Managing Pavement Markings:
Fundamental Requirements for a Functional Pavement Marking Management System

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ABSTRACT

Pavement marking is a delineation practice that, until recently, has not been emphasized as much as other forms of delineation. The Federal Highway Administration (FHWA) is currently in the process of determining if there should be minimum retroreflectivity criteria for pavement markings. If these criteria become mandatory, road management agencies will be forced to understand the retroreflectivity of edge lines and centerlines and the retention of retroreflectivity with exposure to weather, snowplowing, road salt and sand, and traffic density. The three key characteristics of greatest interest when selecting a marking material are: durability, retroreflectivity, and cost.

This study examines how agencies in Missouri, Iowa, and Minnesota have implemented and evaluated their respective Pavement Marking Management Systems (PMMS). Whether it is through field studies, software development, or a consultant’s advice, these agencies are taking steps to better manage their delineation assets and reshape the state-of-the-practice. Conversely, Texas and Australia have documented deficiencies in their pavement marking management. From these case studies, lessons learned are exposed and best practices for the future management of pavement markings are recommended.

Furthermore, management and decision making tools are thoroughly discussed to illustrate how good management practices can lead to cost savings, improved safety, and a better understanding of material performance. A PMMS provides a method to track and determine actual costs per foot of pavement marking, ensuring accurate budget planning and the most efficient division of available funds.

1.0 INTRODUCTION

Pavement markings are an important means of communicating information to drivers. Due to variations in agency policies and climate regions, there are many differences in pavement marking practices among state and local transportation agencies in the United States and Canada. The delineation practice of pavement marking, until recently, has not been emphasized as much as other forms of delineation. The Federal Highway Administration (FHWA) is currently in the process of determining if there should be minimum retroreflectivity criteria for pavement markings. If these criteria become mandatory, road management agencies will be forced to understand the retroreflectivity of edge lines and centerlines and the retention of retroreflectivity with exposure to weather, snowplowing, road salt and sand, and traffic density. The three key characteristics of greatest interest when selecting a marking material are: durability, retroreflectivity, and cost.

Many agencies spend significant amounts of money on pavement markings; therefore, it is important that agencies implement marking systems that offer optimal performance for minimal costs. This study examines how agencies in Missouri, Iowa, and Minnesota have implemented and evaluated their respective Pavement Marking Management Systems (PMMS). Whether it is through field studies, software development, or a consultant’s advice, these agencies are taking steps to better manage their delineation assets and reshape the state-of-the-practice. Conversely, Texas and Australia have documented deficiencies in their pavement marking management. From these case studies, challenges and lessons learned are exposed and best practices for the future management of pavement markings are recommended.

Furthermore, management and decision making tools are thoroughly discussed to illustrate how good management practices can lead to cost savings, improved safety, and a better understanding of material performance.

2.0 BACKGROUND

State transportation agencies have provided some form of delineation, for the traveling public, on roadways across the globe since shortly after the automobile was invented. In recent years pavement markings have gotten more recognition in the shadow of minimum retroreflectivity levels and as a result have surface as a complex road asset in need of thorough management.

2.1 Pavement Marking Systems

The primary performance purpose of linear pavement markings is to facilitate safe, efficient, and comfortable traffic flow on roadways. The intention of a pavement marking system is to provide visual guidance and direction to road users in both day and night conditions. The visibility of a pavement marking is often quantified in terms of retroreflectivity. Retroreflectivty is defined as the measure of light reflected back to the driver (1). It is suggested by many researchers that retroreflectivity should be measured under a variety of conditions, such as daylight, darkness, wet, dry, etc.

Several pavement marking systems are currently in use throughout Canada and the United States. The most common systems of pavement markings make up 90% of all markings used in North America. This report will solely focus on these common systems: conventional paints (alkyd-based or latex-based paints), epoxy paints, thermoplastics, and preformed tape.

2.1.1 Conventional Paint

The three main components of paints are pigment (for colour and reflectivity), binder (base material), and solvent (2). Historically, latex paints have been favoured over alkyd paints due to environmental and safety concerns, however, alkyd paints have been reformulated to meet currently environmental standards. One of the disadvantages of the reformulated alkyd paints is they are extremely flammable and require the use of harsh solvents to clean the striping equipment. Latex paints are more environmentally friendly and lack heavy metals and volatile organic compounds, without compromising service life. Overall, both paints are relatively inexpensive and typically provide less than one year of service life on high volume roads.

2.1.2 Epoxy Paint

In general, epoxy paints consist of two materials: pigment and binder at a ratio of approximately 1:4. Glass beads are added to the pigment and binder at the time of application to the road surface. The actual binder material is composed of resin and a catalyst. The components chemically react when mixed together and form a hard material that adheres the colour pigments and the glass beads to the roadway surface. Epoxy paints are significantly more expensive than conventional alkyd or latex paints, but offer a longer service life and higher levels of retroreflectivity.

2.1.3 Thermoplastic

Thermoplastics are typically composed of four main materials: binder, glass beads, titanium dioxide and calcium carbonate at a ratio of approximately 2:2:1:5. The binder is uded to hold the mizture together as a rigid mass, the glass beads provide retroreflectivity, the titanium dioxide allows for retroreflectivity enhancement, and calcium carbonate is used as an inert filler material. Thermoplastics costs significantly more than conventional and epoxy paints but are the most durable marking compared to other commonly used pavement markings.

2.1.4 Preformed Tape

Preformed tape pavement markings are pre-made strips or patterns of durable reflective material that are glued to the pavement surface. The materials found in tapes include: PVS resin binders, pigment, inert fillers, extender, and glass beads (3). Tape products are manufactured with an adhesive backing for ease of installation. The service life of tape is comparable to thermoplastics; however their retroreflectivty does not maintain the same longevity.

2.2 Installation

Regardless of the material quality, if pavement markings are not installed properly they will under perform in both effectiveness and service life. A report produced in association with Clemson University details best practice installation procedures (4):
Prior to marking:

- Check for proper material and equipment
- Perform required pavement surface preparation
- Record air and road surface temperatures to assure the value is within the proper range

During marking:

- Check pavement marking alignment and width quality
- Check thickness of material using paint film thickness gauge
- Check uniform curing of material
- Check glass bead distribution and embedment with microscope

After marking:

- Use camera for documentation before roadway is open to traffic
- Check retroreflectivity of material using retroreflectometer
- Inspect markings on a regular basis

Surface preparation can have a big impact on the longevity of the marking. The Iowa DOT recommends a basic three step surface preparation for the application of waterborne paints (4):

- Removal of dirt, gravel, debris vegetation, or other miscellaneous objects from the surface with a broom truck
- Removal of overhanging vegetation
- Marking the spot lateral location of lines and terminal points

Additional steps must be taken when preparing the pavement surface for durable markings. The old markings must be removed, followed by vacuuming, sweeping, and blowing the surface.

2.3 Evaluation Criteria

When selecting a pavement marking system the goal is to end up with the most cost effective option for a given scenario. There are typically three key criteria used to evaluate the cost effectiveness of pavement markings: durability, retroreflectivity, and cost.

2.3.1 Durability

The measure of staying power of a marking is referred to as durability. It includes the strength of the bond between the pavement and the marking material. Durability is also a measure of a markings resistance to abrasion from traffic and snow removal activities. The greater the durability of a marking the less frequently it needs to be replaced is therefore more cost effective. The variables that influence the durability of a pavement marking include: pavement type, pavement surface texture, weather conditions, surface preparation, traffic volume, snowplow activity, and the application of sand or salt (5).

2.3.2 Retroreflectivity

The portion of incident light from a vehicle's headlights that is reflected back toward the eye of the driver of the vehicle is referred to as retroreflectivity. Glass or ceramic beads that are partially embedded in the surface of the pavement marking material provide a degree of retroreflectivity. The beads must be transparent and round to as like lenses. As the light enters a bead, it is refracted or focused down through the bead and reflected back toward the path of entry (Figure 1).

Retroreflectivity is measured by R_L, the coefficient of retroreflected luminance, in millicandelas per square metre per lux ($mcd/m^2/lux$). R_L is an absolute value and is not affected by day or night conditions. New pavement markings typically have an $R_L$of 250 $mcd/m^2/lux$ or greater, but this value decrease over time.

Retroreflectometers are used to measure the level of retroreflectivity. Minimum retroreflectivty standards could be difficult to enforce as a result of the high degree of variability amongst retroreflectometers and the fact that readings are often not repeatable. Retroreflectivity values are constantly changing as a result of general wear, surface moisture, and paticles of debris (soil, dirt, and dried salt) on the roadway.

2.3.3 Cost

Cost is a key factor, especially considering that most agencies have to remain within a budget and are restricted by limited funding. A higher initial cost is not indicative of a higher life cycle cost. It is important to consider not only the cost of the material, but also the cost of the crew and the application equipment. It is good practice to also calculate and add the road user delay costs to the total costs for marking installation.

When comparing costs between manufacturers it is important to be aware of manufacturer guarantees over a specified time. Many manufacturers of pavement markings will replace deteriorating materials free of charge if their product does not achieve performance specifications.

3.0 CASE STUDIES

Numerous agencies operate a Pavement Management System (PMS) that incorporates pavement markings and markers as a minor item in a very large structure, but very few agencies have implemented an exclusive Pavement Marking Management System (PMMS). More and more Agencies are recognizing the benefits of proactively managing assets such as pavement markings versus just inventorying them. Some agencies have taken it a step further and hired consulting companies to help assess and develop applicable management systems.

3.1 Missouri

Missouri Department of Transportation hired BC Engineering to address the need for statewide technical assistance, training, verification of consistent processes and adequate quality control and quality assurance. Missouri BC Engineering evaluated the effectiveness of MoDOT’s pavement marking operations and developed a customized management system to track both contractor and in-house pavement markings. To develop further knowledge on the expected life of particular materials, BC Engineering provided retroreflectivity readings for 5000 miles of pavement markings (Table 1) where AvgMCD stands for the average retroreflectivity reading (MCD is short for the units of retroreflectivity units mcd/m2/lux). Daily striping logs also helped to provide additional insight (Figure 2).

MoDOT’s District 7 defines “quality control” for pavement markings as the checks done prior to placement of a stripe to ensure its quality. Although District 7’s quality control program was already at a high enough level to ensure consistency in the pavement markings even prior to the execution of their PMMS, the District found that the implementation of the recommendations by BC Engineering still resulted in substantial improvements in the quality of their pavement markings.

To help improve quality control, BC Engineering representatives discussed the issues involved with placing a good stripe and then used the Laserlux retroreflectivity readings to show the crews and supervisory personnel actual improvements. The following chart, developed by BC Engineering, shows the increase in retroreflectivity readings when BC Engineering worked with one of the striping trains in District 4 for a very brief time on calibration and bead gun adjustment (Figure 3).

The quality control measures taken by MoDOT’s District 7 to ensure proper placement of stripe included: frequently calibrate beads and paint, monitor pump pressure, monitor application temperature of paint, and apply at the proper speed.

3.2 Iowa

Previously, the Iowa Highway Research Board expressed interest in developing an ongoing program to evaluate the various products used in pavement marking. This program included a database of performance and cost information designed to assist state and local agencies determine which materials and placement methods are most appropriate for their use.

Iowa continues to recognize the value of pavement marking assets and is currently building upon their pavement marking expertise to plan, develop, and implement the Iowa Pavement Marking Management System (IPMMS). Initial planning of the IPMMS has identified key factors to be inputs including: type of road surface, volume of traffic, quality control at the time of installation, winter snow removal practices, schedule of pavement maintenance activities, and inconvenience experienced by the traveling public during installation. Other important facets that Iowa is planning to look into are collection of retroreflectivity data and developing contracts that include warranty specifications.

3.3 Minnesota

The Minnesota Department of Transportation (MnDOT), with the help of the Federal Highway Administration (FHWA), jointly developed a Pavement Marking Management System (PMMS). The PMMS system is information technology which will enable agencies to make data driven decisions. The system is essentially a pool of data that can be developed and deployed to resolve decision making headaches and reduce costs through improved operating efficiency.

The PMMS System was designed to track the useful life of pavement markings. The data tracked in the system includes:

- Installations (location, date, line, type, and quantity of material)
- Inventory
- Retroreflectivity
- Specific action steps
- Costs (employee, equipments, material)
- Suppliers

The state-of-the-art system uses a Windows based software program that works with a Paradox database program. The software program is very user friendly and comes complete with reference manual which provides details for conducting a field survey and using the software. Example pictures of screen shots are presented in the manual to show the user what to expect and how to enter data. Uniform data entry it vital to maintaining the integrity of any database system.

3.4 Texas

Texas is an example of a state that is in need of an efficient pavement marking management system. The Texas DOT spends million of dollars on pavement markings each year, but currently does not have an objective statewide pavement marking management program. They recognize that markings should be looked upon as a manageable asset and are considering developing a PMMS in the future.

Very little engineering is currently involved with the selection and construction of pavement marking materials and the maintenance and rehabilitation of markings. Most districts base restripe decisions on visual observations performed on an annual bases, while some restripe based on a regular cycle. On many occasions, markings are restriped before r after their end of service life, wasting monetary resources and presenting safety issues. The Texas DOT realizes that if the federal officials intervene and implement minimum in-service levels of retroreflectivity, they will be forced to develop a efficient and objective system to manage their marking assets. Basing restripe decisions strictly on schedule and durability can be very costly and does not follow the three evaluation criteria discussed earlier.

3.5 Australia

A recent review of the management of pavement markings in Australia revealed some noteworthy conclusions that are applicable on an international level. Pavement markings are a road safety measure as they provide delineation for all drivers. The driving population pavement markers serve are the same across the country, however the performance standards for both installation and maintenance vary significantly between States (6). In addition, many State standards are fall below international requirements.

Australia has quickly learned that setting performance standards is important; however the standards are useless if there is insufficient measuring in the field to monitor the performance of the marking. Follow up measurements are vital for performance based contracts to see if the specified standard is being met and to determine at what point in the service life maintenance restriping is required. Current system maintenance restriping is based on set interval schedules and not performance despite the presence of performance contracts.

4.0 REQUIREMENTS FOR AN EFFECTIVE PMMS

Based on research and case studies of specific states there are some clear observations about the role of PMMS within transportation agencies. The industry’s understanding of how pavement markings function has grown exponentially over the past 10 years. In determining the most optimal PMMS it is important to learn from challenges and triumphs experienced by predecessors and to understand the importance of data requirements and the collection process.

4.1 Lessons Learned

In order to effectively manage pavement markings, agencies must have complete information about the pavement marking installation. To make data driven pavement-marking decisions managers need to complete installation information. This important information allows managers and supervisors of the pavement infrastructure to identify problem areas, determine maintenance schedules, and effectively plan budgets. It is not enough to just inventory the markings. Information must be transferred to an electronic database in a timely manner. Computers systems installed on the striping equipment enable markings to be tracked as they are installed on a daily basis and the data is easily updated to a database application to be used in-office.

Tracking installation information also allows agencies to track suppliers and batch numbers of materials used to strip. Problematic installations can be traced to suppliers and even other locations where the same specific batch of material was used. The advantage is clear, if a batch is found to fail in one location, an agency can monitor other areas with the same batch material closely that may potentially fail in the near future. Agencies can also closely monitor and compare material suppliers to make more educated decisions on material selection that are not strictly based on cost.

The management process does not end at installation. It is crucial for agencies to monitor degradation over the life of the pavement marking. Measuring retroreflectivity is a good method to quantify the effectiveness of markings. Readings should be taken soon after installation and then at specified intervals over the life of the marking. The goal is to maximize the life of the pavement marking without reaching the minimum acceptable retroreflectivity threshold.

The accuracy and reliability of measurements is crucial in order to sustain a dependable PMMS. To increase the trustworthiness of the data agencies should supply proper training to staff and detailed specifications to ensure that all measurement are taken and recorded in a uniform manner.

Finally, it is most important that agencies track costs. A well designed PMMS is capable of providing agencies with the data they need to manage striping costs. Appendix A illustrates the amount of money agencies spend annually on pavement markings. It is most logical to replace only markings that are at the end of their useful life. Pavement markings themselves are only one part of the cost equation. With a solid PMMS in place, agencies can track employee, equipment, and material costs which are key components in pavement marking cost.

4.2 Data Requirements

The tables provided in this section are suggestions of what agencies can adopt to capture all of the fundamental data requirements. There is no restriction on the amount of data that can be incorporated into a PMMS. The more detail that is collected the greater the benefits that can be realized by the system. The charts developed in Missouri provided an excellent foundation on which to build a functional PMMS. From the lessons learned, it was established that there are 4 bases for which data needs to be collected: Pavement marking installation (Table 2), supplier/contractor performance tracking (Table 3), pavement marking maintenance (Table 4), and pavement marking monitoring (Table 5).

The information that should populate Table 2 is as follows:

- Date – dd/mm/yyyy
- County – County name
- Route – Route or highway number
- Road Class – Freeway, arterial, local, collector, etc.
- Direction – North, south, east, west
- Begin MP – Starting milepost/reference marker id
- End MP – Finish milepost/reference marker id
- Line Type – Centreline, edge line, skip line, etc.
- Colour – Yellow or white
- Material – Convential paint, epoxy, thermoplastic, tape, etc.
- Avg MCD – Retroreflectivity reading in millicandelas
- Pavement Type – AC flexible, PCC rigid, etc.
- Pavement Age – Age of the pavement surface in years
- Pavement Condition – A pavement condition index RCI, IRI, etc.
- AADT – Average annual daily traffic
- Weather – Ambient temperature, precipitation conditions, cloud cover, etc.
- Remarks – Any noteworthy observations at the location

Table 3 can double as a log for contractors as it details many of installation site characteristics. Some of the headings from Table 2 are repeated, the additional information that should populate Table 3 is as follows:

- Volume of material – Gallons, litres, or linear metres or feet of a material
- Bead Usage – Quantity of beads applied to the surface
- Equipment/Vehicle Type – Stripping equipment and vehicles employed
- Time Start – Time in hours work commenced
- Time End – Time in hours work was completed
- Delay Type – If delay was experienced what was the cause

All of the headings from Table 4 were previously explained for Table 2. The Maintenance data requirements are similar to installation requirements as both require the installation of new material.

Monitoring should occur at 6 month intervals, or more frequently. Some of the headings from Table 2 are repeated, the additional information that should populate Table 5 is as follows:

- Percent Remaining – Percentage of the marking remaining on the surface (a subjective indication of durability)

Pavement type, age, condition and AADT values may be extracted from an existing Pavement Management System (PMS). Ideally the PMMS should have the capacity to integrate with a PMS and a safety management system. It is vital that the same reference markers be utilized in all three databases so that locations are clearly identifiable and cross tabulation is achievable. Integration of all three data management systems will allow agencies to efficiently and cost effectively plan pavement and infrastructure maintenance and evaluate the safety effectiveness of different pavement marking materials.

5.0 CONCLUSIONS

Pavement markings have proven to be an effective way to provide delineation to drivers from both a safety and cost perspective. Agencies invest significant amounts of money into pavement markings, therefore it only makes sense that they would want to maximize their functionality and service life. The three key criteria to evaluate pavement markings are durability, retroreflectivity, and cost. With the looming FHWA minimum retroreflectivity requirements, it is more important now, than ever that agencies get a first-rate PMMS in place.

Based on real life examples of agencies, with either successful or deficient PMMS, the lessons learned led to conclusions about the fundamental requirements for an effective PMMS. There are 4 bases for which data needs to be collected: Pavement marking installation, supplier/contractor performance tracking, pavement marking maintenance, and pavement marking monitoring. Collectively all 4 bases work together to create the big picture for agencies. The PMMS should be designed so that it has a referencing system that can link to a PMS and a safety management system to help agencies make sound decision on a network level that tackles both safety and cost issues.

As agencies implement and improve effective PMMS they should share their knowledge and continue to improve value of the system through continued research efforts outlined in the recommendations. The time is now to stop taking pavement markings for granted and start recognizing them as a vital asset on our roadways.

6.0 RECOMMENDATIONS FOR FUTURE RESEARCH ENDEAVORS

The world of asset management is growing and its role in decision making is getting noticed. Pavement Marking Management Systems are no exception. This document only touches the tip of the iceberg and there are still many outstanding issues to be explored and resolved. The following recommendations are suggested for more extensive research based on the work presented in this report:

- Study the impacts of using GIS tools to manage and store data in the PMMS. GIS could also be a useful tool for merging multiple data management systems.
- Evaluate if the service life of pavement markings actually increases with the implementation of a sound and efficient management system.
- Can safety effectiveness increase with the realization of a solid PMMS. Study the number of collisions in a stringent before after study.
- Monitor if supplier complacency is reduced as a result of PMMS that frequently tracks durability and retroreflectivity for performance contracts. Also investigate if material performance is improved on account of a broad knowledge base of quantifiable data.

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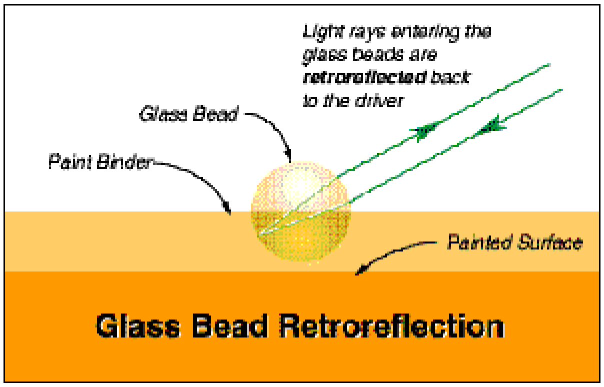

Figure 1 Glass Bead Retroreflection (7)

County	Route	Beg LP	End LP	Line	D	Date Reading	Paint Material	Year Stripe	Sub Rate	Avg MCD	Std Dev	Surface	Weighted AADT for the appropriate year
BARRY	60 Bus	1.00	1.70	CL	E	10-Nov-00	Waterborne	2000	3	161	31	Hot Mix	4286
	60 Bus	1.00	1.70	CL	E	24-Jun-01	Waterborne	2001	4	277	79	Hot Mix	6226
	60 Bus	1.00	1.70	CL	E	27-Sep-01	Waterborne	2001	3	105	33	Hot Mix	6226
	60 Bus	1.00	1.70	CL	E	20-May-02	Waterborne	2001	3	168	54	Hot Mix	Not Available
BARRY	60 Bus	1.00	1.70	CL	W	10-Nov-00	Waterborne	2000	3	164	30	Hot Mix	4286
	60 Bus	1.00	1.70	CL	W	24-Jun-01	Waterborne	2001	3	209	49	Hot Mix	6226
	60 Bus	1.00	1.70	CL	W	27-Sep-01	Waterborne	2001	3	100	29	Hot Mix	6226
	60 Bus	1.00	1.70	CL	W	20-May-02	Waterborne	2001	3	205	24	Hot Mix	Not Available
BARRY	76	15.10	19.40	CL	W	10-Nov-00	Waterborne	2000	4	186	41	Hot Mix	3659
	76	15.16	19.38	CL	W	06-May-01	Waterborne	2000	3	129	40	Hot Mix	3843
	76	15.16	19.38	CL	W	27-Sep-01	Waterborne	2000	3	101	32	Hot Mix	3843
	76	15.16	19.38	CL	W	20-May-02	Waterborne	2000	2	113	34	Hot mix	Not Available
BARRY	86	14.00	19.00	CL	W	10-Nov-00	Waterborne	2000	4	220	48	Hot Mix	1362
	86	14.06	18.95	CL	W	06-May-01	Waterborne	2000	3	134	37	Hot Mix	1703
	86	14.06	18.95	CL	W	27-Sep-01	Waterborne	2000	3	117	30	Hot Mix	1703
	86	14.06	18.95	CL	W	20-May-02	Waterborne	2000	2	147	39	Hot mix	Not Available

Table 1 Sample of retroreflectivity reading by route, material, and line type (8)

DAILY STRIPING OPERATION LOG

MISSOURI DEPARTMENT OF TRANSPORTATION

DISTRICT 7 – JOPLIN, MO

STRIPER NUMBER: __________ DATE:__________

EMPLOYEE NAME	FUNCT CODE	REG. HRS	OT HRS	BENEFIT TYPE	BENEFIT TIME	EQUIP TYPE	VEHICLE I.D.	END MILEAGE

						LINE MILES INSTALLED				GAL./LINE(S) INSTALLED										
COUNTY	ROUTE	RTE CLASS	BEGIN LOG MILE	END LOG MILE	DIR. ST. N,S, E,W	YELLOW LT	YELLOW CL	WHITE LL	WHITE RT	YELLOW LT	YELLOW CL	WHITE LL	WHITE RT	BEAD USAGE	TRAVEL TIME	WEATHER DELAY	EQUIP DELAY	PVMT TEMP	AIR TEMP	HUMID %
		MATERIAL TOTALS				0	0	0	0	0	0	0	0	0	NOTES:					

Figure 2 Sample daily striping operation log for MoDOT: District 7 (8)

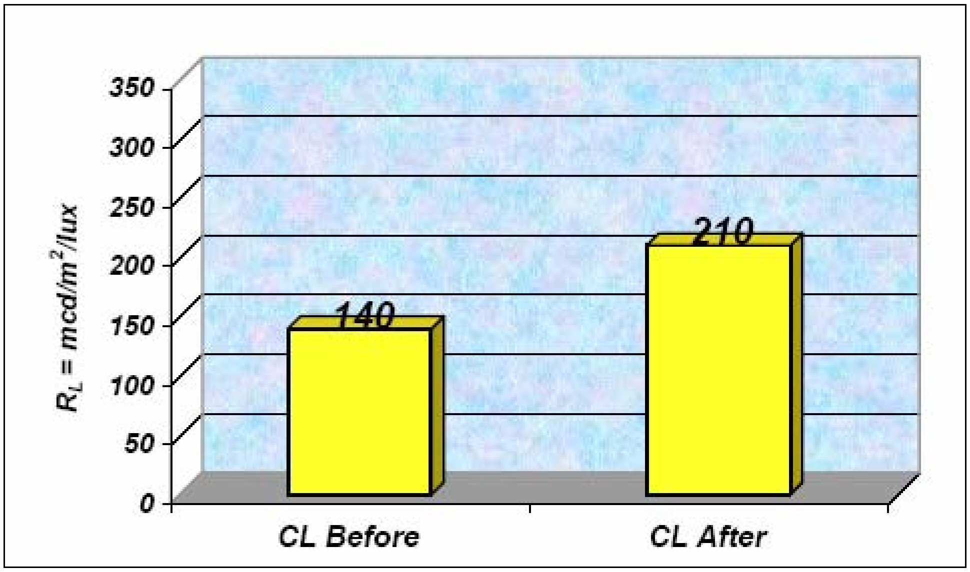

Figure 3. Retroreflectivity readings before and after working with BC Engineering (8)

Table 2 Pavement Marking Installation Data Requirements

Date	County	Route	Road Class	Direction	Beg MP	End MP	Line Type	Colour	Material	Avg MCD	Pavement Type	Pavement Age	Pavement Condition	AADT	Weather	Remarks

Table 3 Pavement Marking Supplier/Contractor Tracking Data Requirements

Date	County	Route	Road Class	Direction	Beg MP	End MP	Line Type	Colour	Material	Volume of Material	Bead Usage	Equipment/ Vehicle Type	Time Start	Time End	Delay Type	Remarks

Table 4 Pavement Marking Maintenance Data Requirements

Date	County	Route	Road Class	Direction	Beg MP	End MP	Line Type	Colour	Material	Avg MCD	Pavement Type	Pavement Age	Pavement Condition	AADT	Weather	Remarks

Table 5 Pavement Marking Monitoring Data Requirements

Date	County	Route	Road Class	Direction	Beg MP	End MP	Line Type	Colour	Material	Avg MCD	Pavement Type	Pavement Age	Pavement Condition	Percent Remaining	AADT	Weather	Remarks