Evaluation of ATM 300 Permanent Durable Tape
Initial Report

December 2007

Report 2007 – 18
Reporting on Work Plan 2007-5

State of Vermont
Agency of Transportation
Materials and Research Section

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16. Abstract

In an effort to evaluate the service life of Durable tape, the Vermont Agency of Transportation applied an experimental pavement marking material, known as ATM 300, to a preexisting roadway on the Montgomery-Berkshire repaving project, STP 2125(1) S, located located on VT 118 between mile marker (MM) 5.565 in Montgomery and MM 1.565 in Berkshire in September of 2007.

Following the placement of the markings, data collection, including retroreflectivity and wear readings, was conducted using uniform methods. All of the Marking Tape was found to be in compliance with ASTM D 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.

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ATM 300 Marking Tape Traffic Markings	No restrictions

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INTRODUCTION:

Pavement markings provide an important means of communication for all roadway users and must be capable of conveying information during inclement weather and evening hours when there may be little to no contribution from overhead lighting. However, traffic markings are often subject to abrasion from tire treads and winter maintenance practices as well as ultraviolet sunlight and fading pigments following application. These factors result in altered color, a loss of binder and loss of reflective elements over time. Durable markings are often applied to newly constructed pavements in the state of Vermont and re-striped with waterborne paint when warranted. According to the "2006 Standard Specifications for Construction," "durable pavement markings are classified as pavement marking tape, epoxy paint, thermoplastic markings, polyurea paint, and methyl-methacrylate." Each of the referenced markings, comprised of various elements, has been shown to display unique characteristics and varying life cycles.

Durable tapes vary greatly from other liquid applied markings as they are manufactured under controlled conditions which may allow for more consistency in the product whereas markings such as thermoplastic and polyurea are applied in a liquid form to the road surface. Glass beads, which allow drivers to see pavement markings at night, are also incorporated into the material during the tape manufacturing process versus a drop on application for liquid markings. Finally, in accordance with our specifications, pavement marking tapes, when used as durable markings, are to be inlaid into the pavement during compaction of the hot mix asphalt or HMA whereas liquid markings are surface applied following roadway construction.

A recent statewide investigation of various pavement markings proved that winter maintenance practices are one of the largest factors that influence marking decay due to shearing effects produced by plow operations. If properly inlaid, durable tapes should be less vulnerable to winter maintenance practices as the surface of the marking should be level to the surface of the pavement. However, durable tapes have a higher average initial cost making them a less viable alternative to other markings, such as thermoplastic. Finally, durable tapes should be more tolerant of varying pavement surface textures as a roughened surface will distribute liquid line striping substrates over a larger surface area per unit area, generating an inconsistent thickness or inadequate thickness for the larger diameter beads resulting in premature bead loss. However, a greater surface area between the underlying pavement and tape may produce a greater or more consistent

The following report outlines the initial observations with regards to the application of both an experimental permanent marking tape known as ATM 300 and a control marking consisting of standard thermoplastic paint with respect to longitudinal pavement markings. In addition, the report contains information pertaining to field data collection to determine the durability, luminance and cost effectiveness of the markings over time. Efforts will be made to provide a comparative analysis with regards to a standard application of thermoplastic.

PROJECT DETAILS:

In association with a federally approved work plan, WP 2007-5, ATM 300 Permanent Durable Tape was applied to a portion of the Montgomery-Berkshire repaving project, STP 2125(1) S, located on VT 118 between mile marker (MM) 5.565 in Montgomery and MM 1.565 in Berkshire. In accordance with the plans, this project included cold planing, reclaiming sections and resurfacing of the existing highway with a combination of leveling and wearing courses, new pavement markings, guardrail installation, drainage improvements and incidental items. Specifically, 2.25" of pavement were cold planed within project limits. In all cases, the wearing course consisted of a Marshall Type III mix. A Type III wearing course contains a nominal aggregate size of ½" resulting in a rougher pavement surface than a Type IV Marshall wearing course which contains a nominal aggregate size of 3/8". The average annual daily traffic (AADT) in 2006 varied from 1,800 to 2,600 throughout the length of the project, a moderately low AADT for Vermont.

Advanced Traffic Markings offered to supply the state with a total of 9000 linear feet of white and yellow durable marking tape. All markings were 4" wide. Approximately 4682 LF of white edge lines were applied between MM 7.79 and MM 8.23 and 5164 LF of yellow centerlines were applied between MM 7.74 to MM 8.23 at the discretion of the resident engineer. The AADT specific to this area is 2,200. Thermoplastic paint markings were applied to the remainder of the project as shown within the quantity sheets of the project plans.

PRODUCT DETAILS:

According to the manufacturer, Advanced Traffic Markings, Inc. from Roanoke Rapids, NC, ATM 300 Permanent Durable Tape is lead free and environmentally safe. Reportedly, it meets or exceeds ASTM D4505, "Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life" and is marketed as a tape consisting of high quality polymeric materials, pigments, and glass beads to assure long term retroreflectivity. It's pre-applied, pressure sensitive adhesive minimizes tape movement in hot and cold climates. The ATM adhesive system is claimed to extend the application season as well. When applied in accordance with the manufacturer's recommendations it will adhere to asphalt or Portland cement roadway surfaces and should provide a minimum service period of 16 months in a light to moderate traffic volume.

ATM 300 Permanent Durable Tape is the manufacturer's "moderate grade" permanent tape. The tape is recommended for use in both longitudinal and transverse applications. It is a minimum of 60mil (1.52mm) thick to resist wear. The tape offers optional anti-skid particles and should have an initial minimum skid resistance of 45 BPN when tested according to ASTM E 303-83, "Test Method for Measuring Surface Frictional Properties Using the Bridge Pendulum Tester." In accordance with the manufacturer's specifications, the inlay method requires pavement temperatures of 120°F to 175°F. All specifications and application instructions are provided in Appendix A.

INSTALLATION AND OBSERVATIONS:

Application of the ATM 300 permanent tape was completed on Monday and Tuesday, September 17th and 18th, 2007. According to the construction notes, the temperature ranged from 32°F to 67°F on September 17th, and from 38°F to 69°F on September 18th. Conditions on both days were sunny with no reported precipitation. The average humidity was roughly 80% on both days. Scott's Line Striping was the subcontractor on the project.

Scott's Line striping monitored the apparent temperature of the HMA following initial compaction efforts to determine the appropriate time for the placement of the permanent marking tape. With respect to the longitudinal markings, once the pavement cooled to acceptable temperatures, the striping company offset the placement of the centerline marking from the pavement joint so that the marking material would not be applied directly over the joint. After the centerline was established, both white edge lines were marked in accordance with the plans. Then a handcart was used to apply the marking tape. The handcart was equipped with a special cutting blade providing a nice even finish. Finally, the final roller for compaction of the HMA inlaid the tape into place. Please note that this process does require special attention to sequencing. If utilized for a great length, this process may inhibit the rate of pavement lay down. A summary of the application dates along with ambient temperature conditions are provided below in Table 1. In reference to the specifications from ATM, "ambient temperatures, 24 hours before and after (application), of 40°F or rising (is required)." In examining the ambient air temperatures provided below, this requirement was not met during evening hours.

Beginning Station	Ending Station	Application Location	Marking Type Applied	Date of Application	Application Ambient Temperature
411+25	434+66	Northbound Lane	ATM 300 White Edge	09/17/2007	32°F to 67°F
411+25	434+66	Southbound Lane	ATM 300 White Edge	09/18/2007	38°F to 69°F
408+93	434+78	Centerline	ATM 300 Yellow Center	09/18/2007	38°F to 69°F
488+77	82+24	Centerline	Thermoplastic Yellow Center	09/25/2007	55°F to 83°F
290+90	488+77	Centerline	Thermoplastic Yellow Center	10/01/2007	44°F to 67°F
291+60	82+28	Southbound Lane	Thermoplastic White Edge	10/04/2007	60°F to 80°F
291+60	380+35	Northbound Lane	Thermoplastic White Edge	10/04/2007	60°F to 80°F
380+35	411+25	Northbound Lane	Thermoplastic White Edge	10/05/2007	50°F to 84°F
434+68	82+28	Northbound Lane	Thermoplastic White Edge	10/05/2007	50°F to 84°F

Table 1 – Pavement Marking Installation Data

Pavement temperatures were monitored by staff from the Research and Development Unit during application of the ATM permanent tape. All readings were found to be

within the manufacturer's recommendation. An average temperature was calculated for each established test site as displayed in Table 2. A * indicates that an application temperature is not available as the markings were already in place prior to arrival onsite.

Test Site	Station on VT 118	MM	Temperature
3	415+00	7.86	160°F
4	420+00	7.95	170°F
5	428+00	8.11	140°F
6	433-78'	8.18	*

Table 2 – Location and Pavement Temperature Readings

Some general observations during application included the ease of tape removal. As depicted in Figure 1, the tape readily lifted with hand force. However, the tape does appear to be well adhered to portions of the pavement. This may indicate that the pavement has not thoroughly set. There was also some evidence of shrinkage at the beginning and ending of each continuous tape section. The shrinkage appeared to pull the surface of the HMA as well. Interestingly, application literature states, "if tape distorts or wrinkles, surface temperature may be too hot or roller speed may be too fast." These areas will continue to be monitored overtime.

Figure 1 – Tape lifted

SURVEILLANCE AND TESTING:

A total of six 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". Two test sites, denoted as TS 1 and TS 2, were established along the thermoplastic traffic markings as well as four, identified as TS 3 through 6, along the experimental permanent tape. 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 September 18th and September 25th, on the day of application and 7 days following application, respectively. An initial assessment of the thermoplastic markings was conducted on October 10th, 5 days following the application of the white edge line thermoplastic markings and 9 days following the application of the yellow centerline traffic markings. All pavement markings were found to be intact. Gas bubbles were noted within the thermoplastic markings as well as shadows as displayed in Figure 2 and 3. According to literature provided by Ennis Paint, gas bubbles are generally caused by either moisture or solvent trapped in the hoses or from overheating. Thermoplastic shadows may be generated by a heavily undulated road surface or die not riding evenly on the substrate. In either case, evidence suggests some problems during application which will most likely affect long term durability and retroreflectivity.

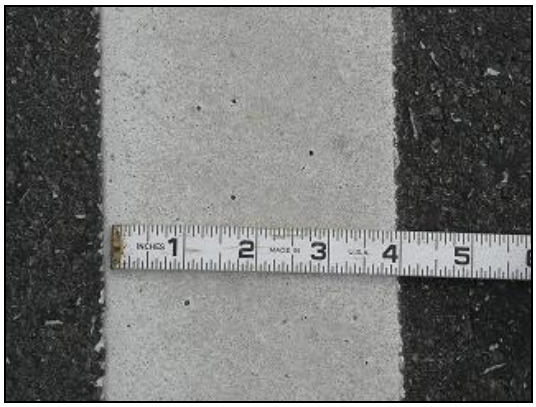


Figure 2 – Gas Bubbles in Line (TS 1)

Figure 3 – Material Shadows on Line (TS 2)

A summary of initial retroreflectivity readings are provided below in Tables 3 through 6. Please note that most of the experimental markings and all of the thermoplastic 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. . It should be noted excess asphalt binder was observed on top of the permanent tape markings located in the northbound lane of test site 3 and 4 most likely resulting in inadequate retroreflectivity.

ATM 300

Retroreflectivity Readings of White Lines Edge Lines				
Test Site ID:	**Northbound**		**Southbound**	
	09/18/2007	**09/25/2007**	**09/18/2007**	**09/25/2007**
TS 3 - Sta.415+00	111	258	489	719
	90	188	687	743
	58	158	593	747
	102	265	651	750
	114	224	639	697
Average	95	218.6	611.8	731.2
Std. Dev.	23	46	76	23
TS 4 - Sta.420+00	134	201	1078	990
	127	189	1055	959
	109	219	1028	987
	100	169	766	989
	86	125	946	880
Average	111.2	180.6	974.6	961
Std. Dev.	20	36	127	47
TS 5 - Sta.428+00	597	710	736	666
	729	813	655	635
	779	853	716	644
	712	809	713	627
	624	677	704	708
Average	688.2	772.4	704.8	656
Std. Dev.	76	75	30	33
TS 6 - Sta.433+00 - 78'	756	702	814	312
	764	576	839	369
	696	550	606	528
	583	524	882	688
	585	511	969	617
Average	676.8	572.6	822	502.8
Std. Dev.	89	77	134	160
Overall Average:	**393**	**436**	**778**	**713**

Table 3 – ATM 300 White Lines Retroreflectivity Readings

ATM 300

Retroreflectivity Readings of Yellow Centerlines				
Test Site ID:	Northbound		Southbound	
	09/18/2007	09/25/2007	09/18/2007	09/25/2007
TS 3 - Sta.415+00	659	732	669	688
	660	745	776	751
	656	779	594	783
	766	806	693	810
	748	786	760	826
Average	698	770	698	772
Std. Dev.	54	30	74	55
TS 4 - Sta.420+00	656	694	621	605
	610	667	589	587
	581	683	654	563
	603	621	679	538
	649	583	815	793
Average	620	650	672	617
Std. Dev.	32	46	87	101
TS 5 - Sta.428+00	668	678	754	753
	723	709	762	700
	789	740	784	738
	719	776	777	851
	648	715	758	839
Average	709	724	767	776
Std. Dev.	55	37	13	66
TS 6 - Sta.433+00 - 78'	636	661	758	501
	656	704	734	557
	602	640	640	579
	637	617	595	451
	436	625	706	530
Average	593	649	687	524
Std. Dev.	90	35	68	50
Overall Average:	**655**	**698**	**706**	**672**

Table 4 – ATM 300 Yellow Lines Retroreflectivity Readings

Thermoplastic

Retroreflectivity Readings of White Edge Lines				
Test Site ID:	Northbound		Southbound	
	10/10/2007	11/14/2007	10/10/2007	11/14/2007
TS 1 - Sta.404+00 - 50'	402	441	367	385
	417	437	393	368
	411	468	391	404
	387	410	329	386
	398	460	368	391
Average	403	443	370	387
Std. Dev.	12	23	26	13
TS 2 - Speed limit sign - 50'	416	462	400	353
	409	474	393	357
	408	471	410	365
	431	471	378	350
	400	485	426	368
Average	413	473	401	359
Std. Dev.	12	8	18	8
Overall Average:	**408**	**458**	**386**	**373**

Table 5 – Thermoplastic White Lines Retroreflectivity Readings

Thermoplastic Retroreflectivity Readings of Yellow Centerlines				
Test Site ID:	Northbound		Southbound	
	10/10/2007	11/14/2007	10/10/2007	11/14/2007
TS 1 - Sta.404+00 - 50'	199	196	200	194
	192	190	195	194
	201	194	189	188
	202	198	184	194
	192	186	193	187
Average	197	193	192	191
Std. Dev.	5	5	6	4
TS 2 - Speed limit sign - 50'	198	180	182	170
	201	181	181	177
	200	175	182	182
	191	166	189	185
	195	170	190	185
Average	197	174	185	180
Std. Dev.	4	6	4	6
Overall Average:	**197**	**184**	**189**	**186**

Table 6 – Thermoplastic Yellow Lines Retroreflectivity Readings

COSTS:

Advanced Traffic Markings furnished roughly 9846 linear feet of ATM 300 permanent marking tape at no additional cost to the state. Specifically, the installation included 2341 linear feet of 4" white edge line traffic markings and 2582 linear feet of yellow centerline markings along both lanes within one roadway segment. As an aside, the ATM 300 permanent marking tape costs roughly $\$2.00/ft^2$. This is equivalent to \$0.66/LF for a 4" wide line. For comparison, thermoplastic paint typically costs \$0.48/LF for a 4" wide lane.

DISCUSSION:

An experimental permanent pavement marking tape known as ATM 300 was applied to the Montgomery-Berkshire repaving project, STP 2125(1) S, located on VT 118 between MM 7.74 and MM 8.23 in the town of Montgomery on Monday and Tuesday, September 17th and 18th, 2007 by personnel from Scott's Line Striping. This process was somewhat labor intensive as compared to the installation of liquid pavement markings, such as thermoplastic and polyurea, and had to be accomplished in concert with the construction of the hot mix asphalt. Basically, the striping crew delineated the future placement of the centerline which was offset from the joint along with the white edge lines. Following initial compaction of the HMA, the surface of the pavement was allowed to cool to a recommended temperature range of 120^oF to 175^oF. Then the permanent tape was applied through the use of a hand cart. According to the manufacturer, the ambient air temperature should be at least 40°F for 24 hours before and after the application. On September 17th, the first day of the ATM 300 installation, the temperature dropped as low as 32°F. It is not yet known what affect, if any, this will have on the adhesion of the marking tape.

Thermoplastic marking paint was applied to the remainder of the project on Tuesday, September 25th, Monday, October 1st, Thursday, October 4th and Friday, October 5th. This marking will be considered the control for comparative purposes. During an initial inspection gas bubbles and line shadowing was observed providing evidence of improper application. This will most likely have an affect on the overall durability and retroreflectivity.

Most of the white experimental markings and all of the experimental yellow markings were found to be above the current minimum retroreflectivity requirements immediately following application with values of 250 mcdl and 175 mcdl for newly applied pavement white and yellow markings, respectively, within 14 days of application as stated within ASTM standard, ASTM D 6359-99. The average initial retroreflectivity of the white and yellow ATM 300 markings was 585 and 680 mcdl, respectively. Normally, yellow markings display decreased luminance readings as opposed to their white counterparts due to the effect of pigmentation. Excess binder was observed on top of the permanent tape markings located in the northbound lane of test site 3 and 4 which most likely accounts for the inadequate retroreflectivity. Readings collected 7 days following application were consistent with those collected immediately following application. Comparatively, the average retroreflectivity of the thermoplastic markings 5 days

following the application of the white edge lines and 9 days following the application of the yellow centerlines was 397 mcdl and 193 mcdl, respectively. The ATM 300 permanent tape displayed moderate standard deviations indicating some variability while the standard deviations for the thermoplastic traffic markings were very low signifying consistency of the material.

Overall, there are some concerns related to the ease of application, associated driver delays, recommended application temperatures and required coordination of tasks between the pavement contractor and line striping company. Preliminary retroreflectivity results were satisfactory. In addition, as this product is inlaid, it may be less vulnerable to winter maintenance practices resulting in greater durability over time.

FOLLOWUP:

Research personnel will continue to monitor the permanent tape markings as well as thermoplastic traffic markings and collect durability and retroreflectivity readings in accordance with the research work program. Minimum reported service life of 16 months for the ATM 300 series will be assessed. In addition, information regarding the impact of winter maintenance practices with consideration to durability will also be examined. A final report will be published evaluating the overall performance of the ATM 300 series along with future recommendations for placement. A service life cost analysis will also be performed.

REFERENCES:

ASTM D 4505, "Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life," ASTM International, West Conshohocken, PA, <www.astm.org>.

ASTM D 6359-99, "Minimum Retroreflectance of Newly Applied Pavement Marking Using Portable Hand-Operated Instruments," ASTM International, West Conshohocken, PA, <www.astm.org>.

ASTM D 913-03, "Evaluating Degree of Resistance to Wear of Traffic Paint," ASTM International, West Conshohocken, PA, <www.astm.org>.

ASTM E 1710-97, "Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer," ASTM International, West Conshohocken, PA, <www.astm.org>.

ASTM E 303-83, "Test Method for Measuring Surface Frictional Properties Using the Bridge Pendulum Tester," ASTM International, West Conshohocken, PA, <www.astm.org>.

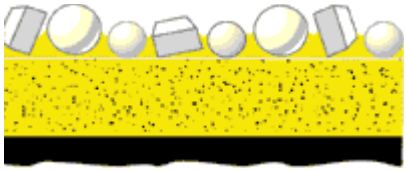
"Criteria for a Successful Thermoplastic Application." Ennis Paint Company. 6 Dec 2007 <http://www.ennispaint.com/products/CRITERIA%20FOR%20SUCCESSFUL%20THERMOPLASTIC%20APPLICATION.pdf>.

Fitch, Jennifer and Peterson, Christopher. *Work Plan for Research Investigation: ATM 300 Permanent Durable Tape, Work Plan No. WP-2007-5*. Vermont Agency of Transportation, 2007.

Vermont Agency of Transportation. *2006 Standard Specifications for Construction*. 2006

APPENDIX A

ATM Permanent Series 300 & 400
Preformed Polymer Tape
Specifications[1]



- Meets Or Exceeds ASTM D4505-01a Standard Specification For Preformed Retroreflective Pavement Marking Tape For Extended Service Life

Series 300 Durable preformed plastic, permanent marking tapes are designed for usage on asphaltic or concrete surfaces. Series 300 tapes are suitable for longitudinal markings and transverse markings including word/symbol markings. Series 300 Durable tape is available in white, yellow and custom colors.

Series 400 Extended Life preformed plastic, permanent marking tapes are designed for usage on asphaltic or concrete surfaces. Series 400 tapes are suitable for longitudinal markings and transverse markings including word/symbol markings. Series 400 Extended Life tape is available in white, yellow and custom colors.

PHYSICAL PROPERTIES

Composition: All Permanent Series Tapes consists of a pre-applied, pressure sensitive adhesive with high quality polymeric materials, pigments and glass beads assuring long term retroreflectivity.

Applicability To Pavement Surfaces: Ambient temperatures, 24 hours before and after, of 50°F (10°C) and rising. See Manufacturers Application Instructions included in each box.

Adhesion: Permanent Series Tapes will adhere to asphalt or portland cement concrete roadway surfaces when applied according to the manufacturer's recommended procedures.

Pigmentation: Permanent Series Tape pigments are selected and blended to provide a marking tape in white or yellow conforming to standard highway colors.

Skid Resistance: Permanent Series 300 and 400 tapes will have an initial minimum skid resistance value of 55 BPN when tested according to ASTM E 303.

Reflectance: Permanent Series Tapes have the following minimum results when tested in accordance with ASTM D4061.

	White		Yellow	
Entrance Angle-Degrees	86.0	86.0	86.0	86.0
Observation Angle-Degrees	0.2	0.5	0.2	0.5
Specific Luminance (mcd ft^{-2} $(fc)^{-1}$)	1770	1270	1310	1000
LTL 2000 Reflectometer	800		600	

Performance Requirements: Series 300 tape, when applied according to the manufacturer's recommendations, shall provide a minimum service period of 24 months in light to moderate traffic volume.

Series 400 tape, when applied according to the manufacturer's recommendations,shall provide a minimum service period of 36 months in moderate to heavy traffic volume.

In snow removal areas, plowing may shorten tape's life cycle.

Series 300 and 400 are also available with extended four and six year warranties. Please contact your ATM Sales Representative for specifications.

[1] From http://www.trafficmarkings.com/atm_300_tape_specs.html

ATM PERMANENT PREFORMED POLYMER TAPES APPLICATION INSTRUCTIONS[2]

Overlay Method

- Air and surface temperature must be 50°F (10°C) and rising.
- Surface must be completely dry.
- Surface must be clean and free of any contaminants which may include but not limited to oils, grease, sand, dirt, dust, loose aggregate, curing compound, mud, soil and salt.
- Portland Cement concrete curing compound must be completely removed by pressure washing, sandblasting, or grinding the road surface.
- ALWAYS USE BUTT SPLICES.
- Do not apply tape directly over deteriorating markings or substrates, or lane delineation devices.
- Tapes or Rumble Strips applied directly over seams and joints must be cut through 1" on both sides of the joints or seams to prevent de-bonding of large sections of tape.
- Apply an ATM primer on all surfaces except newly laid asphalt, up to one year and in good to excellent condition. Allow adhesive to completely dry before installing the markings.
- Use ATM Permanent Primer on completely cured surfaces if it has rained 6 hours prior to, or it is expected 24 hours after installation.
- Firmly tamp longitudinal tape in the same direction as tape was applied on the initial pass. A minimum of three passes total are required. Use a tamper device with a minimum 200 lb. (90kg) load and a tamping surface a minimum 2" wider than the width of tape being applied. Never twist the tampering device during tamping. Repeat tamping as necessary to insure tape has completely conformed to the road surface.
- Marked roadway can be open to traffic immediately.
- Firmly tamp transverse marking symbol/legends using an approved ATM Tamper Cart with a minimum 200lb./90kg load. A minimum of three passes total are required.

Inlay Method

General Conditions:

- Surface temperature must be 120°F (49°C) - 175°F (79°C)
- Do not attempt to inlay tape during rain.
- Apply tape only after initial compaction has taken place.

Application Procedures:

- Insure general conditions can be met.
- After compaction, mark surface where tape will be applied. DO NOT LAY TAPE ON SEAMS OR JOINTS
- Apply tape either by hand or with the ATM Tape Applicator Cart.
- ALWAYS USE BUTT SPLICES.
- Finish rolling pavement surface.

NOTE: IF TAPE DISTORTS OR WRINKLES, SURFACE TEMPERATURE MAY BE TOO HOT OR ROLLER SPEED MAY BE TOO FAST.

[2] From http://www.trafficmarkings.com/overlay.html