Evaluation of Ultra Hydrophast with Rhoplex Fastrack HD-21A Initial Report

October, 2007

Report 2007 – 13
Reporting on Work Plan 2007-R-3

State of Vermont
Agency of Transportation
Materials and Research Section

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16. Abstract

In an effort to extend the service life of waterborne markings while reducing the overall cost of labor and equipment, the Vermont Agency of Transportation applied an experimental marking material, known as Ultra Hydrophast with Rhoplex Fastrack HD-21A, an acrylic polymer. This substrate is reported to provide multi-year performance by providing a tight, strong anchor to glass beads and road surfaces. In addition to an examination of the binder, Visibeads consisting of glass spheres three to four times larger than conventional beads, were also dropped onto the marking material during application an effort to assess sustainability as studies have shown a greater likelihood of dislodging due to greater protrusion above the marking binder.

The following report outlines the initial observations with regards to the application of both an experimental marking with HD-21A and control marking of standard waterborne paint. In addition the report contains information pertaining to laboratory results in order to quantify the unique characteristics of the experimental material as well as field data collection to determine the durability and luminance of the markings over time.

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INTRODUCTION

Cost effective and durable highway pavement markings are important for the safety of the traveling public. Longitudinal markings delineate driving lanes, segregate traffic in opposing directions and indicate where passing is permissible. Following application, the binder of the pavement markings wears away over time. Some of the reflective elements become dislodged reducing both daytime and nighttime visibility. As part of an annual statewide marking program, standard waterborne traffic markings at a dry film thickness of 15 mils are typically applied to all interstates, Vermont and US Routes. However, with an annual snowfall rate of 100" and associated winter maintenance activates, these markings are subject to abrasion from snow plows and studded tires, resulting in an acceptable service life of approximately 9 months. With respect to incurred costs, it is important to not only consider materials but also labor and equipment. Over time, a greater amount of money is expended when these activities occur at higher frequencies.

In an effort to extend the service life of waterborne markings while reducing the overall cost of labor and equipment, the Vermont Agency of Transportation applied an experimental marking material, known as Ultra Hydrophast with Rhoplex Fastrack HD-21A, an acrylic polymer. This substrate is reported to provide multi-year performance by providing a tight, strong anchor to glass beads and road surfaces. In addition to an examination of the binder, Visibeads consisting of glass spheres three to four times larger than conventional beads were also dropped onto the marking material during application in an effort to assess sustainability, as studies have shown a greater likelihood of dislodging due to a greater protrusion above the marking binder.

The following report outlines the initial observations with regards to the application of both an experimental marking with HD-21A and control marking of standard waterborne paint. In addition the report contains information pertaining to laboratory results in order to quantify the unique characteristics of the experimental material as well as field data collection to determine the durability and luminance of the markings over time.

PROJECT DETAILS:

The Vermont Agency of Transportation's Traffic Shop personnel applied the Ultra Hydrophast with Rhoplex Fastrack HD-21A, or experimental traffic markings, to the Berlin State Highway, Airport Road and Fisher Road in the town of Berlin. Berlin State Highway is a three lane roadway with a posted speed limit of 50 mph and an AADT, or average annual daily traffic, of 7600. This roadway segment also consists of a large curved alignment including a 9% grade. Airport and Fisher Rd. are both characterized as federal aid urban streets. Airport Rd. is considered a two lane minor arterial with a reported AADT of 4100. Fisher Rd. is classified as a two lane collector with a reported AADT between 5800 and 9300. Both locations consist of relatively flat grade and straight alignment. A summary of each roadway segment is provided in Table 1. In accordance with the work plan and manufacturers specifications, the Traffic Shop applied a minimum thickness of 26 wet mils, a slightly greater application rate as compared to the specified 15 wet mils.

Test Site Description - Ultra Hydrophast with HD-21A					
Designation:	**Functional Classification**	**Number of Lanes**	**Minimum AADT:**	**Maximum AADT:**	**Notes:**
Berlin State Highway	Minor Arterial	3	7600	-----	Curved Alignment at 9% grade
Airport Rd.	Minor Arterial	2	4100	-----	Flat grade and alignment
Fisher Rd.	Collector	2	5800	9300	Flat grade and alignment

Table 1 – Summary of Roadway Characteristics

PRODUCT DETAILS:

According to the manufacturer of the Ultra Hydrophast with HD-21A, Franklin Paint Company, Inc. from Franklin, Massachusetts, this waterborne traffic paint is both lead free and VOC compliant. Rhoplex Fastrack HD-21A is manufactured by Rohm and Haas of Springhouse, PA. It is marketed as a fast drying paint marking material that provides a multi-year performance similar to thermoplastic and epoxy markings. As stated above, it is reported to provide a tight, strong anchor to glass beads. The manufacturer states that the experimental marking materials display high initial and sustained long-term retroreflectivity. According to the manufacturer's specifications, this marking material is to be applied at a wet thickness of 25 mils. At this application rate, the paint marking material is expected to dry within 15 minutes. This is recognized as a deviation from a 10 minute track-free condition in accordance with the American Society for Testing Materials (ASTM) D-711, "Test Method for No-Pick-Up Time of Traffic Paint." A minimum application temperature of 50^{o}F is recommended.

Visibeads, produced by Potters Industry, are reported to enhance driver's nighttime visibility, particularly in rain, fog or melting snow, for dramatic improvements in mobility and highway safety. According to Potters, Visibeads are manufactured in a proprietary process that creates glass marking spheres that are three to four times the diameter of conventional highway safety marking spheres. Therefore, they sit higher above the marker material as compared to standard glass beads allowing for additional delineation. Visibeads are compatible with waterborne or solvent based paint, epoxy, polyester, thermoplastic and polyurea markings. Please note that both Visibeads Plus II and standard glass beads (in compliance with AASHTO M247, "Standard Specification for Glass Beads Used in Traffic Paints") were utilized in a double drop application.

LABORATORY TESTING:

As stated within Work Plan 2007-3, several laboratory tests were conducted in order to examine the material properties of the experimental pavement marking. For application purposes, it is important that the paint is light enough to flow readily and that the pigment is smooth enough as to not clog the painting apparatus. The assessment began with an examination of the pigment of the paint in accordance with ASTM D 1475, "Density of Liquid Coatings." The white pigmented paint was found to have a density of 13.91 lbs per gallon and the yellow pigmented paint was found to have a density of 13.63 lbs per gallon well within the specifications of 13.7 to 14.3 lbs per gallon for the white pigment

and 13.3 to 13.9 lbs per gallon for the yellow pigment. In order to assess the viscosity of the traffic paint marking material with regards to potential clogging of spray nozzles, both the white and yellow paint was tested in accordance ASTM D 562, "Consistency of Paints Using the Stormer Viscometer." The white and yellow marking material was found to have a kinematic viscosity of 93 ku. This also met the viscosity specification of 78 to 95 ku which is universal for both colors of marking paint. Please see Appendix A and B for a copy of the laboratory testing results for the white and yellow marking paint, respectively.

In addition to an examination of the characteristics of the experimental materials, a third assessment was performed in accordance with ASTM D 711, "Test Method for No-Pick-Up Time of Traffic Paint." This laboratory test seeks to evaluate the amount of time needed to fully cure under varying ambient conditions with consideration to temperature and humidity. In general, the white experimental marking material was found to dry within 14 minutes at an ambient air temperature of 72^{o}F and humidity of 50% while the yellow marking paint was found to dry in 15 minutes at an ambient temperature of 72^{o}F and humidity of 49%. As stated above, this deviates from a no track time of 10 minutes.

Finally, the experimental glass beads, Visibeads Plus II, were examined for roundness in accordance with ASTM D 1155, "Standard Test Method for Roundness in Glass Spheres," and gradation in accordance with ASTM D 1214, "Standard Test Method for Sieve Analysis of Glass Spheres." The roundness test results revealed a 91 (Visibeads) and 95 (AASHTO Type I) percent of spheres were in compliance. Studies have shown that both roundness and gradation have a direct influence on the initial and long term retroreflectivity of traffic markings. Beads must be round to provide retroreflectivity, otherwise known as luminance. It may be surmised that a greater percentage of spheres provides for greater retroreflectivity. Gradations are important in consideration to bead embedment, application equipment and wet mil thickness. In order to attain a preferred embedment depth of 50 to 60% of the bead's diameter, larger glass beads require greater mil thickness. Generally, beads are subject to compliance with AASHTO specification M 247, Type I designation, which states a maximum gradation of 850um. Table 2, provided below contains the gradations and roundness for both the Visibeads Plus II and standard Type I glass beads. Please note that the Visibeads were collected onsite directly from the spreader nozzle which is not standard testing protocol. Therefore the reliability of the data set may be moderate.

UltraHydrophast with HD21A Glass Bead Gradation Comparison			
	Nominal Sieve Opening (mm)	Percent Passing	
Sieve #:		Visibead Plus II	M 247 Type I
10	2.000	100	---
12	1.700	99.8	---
14	1.400	87.6	---
16	1.180	16	---
18	1.000	0	---
20	0.850	-----	100
30	0.600	---	75-95
40	0.425	---	---
50	0.300	---	15-35
80	0.180	---	---
100	0.150	---	0-5

Table 2 – Gradation Results

INSTALLATION AND OBSERVATIONS:

On Tuesday, August 14, 2007, personnel from the Materials and Research Section accompanied by the Painting Crew from the Traffic Shop as well as employees from Rohm and Haas and Potters Industries Inc. observed the application of the experimental marking material, Ultra Hydrophast with HD-21A and reflective elements, standard glass beads and Visibeads. Application of the marking materials began at 12:38 PM to the Berlin State Highway in the town of Berlin in order to allow the pavement surface to dry properly prior to application. According to weatherunderground.com, the ambient air temperature was approximately 68^{o}F with a wind speed of 8 mph and 50% humidity.

Prior to installation, the Traffic Shop's paint truck was modified for a double drop application. First, a 500 lb bead tank was added for the larger Visibeads. There was a need for two separate tanks because the smaller standard size beads would fall to the bottom if the two beads are mixed together. Then a separate air line was connected to the new 500 lb tank to pressurize the beads for a consistent bead drop. A bead delivery hose was connected from the bottom of the tank to a Visigun. This gun allows for even distribution of the larger beads, which may be adjusted to deliver a smaller or larger volume. The existing guns for the standard glass beads were moved to the back of the Visigun for a double drop application.

The Paint Crew did not perform any special surface preparations to the roadway prior to installation, such as the removal of any dirt or debris. The previously applied pre-existing pavement markings were observed to be in poor to fair condition with visible wear from tire treads and snow plow operations. The experimental marking material was applied at a relative wet thickness of 26 mils along with a double drop of standard glass beads and Visibeads. The paint truck was originally equipped with yellow marking material and began striping operations at the base of Berlin State Highway and then

transitioned onto Airport Road. The truck completed the placement of the yellow center line on Fisher Road located across an intersection with Airport Road. The paint truck was brought back to the Traffic Shop where it was retrofitted with the experimental white marking paint. Once properly loaded, the paint truck then proceeded to stripe the southbound and northbound white edge line as well as the southbound white skip line along Berlin State Highway as shown in Figure 1 below. The paint truck completed striping operations along the eastbound white edge line at approximately 4:24 PM.

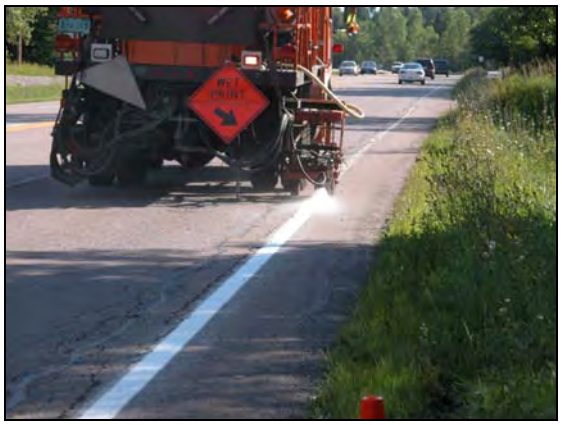

Figure 1 – Application of the White Edge Line

Following application and proper dry time, the overall appearance of the experimental paint markings appeared to be better in comparison to standard waterborne paint as the HD-21A and Visibead application retained a consistent texture and greater dry thickness. In accordance with standard practices, a 4" wide line is typically applied along State and US Routes. However, a consistent width of 5" was measured throughout the length of the project. Representatives from Rohm and Haas explained that the traffic markings would eventually wear to 4" in width as the substrate is thinner along the edge of the marking making it less durable. Figures 2 and 3, provided below, depict the white and yellow experimental markings following sufficient dry time.

Figure 2 – HD-21A White Edge Line

Figure 3 – HD-21A Yellow Center Line

Observations with regards to relative humidity, temperature, wet mil thickness and approximate dry time were recorded for the experimental markings. Actual wet

thicknesses appeared to range from 24 to 28 mils. This will have an effect on the overall observed drying time as a thinner line is expected to dry more quickly while a thicker line is suspected to dry more slowly. Please note however, that all wet mil thicknesses in relation to dry time were recorded. Table 3, provided below, depicts the relationships between marking type, dry time, ambient air temperature and relative humidity. Extended drying times were anticipated due to greater application rates (26 wet mils for the HD 21A vs. 15 wet mils for standard waterborne markings).

Field Drying Time of HD-21A Berlin State Highway							
Type of Paint	Color	Direction	Dry to Touch Time Minutes	Air Temperature Deg. F	Relative Humidity %	Pavement Temperature F	Comments
HD-21A W/Visibead Plus II	White	Up Hill	30	70	39	100	At 1st driveway on the right.
HD-21A W/Visibead Plus II	White	Up Hill	>30	70	39	78	In the shade Up Hill. On right.

Table 3 - Field Drying Time HD-21A White Lines

In examining Table 1, the conditions were optimal and the drying time was longer than tested in the Materials and Research lab. The lab dry time tested at 72ºF for 15 wet mils was approximately 14 to 15 minutes.

CONTOL SECTION:

Unfortunately, a control section consisting of standard waterborne paint could not be applied during the same time frame due to the modifications of the paint truck and site constraints. In an effort to comparatively evaluate the experimental and standard paint markings, similar wear and environmental conditions were warranted. Therefore, the Materials and Research Section requested to be notified when standard waterborne paint markings were applied in the area. According to Russ Velander, standard waterborne paint markings at a thickness of 15 wet mils were applied to the remainder of Airport Road on Wednesday, August 29th. The ambient air temperature was 83ºF with a relative humidity of 51% and wind speed of 6.9 mph as reported by weatherunderground.com at approximately 1 PM. This is an approximate temperature differential of 15ºF as compared to experimental marking application ambient conditions. Cure times are often reduced at higher temperatures with elevated humidity, generally resulting in greater bond strength between the underlying pavement and glass beads.

SURVEILLANCE AND TESTING:

A total of seven test sites were established throughout the length of the project in order to collect retroreflectivity readings in accordance with ASTM E 1710-97, “Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Potable Retroreflectometer”, and durability, in accordance

with ASTM D 913-03, “Evaluating Degree of Resistance to Wear of Traffic Paint”. Five test sites, denoted as TS 1 through 5, were established along the Ultra Hydrophast with HD 21A traffic markings as well as two along the standard waterborne markings, specified as TS 6 and 7. Each test site was established in an area with good sight distance on a straight away and consisted of a total length of 40 feet with data collection conducted at 10 foot intervals starting from the beginning of the test site. Each data collection location was identified with white marking paint along the shoulder of the driving lane in order to ensure that all future readings will be collected from the same location.

Retroreflectivity readings and visual assessments were collected utilizing a LTL 2000 retroreflectometer which employs 30 meter geometry. Photographic documentation was also gathered at individual test site locations during each field visit. All retroreflectivity and durability readings were recorded onto the appropriate field forms and then compiled into a dedicated spreadsheet. Initial site visits concerning the experimental markings were conducted on Friday, August 17th and Wednesday, August 29th, 3 and 15 days following application, respectively. All pavement markings were found to be intact. A summary of initial retroreflectivity readings are provided below in Table 4 and Table 5. Please note that most of the experimental markings were found to be in compliance with ASTM 6359, “Minimum Retroreflectance of Newly Applied Pavement Marking Using Portable Hand-Operated Instruments” which requires a minimum retroreflectivity of 250 mcdl for white marking and 175 mcdl for yellow markings within 14 days of application. Any readings below the referenced ASTM standard are highlighted in red.

Ultra Hydrophast with HD21A Initial Retroreflectivity Readings of the White Lines (HD 21A)						
	Northbound		Southbound			
	White Edge		White Skip		White Edge	
Test Site ID:	8/17/2007	8/29/2007	8/17/2007	8/29/2007	8/17/2007	8/29/2007
TS 1 - Berlin State Highway - MM 2.21	477	406	434	---	389	345
	491	406	400	---	384	338
	444	406	421	---	330	355
	394	373	419	411	350	325
	445	395	423		342	347
Average	450	397	419	411	359	342
Std. Dev.	37	14	12	N/A	26	11
TS 2 - Berlin State Highway - MM 2.00	367	345	370	---	403	246
	388	339	407	---	404	373
	382	389	353	373	364	369
	337	299	374	---	390	388
	385	318	279	---	388	399
Average	372	338	357	373	390	355
Std. Dev.	21	34	48	N/A	16	62
TS 3 - Berlin State Highway - @ Slower Traffic Keep Right Sign	363	286	389	---	378	379
	350	299	381	---	355	338
	322	321	352	---	349	419
	323	298	326	341	397	375
	325	303	350	---	371	376
Average	337	301	360	341	370	377
Std. Dev.	19	13	26	N/A	19	29
TS 4 - Airport Rd. @ Airport 1 Mile Sign	263	293	---	---	---	---
	295	344	---	---	---	---
	284	312	---	---	---	---
	266	322	---	---	---	---
	312	312	---	---	---	---
Average	284	317	---	---	---	---
Std. Dev.	20	19	N/A	N/A	N/A	N/A
Overall Average:	**361**	**338**	**379**	**375**	**373**	**358**

Table 4 – Summary of Initial Retro Results from White Line

Ultra Hydrophast with HD21A Initial Retroreflectivity Readings of the Yellow Lines (HD 21A)				
	Northbound		Southbound	
Test Site ID:	8/17/2007	8/29/2007	8/17/2007	8/29/2007
TS 1 - Berlin State Highway - MM 2.21	377	297	369	328
	356	313	284	329
	295	312	305	323
	279	343	293	287
	284	366	314	262
Average	318	326	313	306
Std. Dev.	45	28	33	30
TS 2 - Berlin State Highway - MM 2.00	238	183	209	211
	273	309	211	219
	288	247	232	231
	276	264	213	206
	289	321	190	184
Average	273	265	211	210
Std. Dev.	21	55	15	17
TS 3 - Berlin State Highway - @ Slower Traffic Keep Right Sign	184	221	208	224
	203	245	204	204
	204	213	203	223
	180	225	216	209
	290	290	192	190
Average	212	239	205	210
Std. Dev.	45	31	9	14
TS 4 - Airport Rd. @ Airport 1 Mile Sign	264	270	245	270
	277	254	230	293
	251	289	271	286
	276	249	233	278
	272	268	247	299
Average	268	266	245	285
Std. Dev.	11	16	16	12
TS 5 - Fisher Rd in Front of Hospital Entrance	205	317	306	335
	248	310	174	284
	294	299	155	397
	278	304	309	417
	278	327	330	348
Average	261	311	255	356
Std. Dev.	35	11	83	53
Overall Average:	**266**	**281**	**246**	**273**

Table 5 – Summary of Initial Retro Results from Yellow Line

Initial retroreflectivity readings regarding the standard waterborne paint that was applied on Wednesday, August 29th was conducted 14 days following application on Wednesday, September 12th. Two test sites were established on Airport Rd. A summary of initial readings is provided in Table 6 below. All of the standard waterborne markings were found to be in compliance with ASTM 6359.

Ultra Hydrophast with HD21A Initial Standard Waterborne Retro Readings				
	White Edge		Yellow Centerline	
Test Site ID:	East	West	East	West
TS 6 - Airport Rd. - MM 0.60	332	286	190	254
	326	290	222	243
	371	291	225	242
	350	281	229	238
	341	294	219	232
Average	344	288	217	242
Std. Dev.	18	5	16	8
TS 7 - Airport Rd. - In front of Airport	313	333	193	260
	310	309	249	252
	371	313	238	256
	355	310	245	257
	382	301	245	240
Average	346	313	234	253
Std. Dev.	33	12	23	8
Overall Average:	**345**	**301**	**226**	**247**

Table 6 – Summary of Initial Control Retro Results

COSTS:

While this is still considered an experimental marking material by the manufacturer, the current cost for Ultra Hydrophast with HD21A is $10 for a gallon of white or yellow marking paint. This price is higher than standard waterborne traffic paint, which is normally $5.00 a gallon. At a wet mil thickness of 25 mils and width of four inches, each gallon is projected to cover approximately 190 linear feet for an approximate material cost of $0.05 per foot. Table 7 provides a cost comparison between the HD-21A and standard waterborne markings.

Berlin State Highway Material Cost Comparison						
Material	Cost Per Gallon	Wet Mil Thickness	Length (LF)	Cost Per LF	Labor and Equipment	Total Cost
Standard	$5.00	15	300	$0.02	$0.12	$0.14
HD-21A	$10.00	25	190	$0.05	$0.12	$0.17

According to a representative from Potters Industries, standard Type I glass beads cost roughly $0.25 to $0.30/lb whereas Visibeads Plus II cost $0.55 to $0.60/lb. Franklin Paint and Potters Industries supplied all materials to the Traffic Shop for application.

DISCUSSION:

A new experimental pavement marking, known as Ultra Hydrophast with HD21A, was applied to Berlin State Highway, Airport Road and Fisher Road on Tuesday, August 14th by personnel from the Traffic Shop. In addition to examining a new marking material, Visibeads Plus II, a reportedly superior glass bead for adverse weather conditions, was applied to the marking binder in a double drop application along with standard Type I glass beads in compliance with AASHTO M247. Only standard waterborne paint trucks are required for application. In addition, it appears to be compatible with standard waterborne paint as flushing of the hoses and inside of the truck was not required. However, the paint truck had to be modified for a double drop application. A target thickness of 26 wet mils was utilized. This deviates from a standard thickness of 15 wet mils for standard waterborne markings in association with our annual Operations Division marking program. As a final aside, the experimental marking did not require the removal of debris or any other roadway surface preparation. Dry times were longer than anticipated in accordance with the manufacturer's specifications and laboratory testing. A control section consisting of standard waterborne paint markings was applied on Wednesday, August 29th on a portion of Airport Road and Berlin State Highway.

In consideration to laboratory testing, results indicate the that paint is sufficiently viscous to flow readily and the pigment is smooth enough as to not clog the painting apparatus as it was found to meet the specification within SDTM D 1475, "Density of Liquid Coating" and ASTM D 562, "Consistency of Painting Using the Stormer Viscometer." In addition to an examination of the characteristics of the experimental materials, a third assessment was performed to evaluate the amount of time needed to fully cure under varying ambient conditions with consideration to temperature and humidity. As the temperature drops and humidity increases, dry time also increases. In addition, laboratory testing did verify an approximate drying time of 15 minutes at a thickness of 25 wet mils. This is recognized as a deviation from a 10 minute track-free condition in accordance with ASTM D-711, "Test Method for No-Pick-Up Time of Traffic Paint." Finally, the Visibeads Plus II were tested for gradation and percent spheres. The Visibeads were found to be about 3 to 4 times greater in size as compared to standard Type I glass beads. The percentage of spheres was lower than anticipated at 91% as compared to average results of 95% or greater for standard Type I glass beads.

All of the white and the majority of the yellow experimental markings were found to be above the current minimum retroreflectivity requirements immediately following application with values of 250 and 175 mcdl, respectively, for newly applied pavement marking within 14 days of application as stated within ASTM standard, ASTM D 6359-99. However, a great increase in retroreflectivity of experimental yellow markings that failed to meet the initial requirements was noted during the subsequent data collection event. It is surmised that the glass beads were not properly embedded in the marking substrate at this location resulting in low readings. Wear may have dislodged beads that were less than 50 to 60 % embedded in the marking substrate or exposed beads with a greater embedment depth. An average loss of 14 mcdl was observed in the white experimental traffic marking while an increase of 21 mcdl was noted in the yellow

HD21A markings over a 12 day period. All of the standard waterborne markings were found meet the minimum criteria. Finally, the average retroreflectivity readings of the white and yellow experimental markings were found to be 357 mcdl and 277 mcdl, respectively at 15 days following application. The average retroreflectivity readings of the white and yellow standard waterborne markings at 14 days following application were 323 mcdl and 236 mcdl, respectively.

Thus far, preliminary results are encouraging with consideration to ease of application and compatibility with standard waterborne paint. In addition, satisfactory minimum retroreflectivity results were obtained. Dry times are of some concern in a cold weather region. Due to the minimum recommended ambient application temperature of 50°F and extended drying times beyond ASTM specifications, proper curing is of concern in addition to tracking of the marking substrate from roadway users. And while this marking may extend the amount of time needed until restriping is warranted, the material cost is twice that of standard marking materials. However if extended durability is realized, there will be a projected savings in equipment and labor costs.

FOLLOWUP:

Research personnel will continue to monitor and collect additional information with regards to the overall durability and reflectivity of all test sites in accordance with the work plan. Following a determination of service life, a final report will be published comparing the performance of Ultra Hydrophast paint with, HD-21A, Visibead Plus II and standard retroreflective beads with standard waterborne paint.

References

AASHTO M 247, "Standard Specification for Glass Beads Used in Traffic Paints." American Association of State and Highway Transportation Officials.

Patterson, Kat. **"**Category II Work Plan for Ultra Hydrophast with Rhoplex Fastrack HD-21 A, Work Plan 2007-R-3." Vermont Agency of Transportation, 2007**.**

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ASTM D 562, "Standard Test Method for Consistency of Paints Using the Stormer Viscometer." American Society for Testing and Materials.

ASTM D 711, "Standard Test Method for No-Pick-Up Time of Traffic Paint." American Society for Testing and Materials.

ASTM D 1155, "Standard Test Method for Roundness in Glass Spheres." American Society for Testing and Materials.

ASTM D 1214, "Standard Test Method for Sieve Analysis for Glass Spheres." American

Society for Testing and Materials.

ASTM E 1710-97, “Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer.” American Society for Testing and Materials.

ASTM D 913-03, “Evaluating Degree of Resistance to Wear of Traffic Paint.” American Society for Testing and Materials.

ASTM D 6359-99, “Minimum Retroreflectance of Newly Applied Pavement Marking Using Portable Hand-Operated Instruments.” American Society for Testing and Materials.

APPENDIX A

Vermont Agency of Transportation
Materials & Research Laboratory
Paint Test Report

Lab No. 2007-046 Project Name & No. FIELD TRIAL

Pay Name _____ Pay Item _____

Sample Type: Traffic Shop ____ Acceptance ____ Investigative X Other ____

Material Description ULTRAHYDROPHAST WHITE WATERBORNE TRAFFIC PAINT

Material Source FRANKLIN PAINT CO Manufacturer FRANKLIN PAINT CO.

Lot No. 14121 Date of Manufacture 7-6-07

Date Received 7-11-07 Date Tested 7-13-07 Tested by JEREMY MCMAHAN

Temperature (Specification = 23±2°C) 22-2 Humidity (Specification = 50±5%) 50

SPECIFICATION REQUIREMENTS		RESULT
No-Pick-Up Time ASTM D-711	10 Minutes	14.0 FAIL
Pounds per Gallon ASTM D-1475	Yellow 13.3min. – 13.9max. White 13.7min. – 14.3max.	13.91
Viscosity ASTM D-562	78ku min. – 95ku max.	93

Results within specifications? NO

Comments FIELD TRIAL - THIS PAINT IS NOT DESIGNED FOR QUICK DRYING.

Analyst _____ Supervisor _____

APPENDIX B

Vermont Agency of Transportation
Materials & Research Laboratory
Paint Test Report

Lab No. 2007 - 047 Project Name & No. FIELD TRIAL

Pay Name _____ Pay Item _____

Sample Type: Traffic Shop ____ Acceptance ____ Investigative X Other ____

Material Description ULTRA HYDROPHAST YELLOW WATERBORNE TRAFFIC PAINT

Material Source FRANKLIN PAINT CO Manufacturer FRANKLIN PAINT CO.

Lot No. 14122 Date of Manufacture 7-6-07

Date Received 7-11-07 Date Tested 7-13-07 Tested by JEREMY MCMAHAN

Temperature (Specification = 23±2°C) 22.3 Humidity (Specification = 50±5%) 49

SPECIFICATION REQUIREMENTS		RESULT
No-Pick-Up Time ASTM D-711	10 Minutes	15.0 FAIL
Pounds per Gallon ASTM D-1475	~~Yellow 13.3min. – 13.9max.~~ ~~White 13.7min. – 14.3max.~~	13.63
Viscosity ASTM D-562	78ku min. – 95ku max.	93

Results within specifications? NO

Comments FIELD TRIAL - THIS PAINT IS NOT DESIGNED FOR QUICK DRYING.

Analyst _____ Supervisor _____