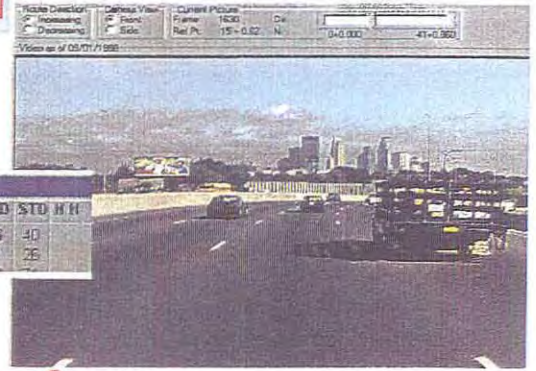
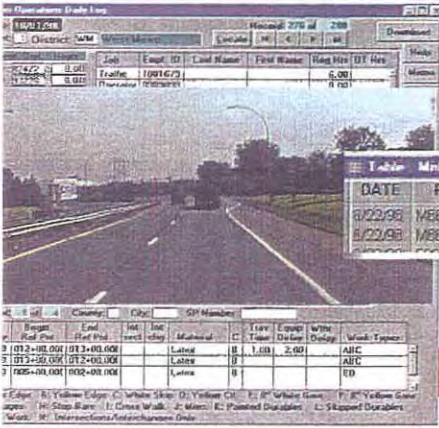
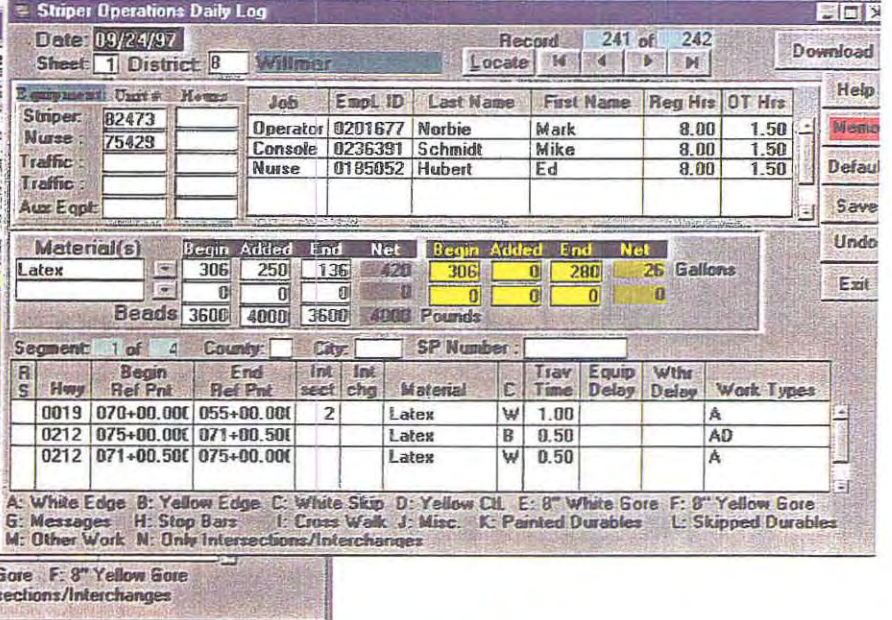
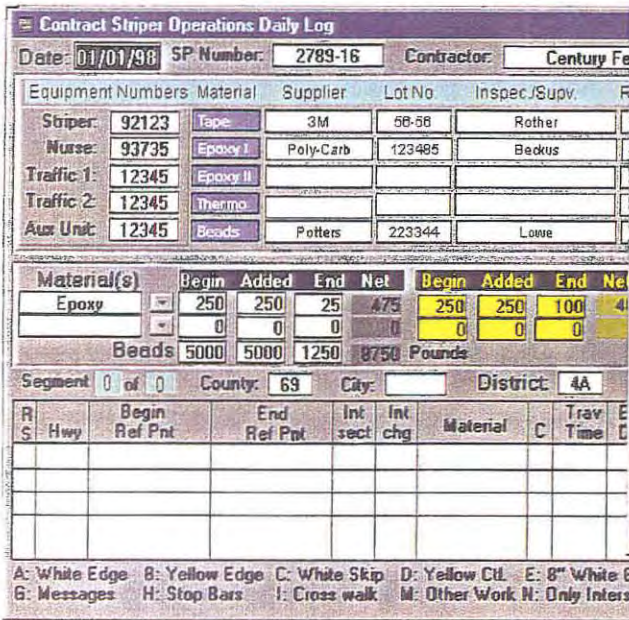


MINNESOTA DEPARTMENT of TRANSPORTATION



Pavement Marking Management System



Reference Manual

DATE	FILE	BSK	HWY	BEG RP	END RP	RDWY	MA	ADT	DIST	LINE	MAT	INST	MCD	STI	HT
6/23/98	FBE9033	1F	55	186.00	184.70	MIN55-D	8	WM	LL	T	96	208	71		
6/23/98	MBE9035	1M	55	186.00	184.00	MIN55-D	6	WM	LL	T	96	209	84		

June 1999

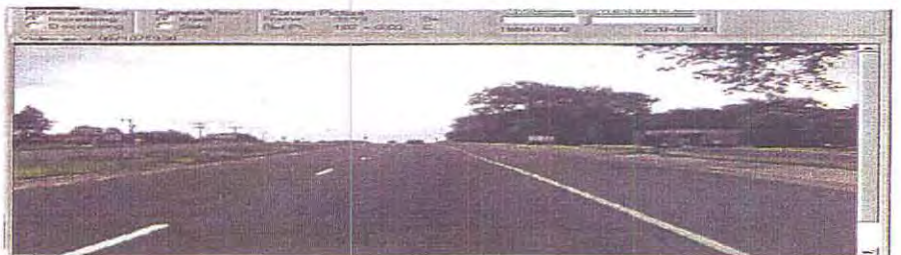


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Overview of the Pavement Marking Management System

A number of forces have driven the creation of the Pavement Marking Management System (PMMS) and are ensuring its continued existence. The PMMS system in essence provides a pool of data that can be developed and deployed to resolve complex problems facing transportation agencies. The Pavement Marking Management System is information technology, which can be viewed as putting in place a system that will allow its users to make data driven decisions.

information technology applications are enabling agencies to reduce cost through improved operating efficiency. Some systems were not considered key elements, which was especially true for pavement markings, until the passage of the appropriations act of 1993 (i.e., the **ISTEA** bill). One of the central parts of **ISTEA**, which is aimed at improving highway safety, is the establishment of a minimum value for pavement marking retroreflectivity.

Pavement markings play an essential role in the safe and **efficient** movement of traffic, especially during hours of darkness. It is a well-known fact that in order for pavement markings to be seen at night they must be retroreflective. Glass beads, which are imbedded into the marking material, make pavement markings retroreflective. Retroreflectivity is the technical term used when describing how a vehicle headlight illuminates a pavement marking. It is technically wrong to describe pavement markings as being “bright,” but for simplicity this term **will** be used in this manual.

One of the original driving forces behind the development of PMMS is the Federal Highway Administration (FHWA) legislative mandate to set minimum retroreflective values for pavement markings. With this in mind, responsible agencies are stepping up efforts to develop new processes so that minimum values can be maintained.

The Minnesota Department of Transportation, with the help of FHWA, jointly developed this system. The aim was to develop a comprehensive system that will track the useful life of pavement markings. PMMS will track all of the following:

- **Installations-**
 - location, date, line, type and quantity of material
- inventory
- Retroreflectivity
- Record specific action steps
- **Costs-**
 - employee, equipment, material
- Suppliers

At this time, there is no standard/guideline for minimum retroreflectivity values on public roads. However, FHWA is expecting to start the rule-making process to establish threshold values in 1999. In the next update to the Manual on Uniform Traffic Control *Devices*, FHWA will provide pavement marking retroreflectivity guidance. Although no such guidance currently exists, many transportation agencies have for some time focused efforts toward reducing the loss of visibility of pavement markings during the hours of darkness.

Special instruments (i.e., retroreflectometers) are needed to collect pavement-marking retroreflectivity. They are used to determine how bright the markings appear at night to motorists. All reflectometers are designed to read pavement markings within specified geometric ranges. FHWA has determined that 30-meter geometry replicates typical driving experiences and has adopted it for their rule-making processes. This geometry conforms to what an average passenger automobile driver sees when viewing 30 meters ahead of the vehicle at night. Various manufacturers are producing a **wide** range of both handheld and mobile retroreflectometers. Handheld reflectometers are used by placing the meter over markings at specified intervals. Once the total number of handheld readings at each interval is collected and averaged, an entire segment average is determined. Mobile instruments measure retroreflectivity of pavement markings while driving at highway speeds. An **onboard** computer is responsible for collecting and analyzing the retroreflectivity data. No matter which instrument is used, an averaging of all the readings taken over a specified segment length should be done. Averaging the measurements, whether mobile or handheld, normalizes the variability present in all markings.

The industry's collective understanding of how pavement markings function has grown exponentially over the past 10 years. And, with the advent of various pavement marking management systems the ability to actively manage pavement markings is adding to responsible agencies cornucopia of managerial tools.

Installations

In order to effectively manage pavement markings, agencies must have complete information about their pavement marking installations. This could be considered the heart of this system. To make data driven pavement-marking decisions managers need complete installation information. With this type of information, managers/supervisors can identify problem areas, determine maintenance schedules, and effectively plan budgets.

In order for this level of decision-making to be possible, processes that track complete and accurate installations must be incorporated. Critical components that should be tracked include location, date, specific line, material type, and quantity of material used at time of installation. The location should track from reference point to reference point, or some such common beginning and end points, where the markings were installed. Each line (e.g., centerline, edgeline, lane line, etc.) should be tracked by installation date. Material type indicates what type of line was installed. Some of the most

common types are latex, tape, thermoplastic, or epoxy. Many agencies will call for multiple material types within the same locations, which is not a problem for PMMS. Example, agencies will specify tape for the lane lines (skips) and will use epoxy for the edgelines. Again, PMMS is capable of tracking multiple material installations. Tracking materials is one of the foundations that this system was designed to track.

Inventory

Many of the decision options that PMMS can provide depend on accurately tracking pavement-marking installations. Without this type of process, developing an inventory could be very expensive. PMMS approaches this by tracking daily installations. This is one of the principle reasons that both maintenance and contracted input screens were developed. One major problem with tracking any inventory is that the database (i.e., the inventory) is usually out of date by the time it is entered into a data base. PMMS inventory will never be out of date if markings are tracked as they are installed.

Retroreflectivity

If pavement markings are to be seen at night they must be retroreflective. Retroreflectivity refers to the principle of light being directly returned to its source. In automobiles the light source is the headlight of the vehicle. Again, special instruments that have been designed to read at a specific geometry measure this light intensity. A central part of PMMS is the requirement that field inspection for retroreflectivity be completed.

The type of reflectometer used to measure markings does not matter. Agencies will specify the process for field inspections, and the Manual on Uniform *Traffic* Control Devices (MUTCD) will provide guidance on retroreflectivity values and reflectometer geometry. Many of these factors will vary from region to region and State to State. A central focus of PMMS is the ability to track pavement markings so that the various pavement marking's life cycles can be determined.

Collecting retroreflectivity with either mobile or handheld meters can be time consuming and expensive. Before determining which process to use agencies should consider:

- . Average Daily **Traffic** (ADT) count for the area to be measured
- . Length of segment
- . Location of line to be measured (i.e., centerline vs. edgeline)
- Number of readings that are required per segment
- Traffic control requirements

PMMS is designed to allow inspectors to collect retroreflectivity data and store it in tables for future reference.

Record Specific Action Steps

Once life cycles can be established for each type of marking used, the responsible agency will have many options. The ability to determine when or how often markings are in need of maintenance is first and foremost. PMMS will give an agency the ability to record specific action steps. In addition to enabling effective maintenance, PMMS offers agencies the following benefits.

- PMMS can provide an agency with data to set striping priorities
- It can provide information for the analysis of persistent problems
- This system records steps taken or not taken for defense against tort liability claims

These benefits cannot be gained without timely, efficient, and comprehensive recording practices. The memo field in either the maintenance or construction daily log offers agencies the opportunity to record and store this information. Agencies should consider including some of the following in the memo **field**.

- If an area was reported as being deficient, record the source of the information as, for example, agency employee, private citizen, public official, contract, or in-house inspectors
- Record specific actions taken, for example, location reinspected and retroreflectivity readings taken, or additional **traffic** control devices applied
- Record when and by whom the situation was reviewed

costs

It is more important today than ever to have the ability to track costs. PMMS is designed to provide agencies/authorities **with** the data they need to manage striping costs. It makes sense to replace only pavement markings that need replacement, or in other words, only markings that are at the end of their useful life. Pavement markings themselves are only one part of the cost equation. PMMS allows agencies the opportunity to track employee, equipment, and material costs, which are key parts of developing pavement-marking cost.

Suppliers

Tracking suppliers, and more specifically, material batch numbers, can answer many questions when problem installations are uncovered. Past experience has shown that failures can be tracked to specific batches of material. An advantage of tracking areas in this detail becomes clear when you can uncover other areas with the same material that may also reveal a failure.

This is exactly the type of information that managers/supervisors need when determining system needs. Another use for such information is to compare suppliers

against one another. This type of information can lead to quality improvement in an overall pavement marking program.

PMMS Software Structure

The PMMS software is a Windows™ based Paradox® data base scripted program. The software is designed for Windows version 95/98 or NT version 4.0 or higher. The software is designed as a “run-time” application, and is therefore a royalty free program. In other words, installing Paradox is not required to install and add information to the program. However, in the scripted format the program will only allow user to input the information. To fully utilize the program users will need to have a full version of Paradox, or another comparable data base program. Paradox is a commercially available program, which can be run within any Windows environment. This program assumes nothing about an operator’s level of computer knowledge. We have strived to develop a program that can be used by even the most novice computer user.

Entering information into the program is accomplished by entering the data directly into a scripted form. This program has been designed so that all relevant data can be entered directly into one of two screens: the daily maintenance, or contracted screen.

This program takes advantages of many Windows programming options. Keep in mind that you can use the right mouse button on parts of data input screen. Although you can move through the menus to do most things in the PMMS program, using the right click on your mouse will reveal additional menus that can save time. Highlighting (i.e., left clicking in the appropriate box) the **District, Job, or Empl. ID** portions of the input screen, and then right clicking the mouse button will allow access their sub-menus. Each of these sub-menus can be changed to fit specific needs.

System Requirements

Component	Description/Comments
Microprocessor	486 or higher
RAM	6MB (8MB is recommended.) Performance will increase with more memory.
Hard disk →	A hard disk is required. System files installed using this minimum Paradox installation requires approximately 8 MB.
Video monitor	EGA or higher
Microsoft Windows	Version 95, 98, or later NT 4.0
Mouse	Although not required, a mouse is strongly recommended. Some design features can be accessed only with a mouse.

Overview of Conducting Field Surveys

Conducting field surveys of the condition of pavement marking is not easy. Many aspects need to be considered prior to conducting field surveys. For example, markings are considered new within 14 days of installation, with all excess glass beads removed. When or how long after installation should retroreflectivity tests be taken? The fact is that it depends on the type of marking. Some markings can be read immediately after installation, and some should be allowed to brighten before their retroreflectivity is determined. Performance contracts for pavement markings are showing up throughout the United States across the country. And many of these contracts specify when readings **will** be taken.

Other items that should be considered prior to field inspection:

- How many readings should be taken?
- Will the readings be done with a mobile or handheld reflectometer?
- Determine how much of the line needs to be read (i.e., total samples)?
- How many times, or at what intervals, **will** readings be taken?

There are many factors (e.g., road surface, safety needs, alignment, material type) to be considered before pavement markings are installed. There is no one part or link in a pavement marking value chain that is more important than any other. One of the underlying premises of PMMS is that field inspections, or more specifically, the retroreflectivity of pavement markings, must be collected.

The following is included for consideration purposes only, and is not intended to take the place of any specific agency or organization specifications. It is provided as information to those agencies that have not performed field inspections. Agencies may also want to consider the following standards

ASTM Standards

- E284 Terminology of Appearance
- E809 Practice for Measuring Photometric Characteristics of Retroreflectors
- D4061 Test Method for Retroreflectance of Horizontal Coatings
- E 1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry using a Portable Retroreflectometer

Other Standards

- **CEN/TC226** WG2 Horizontal Signalization
- **PrEN 1436:1994** Road Equipment. Horizontal signalization. Road marking performance for road users

Test Method for Determining the Retroreflectivity of Pavement Markings

The following specifies a procedure that can be used to evaluate the retroreflective performance of horizontally applied (in-service) pavement markings. This test procedure is only intended for field measurement. Because the entrance and observation angles of the retroreflectometer affect the readings of pavement markings the entrance and observation angles (geometry) shall be specified. Evaluation of pavement markings shall be done within specified zones and time intervals. Criteria are included for determining inspection zones that appear, by visual or mobile instrument inspection, to fall below the specified minimum performance value.

Retroreflective field data can be collected with either portable (i.e., handheld) or mobile reflectometers. The Engineer has the option of determining whether the readings shall be done at night or during daylight, but in either case the readings will be done in dry conditions. Data shall be collected in the direction of traffic, when ambient temperature conditions are compatible with specifications for the instrument. When encountering pavement markings that separate opposing traffic (i.e., centerline, lane line, skip lines, etc.), the Engineer may request that pavement markings be evaluated in both directions, and that the centerline be measured for each stripe.

This process is an improvement over visual inspections because it allows collection of data that can be used to objectively determine the retroreflective qualities of the installation. We do not intend to discourage visual inspections, especially visual inspections done at night. Visual nighttime inspections are encouraged because they may reveal deficient areas that should be inspected.

30-Meter Measurement Geometry

Instrument geometry is specified because it is a primary driver in determining retroreflective values. Thirty meters has been selected because it most closely correlates an average automobile drivers vision geometry. Instruments used to measure the retroreflective properties of pavement markings shall conform to the following measurement geometry(s):

- The **entrance** angle (the angle between the illumination axis and the retroreflector axis) shall be $\geq 88.50^\circ$ and $\leq 88.76^\circ$, and the observation angle (the angle between the illumination axis and the observation axis) shall be $\geq 1.0^\circ$ and $\leq 1.05^\circ$. The **co-viewing** angle (the complement of the entrance angle) shall be $\geq 2.29^\circ$ and $\leq 2.50^\circ$.

All readings taken, or the **coefficient** of retroreflected luminance, shall be expressed as the metric equivalent ($\text{mcd}/\text{m}^2/\text{lux}$).

Scheduling for Data Collection and Reporting

Field evaluations (data collection) should not be started until the markings have been in-service for a minimum of 2 weeks. The 2-week minimum time frame is very dependent on the type of material that is being installed. Data collection should be completed within 6 weeks of installation (weather permitting). Waiting any longer could jeopardize the ability of some marking material to meet minimum values. This is especially true for areas with high volumes of traffic or areas where vehicles make numerous turning movements.

After field evaluations are completed, a written report shall be submitted to the Engineer. Contained within the report shall be:

- . State project number
- The test date
- . Average of the readings at each test location
- Standard deviation (one deviation)
- . Geographical location of the test site(s), including distance from the nearest permanent site identification (such as a reference point/mile marker)
- Identification of the pavement marking material tested: type, color, age, and transverse location on the road
- Identification of the retroreflectometer
- . Remarks concerning the overall condition of the line, such as carryover of asphalt, snowplow damage, uneven distribution of beads, etc.

Method for Determining Portable Reflectometers Measurement Zones, and Minimum Sampling Rates

The evaluation of longitudinal pavement markings shall be made after identifying the zone(s) to be measured. Any installation less than 300 meters (1000 feet) shall be considered a zone. One zone of measurement should be identified for installations that fall between 300 meters and 1.5 kilometers. Any installation greater than 1.5 kilometers shall have a minimum of one zone selected for each kilometer of striping. The 300 meters shall be continuous in length. The random segment(s) may be selected after a visual inspection. A minimum of 26 readings on each line will be taken within each test zone. When reading broken lines (skip stripes), every other skip shall be read, with no more than three readings taken on any one skip stripe. A minimum of two readings should be taken on individual skip lines, and they should be taken approximately 500 millimeters (20 inches) from each end of the skip. On continuous lines, break the measurement zone into a minimum of ten 30-meter (100-foot) areas, and space the 25 readings a minimum of 33 feet apart but no more than 100 feet apart. The Engineer may determine that more samples shall be taken.

Note: **After** the initial evaluation, regardless of the results, the-Engineer can define new checkpoint areas if they are considered critical for road safety.

Method for Determining Dynamic (Mobile) Measurement Zones, and Minimum Sampling Rates

Mobile instruments shall conform to specified geometry and shall be capable of reporting both $\text{mcd/m}^2/\text{lux}$ average and standard deviation for each line and each segment. When reading longitudinal lines, the minimum interval for averaging both, a segment's individual $\text{mcd/m}^2/\text{lux}$ readings and the segment's standard deviation will be no less than 100 feet; however, all of the individual readings shall be used when determining a zone's overall average. Inspectors shall not group together, in any one report, two lines or two color lines in the same data file. When collecting data on longitudinal continuous lines, readings shall be collected at a minimum rate of not more than 8 feet apart. When collecting data on longitudinal broken lines, readings shall be collected at a minimum rate of not more than 5 feet apart.

Repeatability of the mobile instrument shall be considered acceptable if the instruments deviation within the same inspection zone is $\pm 10\%$. The maximum acceptable deviation for measurements made by two different instruments manufactured by the same manufacturer, within the same zone of measurement, shall not be greater than $\pm 15\%$. The calibration of the instrument shall conform to the manufacturers instructions. Mobile instruments shall measure a minimum of 20% of each installed line. And, reading entire segments of installed lines should be considered.

Note: Upon evaluation, despite the results of the inspection, the Engineer can define additional inspection areas if they are considered, critical for road safety.

Symbols and Legends

For each contract, the zone of measurement can be considered **as** the contract length. Inspectors shall take and report a representative sample of each type of symbol.

Using the PMMS Software

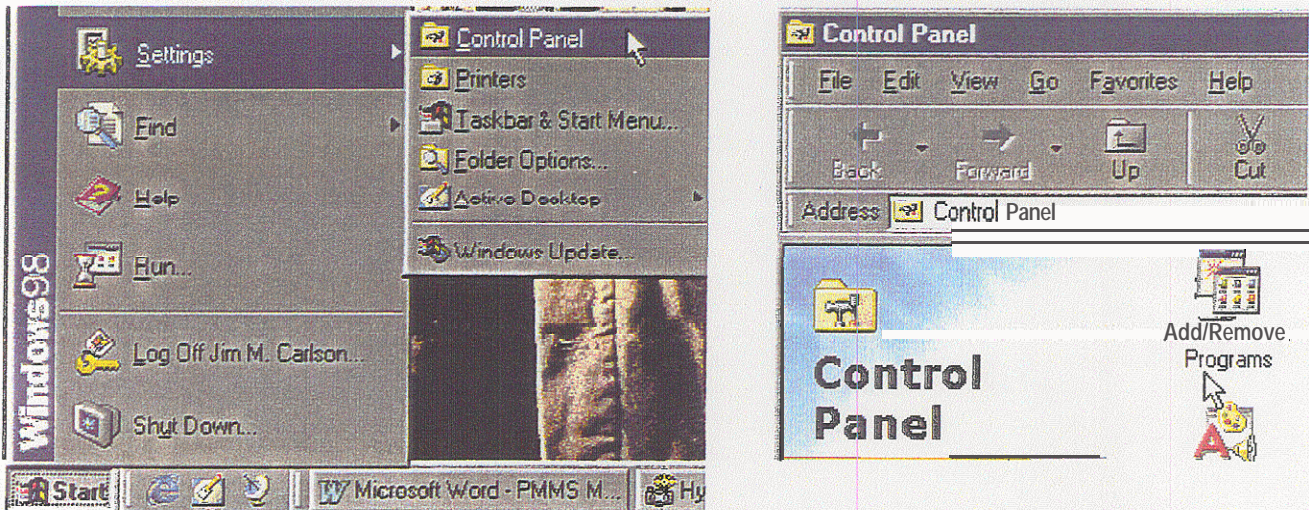
Minimum System Requirements

- IBM/compatible computer with 486 or higher processor
- 6MBFMA
- 3.5" floppy disk drive
- Windows95 (Win95), Windows98 (Win98), or Windows NT (NT 4.0)

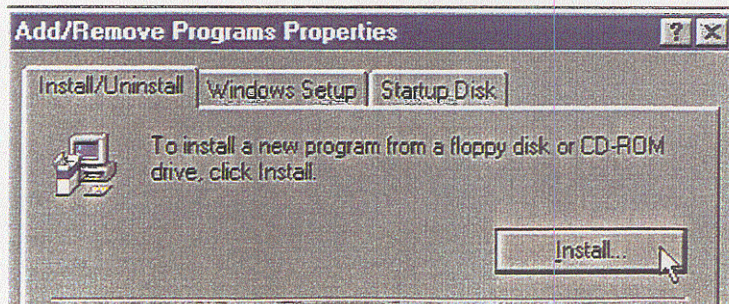
Installing PMMS



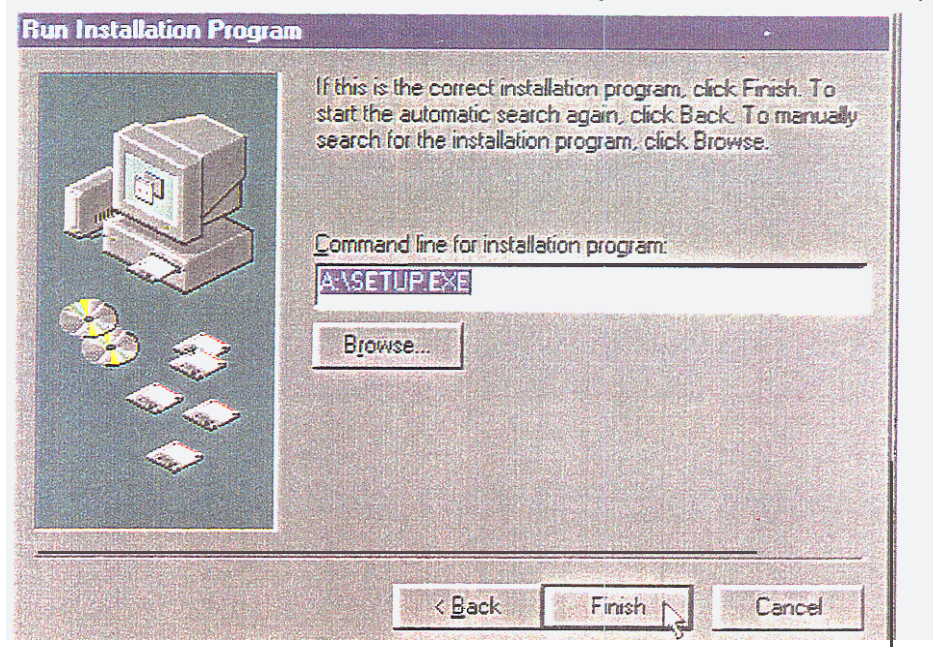
1. Insert the floppy/CD disk in the appropriate drive
2. From Windows desk top click on Start, Settings, and Control Panel



3. Double click the Add/Remove Programs icon.



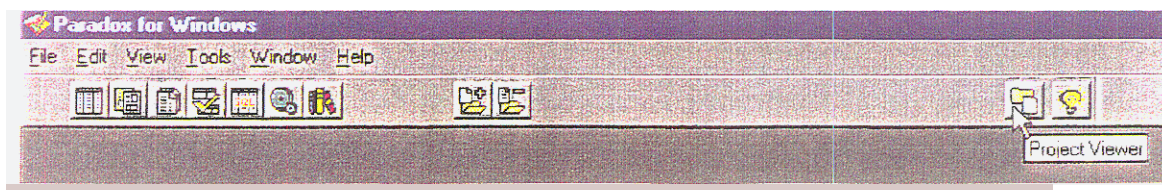
- Windows will automatically detect the installation disk, if not click on the browse button and indicate where the installation disk is located. If the correct directory is displayed, click on the Finish button to continue. Follow the installation wizard and it will lead you through the rest of the set-up.



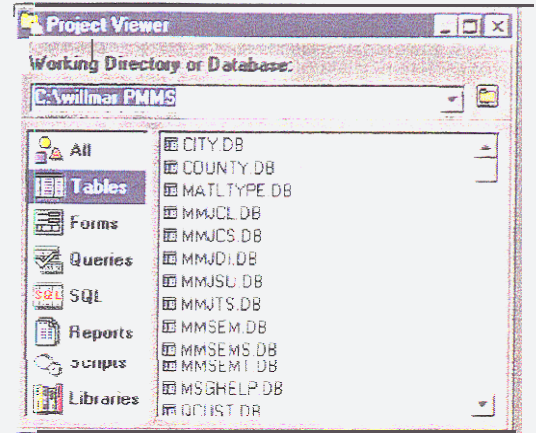
The default is c:\ Programs\Minnesota Department of Transportation, If another destination is preferred change the directory when prompted.

Starting PMMS

1. Navigate to the where the program installed the programs and double click on the desired script.
2. In Win95/98/NT click on the Start button, move the cursor to Programs, from programs select Paradox menu; and then double click on the Paradox program (see picture below for full sequence).
3. Opening the Project Viewer-You can easily access all Paradox's options by left clicking the Project Viewer on the main Paradox screen. If no buttons appear when Paradox opens, select (i.e., click) View: Toolbars, Standard, and click OK.



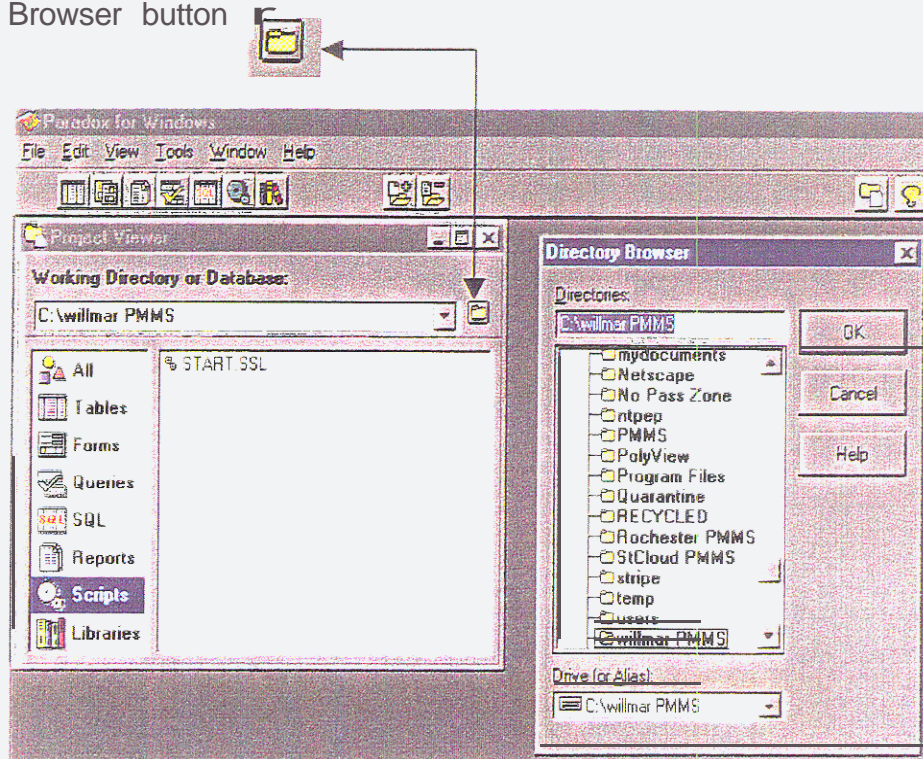
Project Viewer is the user interface that allows you to access Paradox's options they include AR, Tables, Forms, Queries, SQL, Reports, Scripts, and Libraries. PMMS focuses on Tables and Scripts. When you highlight any option, you will see a listing on the right hand side of the screen. This listing includes each specific file that can be accessed for that option. in the example given, you will notice that the right hand side of the screen shows all of the database tables that can be accessed in the Tables submenu.



4 Setting the Working Directory

The first box in the Project Viewer is the Working Directory or Database. input area. As you can see in the box below, the working directory is set for C:\Willmar PMMS. You should set your working directory to the location that you selected when the program was installed or to the default location. If you need to search for your directory, click on the yellow folder (button) on the right side of the Working Directory or Database line

Directory Browser button



The Directory Browser will appear. Locate and click on your directory, and click OK.

- 5 Start the PMMS data input screen by highlighting (i.e., left clicking) on Scripts
- 6 Move your mouse pointer over the START.SSL option and double (left) click
- 7 The main screen starts (see picture below) and you are ready to begin data entry

Main (Maintenance) Input Screen

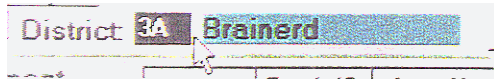
The main screen will be broken into sections for further discussion

The header section at the top of the screen will be broken into parts for further discussion. The parts include Date, Sheet, District, Record Number, and the five Locate buttons.

As you can see, the Date field is highlighted (i.e., black), which indicates that this is the active field. Date is a required field. A required field is one that must have information entered into it before the program will allow you to move on. In other words, further data entry will not be allowed until a date is entered.

The default setting for Sheet is one. The majority of the time you will need only one sheet. One reason for changing this number would be if two crews were working on the same day, as for example, when two crews are using the same equipment, but are working two different shifts.

The District name and number can be entered by using a submenu (Lookup help) option. Using your mouse, left click in the District box. The box will turn black, indicating that it is the active field. Leave your mouse pointer **over** the box and right click. The following supporting data input screen will pop up



Left click on the number or the name of the area you want to enter and click the OK button

MMJDI	MMJDISTNUM	MMJDISTNAME
5	3A	Brainerd
6	3B	St. Cloud
7	4A	Detroit Lakes
8	4B	Morris
9	6A	Rochester
10	6B	Owatonna
11	7A	Mankato

The Locate and arrow buttons allow you to search through your records. The counter (e.g. the example below shows 1 of 9) above the arrow buttons reveals the number of the currently displayed record, and the total number of records entered to date. To locate a specific record, click on the Locate button. This will bring up the Search screen. The three options you have for searching for a specific record include Stripper Unit, Date, or Highway. Once you have selected a field for your search, and entered a search value, click the OK button. To search individual records use the arrow buttons.



Search one record at a time

Moves to beginning or end

Search

Search using field:

- Stripper Unit
- Date**
- Highway

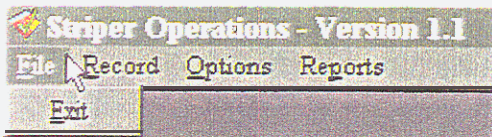
Search for Date value:

03/08/97

OK Cancel

Once the input screen opens the menu bar will change to File, Record, Options, and Reports. Enter the sub-menus by left clicking on the menu option, or use the keystrokes that are identified on the right of the menu option. For example. New

Record can be used by either clicking on the New Record sub-menu item or try hitting the ins (i.e. the insert,) key on your keyboard.



File

Left click on file, and again on Exit to close the input screen

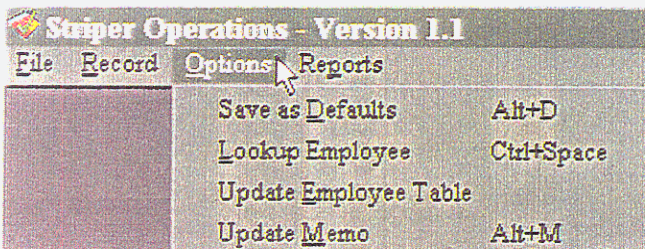
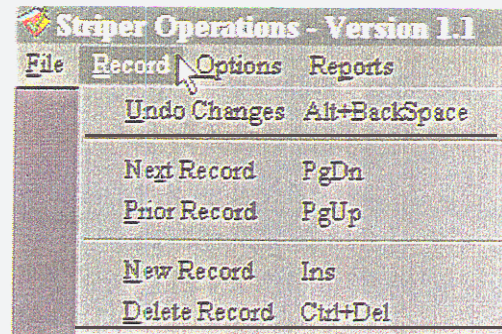
Record

Undo Changes will undo any changes that were made to the input screen since the last save

Next Record and Prior Record are options that can be used to scroll from one record to another

Click on New Record to start a new day's data entry

Use the Delete Record option to remove (delete!) the current record from the file



Options

Save as Defaults allows you to keep the current equipment numbers, Job classifications, employee names, employee numbers, and hours. When you start to enter another day's data the defaults will automatically be entered.

Use the Update Employee Table to add/remove employees to the Striper Employee Table. This is the sub-table (lookup Help table) that can be used to quickly add/change employees.

Click Update Memo option to gain access to the current record's Memo field

Reports

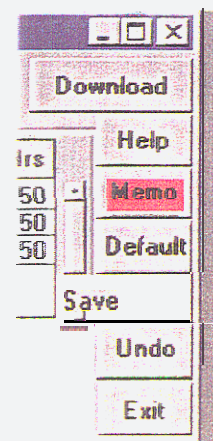
Striper Operations Index is an automated report that will outline the date, district, striper unit, and operator for each day of production.



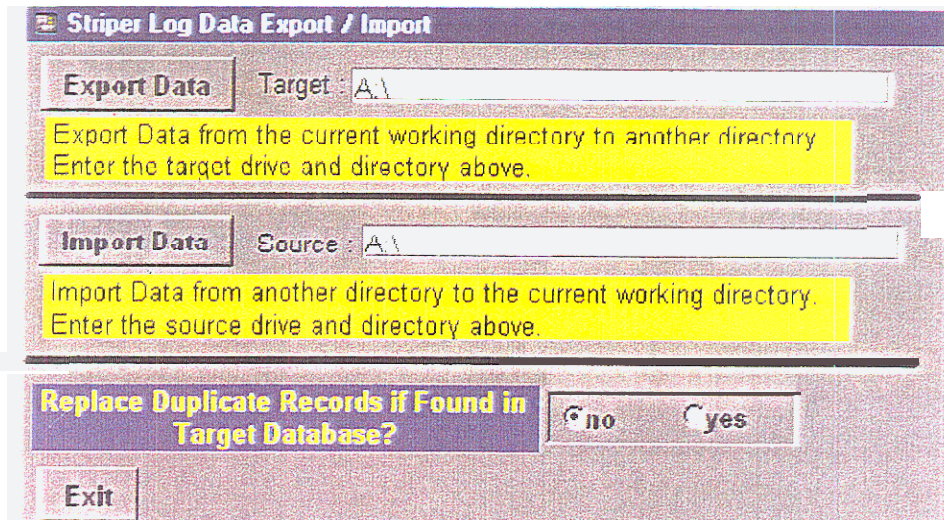
There are seven buttons on the right side of the data input screen: Download, Help, Menu, Default, Save, Undo, and Exit.

Download

The download button is designed to automatically allow you to move your data between sources. This option can also be used to back up your data. The terms used to express this are Export or Import. To activate the



download feature simply move your mouse over the download button and left click
Download Screen



Export (moving your data from the working directory to a target directory)
To move your data from the default directory to a diskette set the target (in most cases it will be a \) and left click the Export Data button,

Import (moving your data from a source to your working directory)
To move the data from the diskette to the current working directory set the source directory (again in most cases it will be a:\) and left click on the button. The import button will automatically detect your working directory and move the data to that directory in other words, the source is where the data is coming from, which will usually be the a:\.

Prior to clicking on either button, determine whether you want the program to replace any duplicate records. Example, If you have edited any previous records you will want to click yes.

Help

Get help on particular parts of the screen

Memo

Opens a memo field so that you can save daily notes. Once a memo has been entered the button will turn red In other words, a red memo button indicates that a memo has been entered for that day

Default

Sets screen defaults for District, Employees, and Equipment. When new data is entered into the system, the program will automatically enter these fields into their proper areas

Save

Click on the Save button to automatically save your data input and move onto the next day's input.

Hint! Every time the **Save** button is pushed a popup program box will advise you that your data is saved. The program will then open a clear screen, and move to Date waiting for you to start another day's entry Every time you click the save button it assumes that a new day of data entry is going to be entered. If you do not want to enter more data click the UNDO button The program will ask you to confirm the Undo. and will then drop you to the last day that data was entered.

Undo

Click on the Undo button to remove mistakes

Exit

Use the Exit button to exit the data entry screen

Equipment (Top Section)

Enter the equipment numbers, and total hours for each day's production

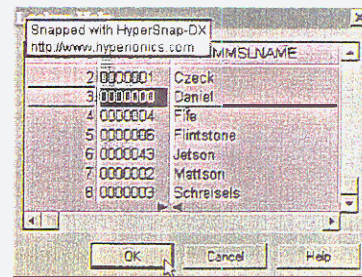
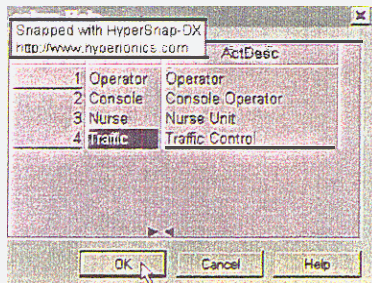
Equipment:	Unit #	Hours
Striper:	82473	
Nurse:	75429	
Traffic:		
Traffic:		
Aux Eqpt:		

Employees

Job, Employee ID, Name, and Hours are used to document each member of the striping crew. The Job column is broken out by duty The Operator is the driver of the striper Console Operators perform all other striper related functions (e.g., monitor paint pressures, turn on and Off paint guns, etc.). Employee identification (ID), Last, and First names, are optional columns and can be used alone to identify specific employees. Regular (Reg) and Overtime (OT) hours will track daily hours.

Job	Empl. ID	Last Name	First Name	Reg Hrs	OT Hrs
Operator	0201677	Norbie	Mark	8.00	
Console	0236391	Schmidt	Mike	8.00	
Training	0358767	Posusta	Kim	8.00	
Nurse	0723952	Selden	Pam	8.00	

Supporting data entry tables

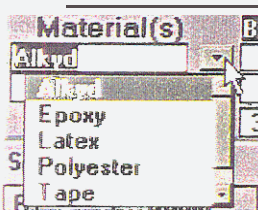


To quickly enter employee information left click in either the Job or Empl ID cells. With the cursor in the highlighted cell, right click to bring up a supporting table. Left click on your selection and click OK.

Material Section (Middle Section)

The materials section will track total quantities of materials used in a day's production. As you can see, there are three lines provided. The first two lines will track the type of material, and the amount of material that has been installed. The third line will track the total quantity of beads applied. The materials section has been further broken down into **Begin**, **Added**, **End**, and **Net**. Enter the total amount of material in the striper tanks at the beginning of the production day. **Added** shows how much material has been added to the tanks during the day. **End** is the amount of material in the tanks at the end of the production day. **Net** shows the total amount of material used, for that day's production. Do not try to enter into the **Net** column, the program is designed to automatically calculate this column. The program adds the **Begin** and **Added** columns together and then subtracts the **End** column to determine the **Net** quantity for the day.

Material(s)	Begin	Added	End	Net	Begin	Added	End	Net
Latex	306	250	136	420	306	0	280	26
	0	0	0	0	0	0	0	0
Beads	3600	4000	3600	4000	Pounds			



To add or remove material(s) to the drop down menu exit the program, highlight Tables on the Project Viewer, and double click the MATLTYPE table.

Note! To edit any table Click on the Edit



Data toolbar button, or hit F9 on your keyboard.

Run Section (Bottom Section)

The term run in this section is used to describe the beginning and ending points of an application. **Segment** indicates the total number of runs entered into the program for a particular day. In the example below you see that it indicates 1 of 4. This indicates that 4 lines were entered that day. **County** and **City** cells allow you to track, by number, the county and city installations. **SP** Number is short for special project, or state project number. This column tracks individual projects or contract project numbers.

Segment		1 of 4		County:	City:	SP Number:					
R S	Hwy	Begin Ref Pnt	End Ref Pnt	Int sect	Int chg	Material	C	Trav Time	Equip Delay	Wthr Delay	Work Types
	0019	070+00.00	055+00.00	2		Latex	W	1.00			A
	0212	075+00.00	071+00.50			Latex	B	0.50			AD
	0212	071+00.50	075+00.00			Latex	W	0.50			A

A: White Edge B: Yellow Edge C: White Skip D: Yellow Ctl. E: 8" White Gore F: 8" Yellow Gore
G: Messages H: Stop Bars I: Cross Walk J: Misc. K: Painted Durables L: Skipped Durables
M: Other Work N: Only Intersections/Interchanges

The first column (RS) indicates that either a City or a County was striped in this run. Enter R for County, or S for City. Hwy indicates the number of the road that was striped.

Begin Reference (Ref) Point (Pnt), and End Ref Pnt track where pavement marking installations start (begin) and stop (end), for each individual line. The program automatically converts all reference points to "true reference points" after they are entered. In other words, to enter an ending reference point of seventy-seven point five you should enter the numbers 77.5 in the End Ref Pnt column. The program will automatically change 77.5 to 077+00.500. True reference points are used because they allow for changes in roadway alignment.

Intersection sections (Int sect), interchanges (Int chg) track the total number of each striped during that run.

Material indicates which material was installed. If only one type of material was indicated in the materials section the program will default the material in the material column.

The column "C" indicates each color of material. There are three options available: W for white, Y for yellow, and B for both.

Travel Time (Trav Time) tracks the total amount of non-production time used to travel from one location to another. For example, the striper travels one hour to its first installation location. At the completion of that installation, the striper travels another one-half hour to its next location, and so on.

Equipment Delay (Equip Delay) tracks total hours of equipment down time.

Weather Delay (Wthr Delay) indicates the total number of hours that the crew was held up due to weather delays.

The Work Types column tracks each specific line installed during a run. Each of the possible indicators has been included on the bottom of the screen. See appendix C for a complete description of the Work Types.

The Contract Striper Operations Daily Log

The Contract Striper Operations Daily Log tracks contracted pavement marking installations. The actual input of data is very similar to that of the Striper Operations Daily Log. All of the actual buttons (e.g., Help, Save, Download, etc) are the very same so they will not be discussed in this part. See the previous section for operational descriptions for each button.

Following is an example of the Contract Daily Log.

The Header Section

The top section of the form tracks the Date, SP Number, Contractor, and provides an indicator which reveals which number record is being displayed.

- Date is a key field which means it must be filled in whenever a new days data is entered. A key is a field, or group of fields, in a Paradox table that is used to order records, or ensure referential integrity
- SP Number can be considered special project, or state project number it will track the number that is assigned to the project.

- Contractor tracks who is installing the pavement markings
- Record displays, in the first box, the number of the current record and then indicates the total number of records entered,

The Top Section

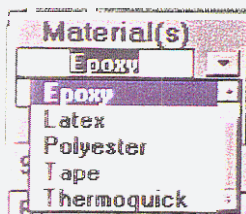
Again, the top section is similar to the Striper Daily icy (Maintenance) input screen. The largest change is that Contract data input screen tracks materials by supplier and lot numbers. The employee section of the table can track either the inspectors or the contractor employees. As you can see both regular and overtime hours are included, but are meant as mandatory fields. In other words, some agencies may want to track how much time is being devoted to installation inspection, or monitoring the contractor

Equipment Numbers	Material	Supplier	Lot No	Inspecl/Supvr	Reg Hrs	O T Hrs
Striper: 92123	Tape	3M	58-58	M. Bother	10.00	
Nurse: 93735	Epoxy I	Poly-Carb	123485	R. Beckus	8.00	10.00
Traffic 1: 12345	Epoxy II					
Traffic 2: 12345	Thermo					
Aux Unit: 12345	Beads	Potters	223344	D. Lowe	8.00	2.00

The Middle (Material) Section

The material section operates the same in both version of the program

Material(s)	Begin	Added	End	Net	Begin	Added	End	Net	
Epoxy	250	250	25	475	250	250	100	400	Gallons
	0	0	0	0	0	0	0	0	
Beads	5000	5000	1250	8750					Pounds



To add or remove material(s) to the drop down menu exit the program, highlight Tables on the Project Viewer and double click the MATLTYPE table,

Note! To edit any table Click on the Edit



Data toolbar button or hit F9 on your keyboard.

Bottom (Run) Section

The run tracking section works exactly the same in both versions. A complete description for documenting a run can be seen above, or in Appendix A. The only difference is in the number of Work Type options. Work Types could be changed to fit individual needs.

Segment		1 of 2		County:	69	City:		District:	4A			
R S	Hwy	Begin Ref Pnt	End Ref Pnt	Int sect	Int chg	Material	C	Trav Time	Equip Delay	Wthr Delay	Work Types	
	0169	054+00.000	025+00.000	5		Epoxy	B	0.50		0.50	AB	
	0169	025+00.000	054+00.000	5		Epoxy	W				A	

A: White Edge B: Yellow Edge C: White Skip D: Yellow Ctl. E: 8" White Gore F: 8" Yellow Gore
 G: Messages H: Stop Bars I: Cross walk M: Other Work N: Only Intersections/Interchanges

Appendix A

The Paper form of Striper Operations Daily Log

The paper form of the Striper Operations Daily Log is a data collection form used to track all pavement marking installations. Once this form is completed, a selected crew, or office employee should transfer the information into the database. If multiple crew are installing markings, and are tracking their own installations they should come to a consensus, or common ground, on everything they are tracking. It is important that each crew tracks, and records the information the same way.

It is recommended that each day a striping related activity is done a Striper Operation Daily Log, or Contract Daily Log should be filled out. In other words, a form should be filled out for each day that: equipment maintenance, material handling (shipping, receiving, or moving), equipment or whether delays, striping related training/conferences was done. To make data input into the computer easier this form has been intentionally designed to look like the computer data-input screen.

The tables (A, B, and C) below are intended to resemble the Striper Operations Daily Log. They will be referred to throughout this description. Again, as it was earlier, the term RUN (or pass) is used. A single striping pass includes all material applied from a beginning reference point (or mile marker), to an ending reference point in one direction. A run is listed on this form on table C under T.H. (trunk highway); therefor, each individual line filled out under T.H. is considered a run, or a pass of the striper.

Table "A" is the top of the Striper Operations Daily Log. This portion of the form will track equipment, employee(s), and employee daily regular and overtime hours. Each column has been given a specific number (i.e., 1,2,3). Use the column number to find the written description for each column.

TABLE A

Column No.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Equipment	Job	Employee ID	Last Name	First Name	Reg Hrs	O.T. Hrs
Striper:						
Nurse:						
Nurse:						
Traffic:						
Aux Equip:						

Equipment: (Table A, Column No. 1)

Record in column 1 the unit number, and the total hours, for each piece of equipment assigned to that day's operation. Aux. Equip. (i.e., auxiliary equipment) should be used to indicate any additional equipment that is used.

Job: (Table A, Column No. 2)

Indicate in this column each crew members assigned job. For example, on the line that is identified Stripper (with the unit number next to it) describe in the job column "operator" to identify the crew member that is driving the stripper unit. There are five activities that are associated with striping: 1. Operator, 2. Cons. Op. (i.e., console operator, or button pusher), 3. Nurse truck, 4. Traffic control, 5. Training.

If during a single day a crewmember does two different jobs (i.e., drives for 4 hours, and runs the console for 4 hours) identify this on the form. When the information is entered into the computer two lines will be used to cover this situation.

Employee ID, Last Name, First Name: (Table A, Column 3,4 8 5)

These three columns identify each member of the crew. If additional room is needed turn the form over and identify each additional employee's information of the back of the form.

Reg. Hrs. and O.T. Hrs: (Table A, Column 6 & 7)

Indicate total daily hours in these two columns. Again, a sheet should be filled out anytime anyone on a crew is doing a striping related function. These include, but are not limited to equipment repair/maintenance, striping related training, and whether delays.

TABLE B

	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
	Materials	Begin	Added	End	Net	Begin	Added	End	Net	Gallons
Line 1										
Line 2										
Line 3	Beads									

Materials: (Table B , Column 6)

Indicate in this column the type of material used. This is a column that has changed from the original form. A quick check of this column will reveal if two materials were installed within a given segment, or within a given day. Notice that two columns are included in the material section. For most of our day-to-day maintenance operations only one material will be used. It is important to track whenever multiple materials are used within the same reference points (e.g., tape centerlines and epoxy edge lines). When recording a run(s) that have multiple materials within them, please break each nm out by a single material.

WHITE Begin Added, End, Net: (Table B , Column 9,10, 11 & 12 Line 1)

Document the amount, or quantity, of WHITE material used throughout the day. In column number 9 indicate how much material is in the white tank at the beginning of the striping day. Example, if your truck has a total white of 3000 gallons and you are starting with a half tank indicate 1500 in column 9 line 1. In column number 10, line 1, indicate how much white material was added during the day. At the end of each day, inspect the white tank to determine how much material is left and add that amount to End (column 11, line 1). You do not need to do anything for the net column (number 12). Once the data is entered into the computer, the software will automatically calculate the material used. If you would like to do math, so that you will have a quick check, please do. Doing the calculations is an excellent way to spot check to see if the equipment is working properly.

YELLOW Begin Added, End, Net: (Table B , Column 13,14,15 & 16 Line 1)

Document the amount, or quantity, of YELLOW material used throughout the day. In column number 13, line 1, indicate how much material is in each tank at the beginning of the striping day. In column number 14, line 1, indicate how much material has been added to the yellow tank during the day. Inspect the bead tank at the end of each day to determine how much material is left and add that amount to End (column 15, line 1). Again column 16 will be filled out automatically by the computer.

BEADS Begin, Added, End, Net: (Table B , Column 9,10,11 & 12 Line 3)

Document the amount, or quantity, of BEADS used throughout the day. In column number 9, line 3, indicate how much material was added to the bead tank at the beginning of the striping day. In column number 10, line 3, indicate how much material was added to the bead tank during the day. At the end of the striping day, inspect the bead tank to determine how much material is left and add that amount to End (column 11, line 3). Column 12 will be filled out automatically by the computer.

Again, one of keys to the Pavement Marking Management System is making sure that correct information is collected. Please, take the time necessary to make sure that each days log is filled out **as accurate** as possible The bottom portion of the Striper Operations Daily Log (table C) tracks where markings are installed.

TABLE C

Column No.

(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
R S	T.H.	Beg. R.P.	End R.P.	Int. Sect	Int. Chg	Mat	C	Trav Time	Equip. Delay	Wthr Delay	Work Types
	169	30.25	35.25			Latex	W	.5			B
	169	35.25	30.25			Latex	W				A
	35W	57	67			Tape	Y				B
	35W	57	67		3	Latex	W	.5			AC

RS or Route System: (Table C , Column 17)

Indicate in the Route System column whether a county or municipality was striped. Use a "C" to indicate county, or "M" to indicate municipal. A blank column will indicate that a state road was striped.

T.H. or Trunk Highway: (Table C , Column 18)

Record in this column the trunk highway, county, or municipal road number for each striping run.

Beg. R.P. and End R.P.: (Table C , Column 19 & 20)

Indicate the beginning (column 19) and ending reference points (column 20) for each run. In the example above you will notice that four striping runs were completed. On run one pavement markings were installed from reference point 30.25 to reference 35.25. During run two markings were installed in the opposite direction (35.25 to 30.25). Reference points in the state of Minnesota progress in numerical number from West to East, and Tom South to North. Trunk highway 169 runs from north to south; therefore, from the information in this example we can tell that the first run one was done in a northerly direction and second run was done southbound.

Int. Sect and Int. Chg.: (Table C , Column 21 8 22)

Indicate in these two columns the total number of Intersections or interchanges that were completed. The indication given in the column should be the total number of completed for each day. Example, if you are striping a two lane two way roadway and you do not stripe the turn lanes during a striping run do not indicate anything in column 15. From the example above, if during a single day you completed everything (including intersections or interchanges) within the reference points you indicate you should also indicate the total number of completed Intersections or interchanges.

Material and Color: (Table C , Column 23 8 24)

Identify the type and color of material applied during each run. Material has been added to the form so that different materials, within an individual run, can be identified. Example, when two types of material are installed within the same reference points (i.e., tape centerline, and epoxy edge lines). In column 18 indicate W (white), Y (Yellow), or B (Both). B should be indicated when ever a striper is shooting a yellow edge line, and a white skip line within a run. In most cases the material identified in column number 17 will be- the same as that identified in table B column 6.

Travel Time: (Table C , Column 25)

Include in this column the time spent deadheading. Also included in this column. (or within each run): time it takes to get to a job location, time it takes to return to your home location, if there is significant time spent driving between job locations. For striping operations the definition of significant time is a half-hour or more. From the table above, notice that the crew completed two runs on T.H. 169 and then headed to I 35W to continue striping. In the Travel Time column, I have indicated the time that it took the crew to travel from one job location to the other.

Equipment Delay: (Table C , Column 26)

Indicate in this column any time that a crew is not installing markings because the equipment is either down for service, or is broken. Again, indicate, or track, only significant (one half hour or more) of down time. This column could show as much as 8 or 10 hours of delay. This would be appropriate if the major delay or breakdown (i.e., engine, transmission, paint gun failure, etc.) keeps the crew from installing markings. In the event of a major equipment failure, indicate just the employees assigned (e.g., operator, and console operator) to fixing the equipment. This is especially important if the other crewmembers are assigned to other daily jobs. We want to track the time that the equipment is down, but we only want to track the employees that are assigned to the crew during the breakdown.

Weather Delay: (Table C , Column 27)

This column is intended to track any time the crew is held up because of whether. Again, this is intended to track significant time only. This column is intended to work the same as the equipment delay column. In other word, track the time that the crew is held up due to whether, but in the case of extended whether days we only want to track the employees assigned to the crew during the delay. Example, if crew members are servicing equipment during the delay, there total hours should be included on the form.

Work Types: (Table C , Column 28)

Include in this column each type of line applied during a run. For a description of the Work Types see the Description of Work Type Key table.

Appendix B

Description of Work Type Key

<u>KEY</u>	<u>DESCRIPTION</u>
A. White Edge	Includes all continuous white edge lines
B. Yellow Edge	Includes all continuous yellow edge lines
C. White Skip	Include all skip lines (lane lines) 4", 8" and cat tracks in any spacing configuration (example, 40' gap with a 10' skip, or any metric combination)
D. Yellow Ctl.	Indicates that the striper installed a yellow centerline during this run. This category includes skips, no passing zones, or <u>any</u> combination of skip and solid lines.
E. 8" White gore	Use this work type to Indicate white 8" gore areas were painted
F. 8" Yellow gore	Use this work type to Indicate yellow 8" gore areas were painted
G. Messages	Indicates the installation of pavement marking messages. On the back side of the sheet indicate what type and the total number of messages installed.
H. Stop Bars	Indicates the installation of stop bars. On the backside of the sheet indicate the total number of bars installed.
I. Cross Walk	Indicates the installation of Cross Walk (s). On the back side of the sheet indicate the total number of bars that were installed
J Misc.	This is a catchall category. For items not included on the list, indicate a "J" in the work type column. Then, turn the sheet over and give a brief explanation of your entry and the total hours (if necessary). For example, it is appropriate to use this work type indicator for such items as, training, service equipment, conferences, or construction delay (e.g., on the back of the sheet indicate construction delay = 2 hours.).
K. Painted Durable	Using this work type indicates that durable materials are within the run, and that the striper (you) painted over them. In other words, you have replaced the durable material.
L. Skipped Durable	Using this work type indicates that durable materials are within the run, and that the striper did not paint over them. In other words, the materials are still in place.
M. Other Work	Use this work indicator to identify work done under a cooperative agreements, such as working for a county, or city.
N. Only Intersection/ Interchanges	The ONLY indicator ("N") indicates that intersections or interchanges were striped separately from main line. In other words, when N is indicated in the work type indicator column it means that material was only added to intersections or interchanges.

Construction Striper Operations Daily Log

DATE: ___ / ___ / ___

SP #: _____

STRIPING CONTRACTOR: _____

DISTRICT: _____

Equipment Numbers	Material Supplied	Suppliers Name(s)	Material Lot Number	Inspector(s) & Contract Supv. Name(s)	Reg Hrs	O.T. Hrs
Striper:	Tape					
Nurse:	Epoxy Type I					
Traffic:	Epoxy Type II					
Traffic:	Thermo					
Aux. Eq:	Beads					

Materials (in gal./ft.)	White				Yellow			
	Begin	Added	End	Net	Begin	Added	End	Net
BEADS					Pounds			

HWY	Begin Ref. Pnt	End Ref. Pnt	Int. Sect.	Int. Chg.	Material	Color	Wthr Delay	Work Types

- A.** White edge **B.** Yellow edge **C.** White skip **D.** Yellow Ctl. **E.** 8" White gore **F.** 8" Yellow gore
G. Messages **H.** Stop bars **I.** Cross walk **M.** Other Work **N.** Only Intersections/Interchanges

Striper Operations Daily Log

DATE: / /

DISTRICT:

Equipment Number	Job	Employee ID	Last Name	First Name	Reg Hrs	O.T. Hrs
Striper:	Operator					
Nurse:	Console					
Traffic:	Console					
Traffic:	Nurse					
Aux. Eq:	Traffic					

		White				Yellow					
Materials	Begin	Added	End	Net	Begin	Added	End	Net			
										Gallons	
BEADS										Pounds	

COUNTY:

CITY:

SP NUMBER:

R S	HWY	Begin Ref. Pnt	End Ref. Pnt	Int. Sect.	Int. Chg.	Material	C	Trav Time	Equip Delay	Wthr Delay	Work Types

- A. White edge B. Yellow edge C. White skip D. Yellow Ctl. E. 8" White gore F. 8" Yellow gore
 G. Messages H. Stop bars I. Cross walk J. Misc. K. Painted durable
 L. Skipped Durable M. Other Work N. Only Intersections/Interchanges

Appendix C

Description of Pavement Marking Management Systems Database Tables

All of the data entered into the PMMS input screens are stored in database tables. To retrieve information stored in these tables you can use the Paradox Query function. A query is a question you ask Paradox about information in your tables. It can be anything from a simple question about the information in one table, to a complex question about information in several tables. To learn more about running a query you can use the main menu help, or the manual supplied with every version of Paradox. To view all of the tables associated with the program highlight the Tables option on the Project Viewer. The table will be listed on the right side of the Project Viewer. Any of these tables are accessible by double left clicking on the one you want to use.

The following described what type of data that is captured in each table. Some of the information may appear repetitive when in fact it is captured this way to make querying easier.

City

The city (bd) database table is used for ease of data entry. Access this table to add/remove cities from this table.

County

County is used the just like the City database. Access this table to add/remove Counties from this table.

Matltype

This table tracks each variety (i.e., tape, epoxy, latex, etc) of marking material. It is used as an aid in speeding up data input. This table can be accessed to add/remove material types.

MMJDI

This table aids in the tracking of each District/Areas where materials are being installed.

MMJCL

Default table used by the program. Do not enter any information into this table.

MMJCS

Default table used by the program. Do not enter any information into this table.

MMJSU

Default table used by the program. Do not enter any information into this table.

MMJTS

Default table used by the program. Do not enter any information into this table.

MMSEM

Default table used by the program. Do not enter any information into this table.

MMSEMS

This table tracks employee name and numbers.

MMSEMT

This is a default table used by the scripted program. Do not enter any information into this table.

STRACTE

Job titles or types (i.e., Operator, Console, Training, etc) are tracked in this table.

STRDEFI

This is a default table used by the scripted program. Do not enter any information into this table.

STRDEF2

This is a default table used by the scripted program. Do not enter any information into this table.

STRIPE1

This is a default table used by the scripted program. Do not enter any information into this table.

STRLOG

The STRLOG, or stripe log, along with the STRLOGE and STRLOGR are the main database tables. Most of the information that you will want to get out of the system is stored in these tables. This STRLOG table will track equipment, SP (special project or state project numbers), city/counties, and material quantities used. The STRLOG table contains the following items:

- * Log Date
- * Striper unit number
- * Sequence number
- * District number
- * SP number
- * County
- * City
- * Nurse unit number
- * Traffic control unit(s) number
- * Material quantities (beginning, added, ending, and net)
 - White
 - ✕⌘●●□•
 - Beads

STRLOGE

This table tracks the amount of employee hours used. The STRLOGE table contains the following items:

- Log Date
- Striper Unit
- Seq Num or Sequence number
- Emp Seq Num or Employee sequence number
- ActNum or activity number
- Empl ID or employee identification number
- Reg Hrs or regular hours
- OT Hrs or overtime hours

STRLOGM

This table tracks the amount of employee hours used. The STRLOGM table contains the following items:

- Log Date
- Striper Unit number
- Seq Num or sequence number
- Strmemo or the memo field

STRLOGR

This table tracks location of marking installation, what specific lines were installed, and other aspects of efficiency of operations. The STRLOGR table contains the following items:

- * Date
- * Striper unit number
- * Seq Num or sequence number
- * Rte Seq Num or route sequence number
- * Route System
- * Route Number
- * Beg Ref Point or beginning reference point
- * End Ref Point or ending reference point
- * County
- * Intersections
- * Interchanges
- * Material
- * Color
- * Travel Time
- * Equipment delay
- * Weather delay
- * Work Type

Appendix D

Sample Reports

These reports are provided as examples of reports that can be generated from the data that PMMS collects. At this time, the reports are not automated. In other words, the system is not programmed to generate these reports automatically.

The following is a report which outlines a single striping crews Labor, Material, Equipment usage for a past striping season.

Labor

PMMS data can be broken out to reflect true labor costs. Fringe benefit rates, heavy equipment additives, and labor rates will vary from agency. This is only one example of hdw'labor data could be retrieved from of the system. For example, queries can be developed to breakout monthly, specific job, or location data as needed.

		Reg. Hrs.	O.T. Hrs.	Total Reg.	Tot. O.T.	Heavy Eq. Additive	Total
Operators	Jan -Jun	420.00	0.00	13534.29	0.00	525.00	14059.29
	July - Dec	814.00	0.00	27014.26	0.00	1017.50	28031.78
Console	Jan -Jun	420.00	0.00	13684.67	0.00	399.00	14083.67
	July - Dec	814.00	0.00	27014.26	0.00	773.30	27787.56
Nurse	Jan -Jun	410.00	0.00	13358.85	0.00	225.50	13584.35
	July - Dec	814.00	0.00	27014.26	0.00	447.70	27461.98
Traffic	Jan -Jun	350.00	0.00	11403.89	0.00	192.50	11596.39
	July - Dec	758.00	0.00	25089.41	0.00	415.80	25505.21
Totals		<u>3692</u>	<u>0</u>	<u>121620.5826</u>	<u>0</u>	<u>3388.00</u>	
Total Labor							<u><u>\$162,110.18</u></u>

Labor Hours Jan thru Jun reflect an HMWsr rate of pay for July thru Dec rate after contract raise
 Labor hours reflect a fringe benefit cost 55%, and Maint. Overhead 36.5% The overtime rate labor x 1.5%.
 Heavy Equipment pay differential for Operator, Console operator, and Tandum are included

Materials

The following is an example of how material usage can be developed for a complete season. Again, queries could be developed to meet the needs of the user. Note the use of actual and reported figures. Actual is the total quantity of material delivered. Reported is the total quantity of material reported in PMMS. This crew is very good at reporting their operations. PMMS is a tool that supervisors can use to manage day-to-

operations. Keeping close track of material quantities can lead to many business efficiencies. For example, this information could be used to schedule JIT (i.e., just-in-time) deliveries of materials. This would keep materials on hand to a minimum.

	White Gal.	Yellow Gal	Beads Lbs	White Net	Yellow Net	Beads Net	Mat Total
Actual	29500	17450	269550	199726.8	136960.69	67221.862	403909.35
Reported	28770	19140	308800	194784.41	150225.08	77010.242	422019.73

Material costs reflect cost of material x Maint. overhead 36.5%

Equipment

Equipment can also be broken out in many of the ways previously mentioned. This example shows the equipment breakdown for an entire season.

	Pro. hrs.	Travel	Delay	Weather	Cost. Of Pro.	Delay Cost	Wthr.Cost
68425	722	161.5	169	99.5	57,515.53	13,612.63	14,244.80
90085	203				8,232.49		
95335	447				18,750.06		
Crash Att	722				7785.69		
2 Arrowbd.	722				1527.57		
Forklift	99				1678.38		
Totals	2915	161.5	169	99.5	95,489.72	13,612.63	14,244.80

Total Line Miles Applied

Calculating line miles applied are one of the critical aspects of PMMS. Again, this example shows how many line miles were calculated from a crews entire striping season. Ratio of labor hours and Equipment to Materials used is another management opportunity that PMMS can reveal.

		86425	3175
int-chg			
irk-sect	539	Total	<u>3175</u>

Lineal footage of 4" equivalent line have not been included in any of the line miles applied for: No passing Zones, Ramps, turn lanes.
Ratio of labor hrs & Equipment to Materials 63.78

For managers, supervisors, or owners it always comes down to the bottom line, or how much does it cost to stripe. From the figures given in this report a yearly total cost or cost-per-foot of applied marking can be developed. Again, these are examples that could be tailored to meet specific needs.