MASS

INTERCHANGE

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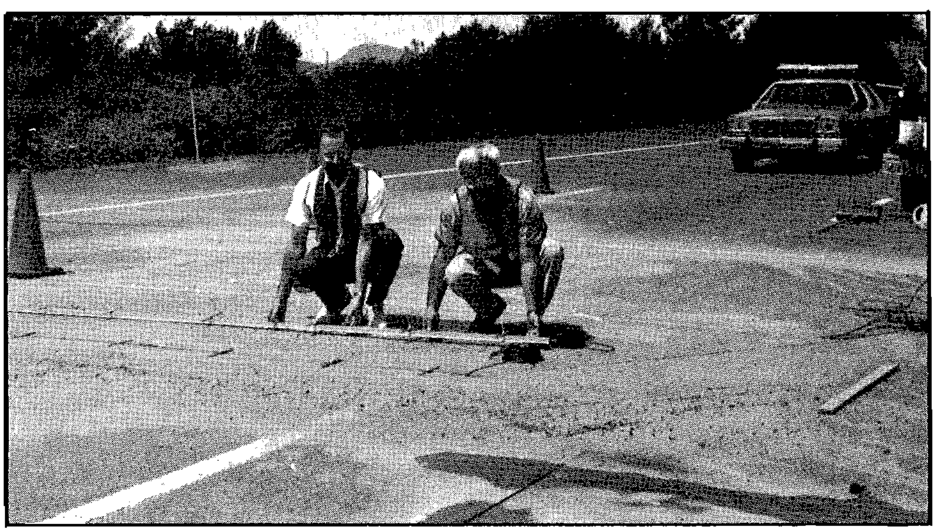
WEIGH IN MOTION TECHNOLOGY ARRIVES IN MASSACHUSETTS

The Massachusetts Department of Public Works (MDPW), Bureau of Transportation Planning and Development (BTP&D) is in the process of installing, calibrating and using new weighing equipment at different locations in the state. This equipment is capable of weighing vehicles in motion by capturing the dynamic forces at the instant of passage over a weight sensor. Weigh-in-Motion (WIM) is available in several different methodologies. The technology selected for use by the MDPW is piezoelectric axle sensing design. International Road Dynamics Inc. (IRD), of Marlborough, MA, and Acushnet Power Line Inc., of Acushnet, MA, are the contractors.

Background

It has long been recognized within the highway industry that the number, size, weight and type of vehicles using a roadway affects its subsequent pavement deterioration and useful life. The MDPW is participating in a long term national research project sponsored by the Strategic Highway Research Program (SHRP) and funded by the Federal Highway Administration. The research will help resolve some of the unanswered questions surrounding these and related issues. A better understanding of the causes of pavement deterioration will allow the MDPW and other highway agencies to more effectively design pavements, thereby ultimately saving money for the taxpayers of Massachusetts.

Four locations were selected by the MDPW for Weigh-in-Motion instrumentation under the SHRP program, including I-195 in Fairhaven, I-391 in Chicopee, Route 27 in Medfield and the Central Artery/3rd Harbor Tunnel Haul Road in South Boston. Two additional sites, I-95 in Woburn and I-93 in Braintree, were added to the WIM program to further advance the research efforts. All six WIM systems are designed to collect extensive data on the physical and operating characteristics of the vehicles using these routes.



Picture 1: Left to Right; Fred Orloski, Transportation Planning Program Manager (FHWA) and Matthew D. Turo, Pavement Management Engineer (MDPW)

Piezoelectricity is a term referring to electric currents or charges that result from the application of mechanical stress to certain crystalline substances. The amount of charge developed is dependent on the magnitude and direction of this stress. Pierre Curie discovered the phenomenon of piezoelectricity in 1884.

System Operation

The sensors are essentially semi-rigid coaxial cables. The sheath of the cable is made from copper tubing which contains piezoelectric ceramic powder with a copper wire through the center. When pressure is exerted on the cable, an electrical potential develops between the center wire and the coaxial sheath. This potential is directly proportional to the pressure or load. An induction loop immediately before the peizoelectric sensor recognizes an approaching vehicle and triggers a sequence of events -- signal detection, amplification, and collection.

This piezo cable is encased in an aluminum housing and rubber filler as illustrated in Figure 1. These load sensors are installed across traffic lanes as illustrated in Picture 1. This picture shows the installation process on Route I-391 in Chicopee, Massachusetts. The piezoelectric cables are installed in 1 1/4" x 1 1/4" grooves cut into the pavement. IRD uses a resin grout to fill in the grooves around the sensors, which are installed 3/16" below the road surface for protective reasons. The IRD grout is semiflexible (about the same rigidity as asphalt concrete pavement) and allows the sensor to deform with pavement rutting.

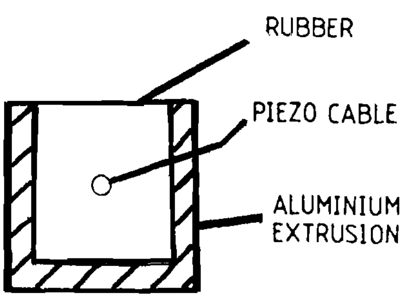
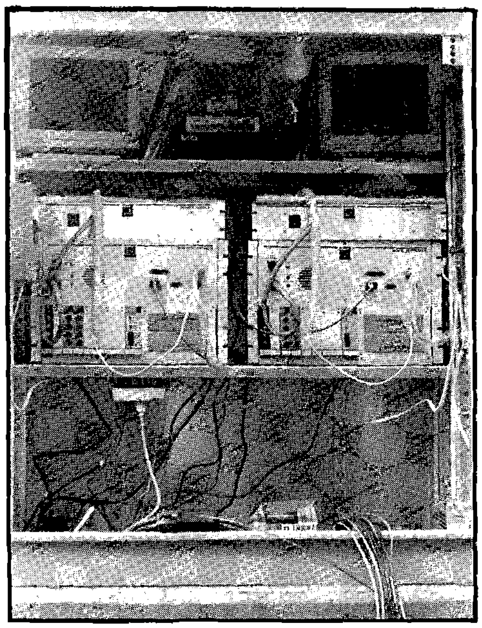


Figure 1: Cross-section of U-shaped piezoelectric axle-load sensor.

The systems which the MDPW procured are designed to operate over a speed range of 5 to 80 miles per hour (mph). Each site has a control unit installed in an on-site traffic cabinet. The WIM system accommodates vehicles of up to 9 axles. It determines the weight of each vehicle axle ± 10% from the mean. It determines axle spacing ± 6% from the mean, vehicle length ± 12" from the mean and vehicle speed ± 1 mph from the mean.

The WIM system provides for fourteen vehicle classifications. Classes 1 through 13 are designed to be used in accordance with FHWA's scheme "F". Class 14 will identify any vehicle which does not conform to the classification criteria of these classes. The WIM station determines which if any axle or axle grouping exceeds preestablished weight limits and will be user programmable by the MDPW.

The Central Units (as shown in Picture 2) of the WIM Systems calculate and temporarily store all specified data on a 40 megabyte storage medium.



Picture 2: The Central Unit pictured here is on Route I-391 in Chicopee.

The on-site data storage devices have the capacity to store a minimum of four (4) days of total vehicle data covering all travel lanes. The storage devices are of a type that are not susceptible to loss of accumulated data should electrical power be interrupted.

Each Central Unit will store the following data:

a) Hourly vehicle counts by class, by speed range and by lane for each 24 hour period.

b) Individual vehicle records for all vehicles equal to class 4 or higher with a front axle weight greater than 4 kips (hereafter referred to as "truck records"). The front axle weight threshold for truck records is programmable by the operator (4 kips is the default setting).

Each truck record includes, as a minimum, the following data:

* Time and Date
* Lane Number
* Vehicle number
* Speed
* Vehicle Classification
* Weight in kips of each axle by axle number
* Spacing in feet between sequentially numbered axles
* Overall length of each vehicle or combination of vehicles in feet
* Code for weight violation
* Code for invalid measurement

Data are calculated and formatted such that all data can be accessed and all required reports can be generated by use of the WIM System Application Automatic Routines.

All equipment is designed to operate properly, within an ambient temperature range of -20 degrees to +122 degrees Fahrenheit.

WIM System Application Automatic Routines and Equipment

An application routine, hereafter referred to as "The System Routine", runs on an existing IBM compatible 80386 processor microcomputer. The System Routine downloads the files from the Central Units by either telecommunication or manual methods, and generates the specified reports and an ASCII file. The data are collected and stored by lane, so that data specific to each lane at the installation may be accessed separately, and reports and data files may be prepared independent of the data for the other lanes.

continued on page 7

DO WE REALLY NEED TRAFFIC SIGNALS?

By Fred L. Orcutt, Jr., P.E. and Darcy Sullivan, P.E.

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Many people believe that an intersection "needs" a traffic signal simply because some motorists are "having a problem" at that location. Such beliefs are often reinforced when traffic counts at the location are at least as high as those stated in the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).* These beliefs are often incorrect because they ignore two important issues.

- First, the benefits of signal installation must outweigh the disadvantages (and there will always be some) before the installation will truly be in the best interest of the motoring and taxpaying public as a whole.

- Second, the guidelines (called warrants) in the *Manual on Uniform Traffic Control Devices for Streets and Highways* are just aids to use in determining whether a traffic signal is needed at a particular location. These guidelines **do not** establish thresholds above which a traffic signal must be or should be installed. Rather, **they establish minimum thresholds below which a traffic signal should not be installed**. At intersections which fail to pass the "MUTCD test" some other solution should be sought.

Tables 1 and 2 (page 4) list the benefits and disadvantages of installing a traffic signal. Table 1 deals with intersections where the installation is justified. If the installation is really in the public interest, the value of benefits in the left column will be greater than the value of the costs in the right column. Table 2 lists the additional costs to be incurred if the installation is not justified.

In addition to the disadvantages to be endured by the motoring public, there are direct monetary costs which are incurred. The cost of installing a traffic signal meeting all the current standards will almost always exceed $20,000 and many installations cost $50,000 to $75,000 or even more. The electricity to operate the signal and the maintenance of the installation will cost an additional $2,000 to $2,500 per year.

Editor's note: According to the Traffic Section of the Mass. DPW; "In Massachusetts signal consultant design fees run $10,000-$12,000 with an average installation cost of $60,000 for a traffic control signal with no geometric improvements."

The warrants or guidelines contained in the MUTCD are the lowest common denominator on which a wide range of traffic and safety professionals can agree. What the MUTCD says, in effect, is that if a location does not satisfy at least one of the guidelines, a traffic signal is probably the wrong answer. There is usually a better or less expensive way to solve the problem or problems which exist at the location.

If a location satisfies the Accident Experience Warrant (all points of it), then a traffic signal is probably needed and should be carefully considered. The frequency of some types of accidents will decrease and the frequency of other types will increase. The trade-off between the number and severity of the various types should be completely understood before a final decision is made.

The condition is not nearly as clear cut concerning the various traffic and pedestrian volume related guidelines. If intersection volumes satisfy one or more of the delay or volume guidelines the decision makers should still answer the following questions.

Does observation of the intersection reveal any problem that requires a solution? Many times there is not really a problem. Requests for signals often come from overly timid or impatient drivers. If there is a problem, the following additional questions are appropriate.

- Is the problem worthy of a solution? Sometimes there are so few motorists experiencing the problem that it is simply not realistic to attempt to solve it. The application of the volume related guidelines will often, but not always, screen out such locations.

- Is the delay occurring to cross-street traffic acceptable considering the effect a traffic signal would have on traffic on the major street? Such delay may seem unacceptable to traffic on the cross street but it may be just as great or even greater with a traffic signal. The delay guideline provides a reasonable standard against which existing conditions can be measured.

- Are cross-street motorists generally making unsafe maneuvers in order to enter or cross the main street? If the maneuvers are really unsafe, some portion of those drivers attempting to enter or cross will become involved in accidents. Warrant 6, Accident Experience, provides a basis for determining whether a traffic signal can be expected to result in an improved accident experience. A study of "traffic conflicts" using accepted study procedures may also help in this evaluation.

If there are apparent problems that a traffic signal could solve, are there less restrictive measures that could be applied to alleviate the problem? Such measures might include;

- prohibition of select low volume movements;

- the addition of a turn lane or the improvement of a corner radius;

- the removal of a sign or vegetation which restricts visibility; or

- the restriction of either on-street or off-street parking which restricts sight distance.

If any of these or other identified actions appear to be potential solutions, they should be tried before installing a traffic signal. Appropriately selected changes should result in improved traffic flow and reduced numbers of accidents at a cost which may be well below the cost of installing a traffic signal.

If, after addressing all the above considerations, you find a traffic signal is needed, one final question must be answered before installing the signal. Is physical improvement of the intersection to increase traffic-carrying capacity necessary in order to avoid creating intolerable conditions for main street traffic? If so, installation of the signal should be deferred until such improvements can be made. In such case, restrictions on various movements may be necessary as an interim measure to assure safety.

In addition to exercising care in the selection of intersections to be signalized, existing signals should be monitored to insure that their operation remains compatible with changing traffic conditions. Even removal of an existing signal may be desirable when changing traffic conditions show it is in the public interest.

As important as the decision to install a signal may be, the principal goals for the installation are met through the phasing and sequencing of the traffic signal. (A phase is a part of a traffic signal time cycle assigned to any combination of traffic movements that move simultaneously. The phase sequence is the order in which the various phases occur during a complete signal cycle.)

The phasing and sequencing of a traffic signal affect both the safety with which the intersection operates and the efficiency of movement. It is the balance of these two often competing aspects of intersection operation that determines the success of a signalized intersection. Far too many signalized intersections have been unsuccessful because the engineer didn't achieve a proper or reasonable balance.

Table 1 ADVANTAGES (BENEFITS) AND DISADVANTAGES (COSTS) OF TRAFFIC SIGNALS

BENEFITS	COSTS
May improve the orderly movement of traffic	Increase delay to major traffic movements
Allow pedestrian and side street traffic to enter or cross heavy major street traffic	Reduce the freedom of drivers to control their own progress
Reduce the frequency of certain accident types (right angle or left turn for example)	Increase the frequency of certain accident types (primarily rear end)
	Installation = \$25,000-75,000
	Maintenance = \$2,000+/year

Table 2 ADDITIONAL ADVANTAGES (BENEFITS) AND DISADVANTAGES (COSTS) OF TRAFFIC SIGNALS *IF THE TRAFFIC SIGNAL IS NOT JUSTIFIED*

None	Increase delay to all movements including those the signal was intended to benefit
	Unnecessary driver frustration and excessive traffic signal violations
	Diversion of traffic through neighborhoods using inappropriate alternate routes

Over the past few years there have been many advances in the technology of traffic signal controller design and manufacturing. These advances have made it possible, both technically and economically, to create complex traffic signal control systems. Unfortunately, there is often a temptation to install a complex system when a simple one would do the job as well -- or even better. There are several principles that the engineer will do well to remember:

- In general, the fewer phases a traffic signal has, the better the overall traffic service it will provide;

- While the introduction of protected turn phases may reduce the incidence of certain types of accidents, their use may result in an increase in other types of accidents; and

- To the extent possible, motorists should be allowed to decide what is best under a given set of conditions. Drivers are able to deal effectively with a range of situations that is often far beyond the comprehension of mere mortal engineers! Don't attempt to make every decision for them.

As simple as these principles may seem, decisions are being made daily which ignore them. As agencies widen streets, it seems that they feel duty-bound to replace perfectly good two-phase signals with five- and eight-phase signals before they are needed. This has resulted in untold amounts of unnecessary delay! As noted earlier, the general rule is "the fewer phases, the better!" Some areas where unnecessary complexities, costs and delays are introduced are discussed in the remainder of this article.

Left-Turn Phases

There are proper applications for left-turn phases, but they should not be overused or applied before they are actually needed. The question that should be asked when considering left-turn phasing is not, "Does the traffic satisfy any left-turn phase warrant?" but, "Can the intersection function effectively and safely without protecting the left turns?" If the answer to the latter question is YES, don't provide a protected left-turn phase.

Right-Turn Phasing

Most signalized intersections do not require any special phasing for right-turning traffic, especially since "right-turn-on-red" has been widely adopted. There are occasions when special treatment of right turns in a signal's sequence is appropriate. Generally, these would involve high-volume (300 vehicles per hour or more) movements where the right turns had one or more exclusive lanes available to them.

Splitting Phases

A phasing technique that is becoming common is that of serving a street, frequently a side street, one approach at a time. The reason for this is generally that traffic from the two approaches would otherwise need to occupy the same space at the same time, an obvious problem. Unless the left-turn traffic is equal to or greater than the through-traffic, this split phasing is very inefficient and other alternatives should be sought.

Preemption

It is often necessary to interrupt the normal operation of a traffic signal or a group of traffic signals to facilitate clearance of traffic that might be backed up onto an active railroad track or to expedite emergency vehicle movement. The most common type of preemption involves overriding of the signal's normal operation by an external device called a preemptor. The preemptor actually takes control of the signals upon receipt of a signal from the railroad or the emergency vehicle.

Preemption of a traffic signal near a railroad crossing is usually appropriate. However, proposals for emergency vehicle preemption should be carefully evaluated. These systems are expensive to install, and require a much higher level of preventive maintenance than most standard control equipment.

Flashing Operation

There are two common reasons for flashing a traffic signal: to reduce the level of control when traffic volumes are low, and to provide a safe method of control when the signal is inoperative. While a traffic signal may be needed at an intersection during much of the day, often the signal is not needed all the time and the signal may be operated in the flashing mode. Several guidelines have been developed for determining when to place a signal into flashing operation. The reality, however, is that very few jurisdictions have the time to evaluate such criteria and the decision is usually made as an engineering judgement. Generally a signal may be flashed if the installation was originally proposed under the school crossing guideline or one of the traffic volume guidelines. A signal installed to reduce or minimize accident occurrence should be placed on flash only when the controller is inoperative. In any case, flashing should only be used when visibility for side street traffic is adequate. If the decision is not clear-cut, more formal analysis should be undertaken.

When a decision is made to flash a signal, the times of flashing operation should be the same as for other signals in the area so as not to violate motorists' expectations. It is not normally a good practice to switch back and forth between flashing and stop-and-go operation during the daytime.

When a signal is operated in the flashing mode, it is generally most efficient for traffic if the major street is flashed yellow and all other streets are flashed red. In some instances, it may be appropriate to flash all approaches red. This is typically done when both streets have essentially the same volume or a significant visibility restriction exists. When a question exists regarding which is more appropriate, a yellow flash to the major street should be tried before implementing the more restrictive all-red flash. Finally, all signal heads facing a given approach should flash the same color.

Conclusions

Advances in traffic signal controller technology have made it possible, both technically and economically, to create very sophisticated and complex traffic signal systems. While we need to take advantage of the benefits sophisticated technology can provide, we should avoid the temptation to install a complex system when a simple, less expensive one would do the job as well if not better.

How many phases we choose to provide and how we sequence those phases will affect the safety with which an intersection operates, the efficiency of movement through the intersection, and the public's perception of how much the agency cares about traffic and the motoring public. It may be wise to install control equipment with advanced capabilities in anticipation of future needs. However, we should wait for that need to develop before we assume the responsibility for making decisions on the driver's behalf.

Both Darcy Sullivan and Fred Orcutt are licensed engineers, hold degrees in civil engineering and have 20-30 years of experience in traffic operations and signal system engineering. This article is reprinted with permission from the Tennessee Technology Transfer Center.

CURRENT EVENTS

Third National Conference
Transportation Solutions for Small and Medium-Sized Areas
October 9-11, 1991
Sheraton Burlington Hotel & Conference Center, Burlington, Vermont
Sponsored by: TRB/NRC, FHWA, ITE, NARC, APA, Vermont Local Roads Program
For more information call:
Steven Gayle, BMTS (607) 778-2443.

Road Surface Management
A Workshop for Local Government Administrators and Road Management Personnel
November 20, 1991; The Bishop Center, University of Connecticut, Storrs, CT
November 21, 1991; Criminal Justice Training Center, Wallingford, CT
Sponsored by the Technology Transfer Center of Connecticut and the FHWA in conjunction with the Technology Transfer Centers of; Maine, Massachusetts, New Hampshire, New Jersey, New York, Puerto Rico, Rhode Island, Vermont.
For more information call the Center for Professional Development (203) 486-3231.

PUBLICATIONS

NEW LISTINGS

Small Highway Department Management (CLRP Report #89-2, 9/89 by Kenneth C. Griffin and William J. Mobbs) This manual covers nine highway department administrative responsibilities that are important for a well-run department. All highway departments perform each of these responsibilities to some extent. Each chapter is designed to provide information to help highway officials stay in control of difficult or complex administrative matters and, in so doing, make their job easier. This manual covers highway department administration in a practical hands-on approach and spends little time on management theory. Personnel management matters are only briefly discussed in this workbook. The information presented in this workbook is especially designed for use by smaller highway departments, typically with 3 to 15 employees. Much of the information is also applicable to larger highway departments. The information presented is aimed at the newly appointed or newly elected highway official, but also should be of value to experienced highway officials. Applicable chapters are: Department Organization, Budget Preparation and Presentation, Scheduling, Winter Snow and Ice Control, Complaints, Managing Your Clear Zones, Road Weight Postings, and Equipment Management. - 107 pp.

Chip Seals and Surface Treatments (CLRP Report #91-5, 3/91) This manual was developed and first offered by the Cornell Local Roads Program (CLRP) in 1991. It is directed to highway officials and public works personnel in county, town, city, and village highway departments who are responsible for surface treatment operations. The purpose of this workbook is to provide information about chip seals and other surface treatments that can be readily applied in the field. If carefully used it can help insure the construction of high quality surface treatments for maintenance of pavements and improvement of aggregate surfaces. The manual was written by Peter Messmer. As the Laboratory Engineer for the Cornell Local Roads Program he provides technical assistance for New York State local highway officials regarding road materials and construction problems. This is an excellent primer on the subject which is good for engineers or non-technical personnel. - 71 pp.

Maintenance Welding Techniques and Applications (CLRP Report #91-6, 4/91) The author of this workbook is Tom Cook, who is an Instructor in the Department of Agricultural and Biological Engineering (Power and Machinery Group) at Cornell University. Mr. Cook has taught the basic and advanced welding courses for the New York Local Roads Program. The content of this manual is directed to new and experienced welders who perform routine maintenance welding in local highway departments. A variety of welding techniques and safety issues are presented here. Chapters include: Introduction, Safety, Torch Uses, Metal Identification, Heat Treatment, ARC Welding, Out of Position Welding, Hard Facing, Welding Defects. - 83 pp.

Principles of Equipment Operation, Safety, and Maintenance (CLRP Report #91-8, 4/91) The author of this workbook is Tom Cook, who is an Instructor in the Department of Agricultural and Biological Engineering (Power and Machinery Group) at Cornell University. Mr. Cook has taught the Equipment Principles course for the Local Roads Program in New York since 1990. The information in this workbook is directed to new and experienced operators of rolling equipment within highway departments. It will be useful to those interested in understanding the basic principles of engine operation, hydraulics, scheduled maintenance, and safety equipment and procedures. - 58 pp.

Safety Resoration during Snow Removal - Guidelines: Synthesis Report (FHWA-TS-90-036, 2/91) This document describes a ranking procedure based on the input and experience of state and local highway maintenance engineers responsible for management and operation of snow and ice control. The report and videotape provide a simple hazard-ranking which can be used to prepare a prioritized list of cleanup activities. Given that snow cleanup resources usually remain constant, the ranking procedure will assist in increasing safety without increasing costs. - 95 pp.

Manual Pavement Management Systems (U of C, Technology Transfer Program, by Clay Castleberry, Senior Field Engineer) All maintenance management and road rating systems have a common purpose: to give the street and road manager a rational method of determining priorities for maintenance and improvement work. These systems usually produce a numerical rating that indicates a facility's relative condition. The complexity of these systems ranges from a manual method that fits on two letter-sized sheets of paper to a complex computer method that uses extremely sophisticated input devices. Only simple non-computerized systems are described in this article. Some were developed for individual localities; the rest were created with federal participation for nationwide use. The author believes that most smaller city or county public works departments that plan to enter the maintenance or pavement management fields should consider starting with a simple system, which is less expensive than a computer system and is generally more manageable in the early stages. - 26 pp.

continued from page 2

The WIM System Routine is "user friendly", hierarchical menu driven, and performs the following applications:

Real Time View

The real time view routine provides for on-line monitoring of traffic. The user has the option of displaying either all traffic or only vehicle classifications 4 through 14, as well as the option of displaying a selected individual lane or all lanes combined.

System Data Modification

The System Data Programming Routine provides for on-line modification to the Central Unit's instructions, including speed and weight calibration factors, vehicle classification parameters, weight violation table parameters, front axle weight threshold, etc.

Manual Downloading Routine

The manual downloading routine provides for the downloading of selected daily data files from the storage medium of the Central Units to the storage medium of the host hardware. This routine provides for a listing of the daily data files stored in the Central Units and provides for user selection of the file or files to be downloaded from such a listing.

Automatic Downloading Routine

The automatic downloading routine provides for unattended downloading of daily data files stored in the Central Units' storage medium to the storage medium of the host hardware. Transmission is at 9600 baud using an error checking protocol.

Report Preparation

The report preparation routine generates specified reports using the downloaded data, which is sent to the host hardware printer. This routine prepares the following daily reports:

* Distribution of vehicle classification by hour of day.
* Distribution of vehicles by speed by hour of day.
* Distribution of weight violations and invalid measurements for vehicle classifications 4 through 14 by hour of day.
* Distribution of gross weights for vehicle classifications 4 through 13 by hour of day.
* Distribution of 18 kip equivalent single axle loadings (ESAL's) by hour of day for vehicle classifications 4 through 13. The routine provides for user input of flexible pavement and structural number.

This routine provides for user selection of the lane or lanes to be covered by the specified report to allow for separate reporting of individual lane data. The default is all lanes. The printed reports note which lanes are represented. The daily data files are created at the start of each day.

Conclusion

The MDPW is currently installing WIM technology at six different sites. They are:

Route I-391 Chicopee
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 6 lanes of piezoelectric road sensor cables.

Route I-195 Fairhaven
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 4 lanes of piezoelectric road sensors.

Route 27 Medfield
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 2 lanes of piezoelectric road sensors.

Haul Road Boston
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 2 lanes of piezoelectric road sensor cables.

Route I-95 Woburn
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 8 lanes of piezoelectric road sensor cables.

Route I-93 Braintree
Work consists of furnishing and installing one (1) complete new station of piezo cable Weigh-in-Motion. This includes one (1) traffic counter cabinet, one (1) underground phone service connection, one (1) underground 120V AC electric connection, and 8 lanes of piezoelectric road sensor cables.

The WIM program is a part of the BTP&D's Engineering Support Division, with construction and operational responsibilities shared between the Traffic Data Collection & Analysis and Pavement Management Sections. Questions or comments regarding the WIM program in Massachusetts may be directed to Mr. Matthew Turo, Pavement Management Engineer or Mr. Philip Hughes, Assistant Director for Engineering Support.

SATELLITE VIDEO CONFERENCE ON HIGHWAY SAFETY DESIGN

On December 11, 1991 the University of Wisconsin, College of Engineering, will broadcast a satellite conference on highway safety design. The satellite conference is intended to inform highway design professionals about the most recent safety design techniques. Safety design improvements for intersections, roadway cross section geometrics, horizontal curves, pedestrian and bicycle safety will be covered.
If interested contact the Baystate Roads Program at 413-545-2604.

IN THIS ISSUE

VIDEO LENDING LIBRARY: NEW ACQUISITIONS

Technical Advancements for Maintenance Workers: For Maintenance Managers and Work Crews MO-182

From the Strategic Highway Research Program.

This video describes the development of new materials, equipment, and procedures to help maintenance workers operate more efficiently and safely. The video describes a number of technical advancements for maintenance workers forthcoming from SHRP Highway Operations studies. SHRP Highway Operations Research products under development include Pavement Maintenance, Safety and Snow and Ice Control. (14:45 min.)

Breakaway Sign Program ST-136

Distributed by USDOT/FHWA

This videotape documents the New Jersey breakaway sign support system. The system was designed in the early 1970s, and since the signing system has been installed in New Jersey, at least 68 breakaway signs have been hit by vehicles. In only 8 accidents were injuries reported and these were minor. Even though the signing system had achieved its safety objective of saving lives, the sign components have been periodically modified to reduce the amount of hardware damage after an impact. (11:36 min.)

Safety Restoration Snow Removal Guidelines ST-137

Distributed by USDOT/FHWA

This 26 minute video program was prepared for State Highway, County Road, and Municipal Street maintenance managers involved in snow and ice control programs. The video program introduces the safety hazards according to their judged risk, potential severity, correctability, and possible hazard exposure factor and describes how these hazards should be handled. (25:24 min.)

The Baystate Roads Program, which publishes *Mass Interchange* each quarter, is a Technology Transfer (T2) Center created under the Federal Highway Administration's (FHWA) Rural Technical Assistance Program (RTAP). FHWA is joined by the Massachusetts Department of Public Works, the Department of Civil Engineering at the University of Massachusetts/Amherst, and local public works departments in an effort to share and apply the best in transportation technologies.

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

To contact the Baystate Roads Program, please call Silvio Baruzzi at (413) 545-2604.

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