

# M A S S I N T E R C H A N G E

Volume 21, Number 1

Winter 2007

## MARKING YOUR ROADS

### Materials for Ensuring Pedestrian & Driver Safety

Pavement marking can dramatically increase both pedestrian and driver safety on local roads. Selecting the correct materials for each project is as important as the application process.

We decided to talk to George Brophy, Sales Manager, and Dan Marcet, Paint and Thermoplastic Formulator, for Franklin Paint Co., Inc. in Franklin, MA, to find out which products are the most effective for use in today's high traffic volume environment.

The Environmental Protection Association (EPA) and the Ozone Transport Commission (OTC) regulates what products can be used in Massachusetts.

The old standby, TTP-85 alkyd base traffic paint, has been banned in Massachusetts, because it far exceeds the maximum of 150 grams or less of volatile organic compound (VOC) per liter. The OTC which regulates products such as traffic paint, does allow low VOC chlorinated traffic paint (less than 150 grams per liter) to be manufactured and sold in the State. This paint is used for painting in low temperature, high humidity conditions because it is a fast drying, durable product for use primarily on crosswalks, stop bars, legends, and center or edge lines. MassHighway allows only the use of waterborne traffic paints by its own marking crews. The majority of users of the low VOC product are municipalities and contractors who work at night when drying time is harder to accomplish. Durability of this product

is determined by traffic count and application procedures. It is critical that the proper amount of mil thickness is applied and monitored during the application process. The standard mil thickness is 15 mils which will yield 100 square feet per gallon. Simple math reveals that a 4" line will have a yield of 300 feet per gallon (see chart on page 2). In 2006 costs averaged \$10.00 per gallon depending on quantity and container size or .035 per foot for a 4" line for material only.

Due to the strict compliance to low VOC by EPA and OTC, waterborne traffic paint is the product of choice here in Massachusetts. Waterborne traffic paint dries in a reasonable time, is as durable as oil based paints, is cost effective and cleans up easily. One other very important factor is that the glass bead retention of waterborne traffic paint (Federal specification #1952 D or better) is superior to the old oil based formulations.



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There have been dramatic improvements in the resins used to manufacture waterborne traffic paints that have made the waterborne products easy and productive to use. Products are now available for use in temperatures as low as 35 degrees and rising (XSR) and formulated for application in excess of 20 mils (HD21A) giving pavement markings a much longer life. The average price in 2006 of \$7.50-10.00 per gallon, depending upon formulation, quantity and container size, equates to approximately .029 per foot for a 4" line (material only).

The quality of both the low VOC compliant and the waterborne traffic paints make them feasible for most municipal budgets. There are, however, field conditions where high volume traffic counts require the use of more costly and more durable products such as thermoplastic, preformed tapes and preformed thermoplastic.

Thermoplastic is manufactured in powder form and then melted out to a liquid form at 400-425 degrees. These temperatures are maintained in sophisticated application equipment as they are applied to the road surface. The high temperatures and high durability formulations will yield from 3-5 years of delineation. In low volume conditions they may last as long as 7-10 years. Yield for a 4" line applied at 125 mils is 2.25 feet per pound. This is the standard specification in Massachusetts. Average cost of thermoplastic in 2006 was \$1,000 per ton depending on quantity. This equates to approximately .23 per foot for material only. The majority of applications using this product is completed by contractors due to the sophistication and cost of the melting and application equipment.

Thermoplastic has been in use on both our Interstate system and busy city streets in the Commonwealth since the late 1950's and has performed well on roads with extremely high ADTs. However, it is no longer used on most of our Interstates and other freeways as it is incompatible with the open graded friction course pavements that are used on these roadways. Smaller public agencies often use a combination of high quality traffic paint and durable thermoplastic so that public ways for both pedestrians and drivers are always well delineated.

There is a product called cold preformed tape that comes in various widths and configurations. This is either inlaid in brand new asphalt or applied after old asphalt has been

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## MATERIAL YIELD CHART

**One gallon of paint covers 100 sq. ft. (Basis upon which to compute yield for any traffic paint application)**

**Six pounds of glass beads are applied for every gallon of paint used**

*Standard MassHighway specifications.*

### COMPUTATIONS

4" line requires 300 feet per gallon

6" line requires 200 feet per gallon

8" line requires 150 feet per gallon

12" line requires 100 feet per gallon

### Container sizes and yields

#### FIVE GALLON PAIL

4" LINE = 1500 FT (300 ft/gallon X 5 gallons)

6" LINE = 1000 FT (200 ft/gallon X 5 gallons)

8" LINE = 750 FT (150 ft/gallon X 5 gallons)

12" LINE = 500 FT (100 ft/gallon X 5 gallons)

#### FIFTY-FIVE GALLON DRUM

4" LINE = 16,500 ft (300 ft/gal X 55 gallons)

6" LINE = 11,000 ft (200 ft/gal X 55 gallons)

8" LINE = 8,250 ft (150 ft/gal X 55 gallons)

12" LINE = 5,500 ft (100 ft/gal X 55 gallons)

*All computations are for 15 mil thick painted traffic lines and pavement markings as specified by MassHighway*

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treated with an adhesive primer. This is a great product but the application process is critical to the final results in terms of adhesion and durability. It is very expensive and can cost as much as \$3.00 per foot (material only) for a 4" line. Life expectancy is about the same as thermoplastic.

A second tape product is actually a preformed thermoplastic and the application process is as simple as heating the surface where you want to apply it, placing the product and then reheating it to ensure proper adhesion. This heating process is accomplished with a hand-held propane torch. The material cost is also in the range of \$3.00 per foot. Life expectancy is in the same range as thermoplastic and the cold tape. This is best used for legends such as arrows, words and handicap symbols. Crosswalks and stopbars are also com-

*continued on page 7*

# John F. Knipe Master Roads Scholar

*On November 17, 2006, Highway Superintendent John Knipe took possession of the latest addition to his department's fleet of vehicles. This new 2007 International Truck with a stainless steel sander body will be immediately put into service for this season's snow maintenance. The vehicle was authorized at the May 2006 Annual Town Meeting in Shrewsbury, MA, at a cost of \$137,364. A second truck is currently being fitted out with an expected arrival in 2007.*



John Knipe has called Shrewsbury, MA, home since 1951 and has worked for the town since January 1972. From 1972 through 1988, John worked in the Engineering Department in many capacities. In December 1988, he was appointed to the positions of Superintendent of Streets and Tree Warden.

During his 34 years of service, John has been involved in the design and construction of numerous public works projects as the town grew from a population of 19,300 in 1972 to the current community of over 33,000. Public street miles extended from 80 to 145 miles. Shrewsbury, like many communities, has seen significantly reduced staffing levels and budget cuts in the Highway Department. Throughout these years of downsizing, however, John and his dedicated staff have continued to provide quality service to the town's residents.

John has been involved in the Central Massachusetts Regional Planning Commission since 1989, holding various positions both on the Transportation Advisory Committee and the Executive Board. He is the current chairman of the Commission, a seat he has held since 2004.

Under John's leadership, the Shrewsbury DPW has assisted in planning a number of projects within the statewide Transportation Improvement Plan including Grafton Street, Route 140, town center (roadway improvements and en-

hancements), and a portion of Route 9 in the Lakeway District (resurfacing and enhancement).

John has also implemented a road opening permit policy for the Town of Shrewsbury.

Serving on many professional associations is an important part of John's commitment to the transportation community of Massachusetts. He has been involved with the Massachusetts Highway Association as a member and past president, the Worcester County Highway Association as a member and past president, the American Public Works Association as a member, the Massachusetts Tree Warden's Association as a member, and the Shrewsbury Federal Credit Union as a member of the Board of Directors. Baystate Roads has benefited from Mr. Knipe's participation on our Advisory Board where he provides valuable feedback and opportunities for improvement for this Local Technical Assistance Program (LTAP).

John graduated from Shrewsbury High School and attended Worcester Industrial Technical Institute receiving a certificate in machine and tool design. He also attended Worcester Junior College where he received an Associate Degree in Engineering.

John finds time for family, home projects and gardening outside of working hours.

# FTA's Drug and Alcohol Forum

The Federal Transit Administration (FTA) Drug and Alcohol Testing web site provides an open forum for anyone with questions about substance use in the transportation industry. The forum features four discussion groups:

- ☐ Regulatory Questions,
- ☐ Seminars,
- ☐ Compliance Audits, and
- ☐ Drug and Alcohol Management Information (DAMIS) Reporting.

You may ask questions of FTA Drug and Alcohol Project employees on a moderated forum by completing a free online registration. Questions are usually answered within a few days of their posting. Here are some questions that have been answered about federal drug-testing policies.

## What role do customer complaints play in determining whether to perform a reasonable suspicion drug test?

**Scenario:** A customer has said he thinks one of your drivers is on drugs. Is this an acceptable reason to give the driver a drug test?

**Response from FTA's Mike Reddington:** *The official word comes from federal regulations 49 CFR Part 655.43 (b) which states "An employer's determination that reasonable suspicion exists shall be based on specific, contemporaneous, articulable observations concerning the appearance, behavior, speech, or body odors of the covered employee. A supervisor(s) or other company official(s) who is trained in detecting the signs and symptoms of drug use and alcohol misuse must make the required observations."*

*A customer complaint is, in itself, not a valid reason for requiring a reasonable suspicion test. However, it may be cause for a supervisor trained in making reasonable suspicion determinations to interview or discuss with the employee the complaint or incident after which the supervisor may decide that reasonable suspicion does exist and would be obligated to require a reasonable suspicion test."*

## Should a pre-employment drug test be performed for an employee who has been on extended leave and absent from the random testing pool for several months?

**Scenario:** An employee who performs safety-sensitive duties has returned after a month's leave. This person was not properly added to the random testing pool and has not been in the testing pool for months. Should he take a pre-employment drug test?

**Response from FTA's Eve Rutyna:**

*According to §655.41 (2)(d), when a covered employee or applicant has not performed a safety-sensitive function for 90 consecutive calendar days regardless of the reason, and the employee has not been in the employer's random selection pool during that time, the employer shall ensure that the employee takes a pre-employment drug test with a verified negative result. As you noted, he/she should also be put back in the random pool immediately.*

## If an employee quits after failing a drug test and then wants to return, can he/she avoid a follow-up test by waiting for a long period of time before returning?

**Scenario:** One of your employees quits after failing a drug test but now wishes to return. Normally, the person must meet with a substance abuse professional and take a return-to-duty test. However, is there any time period where the employee could avoid a follow-up test?

**Response from FTA's Mike Reddington:** *Federal regulations 49 CFR Parts 40 and 655 place no time restrictions on the follow-up testing requirement.*

Visit the forum at:

**<http://transit-safety.volpe.dot.gov/Safety/BBS/default.asp>**

A copy of **What Employees Need to Know About DOT Drug and Alcohol Testing** can be downloaded at the same site under **"Publications."**

*Reprinted with permission from the Kansas University Transportation Center and published in the Kansas TransReporter, July 2006.*





# CEMENT BASE STABILIZATION LOWERS COST AND EXTENDS PAVEMENT LIFE

Significant increases in the cost of asphalt paving material are wreaking havoc with town highway department budgets. The result is that many superintendents have been forced to scale back on what they can accomplish with their limited funds. This is frustrating for them and local residents who expect roads to be kept in good condition.

Reclamation, with or without stabilization, is a good option for rebuilding more miles and staying within budget. Although this article addresses Full Depth Reclamation (FDR) using cement on failed asphalt pavements, there are other types of stabilization which incorporate calcium chloride, foamed asphalt, fly ash, biopolymer, etc. These will be covered in future newsletter articles.

With FDR, the existing in-place materials are reclaimed, saving money and natural resources. Most local roads have a thin asphalt layer or are unpaved and many deteriorated town roads are ideal candidates for FDR. A step beyond basic reclamation is to consider stabilization. By building a new stabilized base you provide an excellent foundation for future pavement performance.

Let's take a closer look at cement stabilization. When reclaiming a road, cement can be added for stabilization. After pulverization, cement is spread on top of the road and mixed with a second pass of the reclaimer. Over the new base, an asphalt surface or a chip seal is applied. The process can reuse up to 12 inches of the top portion of the road. In this case, the asphalt layer to be recycled should not exceed 6 inches.

When an existing road is being reclaimed, a high degree of material variation will likely be encountered during construction. This is why versatility in a stabilizing agent is important. Different locations may have different subgrade and base materials. Another factor is that different asphalt patches of varying depths and mix may have been used over the years.

The good news is that cement can be used successfully with a wide range of materials, from gravels to clays.



*Many miles of local roads were in need of serious repairs*



BEFORE WIDENING



AFTER FDR WITH CEMENT

*FDR for road widening in Montgomery County, NY: The county experienced significant freeze-thaw cycling, so durability issues were a prime concern for their road bases. After experimenting with different products for stabilization, starting in 2000, officials exclusively used cement because they liked its performance in terms of strength and durability.*

*continued on page 6*

Despite its versatility, FDR with cement cannot be used on every road. Selection of the right candidate road and evaluation of local construction costs are key to a successful match.

Pavement design plays a very important role when considering different construction techniques. Every layer of a pavement makes a contribution to the load bearing capacity of the road. If the base material is improved through cement stabilization, thickness can be reduced on the base or on the riding surface. Minimum thickness for construction purposes should be considered for each material.

Through cement stabilization, a stronger, more impermeable base will be achieved and maintenance will be limited to the asphalt surface. Therefore, future maintenance costs will be reduced. In general, cement content varies from 3-6% for FDR, depending on existing materials. The 7-Days compressive strength of a stabilized reclaimed base can average between 300-400 psi.

The alternative pavement design provided here is an example of a design that takes into consideration the behavior of each material. A road is designed as a combination of base and riding surface, so when the load bearing capacity of a base is dramatically improved, it allows for a reduction in thickness on the riding surface.

The pavement section below illustrates a balanced design between base and riding surface. FDR with cement is an economical solution for the improvement of roads without sacrificing quality. For the **"gravel + asphalt" design**, the Asphalt Institute failure model was used (asphalt cracking). For the **"cement base + asphalt" design** the Portland Cement Association (PCA) failure model was used (base cracking).

Next time you plan a road rebuilding project, consider FDR with cement as a cost effective way to improve long term performance.



*In 2005, FDR with cement was used to rebuild 5 miles of Route 2A in Bancroft-Read Plantation, ME. Heavy trucks represented 38% of the local traffic and there was no weight limitation. The new pavement structure is 8" of FDR with cement and 3" of asphalt concrete. This picture shows the new base before being paved with local traffic.*

**For the pavement design details (below):**

*For this design, these assumptions are made:*

Modulus asphalt = 500,000 psi

Modulus gravel = 50,000 psi

Modulus subgrade = 5,000 psi

Axle load = 18 kip single axle (dual tires)

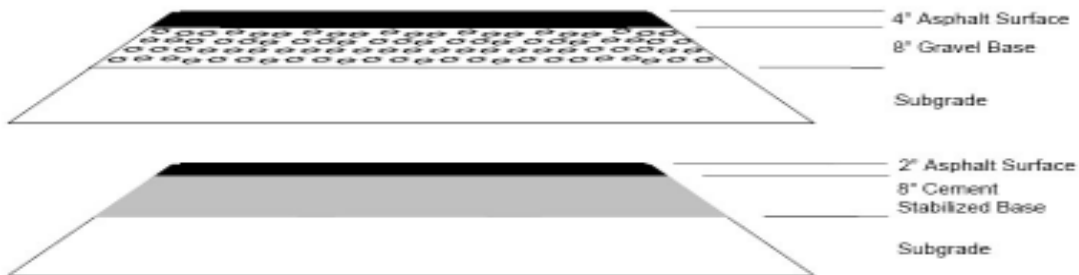
Modulus cement-treated base (CTB) = 800,000 psi

7 - Days compressive strength = 400 psi

Cement content 5% for average FDR materials.

For 4" of asphalt over 8" of compacted gravel, failure can be expected after 850,000 equivalent single axle loadings (ESAL). Using CTB, asphalt thickness can be reduced to 1.5" over 8" of compacted gravel with the same failure rate.

*Thanks to Carolina Carbo, C.E., Pavement Recycling Specialist at the Road Recycling Council--New England Region, for this article. She has presented several seminars for Baystate Roads Program and can be contacted at (857) 998-0119 or ccarbo@roadrecycling.com for more information.*



*Note: Each road should be evaluated for its specific traffic and material conditions before adopting a pavement design for reconstruction. The analysis of these two pavement structures used PCA's program "CTBAnal." Information was provided by David R. Luhr, PhD, PE, Portland Cement Assn.*

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# TRAFFIC PAINT & GLASS BEAD MATERIAL YIELD CHART

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## 12" Reflectorized, Painted Crosswalks, Stopbars & Legends

MassHighway specifications for 12" reflectorized painted lines are 100 linear feet per gallon of paint @ 15 mils thick & 6 lbs. of glass beads per gallon of paint applied.

### EXAMPLE

12,500 linear feet of 12" crosswalks & stopbars  
12,500 linear feet of 12" line divided by 100' per gallon  
= 125 gallons of traffic paint required  
125 gallons of traffic paint X 6 lbs. glass beads per gallon = 750 lbs. of glass beads required

Use 25 five-gallon buckets for 125 gallon total

TRAFFIC PAINT FOR THESE CONTRACTS IS  
PACKAGED IN FIVE-GALLON CONTAINERS  
GLASS BEADS PACKAGED IN 50 LB. BAGS --  
15 BAGS REQUIRED FOR THIS PROJECT

Legends require 100 sq. ft. per gallon of application  
with the same 6 lbs. of glass per gallon.

A typical 8" ARROW & ONLY is approximately  
40 sq. ft. and requires .4 gallons of paint and 3 lbs.  
of glass beads.

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monly applied using this product. The lack of any sophisticated equipment and the ability to apply it in almost any temperature range makes this tape a very practical material in your arsenal of marking materials.

Epoxy has been introduced into the MassHighway pavement marking program in the past few years. It is used mostly on open-graded asphalt projects. Epoxy is basically a product that is sophisticated glue using resins and hardeners, mixed at a two to one ratio before being applied to the pavement surface. This is also a high durability product requiring sophisticated equipment costing from \$150,000-\$350,000 for one specialized applicator truck. For this reason, epoxy is currently applied only by contractors. Average cost for this product is \$25.00 per gallon and is applied at 20 to 25 mils which will yield approximately 225' per gallon for a 4" line. This equates to .115 per foot for material only. Life expectancy is slightly less than tapes and thermoplastics.

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## Reflectorized Center & Edgeline Pavement Markings

MassHighway specifications require 300 linear feet @ 15 mils thick & 6 lbs. of glass beads per gallon of paint applied.

### EXAMPLE

150,000' of double yellow centerline  
300,000 linear feet divided by 300' per gallon =  
1,000 gallons of traffic paint required  
1,000 gallons of traffic paint X 6 lbs. of glass beads per gallon = 6,000 lbs. of glass beads required

Use 4 250-gallon totes or 20 fifty-gallon drums  
for 1,000 gallon total

TRAFFIC PAINT FOR THESE CONTRACTS IS  
PACKAGED IN DRUMS OR TOTES  
GLASS BEADS PACKAGED IN 50 LB. BAGS --  
120 BAGS REQUIRED FOR THIS PROJECT

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MassHighway has also been using polyurea pavement markings on open-graded asphalt projects over the last few years and is in the process of evaluating the effectiveness and durability of the epoxy and polyurea markings on open-graded asphalt.

Please be aware that all of the costs indicated are estimates for the 2006 season and are for the marking material only. The cost of glass beads, labor or application of the material are not included.

Please follow all regulations regarding disposal options and handling stipulated by the Massachusetts Department of Environmental Protection:

**<http://www.mass.gov/dep/recycle/hazardous/paint.htm>**

Thanks to George Brophy and Dan Marcet of Franklin Paint Co., Inc. for their assistance in the preparation of this article. For more information, they can be contacted @ 800-486-0304 or [george@franklinpaint.com](mailto:george@franklinpaint.com)

Congratulations to the newest Baystate Roads Scholars on their fine achievement. Keep saving those certificates and you, too, could be listed here.

<b>Michael Beskid</b>	<b>Danvers DPW</b>
<b>Rose Campbell</b>	<b>Halifax DPW</b>
<b>Robert Demers</b>	<b>Pembroke DPW</b>
<b>Gene Fulmine, Jr.</b>	<b>Pembroke DPW</b>
<b>Tim Kilhart</b>	<b>Warwick DPW</b>



## Baystate Roads Scholars!

### Free CD-ROMs

#### SAFER JOURNEY

##### Interactive Pedestrian Safety Awareness

*Take a virtual journey, test your skills and discover how to take charge of your community's safety*

Useful to police departments or educators for training

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### ?? TRIVIA QUIZ ??

Celebrate 51 years of driving the Interstate by participating in this contest. ....

Win 2 Baystate Roads coffee mugs by identifying:

#### The Longest Interstate Highway

Three names will be chosen from correct responses received by March 23 via **FAX 413-545-6471**.

Please supply your name, phone, and mailing address with entry. **Good luck and safe driving**

The Baystate Roads Program, which publishes *Mass Interchange* each quarter, is a Technology Transfer (T2) Center created under the Federal Highway Administration's (FHWA) Local Technical Assistance Program (LTAP). This newsletter is prepared in cooperation with The Executive Office of Transportation (EOT) and the United States Department of Transportation Federal Highway Administration. FHWA is joined by EOT, UMass Transportation Center at the University of Massachusetts/Amherst, and local public works departments in an effort to share and apply the best in transportation technologies.

In addition to publishing *Mass Interchange*, the Baystate Roads Program facilitates information exchange by conducting workshops, providing reports and publications and videotapes on request, and offering one-to-one technical assistance on specific roadway issues. Because the program relies on input from many sources, inquiries, articles, and ideas are encouraged.

## LTAP Local Technical Assistance Program

To contact the Baystate Roads Program call (413) 545-2604 or FAX 413-545-6471.

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