M A S S

INTERCHANGE

Volume 9, Number 4 Summer 1995

Giving Taxpayers Their Money's Worth

by Lynne H. Irwin

Once upon a time there was an industrialized country in North America where nearly everyone thought it was better to spend as little money as possible to build roads. "Cheaper is better," said Joe Lunchbucket. Joe was running for the Town Board on a platform that promised not to vote in favor of the expenditure of one *penny* of the taxpayers' money without a fight.

This philosophy has nearly brought many local highway departments to their knees. By building the cheapest possible road to begin with, we now have a tremendous backlog of pavement rehabilitation needs. We cannot afford to pay for the upgrading that is needed, so we cut a few corners and make do with what we can afford. This saddles the next generation of taxpayers with tough decisions and big bills, and today's

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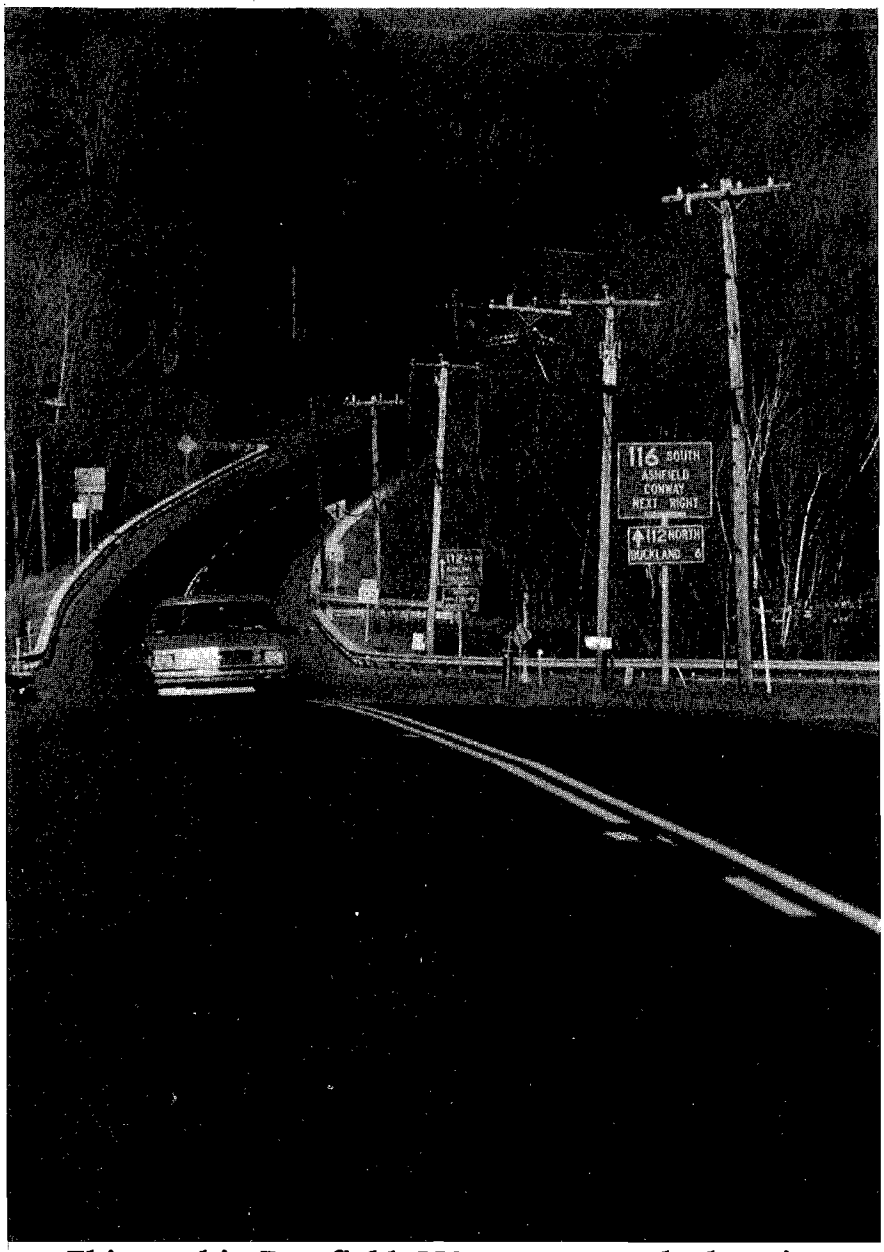

This road in Deerfield, MA represents the best in pavement quality -- smooth, dense, and long-lasting.

Photo by Karen Dodge

Local Technical Assistance/Technology Transfer Center
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Money's Worth. . . *from Page 1*

taxpayers have to drive on roads that are seasonally weak, with ruts and potholes to ensnare vehicles that drift into them.

Meanwhile, in Europe they took a different point of view. "Let's build it well to begin with, and it will cost less in the long run," said Pierre Lunchbouquet. Today our Federal Highway Administration and the state departments of transportation are slowly coming to the realization that the Europeans are right.

"We've always had a focus on initial cost rather than lifetime cost," admits Paul Mack, Deputy Chief Engineer at the New York State Department of Transportation (quoted in the May 2, 1994 Albany, NY *Times-Union*). Mack continues, "We've concentrated on building roads, not on making them last forever. The emphasis was on getting as many facilities in place as quickly as possible. Maybe, in the process, we sacrificed durability."

Ask the European highway engineers and they'll tell you there is no "maybe" about it. In two recent European Study Tours, organized by the FHWA, officials from our side of "the pond" marveled at the quality and durability of European pavements. What was their "secret?" No surprises there! They simply used the analysis methods and technology that we developed in this country, which we have ignored. They paid attention to providing good drainage, used good quality and innovative materials, used generous thicknesses for every pavement layer, carefully inspected the construction (whether it was built by a contractor or by the highway department), and required a guarantee of performance. They were not too conservative to try new methods of construction if the payoff seemed worth the risk.

*"Now, with an increasing inventory of old, worn-out highways on our hands, the 'wolf' is at **our** door."*

There *is* one significant difference in the European approach. When they analyze the economics of a highway rehabilitation project, they try to minimize *the sum* of the agency costs to build and maintain the road, plus the road user costs (i.e., the driver's costs). Here in the United States we only try to minimize the agency costs (which are paid directly by the highway department). Since the road user costs amount to 90 percent of the total over the life of the road, this means we are considering only the tip of the iceberg. That leads to some very erroneous decisions regarding how much we can afford to spend on our roads.

This "European revolution" crept in over the 1960s, 1970s, and 1980s, while we were sitting at home, reading the *Three Little Pigs*. You remember the story. Two of the pigs built their houses out of straw and sticks, while a third, Practical Pig, built his house out of bricks. When the Big Bad Wolf came along, the two cheap pigs had to scurry for their lives to their brother's well-built house. The lesson we were supposed to learn from the tale was to build things well the first time. But, as a nation, we have failed to adopt this principle for our roads. Now, with an increasing inventory of old, worn-out highways on our hands, the "wolf" is at *our* door.

Fact #1: Over the lifetime of a road, out of every $1 spent on highway transportation in this country, 10 cents is spent by the highway department to build and maintain the road, while 90 cents is spent to operate the vehicles on the road (including fuel, lubricants, tires, repairs, and depreciation). Thus when the town or village board agonizes over a decision to overlay or re-seal the road, they are debating the expenditure of a small fraction of their 10 cents. Yet it has a tremendous effect on the vehicle operating cost. And taxpayers are not getting their money's worth, because the rehabilitation does not last long enough.

Fact #2: It costs about 30 percent more per mile to operate a vehicle on a worn-out, potholed street than on a newly paved road. The bill for most of this excess operating cost comes due at the end of the useful life of a pavement, and the cost per mile goes up rapidly as the surface roughness increases. The cost to drive a car on a smooth road (exclusive of taxes) is about 28 cents per mile, while it is about 36 cents per mile on a road in very poor condition.

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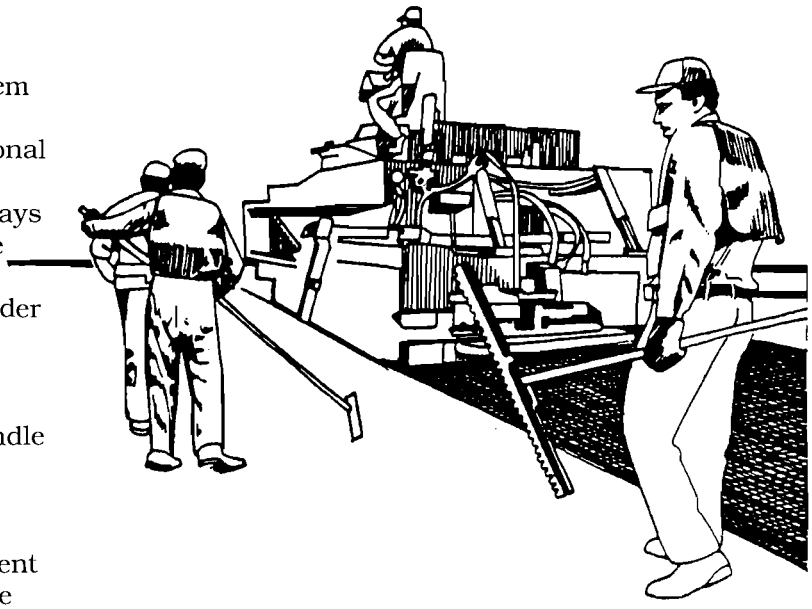
Correction

In our Winter 1995 *Mass Interchange*, we inadvertently omitted the original source for our article "Metric Conversion: You Can Do It!" This article was taken, and revised, from the original article "Think mm-mm-mm-metric!" written by Sammie Jones of the Montana LTAP. We regret the error.

Massachusetts DOT Integrates PMS

by Cornelius Andres and Matthew D. Turo

Management system mandates contained in the Intermodal Surface Transportation Efficiency Act quadrupled the roadway mileage that must be included under a pavement management system in Massachusetts. Most of the additional mileage is local jurisdiction roadways eligible for Surface Transportation Program funds under the ISTEA regulations.



In order to handle this additional responsibility, the Massachusetts Highway Department is working with the Commonwealth's Metropolitan Planning Organizations. This partnership is in keeping with the spirit of the ISTEA regulations and takes advantage of Massachusetts' MPOs experience in pavement management as well as local agency investments in pavement management systems.

An appropriate interagency PMS is being developed to address planning, programming, budgeting, design, and maintenance requirements of a roadway network of various classes of pavement under the control of many jurisdictions. This is being accomplished by making the individual systems work together rather than by standardizing a single PMS. The PMS is also being integrated into a Geographic Information System database shared by other management systems.

Meeting the Requirements

Massachusetts will meet the requirements set forth in the ISTEA regulations with evaluation and inventory of the entire eligible federal-aid highway system in the state - regardless of jurisdiction. This statewide PMS also links a central computerized GIS database, the development of economic models and budgets, procedures to assess the priorities of pavement maintenance and rehabilitation projects, and an institutional framework for the statewide PMS.

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in this issue

Also in this issue . . .

Look for our Safety Tip insert on **Hand Safety**. The convenient loose sheet is perfect for posting on your employee bulletin board!

PMS . . .*continued from Page 3*

The responsibilities for evaluating and analyzing the federal-aid roadway system have been divided between the state highway agency and the MPOs. The MHD will survey all roadways that can be tested with the department's Automatic Road Analyzer. These roadways include the entire National Highway System and other roadways that are eligible for Surface Transportation Program funds. The MPOs will be responsible for the coordination of data collection for the remainder of the federal-aid system. This will include gathering data from the more advanced local agencies that already have acceptable pavement management systems, as well as data for the roadways in communities that do not yet have an acceptable PMS.

Photo by Karen Dodge

Lou Kustwan, a former Baystate Roads Program student employee, makes a presentation at a recent workshop on "Walkable Communities." Lou is now the Assistant City Engineer for the City of Westfield.

PMS Use

Because each PMS has distinctive data requirements for triggering treatment selection, all data will be analyzed using the PMS for which it was collected. Analyzing the condition data within the system keeps the individual integrity of each PMS intact. Correlating condition data to a standard index before analysis would severely diminish the strengths of each individual system. These strengths include features such as triggering actions based on the type of distress, drainage conditions, or curb reveal -- insufficient curb reveal can prohibit certain actions in urban areas. During this phase of network-level analysis conducted by the state for NHS roadways and the MPOs for Surface Transportation Program roadways, potential treatments for candidate projects and estimates of overall budget needs are developed. Treatment selection is based on costs and pavement performance for typical pavements in the region.

Based on this analysis, the MHD forwards candidate projects and cost estimates for local roadways evaluated with the ARAN to the MPOs for inclusion in estimates of their regional needs. The candidate projects will then be refined through project level analysis conducted by qualified personnel such as town engineers, state-aid engineers, MPO staff, consultants, and so on. The MPOs forward the network level project list for state roadways to the MHD for inclusion in estimates of state highway needs. Project-level analysis will then be carried out at the district level of the Massachusetts Highway Department.

Uniformity

Until this point, emphasis has been placed on developing a list of candidate projects and determining network level budget needs. However, in order to observe existing and projected statewide conditions and assess priorities across the state, a uniform measure of pavement condition must be developed. This is the point where the individual systems will be harmonized. This will be accomplished through a correlation of condition surveys. In Massachusetts, this task requires the correlation of the condition ratings of the three most common PMSs to the MHD's PMS. The harmonized condition data will be used by

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PMS *. . .continued from Page 4*

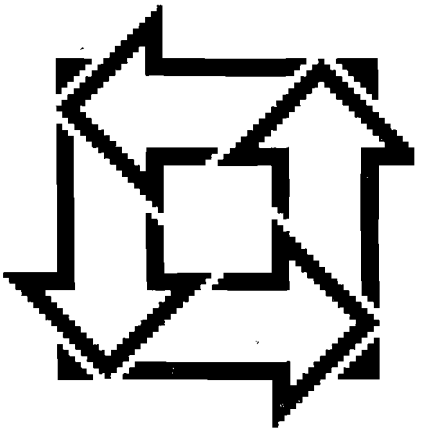
the MHD to assess network conditions and develop a ranking of all NHS and STP projects in order to determine regional funding requirements.

Eventually, through the statewide and metropolitan planning processes that consider the results of the other management systems, projects will be programmed for construction. After construction, the PMS database will be updated with as-built data. The MHD will be responsible for maintaining historical records for its pavements. The MPOs will serve as regional repositories for the historical roadway records of all other federal-aid roadways within their jurisdictions. This regional approach offers the advantage of allowing the pooling of regional deterioration data so that accurate multi-year projections can be made quickly. Obviously, feedback will be crucial and necessary to insure the credibility and reliability of the overall PMS process.

Coordinating Systems

Coordination with other management systems will be accomplished through the use of a shared GIS platform. This approach is a natural outgrowth of previous work efforts mandated by the ISTEA regulations. It also takes advantage of the latest technology available for transportation planning.

Massachusetts began the coordination of the management systems by accomplishing the revision of the urban/rural boundaries and the functional classification update with the GIS system. The completion of these steps determined the federal-aid roadway network that the statewide PMS had to address. Existing state inventory numbers were attached to the roadway segments in the GIS so that existing attribute data such as lane width, pavement type, and jurisdiction could be attached. The functionally classified network has also been used for transportation modeling purposes at the regional level. Traffic monitoring, safety, bridge, and intermodal facilities data will also share a common GIS database.



The results of all the management systems will be examined through the planning process. It is anticipated that coordination of condition, capacity, safety, and mobility factors identified through the respective management systems will provide valuable information to decision makers.

Pavement management systems must fit into institutional systems. In Massachusetts, the PMS fits into the existing MPO-structured regional planning arrangements. This approach is practical and fully consistent with the ISTEA regulations.

Massachusetts chose to harmonize the individual pavement management systems, making them work together rather than mandating a standardized system, because there is no single pavement management system that is appropriate for all agencies. Various pavement management software packages are used to develop candidate projects and cost estimates. The distress indices of the individual PMS software packages will then be correlated to the MHD condition index. This allows the condition of different roadway segments to be compared without compromising the ability of the individual network-level PMS software packages to predict potential treatment.

Pavement management systems can share a common database with other management systems. The roadway inventory portion of the statewide PMS development was based on the urban/rural boundary revision and functional classification update requirements of the ISTEA regulations. These efforts resulted in a GIS database that is being shared with the other management systems.

Communication between agencies is essential. In Massachusetts, this communication was facilitated by establishing pavement management and transportation modeling user groups for regional agencies. These organizations have fostered communication between the MHD and the regions and helped to reduce institutional barriers. ❑

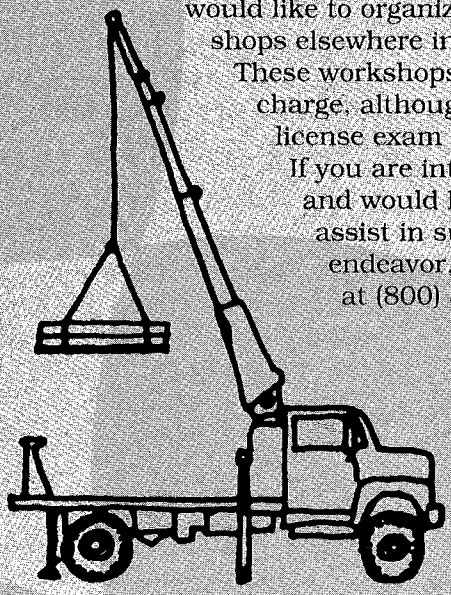
This article is reprinted with permission from the June 1995 issue of ***Better Roads*** *magazine. It was originally excerpted from a presentation at a recent Transportation Research Board annual meeting. Cornelius W. Andres represents the Town of Bourne, MA, and Matthew D. Turo represents the Massachusetts Highway Department. This work was accomplished while Andres was a transportation engineer at the Cape Cod Commission.*

Do You Have Your Hoisting License?

On March 28, the Baystate Roads Program sponsored a hoisting license review and exam workshop. Organized by Bourne Highway Department superintendent Neil Andres, the event was held at the Bourne Sportsman's Club. While 15-20 people were expected to attend, a whopping 55 showed up. After a three-hour review of potential exam questions by Mass Highway Department workshop speaker Frank Belloni, two Department of Public Safety inspectors arrived to present the exam on-site. The lowest grade scored was an 89%.

CONGRATULATIONS TO ALL NEW OPERATORS!

The Baystate Roads Program would like to organize workshops elsewhere in the state. These workshops are free of charge, although the license exam fee is $60. If you are interested and would like to assist in such an endeavor, call Chris at (800) 374-ROAD.



Are You Aware of New Hoisting Engineer Restriction Codes?

New hoisting engineer restriction codes became effective on July 1, 1994. Listed below, these codes are more specific regarding the equipment that people are able to operate. In addition, new requirements include a specified training period between code upgrades.

- All hoisting equipment (except electric and air power hoisting equipment), including all friction clutch machines, derricks, guy derricks, stiff legs, Chicago booms, gin poles, lattice booms, and equipment with telescoping booms with or without wire ropes.
- Equipment with telescoping booms with or without wire ropes.
- Equipment with hydraulic telescoping booms without wire ropes.
- Crawler and rubber-tired excavators, backhoes and front-end loaders.
- Backhoes and front-end loaders.
- Front-end loaders.
- Electric and air-powered hoisting equipment.
- Drill rigs, pipeline sidebooms, concrete pumps, catchbasin cleaners, sign-hanging equipment.

New Publications

Rolling and Compaction of Asphalt Pavement, National Asphalt Pavement Association.

Truck Driving Techniques, National Asphalt Pavement Association.

(Both of the above publications have many illustrations and are written in a cartoon-type format)

Surveying Methods for Local Highway Departments, Cornell Local Roads Program.

This workbook covers basic surveying methods. Topics include how to bank a curve, crown a road, check a grade, take elevations on each end of a culvert, and how to determine pipe length.

Money's Worth. . .*from Page 2*

Fact #3: If we repaved our roads before they became rough and badly potholed, we would save the road users (taxpayers) a significant part of their 90 cents. *The amount of money saved would more than offset the cost of keeping the roads in good condition.* We have known this to be true since 1969 when Robley Winfrey published the first book on highway economics!

Fact #4: If we build our roads only 10 percent thicker, this will yield nearly 50 percent more fatigue life. This means that if we invest more to build the roads to begin with, they will last longer and cost less to maintain. *Especially,* they will cost less to operate vehicles on them, resulting in a substantial reduction of the 90 cents paid by the road users. In urban areas the longer life pays added dividends, because the traffic delays and congestion that come with the closure of a road for rehabilitation will be deferred.

Fact #5: To gain the savings indicated, to reduce our cost of transportation, and to achieve a more competitive position in the international marketplace, *we must change our way of building and managing our road system.* In every corner of this state and across the nation we must abandon the notion that "cheaper is better." It isn't. Not in the long run. It is an irresponsible way to manage our resources.

How much is good enough?" We should strive to build our roads to last at least 30 years for asphalt and concrete pavements, 20 years for cold-mix, and 15 years for chip seals. To achieve this goal we would have to use generous thicknesses of good materials, and provide good drainage above and beneath the road. We would spend a greater portion of our construction money on providing a good foundation for the road than we are now. Later, when the road requires rehabilitation, we would do this *before* the surface is badly distressed, and the new top would last much longer than we currently get.

Today is the best day to accept these facts and begin to operate upon them! Decide today that you are going to build the best, most durable roads that you know how to build. Start educating your board members and the citizens in your community that investing in infrastructure for the long-term makes good sense. In fact, it is *vital* to our economic future. ❑

calendar

Urban Street Tree Planting Symposium

October 24, 1995
Location: Federal Reserve Bank, Boston, MA
Contact: Margaret Gilligan
(617) 247-1613

Multi-disciplinary discussions and workshops will address planting and maintenance techniques to improve tree health and longevity in stressed urban environments.

New Videotapes

DC 147	Municipal Compost Technique
DC 148	Microsurfacing -- Use, Application & Inspection
DC 149	Paving and Compaction Training
DC 151	Slurry Seal -- Use and Application
DC 152	Here's How a Hot Mix Plant Works

This article was written by Lynne H. Irwin, Director of the Cornell Local Roads Program. Cornell Local Roads Program is the LTAP for New York. It is reprinted with permission from the Spring, 1994 issue of the Cornell Local Roads Program Newsletter.

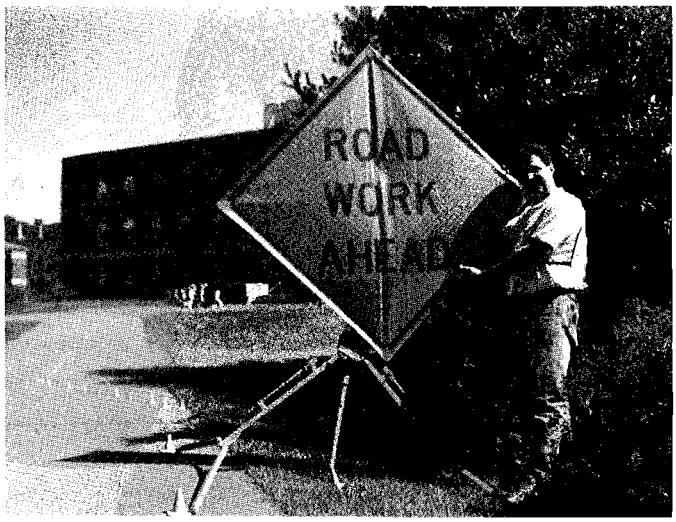
CONTEST!

Wanted: Interesting stories or photos

We need local stories and/or photos for our newsletter! Do you have any interesting work experiences to tell our readers about? Are you using any new methods or techniques around the shop or out on the road which others might find helpful? Or perhaps you know of a human interest story or photo about your department or the public?

Simply write up your experiences on one page or less, and/or send us a photo with a description. We can assist with editing, if needed. Technical articles are welcome, as are human interest stories. Humor is always a plus! Make as many submissions as you want. Entries must be Massachusetts-specific. All articles and photos become the property of BRP and cannot be returned. We will choose the best entry as the winner!

Deadline: November 1st



FIRST PRIZE: Chris Ahmadjian with a 48" fabric sign and a brand new all-terrain sign mount from SHRP. Value: $500. (Sorry, you don't get Chris).

SECOND, THIRD, and FOURTH PRIZE: Safety vest.

Additional prizes: 4" minicones will be sent to all entrants!

We will deliver the First Prize.

The Baystate Roads Program, which publishes *Mass Interchange* each quarter, is a Technology Transfer (T2) Center created under the Federal Highway Administration's (FHWA) Local Technical Assistance Program (LTAP). FHWA is joined by the Massachusetts Highway Department, the Department of Civil and Environmental 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, inquiries, articles, and ideas are encouraged.

To contact the Baystate Roads Program, call (800) 374-ROAD (in state) or (413) 545-2604.

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