M A S S
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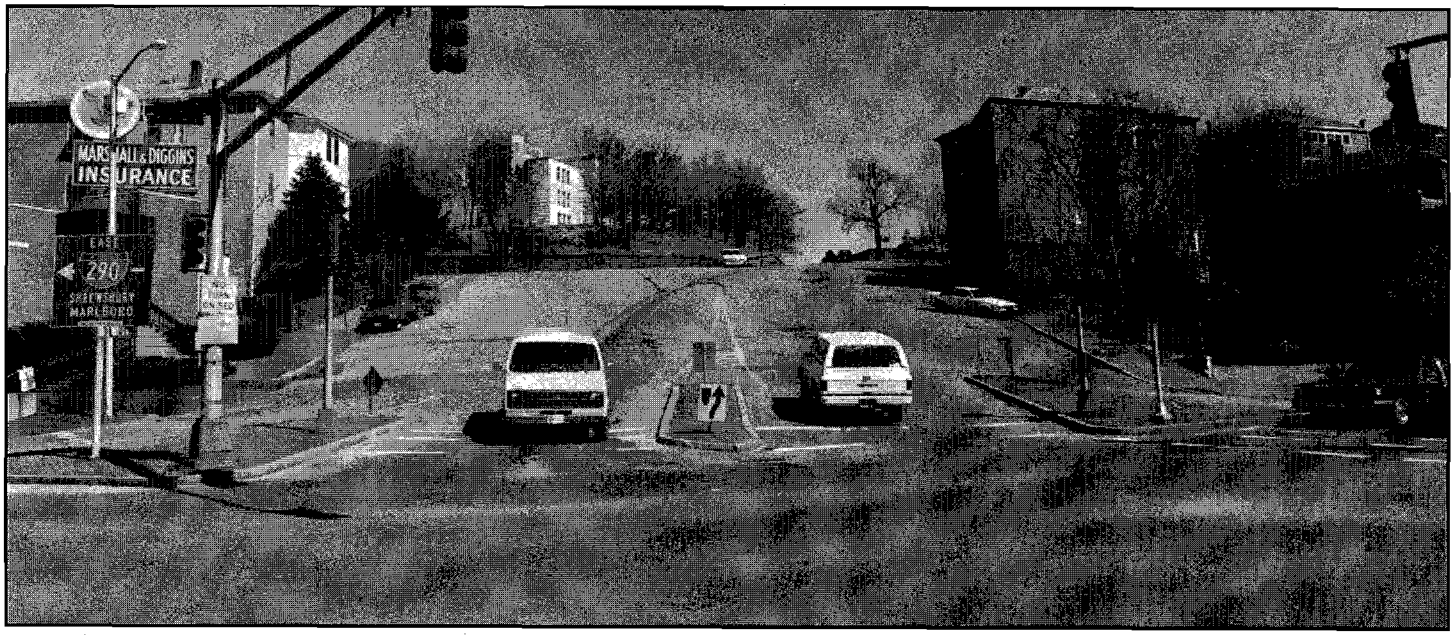

Is this too wide for a residential street?

A Note from the Editor:

In the last few months we have been asked difficult questions about the geometric design of residential streets, such as:

* What pavement width should I use?
* What is the best shoulder width to use?
* Is wider always better?
* If I narrow the road width, where will I store snow and will my emergency vehicles and snow plows have access problems because of the narrow geometry?

We spent some time researching these questions and

Continued on Page 7...

Philosophy of Residential Street Design

In the past, residential streets have been mistakenly viewed as fulfilling only two functions: providing access and conveying traffic. As a consequence of this philosophy, requirements and design guidelines placed undue stress on the efficient movement of traffic — in other words, moving traffic either in greater volumes or at increased speed — and ignored residential streets' many other functions. As stated in *Performance Streets*:

Continued on Page 4...

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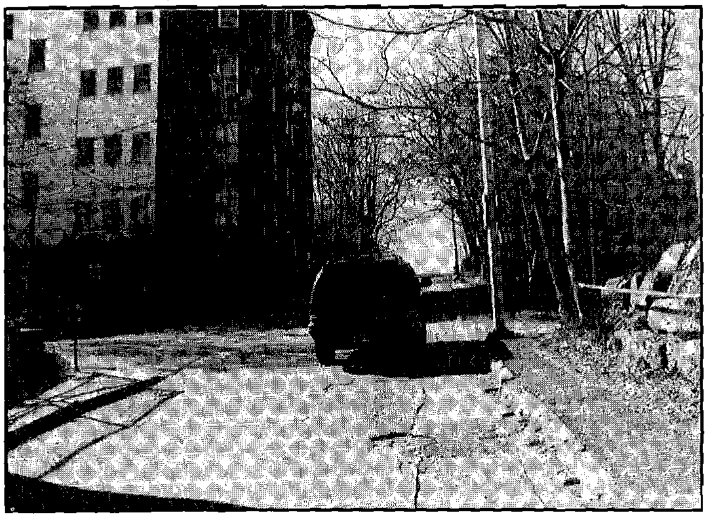
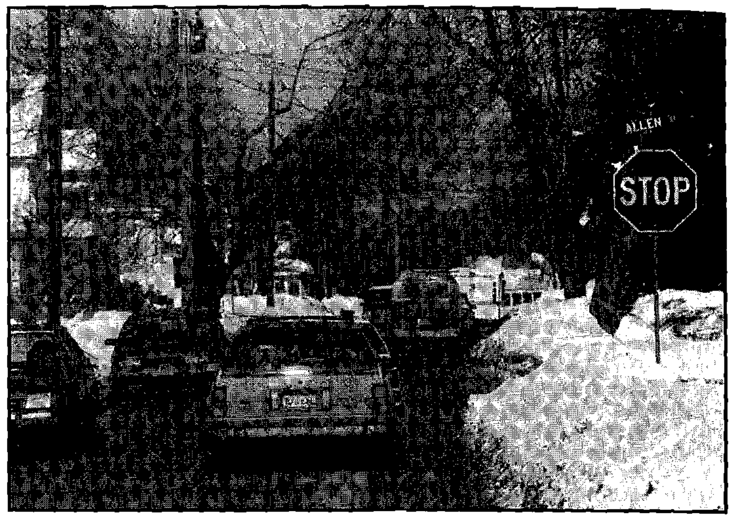
Pavement Widths

Decisions regarding pavement width have significant consequences for a number of characteristics, including resultant vehicle speeds, visual scale, and the cost of construction and maintenance, and, therefore, are of great importance in designing a residential community. The width of a street should be based upon both the volume and type of expected traffic and the amount of on-street parking that will be generated as well as upon the place of the street in the street hierarchy (access street, subcollector, collector).

Residential street pavement width practices have evolved largely from traditional moving lane, parking lane, and design speed concepts. Historically, widths were linked to considerations of convenience for the largest vehicle that might use the street. Such design approaches are appropriate for arterial streets but are difficult to justify for residential streets that serve a small number of homes.

The selection of appropriate widths must account for probable peak traffic volume, parking needs and controls, likely vehicle speeds, and limitations imposed by sight distances, climate, terrain, and maintenance requirements. Designers should select the *minimum* width that will reasonably satisfy all realistic needs, thereby minimizing construction and average annual maintenance costs. The tendency of many communities to equate wider streets with better streets and to design traffic and parking lanes as though the street were a "microfreeway" is a highly questionable practice.
On subcollectors, a 26-foot-wide pavement provides either two parking lanes and a moving or traffic lane or one parking lane and two moving lanes. (In the absence of adequate off-street parking, a 28-foot pavement may be preferable if continuous on-street parking is expected along both sides of the street.) For a cul-de-sac or other access street, a 22- or 24- foot-wide pavement is adequate. Widening the access street a few more feet does not significantly increase capacity but does permit wider moving lanes that,





in turn, tend to encourage higher-speed driving (see figure). A wide access street also lacks the more intimate scale that otherwise makes it an attractive setting for housing. Once the traffic from tributary local streets has reached sufficient volume so that two clear traffic lanes are needed, the street becomes a collector street. A collector street should be designed as a higher-speed traffic artery that permits relatively swift and unrestricted automobile movements. Collector streets with a pavement width of 36 feet provide for adequate traffic movement and two curb parking lanes (see illustration). Where houses do not have access to the collector street and parking is not normally needed, two moving lanes are adequate, with shoulders graded for emergency parking. Ideally, homes should not front on a collector street in order to avoid the multiple traffic hazards of street parking, automobiles entering the street from driveways, and children who may dart unseen into the roadway.

Recommended Pavement Widths

Street Type	Pavement Width (ft.)
Access Street (place or lane)	22-24
Subcollector	26*
Collector	36**

*If on-street parking lines both sides of the street continuously a 28-foot pavement may be preferred.
**If residences do not front on the collector, a 24- to 26-foot pavement with shoulders is sufficient.

Speed...

Traffic speeds on residential streets are generally affected by the following:

- Open width or clearance of the street - a street with wide lanes invites faster movements.
- Horizontal and vertical street alignment - straight streets with long sight distances tend to encourage increased speed.
- The number of access points to the street - streets with many obvious potential conflict points tend to inhibit speeding.
- Number of parked cars or other obstructions on the street - barriers effectively decrease traffic speeds as each barrier may pose a potential conflict.
- Signs and signals at controlled intersections - obvious speed controls within immediate vicinity of the control device help limit speed.

Because of their short lengths, the likelihood of parked vehicles, the presence of children and pets, and other reasons, residential streets should be designed for low vehicle speeds. In addition, given the practical limitations and economics of construction, lower design speeds become a consideration as terrain grows progressively difficult. Design speed for subcollectors and access streets is not a major planning factor; in fact, a speed of 20 mph for all types of local streets is recommended (Table 1) . By contrast, design speed plays a more important role for the design of the collector residential street, more nearly reflecting drivers' desires for expedited movement. Keeping speeds low on subcollectors and access streets can be accomplished by proper design. Speed bumps should not be used on any type streets.

TABLE 1
Design Speeds
(mph)

Street Type	Level	Rolling	Hilly
Access Street	20	20	20
Subcollector	20	20	20
Collector	35	30	25

Resource Material for "Residential Streets"

BAYSTATE ROADS PROGRAM LIBRARY

D&C-27 Local Low Volume Roads & Streets
ASCE November 1992

D&C-59 Designing Safer Roads: Practices for Resurfacing, Restoration and Rehabilitation, Special Report 214 ***(LOAN ONLY)***
Transportation Research Board 1987

D&C-60 Residential Streets, 2nd Edititon
ASCE, NAB, ULI 19906

PLA-39 Take Back Your Streets: How to Protect Communities from Asphalt and Traffic
Conservation Law Foundation May 1995
Residential Streets, Second Edition
ASCE/NAHB/ULI 1990

TRA-43 A Guidebook for Residential Traffic Management
December 1994

ORDER

From the Institute of Transportation Engineers
525 School St., S.W. -- Suite 410
Washington, DC 20024-2729

Telephone: 202-554-8050
FAX: 202-863-5486

Guidelines for Residential Subdivision Street Design
by: ITE, 1993
$35.00 plus shipping
ITE REPORT RP-011c

Residential Street Design and Traffic Control
by: Wolfgand S. Homburger, 1989
Elizabeth A. Deakin, Peter C. Bosselmann
Daniel T. Smith, Jr., Bert Beukers
$60.00 plus shipping
ISBN 0-13-77508-0

in this issue

Philosophy continued from page 1...

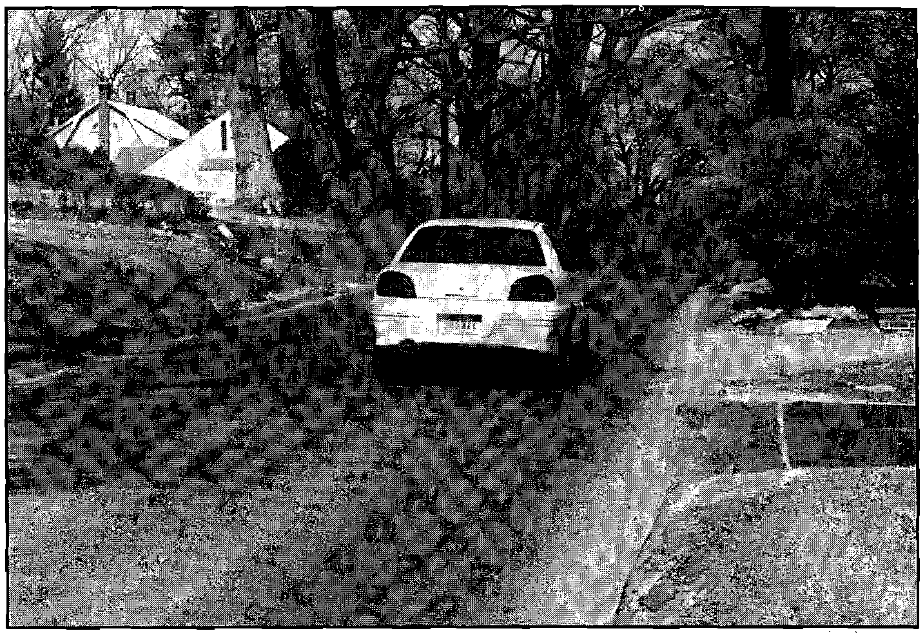
It was often forgotten that residential streets become part of the neighborhood and are eventually used for a variety of purposes for which they were not designed. Residential streets provide direct auto access for the occupant to his home; they carry traffic past his house; they provide a visual setting, an entryway for each house; a pedestrian circulation system; a meeting place for the residents; a play area (whether one likes it or not) for children, etc. To design and engineer residential streets solely for the convenience of easy automobile movement overlooks the many overlapping uses of a residential street.

A residential street's functions include not only its place in the transportation system but its role as part of a residential community's living environment.

The idea of a residential street system as much more than a transportation facility is reflected in the following principles that form the basis for the guidelines presented in this book:

- Street planning should relate to overall community planning.
- Traffic in residential areas should be kept to a minimum to reduce noise, congestion, and hazards to pedestrians.
- The street is an important component of overall residential community design. Properly scaled and designed streets can create more attractive communities and can contribute to a clearly defined sense of place.
- Street design standards should permit flexibility in community design. They should allow street alignments to follow natural contours and preserve natural features or to respond to other design objectives such as the creation of more intimate urban- or village-scaled streetscapes.
- Wherever possible, street layouts should be planned to avoid excessive stormwater runoff and the need for storm sewers.
- The amount of paved area should be kept to a minimum to reduce construction and maintenance costs, stormwater runoff, and heat buildup.
- Streets can serve social functions such as meeting places and centers of community activity. For example, children often use low-traffic streets as play areas.
- In the interest of keeping housing affordable, street cost should be minimized.
- Overdesign of streets should be avoided. Excessive widths or an undue concern with geometry more appropriate for highways encourages greater vehicle speeds.
- Different streets have different functions and need to be designed accordingly. Blanket standards are inappropriate.

These principles suggest that a street system should be designed as a hierarchy of street uses. Routes carrying through traffic should be separated from routes that provide access to residential properties. All streets can be described in terms of their relative service for through-traffic movement. Interstate highways, for example, are designed for high-speed through traffic but provide no direct access to properties. At the other end of the spectrum are residential cul-de-sacs designed only for access. They should be considered more a part of the residential neighborhood than part of a traffic system. In residential street design, the street's contribution to the neighborhood environment is as important as the street's role as a transportation conduit. In addition, the resulting street system should be designed to be easily "read" or understood by users so that the intended function of a particular street segment is readily apparent.



Is this too narrow for a collector street?

Public and Private Streets

Most residential streets are public streets; developers dedicate them to the local governments upon completion (or sometimes after a prescribed period of time — often one year — has passed). The local government is then responsible for maintaining the streets. In some developments, however, a homeowner association or community association owns and maintains some or all of the streets as private streets.

The ownership of the street should not be a factor in its design or function. The width of a street, for example, should be based upon the volume and characteristics of the expected traffic and on the likely amount of on-street parking. Some communities permit flexibility in the design of private streets but have not changed their standards to allow the appropriate design of public streets. The design recommendations in this book are meant to apply to all residential streets regardless of ownership and maintenance responsibility.

Applications

The design principles outlined in this study are applied most frequently to new communities, especially to planned communities, in which a single developer designs the entire circulation system and community plan to complement and support one another.

The same design principles can, however, also be applied to new developments under multiple ownership. Under local government guidance and control, the coordinated development of smaller parcels can create a unified community pattern that offers advantages similar to those enjoyed by the community planned by a single developer. Many of these design principles can also be used to redesign street patterns in older neighborhoods to achieve increased traffic safety and a more livable residential environment.

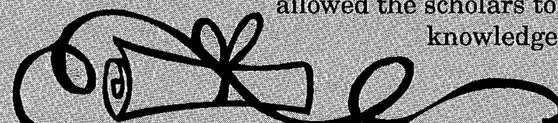
To apply the design concepts in this book, communities may need to rethink the proper role of the residential street and adopt some changes in existing standards, regulations, and policies. The effort of applying these design concepts, however, can result in safer and more cost-effective streets that create more attractive and livable neighborhoods.

The preceding three articles: "Philosophy of Residential Street Design", "Speed..." and "Road Widths", were excerpted with permission of the publisher from <u>Residential Streets, Second Edition</u>, American Society of Civil Engineers, National Association of Home Builders, and Urban Land Institute, 1990.

Hats off to our first graduating class from the Baystate Roads Scholar Program!

Cornelius W. Andres	Town of Bourne
Jack Beaulieu	Town of Agawam
Richard Brodeur	Massachusetts Highway Department
Francis R. Bush	Town of Williamstown
Jack H. Cable	Town of Heath
David P. Capelle	Town of Shrewsbury
Charles J. Cononi	Town of Wellesley
John Cross	Town of Holden
John W. DePriest	City of Chelsea
Richard DeWitt	Town of Holden
Don DiMartino	Town of Bellingham
Toma Duhani	Town of Wayland
John A. Eklund	Town of Phillipston
David Frye	Town of Orange
Ray Johnson	Town of Lancaster
Dennis Kelly	Town of Lee
Jeffrey A. Landry	City of Gardner
Norman LaPointe	Town of Petersham
Maurice E. Manny	Massachusetts Highway Department
Jay Perkins	Town of Williamstown
Robert J. Reardon	Town of Wrentham
Paul Scott	Town of Weston
Ken Scully	Town of Charlemont
Leo W. Senecal	City of North Adams
Jack Sonia	Town of Lancaster
Dean Stratouly	Massachusetts Highway Department
Richard Tellier	Town of Bourne
David A. Webster	Town of Swansea

Congratulations to the first Massachusetts Roads Scholars whose names and towns or cities are listed above. These twenty-eight dedicated employees attended a minimum of seven training workshops, five of which had to be intensive core courses. The one-day seminars allowed the scholars to improve their skills and knowledge with recognized experts who provided practical, up-to-date, and innovative instruction.



New Publications

DRA-28B Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff -- Volume II: Research Report
FHWA November 1996

DRA-30 Evaluation and Management of Highway Runoff Water Quality
FHWA 1996 (LOAN ONLY)

DRA-28A Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff -- Volume I: Research Report
FHWA November 1996

S&I-49 Things to Know Before You Buy a New Plow
Phil Webster 1996

COC-49 American Concrete Institute Certification (Concrete Flatwork Technician & Flatwork Finisher)
[Study guide for exam]
American Concrete Institute

NEW VIDEOS NEW VIDEOS

ST-163 Snow and Ice Control
12 Minutes NACE

A quick guide to the new materials available in snow and ice control with special emphasis on SHRP designs and handbooks. Ranges from plow design to snow fences to deicing tests.

ST-164 Staying Ahead of the Storm
20 Minutes NACE

A dramatized scenario of a road weather information system in action, along with an explanation of benefits and a guide to installation.

ST-165 New Work Zone Safety Devices
17 Minutes NACE

Demonstrates many of the devices designed by SHRP to increase work zone safety including rumble strips, advanced signs, intrusions alarms, snow plow lighting, and crash barriers.

ST-166 Making Safer Roads
12 minutes
Insurance Institute for Highway Safety

One in four motor vehicle deaths involves only that single vehicle hitting a tree, utility pole or bridge support. While interstates have improved safety dramatically, secondary rural roads need to alleviate roadside hazards and use low cost, common sense approaches like tree correction, utility pole placement and properly installed guardrails.

MO-209 SHRP Projects: Spray Injection, Automated Crack Sealing
16 Minutes NACE

A quick discussion of SHRP inventions including spray-injection machines, automated crack sealing vehicles, longer lasting materials and workzone safety.

MO-210 Plows of the Future
8 Minutes NACE

A preview of SHRP designs for snow plows and how changes will increase safety and efficiency. Many examples of improvements available both now and in the future.

Continued from 1...

after considerable thought we have found the answer. **It depends.** It depends on how much money you are willing to spend and more importantly, the functions you want the road to perform? For example:

* A collector road moves traffic. You will probably want wide lanes and shoulders to move large volumes of traffic quickly.
* A residential road not only moves traffic; it is a gathering place for neighbors, a place for children to ride bicycles, and a place for people to walk. You will probably want narrow lanes and shoulders, sidewalks, grass strips and shade trees.

In this issue of Mass Interchange, we offer no easy solutions to the questions asked above. We do, however, present an introduction to these issues and encourage you to order some of our suggested reading. We hope this edition of the newsletter starts discussions in your town and with your peers across the state. It is time to look at your design standards and practices to see if they are creating the best roadway system for your community.

Remember these words of wisdom:

Wider pavements and shoulders are not always better. The wider the pavement, the faster traffic will go.
Slower is better, unless you are the one trying to get somewhere.
Snow has to be stored somewhere.
Emergency vehicles must get there.
Traffic calming is the buzz word for the decade and often is not difficult to implement.

Chris Ahmadjian, Program Manager

Special thanks to Karen Dodge for the photography in this issue.

NEW VIDEOS NEW VIDEOS

MO-211 Concrete Bridge Protection and Repair
5:15 Minutes NACE

A very quick overview of SHRP C-103 Field Guide discussing some techniques for repairing chloride damage.

MO-212 Wheel Loader: Walk Around & Inspection
15 Minutes Vista, Inc.

Review of maintenance checks and safe operating procedures includes cold weather diesel starts, jump starts and proper dress. Personal experience interview with accident victim.

MO-213 Wheel Loader: Operating Techniques
15 Minutes Vista, Inc.

Techniques to prevent operating problems and tips for safety including hand signals, weight limitations, limitations for tipping load and vehicle maintenance.

MO-214 Crawler Excavator: Pre-Start Inspection
10 Minutes Vista, Inc.

Step-by-step, detailed overview of safety instructions necessary for running a crawler excavator.

MO-215 Backhoe Loader: Pre-Start Inspection
10 Minutes Vista, Inc.

Detailed tactics to avoid injury by inspection of a backhoe leader. Includes before and during operation procedures.

MO-216 Backhoe Loader: Safe Operating Techniques
15 Minutes Vista, Inc.

Review of safety rules for basic operation including stabilizing, tool attachments, soil loading and buried cables and pipes. Includes statistics on deaths due to safety.

MO-217 Backhoe Loader: Maintenance & Transport
10 Minutes Vista, Inc.

Step-by-step safety precautions before, during and after operation of a backhoe loader.

DC-157 Evaluation Procedures for Deicing Chemicals
11 Minutes NACE

An overview and demonstration of 12 simple test procedures developed by SHRP to evaluate deicing chemicals. These tests were developed to create national standards for evaluating deicing materials.

BRP CALENDAR

Hot Mix Asphalt
May 7, 1997 Hotel Northampton
June 11, 997 Cape Cod Community College

Surveying II
May 15, 1997 Holiday Inn, Taunton
May 20, 1997 Nichols College, Southboro
May 22, 1997 Hotel Northampton
May 29, 1997 Wyndham Garden, Burlington

Right-of-Way Acquisition and Architectural Access Board Issues for Cities & Towns
May 1, 1997 Sheraton Inn, Plymouth
May 9, 1997 Wyndham Garden, Burlington

Municipal Equipment Management System (Hands-on Software Training)
May 2, 1997 Greenfield Community College, Downtown Campus

Public Works Education Conference
June 5-6, 1997 UMass/Amherst

RHODE ISLAND'S COMING EVENTS...

The Rhode Island Public Works Association, T2 Center and the Rhode Island Interlocal Risk management Trust are planning a series of WORK ZONE SAFETY seminars. *If you would like to participate call Jeff Cathchart at 401-823-4913.*

April 25, 1997
Foster Town House
Chain Saw Techniques

May 9, 1997
Alton Jones Conference Center
Timber Bridge Seminar

MaCAPA Coming Events...

May 13
Wayne Tarr of Bardon Trimount will discuss dispatching and its ramifications, from using pencil and pad to computerized balancing of truck demand.

Make reservations with June at 1-800-242-9525.

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.

Local Technical Assistance/Technology Transfer Center
To contact the Baystate Roads Program, call (800) 374-ROAD (in state) or (413) 545-2604.

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MASS HIGHWAY

Massachusetts Highway Department
Federal Highway Administration
University of Massachusetts/Amherst

Utilities in the Roadway

by Robert Christman, P.E.

This subject has long been a controversial issue for most pavement and utility administrators and managers. Placing utilities in pavements is like mixing water with oil. Yet we need both of these infrastructures to be available to provide safe, efficient, low-cost, healthy and esthetically pleasing service to meet our growing needs. Both of these systems, pavement and utility, act together in a similar environment, provide a needed service, have high initial capital costs as well as known planned preventative maintenance applications throughout their service lives, and cost the taxpayer in one form or another.

Planning and Coordination

Planning activities revolving around each of these infrastructures should include both individual management systems and coordination between the two systems. Most agencies have already implemented sound pavement management systems to factually document pavement performance. Pavement systems vary in performance based upon traffic loading and volumes, material design structure, environmental conditions of temperature, diurnal changes in temperature, moisture present on the pavement surface and surrounds, and moisture present under the pavement. Utility management systems are just beginning to be implemented where an agency can actually find and begin to track utility infrastructure.

Pavement systems and utility infrastructure both have their own known service lives, planned maintenance schedules of repair, and initial and planned maintenance and rehabilitation costs. Each of these infrastructures is like a separate business entity -- they have an initial capital investment, have to be managed, need revenue to be maintained, need good management and marketing, have to be concerned with the environment, safety, laws, external politics, internal politics, and need to look good and/or serve the public well. If road and utility agencies were to manage their infrastructure more like businesses, the road business would most likely not permit the utility business to cut or damage their infrastructure unless it was done with due consideration of the impacts of the repairs. The road business could simply say "go get an easement or purchase the necessary property corridors to install your utility".

Utility Management Systems

Until recently, knowing a utility location, condition, and vintage was uncertain or unknown. Thanks to GIS mapping, efforts by utility companies to better manage their infrastructure, and agreements between agencies and consultants to inventory and rate existing underground lines, we now have the tools and necessary data to provide better management of the rehabilitation and maintenance dollar. Decisions effecting roadway systems can now be based on integrating traffic congestion air quality, travel demand, land use planning, pavement management and life cycle cost analyses relating utility infrastructure age and condition to parent roadway serviceability needs. The goal is to prevent the all too common situation of allowing a newly reconstructed roadway to be inadvertently cut to service an antiquated line below. If an agency is aware of the age and condition of a utility prior to scheduling an expensive capital repair, the agency is more likely to either postpone the reconstruction project until the utility repairs are made, or opt for a lower cost, short-term improvement.

Future Possibilities

Future innovations are needed to devise even better integration of utilities and roadways. Imagine being able to lift off a precast curb and shoulder/driveway plate to access the utility corridor below and never have to break into the load bearing portion of the roadway. How about a precast box culvert or molded unit or metal pipe arch that serves as the underground utility access using perhaps sleeved laterals. Should we be considering dual longitudinal systems along each side of the roadway? Something like a sleeved installation such that faulty lines can be pulled out for repair. Directional drilling continues to demand further attention to better assist the utility and roadway integration. These are only inexperienced guesstamates waiting for an expert committee to be assembled to do the real think-tank work. There are, in most cases, land areas outside the pavement but within the right-of-way where utilities can be located. Only good life-cycle cost analysis with known utility capital costs, performance service lives, periodic maintenance/rehabilitation costs, user delay costs and salvage values could help answer this.

Why Utility Specifications

Specifications need to be updated regarding emergency or planned cutting of roadways. Every roadway must be able to continually serve the movement of people and goods in an efficient, lowest possible life-cycle cost, safe, aesthetically pleasing, comfortable, and environmentally sound manner. To meet this responsibility without the damage caused by utilities is already difficult. Groundwater patterns and soil types are enough to deal with, especially when coupled with oxidation, freeze/thaw cycle, ice-lenses, diurnal temperature stresses, and the effects of various moisture types. Users that continuously test the limits of the facility must be able to drive safely through all seasons of the year, whether on a motorcycle or driving a truck with increasingly higher tire pressures, or using a special permit for heavy construction equipment. Technically, many poorly supported roadways should be shut off to traffic during the spring thaw period because it costs a fortune to allow the damage to occur each year. However, since we don't do that, we must know which roadways are poorly founded and develop sound rehabilitation plans to address these special needs. This may mean that some of these facilities may cost the user more money per year than others.

Utility installation within the roadway proper must also be concerned with moving people and goods in an efficient, lowest possible life cycle cost, safe, aesthetically pleasing, comfortable, and environmentally sound manner. To do this means that good specifications need to be in place. The permit application is the point where two infrastructures start their integration. Software tools allow for location tracking; assessment of age and condition information; analysis of historic soil and pavement records; display of past permit applicant proficiency ratings; and administration of allowable, justified, and approved permit fees. An administrative utility fee should be required with the submission of each permit application to cut into a roadway. It should be structured to cover administrative direct overhead for such items as labor, building space, lighting and insurance together with direct labor costs for certain administration, clerical, legal, accounting, engineering, highway, field inspection and testing. The permit fee may also include an amount to cover the damage of a cut to the roadway if the street does not comparably serve the traveling public similar to the adjacent pavement structure.

Quality Management

Specifications need to cover traffic, pedestrian, worker, and property safety. At a minimum the specifications should address soils and pavement types, multiple-choice proximity cuts, cuts over cuts, peripheral areas around the cut, the types of equipment that will be needed to install, maintain or replace the utility, the temporary and permanent restorations needed, winter work, quality control, and quality acceptance.

Quality control and quality acceptance should be key components of the street cut permit system. In the ideal world, if the utility cut were patched and maintained to match the service condition of the adjacent roadway pavement, there would be no need to administer permit fees. Road and utility concerns could communicate and document what they intend to do, where and when utilizing a seamless integration of the activities. This would allow each business to better serve the public. Unfortunately, the real world has a way to go before it reaches that point.

The public continues to demand better quality. In order to approach the vision outlined above, road managers may consider having the utility businesses certify that they have a good process quality control plan and system in place. The utility companies will need to use certified people to conduct repairs within each of their respective trades, including certified pavement restoration contractors,. Independent test results will have to be provided to the roadway administrators from accredited laboratories using certified testing personnel stating that the materials, depths and densities of all constructed layers are within specifications. The roadway authorities will then have to administer their part of the quality management process by implementing an acceptable procedure based upon incentive and penalty performance specifications.

In short, there needs to be more planning to meet this management challenge. Just as the Federal Highway Administration has recently fostered Quality Management System improvements under the National Quality Initiative for transportation systems, attention now needs to be directed to establish a mutual partnership between the utility and roadway businesses.

Robert Christman, P.E. is the Director of Pavement Services for Vanasse Hangen Brustlin, Inc., He is also one of our favorite workshop speakers.