

SUMMARY AND CONCLUSIONS:

Many of the goals of this evaluation were not achieved. In order to accurately assess the cost and durability of the MetroMark material at varying thicknesses, it would need to be applied consistently and accurately. This could not be accomplished because of the application problems described above. Further, the glass beads specified for use with MetroMark by the manufacturer were not available for the evaluation, which probably affected retroreflectivity.

The evaluation was valuable, however, in many respects. It established the fact that the State's standard marking trucks can be readily converted for use with the MetroMark material. Also, the likely problems with the conversion process and necessary actions to avoid them were identified. Finally, a reasonable "no-track time" was attained, in spite of very unfavorable conditions.

A second evaluation of MetroMark should be scheduled in the near future, using recently gained experience to better control the experiment. Conditions for this evaluation should be worked out well in advance of the event, and mutual agreement as to the experimental controls should be reached to the satisfaction of both the State and the manufacturer.

FOLLOW UP:

The MetroMark applications on I91 in Springfield and Hartford and on Vt 155 will be monitored to determine long term durability and retroreflectivity.