University of Connecticut
School of Engineering

Connecticut Transportation Institute
Technology Transfer Center

Technology Transfer

U.S. Department of Transportation
Federal Highway Administration

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We're Celebrating 20 Years!

In the fall of 1983, the Connecticut Technology Transfer Center published it's first newsletter. In it, John DiBiaggio, then President of the University of Connecticut, said "I can think of few programs that better typify the public service commitment of the University of Connecticut than our effort to assist local transportation agencies through our Technology Transfer Center." Twenty years later we are even more committed to providing the highest level of quality programs to the towns in Connecticut.

We have continued our mission by expanding our programs and services to meet your individual training needs and to meet the continually changing transportation environment. We have grown from training 500 individuals in our first year of operation to training 4,000 individuals last year. We have graduated 303 individuals from our Road Master and Legal Traffic Authority certificate programs and we have implemented a new advanced Road Scholar program for those graduates.

We are most grateful for the support of our workshop participants, even during times of tight budgets and busy schedules. Without you, and the generous support of the Federal Highway Administration and the Connecticut Department of Transportation, we would not be celebrating these 20 years.

The Connecticut Technology Transfer Center is one of a very strong national network of 58 Local Technical Assistance Program (LTAP) centers. As a member of this network, the Connecticut T^2 Center has access to numerous resources, including instructors, materials, new technologies and courses. One of the main premises of LTAP is sharing resources and information, and sharing comes naturally with this program.

As we look enthusiastically ahead to the next 20 years, we think it is a good time to remind you of all of the services you can benefit from through the Technology Transfer Center:

• Technical assistance on problems relating to road and bridge design, construction, maintenance, traffic safety and operation and the latest in transportation technology.

• The Connecticut Road Master Program.

• The Connecticut Road Scholar Program.

The mission of the Technology Transfer Center is to foster the safe, efficient, environmentally sound road-way transportation system required to maintain and improve the economy and quality of life for the citizens of the State of Connecticut by providing training and technical assistance to local transportation agencies.

• The Connecticut Municipal Legal Traffic Authority Program.

• Other workshops on a wide variety of hot topics related to the planning, design and operation of the local transportation system.

• On-line registration for our training programs.

• A quarterly newsletter that provides local officials with information on the latest techniques and practices being used throughout the United States for the management, construction and maintenance of local roads.

• An extensive library with technical publications, video training tapes and technical information on CD-ROM. During 2003, we will be introducing a new on-line searchable database for our library that will enable you to search for resources you need right from your own computer.

• The loan of traffic counting/vehicle speed recording equipment.

For more information about any of our programs, please visit our website at www.cti.uconn.edu/ti/Technology/technology, or contact Donna Shea by phone at (860) 486-5400 or by e-mail at shea@engr.uconn.edu.

We look forward to your continued involvement with the Center and your input about ways we can meet your needs in the future.

Making Two-Lane Roads Safer

The social, environmental, and economic context in which today's highways are designed demands trade-off assessments that require more explicit and quantitative consideration of safety issues than is possible with available tools. The Federal Highway Administration's (FHWA) Interactive Highway Safety Design Model (IHSDM) is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on two-lane rural highways. IHSDM can provide highway project planners, designers, and reviewers in state and local highway departments of transportation and consulting firms with a suite of safety evaluation tools to support these assessments. Highway project decision makers now can use IHSDM to check designs for conformance with design policy, estimate their expected safety performance, and diagnose potential safety and operation issues throughout the highway design process.

Traditionally, designers have relied on compliance with design policy to assure an acceptable level of safety. In today's highway development environment, citizens are asking designers for more context-sensitive designs with broader application of the flexibility afforded by design policy without compromising safety. Making decisions in this environment calls for more detailed, quantitative estimates of a design alternative's expected safety performance. Through IHSDM's quantitative estimates of the expected safety performance of geometric design, IHSDM will help project planners, designers, and reviewers make more cost-effective decisions about safety measures within cost constraints, context, and other considerations.

IHSDM is intended for use throughout the highway design process—from preliminary planning and engineering through detailed design to final review. It may be used both for projects to improve existing roadways and projects to construct new roadways.

The 2003 release of IHSDM for two-lane rural highways has five evaluation modules:

1. Policy review
2. Crash prediction
3. Design consistency
4. Intersection review
5. Traffic analysis

The policy module automates the current process of checking a design against applicable, quantitative design guidelines. The crash prediction module provides quantitative safety performance measures, including expected crash frequency and severity. The remaining modules diagnose factors contributing to safety performance. The design consistency module assesses operating speed consistency. The intersection review module evaluates design elements that influence the safety performance of at-grade intersections. The traffic analysis module evaluates traffic operations on the roadway under current or projected traffic loads.

Additional capabilities are planned for future releases. Research is underway to develop capabilities for IHSDM to perform similar evaluations of multilane rural highways. A sixth evaluation module for two-lane rural highways, driver/vehicle, is also under development and will provide measures of vehicle dynamics, including lateral acceleration as well as rollover and skidding potential.

Policy Review Module

The policy review module checks roadway-segment design elements for compliance with relevant highway geometric design policies. The module provides electronic files replicating quantitative policy values specified by the American Association of State Highway and Transportation Officials (AASHTO) in the 1990, 1994, and 2001 editions of *A Policy on Geometric Design of Highways and Streets* and automates checks of design values against those policy values. IHSDM also provides a tool for inputting policy tables from other agencies' design policies.

The module organizes checks into four categories: cross section, horizontal alignment, vertical alignment, and sight distance. Cross-section checks include through-traveled way width and cross slope, auxiliary lane width and cross slope, shoulder width and cross slope, cross slope rollover on curves, clear zone and roadside slope, normal ditch design, and bridge width. Horizontal alignment checks include radius of curvature, superelevation rate and transition design, length of horizontal curve, and compound curve ratio. Vertical alignment checks include tangent grade and vertical curve length. The policy review module also can check stopping, passing, and decision sight distance.

Crash Prediction Module

The crash prediction module estimates the frequency of crashes expected on a roadway based on its geometric design and traffic characteristics. The crash prediction algorithm considers the effect of a number of roadway variables: lane width, shoulder width and type, horizontal curve length and radius, presence of spiral transition, superelevation, grade, driveway density, passing lanes and short four-lane sections, two-way left-turn lanes, and roadside hazard rating. Intersection variables considered include skew angle, traffic control, presence of left- and right-turn lanes, and sight distance.

The algorithm for estimating crash frequency combines statistical base models and accident modification factors. Base models are available for roadway segments and for three types of intersections: three-legged intersections with

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Supported through a cooperative effort of the Connecticut Department of Transportation and the Federal Highway Administration's Local Technical Assistance Program (LTAP) to provide information on the latest transportation technology to Connecticut's state and local government officials.

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stop control on the minor-road approach, four-legged intersections with stop control on the minor-road approaches, and four-legged signalized intersections.

The accident modification factors adjust the base model estimates for individual geometric design element dimensions and for traffic control features. The algorithm can be calibrated by state or local agencies to reflect roadway, topographic, environmental, and crash-reporting conditions. The algorithm also provides an Empirical Bayes procedure for a weighted averaging of the algorithm estimate with project-specific crash history data.

The crash prediction module can provide input for scoping improvement projects on existing roadways, comparing the relative safety performance of design alternatives, and assessing the safety cost-effectiveness of design decisions.

Design Consistency Module

The design consistency module helps diagnose safety concerns at horizontal curves. Crashes on two-lane rural highways are overrepresented at horizontal curves, and speed inconsistencies are a common contributing factor to crashes on curves. This module provides estimates of the magnitude of potential speed inconsistencies.

The design consistency module uses a speed-profile model that estimates 85th percentile, free-flow, passenger vehicle speeds at each point along a roadway. The speed-profile model combines estimated 85th percentile speeds on curves (horizontal, vertical and horizontal-vertical combinations), desired speeds on long tangents, acceleration and deceleration rates exiting and entering curves, and an algorithm for estimating speeds on vertical grades.

Design consistency evaluations provide valuable information for diagnosing potential safety issues on existing highways. They also provide quality assurance checks of proposed preliminary and final alignment designs.

Intersection Review Module

The intersection review module includes both policy and diagnostic review capabilities. The policy review component checks the following intersection design elements for compliance with design policy: corner radius, turn lane design, intersection angle, and intersection sight distance triangles.

The diagnostic review component is an expert system that leads the user through a systematic evaluation of an existing or proposed intersection geometric design to identify potential safety concerns and possible treatments to address those concerns. The review considers design issues including:

- Intersection configuration: multileg intersections, skewed intersections, offset-T intersections, and more than one minor-road approach on the same side of the major road

- Horizontal alignment: intersection on horizontal curve, curve on intersection leg, and approach alignment differing between opposing approaches

- Vertical alignment: intersection on crest vertical curve, crest or sag vertical curve on intersection approach, steep grade through intersection, and continuity of minor-road profile through intersection

- Intersection sight distance

The intersection review module can provide useful input to project scoping, preliminary engineering, and design review.

Traffic Analysis Module

The traffic analysis module uses the TWOPAS traffic simulation model to estimate traffic quality-of-service measures for an existing or proposed design under current or projected future traffic flows. The traffic analysis module facilitates use of TWOPAS by feeding it the roadway geometry data stored by IHSDM.

TWOPAS is the microscopic traffic simulation model used to develop the two-lane highway chapter of the Transportation Research Board's (TRB) *Highway Capacity Manual*. TWOPAS produces measures including average speed and percentage of time spent following other vehicles.

The traffic analysis module is particularly useful during project scoping and preliminary engineering for evaluating the operational performance of alternatives to two-lane cross sections, including passing lanes, climbing lanes, and short, four-lane sections.

Availability

The 2003 release of IHSDM for two-lane rural highways is now available at no charge for testing and evaluation purposes through the IHSDM web site at www.tfhrc.gov/safety/ihsdm/ihsdm.htm. Visit the site for details on registering, downloading the software and contacting FHWA for technical support, software maintenance, and training.

Excerpted from an article by Raymond A. Krammes and Carl Hayden appearing in Public Roads magazine, Federal Highway Administration, January/February 2003.

Culvert Maintenance and Repair

Poorly working culverts can cause flooding during heavy rains that significantly damages roads and bridges. Even during normal wet weather, a crushed or plugged culvert that allows water to back up in roadside ditches will contribute to the deterioration of the road as the standing water prevents further drainage from the road base and subgrade. A soft base or subgrade will "give" under traffic, hastening break-up of the pavement.

Inspect your culverts at least once a year. After the inspection, prioritize the repair and maintenance they need, and schedule the work through spring, summer, and fall.

Routine Seasonal Maintenance Checklist

Spring

√ Inspect inside as well as both ends of the pipe.

√ Remove blockages (trash, brush, etc.).

Summer

√ Remove blockages.

√ Clean and flush the length of the pipe.

√ Repair, improve, or install headwalls, pipe ends, and splash pads.

√ Trim and remove brush at pipe ends, and mow grass and weeds.

√ Cut and remove trees and limbs that threaten to fall and block upstream ditches.

√ Establish vegetation on bare slopes at pipe ends.

√ Add fill to cover pipe more thoroughly.

Fall

√ Remove blockages.

√ Mark headwalls or pipe ends for snowplow operators.

GUIDE TO CULVERT REPAIR

CULVERT ENDS		
What you observe	***What may be the reason***	***How to fix it***
Scouring or erosion at the inlet	Ditch is too steeply graded. Pipe is poorly located or aligned. No headwalls. Pipe is clogged.	Line the inlet with stone. Realign the pipe. Install headwalls. Clean and flush the pipe.
Scouring or erosion at the outlet	Pipe is sloped too much. No endwalls or aprons. Pipe is too small.	Build a stone splash pad. Install endwalls or aprons. Check size and replace with a larger pipe.
"Ponded" water	Inlet is too high. Ditch grade is too flat.	Reset the pipe; match the inlet to the channel bottom. Regrade the ditch to maintain correct flow.
Dented or crushed ends	Vehicles or snowplows are hitting the ends.	Fix, mark and protect the pipe ends.
Heavy corrosion	Water flowing through the pipe is acidic.	Install a sleeve of PVC in the pipe or replace the steel pipe with a PVC, aluminum, or concrete pipe.
"Piping" around outlet	Pipe is incorrectly installed, causing water to flow along the outside surface of pipe.	Reinstall the pipe on suitable, properly compacted bedding. Install a headwall.
INSIDE CULVERT		
Sediment buildup	Pipe isn't sloped enough. Objects blocking the pipe to the culvert.	Reinstall the pipe at a slope of at least ¼ inch per foot. Debris is traveling from the ditch. Remove the blockage. Install check dams upstream of the culvert.
Sagging bottom	Foundation material has settled or has low bearing capacity.	Reinstall the pipe on suitable, properly compacted bedding.
Crushed top	Cover is inadequate. Soil around pipe isn't compacted sufficiently. Traffic load is too great.	Add cover. Reinstall the pipe more deeply and use suitable, properly compacted bedding and backfill or install multiple small pipes or a pipe with a different shape. Replace pipe with a stronger one.
Heavy corrosion	Water flowing through he pipe is acidic.	Install a sleeve of PVC in the pipe or replace the steel pipe with a PVC, aluminum or concrete pipe.

From "Checklists for Culvert Maintenance and Repair," LTAP Technical Information Sheet #89, The Pennsylvania Local Roads Program, Spring 2001 citing the Maine Local Roads Center.

New Guidance Document Can Help Reduce Railroad Crossing Collisions

In 2002, incidents at public highway-rail crossings in the United States resulted in 311 deaths and 859 injuries. Although the number of incidents at highway-rail intersections has declined significantly, from 4,465 in 1992 to 2,694 in 2002, the death and injury toll is still too high. Advanced technologies and traffic control devices for highway-rail crossings can help make highway travel safer and reduce back-ups as traffic congestion increases.

The U.S. DOT's recent report, *Guidance on Traffic Control Devices at Highway-Rail Grade Crossings*, can help engineers assess driver needs, specify appropriate passive and active traffic control devices and systems, and evaluate potential roadway design improvements. Some key points covered by the report include:

• **Signs**. Signs required or permitted by the *Manual on Uniform Traffic Control Devices* (MUTCD) are discussed. A table provides guidance on when various signs are applicable.

• **Active Traffic Control Devices**. Standard devices, such as flashing-light signals and automatic gates, and supplemental devices, such as active advance warning signs with flashers, are discussed.

• **Preemption/Interconnection**. Situations where preemption/interconnection is required or should be considered to mitigate intersection back-ups are discussed.

• **Pre-signals**. Pre-signals are operated as part of the highway intersection traffic signal system, but their displays are integrated into the railroad preemption program. When to implement the use of pre-signals is discussed.

• **Train Detection Systems**. Train detection systems need to provide a minimum of 20 seconds of warning time. Factors to consider before increasing warning time are listed.

• **Pedestrian and Bicycle Safety**. Fencing, swing gates, pedestrian barriers, pavement markings, and other ideas for improving pedestrian and bicycle safety are discussed.

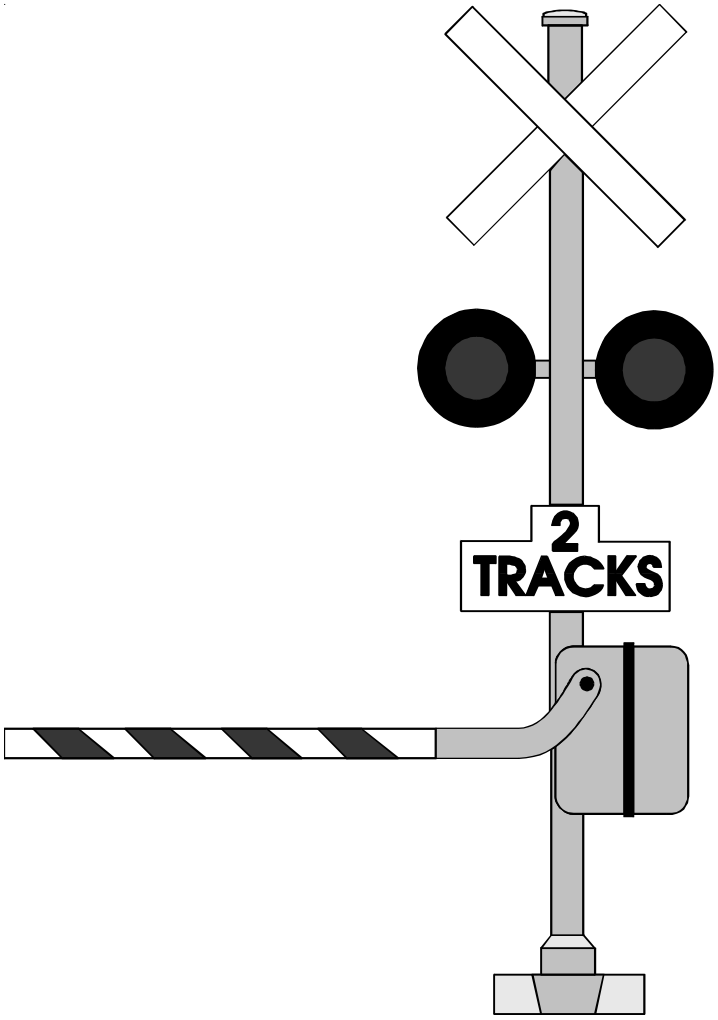
• **Crossing Closure**. Unneeded crossings should be eliminated. Factors to consider when making the closure decision are discussed.

• **Grade Separation**. Life cycle cost analysis rather than initial construction costs should govern decisions on separate grading. Factors to be analyzed are discussed.

Information in the report is intended to assist engineers in selecting among the many options for improving traffic safety at highway-rail intersections. Federal requirements for selecting traffic control devices are governed by the MUTCD. *Guidance on Traffic Control Devices at Highway-Rail Grade Crossings* is a guidance document only and is intended as a helpful supplement to the manual.

The report was written by the Department of Transportation's Highway-Rail Crossing Technical Working Group (TWG) led by representatives of the Federal Highway Administration, Federal Railroad Admini-stration, Federal Transit Administration, and National Highway Traffic Safety Admini-stration. The report is available on line at http://safety.fhwa.dot.gov/media/twgreport.doc

From "Reduce Railroad Crossing Collisions" brochure, U.S. Department of Transportation, 2003.



Pedestrian Safety Campaign

Did you know that a pedestrian is killed or injured every seven minutes? Is pedestrian safety a problem in your community? Do you feel that a Pedestrian Safety Campaign is needed in your community, but you don't know where to start?

The Federal Highway Administration's Pedestrian Safety Campaign Planner is a free ready-made toolkit of outreach materials that states and communities can customize and use locally. The threefold purpose of the campaign is to (1) sensitize drivers to the fact that pedestrians are legitimate road users and should always be expected on or near the roadway, (2) educated pedestrians about minimizing risks to their safety, and (3) develop program materials to explain or enhance the operation of pedestrian facilities, such as crosswalks and pedestrian signals.

The Pedestrian Safety Campaign Planner includes materials designed for use in television, radio, cinema, and print advertising. Some of the materials included are available in both English and Spanish. States and local communities would be responsible for implementing the campaign through local television and radio stations and print medias. A Campaign Planning Step-by-Step Guide that explains in detail how to implement the campaign successfully at the local level is included, as well as:

- Beta video with four TV public service announcements
- Six 30-second radio public service announcements
- Five full-color posters, 24" x 36" and three 11" x 17"
- Two brochures
- Eight cinema slides
- Six press releases
- Fifteen print public service announcements
- Fifteen newspaper articles
- Graphic images for promotional materials

For more information about the campaign or to find out how you can obtain a copy of the campaign materials, please contact:

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(leverson.boodlal@fhwa.dot.gov)
Federal Highway Administration
400 Seventh Street, SW
Room 3407
Washington, DC 20590

From information provided on the "Pedestrian Safety Campaign" web site at www.fhwa.dot.gov/safety/pedcampaign.

"Design for Pedestrians and Bicycles in Connecticut"
June 10, 2003 in Storrs, CT

Learn:

- How walking and biking facilitate community livability
- Design guidelines and standards for pedestrians and bicycles
- How to integrate walking and biking into the existing transportation system
- Design details that promote walking and biking

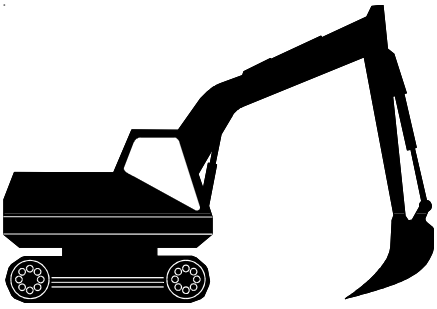
See Conference Calendar for more information.

Mark Your Calendars

Technology Transfer EXPO 2003

Wednesday, September 17
9:00 a.m. to 3:00 p.m.
University of Connecticut
Depot Campus, Storrs, CT

Co-sponsored by the Connecticut Transportation Institute's Technology Transfer Center and the Connecticut Highway Street Supervisor Association (CHSSA)



Technology Transfer EXPO offers an exciting opportunity to experience the latest in public works products, equipment, and services. Vendors, public service agencies, and professional organizations will present static and active hands-on displays, live demonstrations, and educational exhibits. The EXPO will also feature the ever-popular public works challenge. Register a team or individual from your municipality and see how their public works skills and knowledge measure up to last year's champions.

You can view on-line photos of the 2002 EXPO on the Connecticut Transportation Institute's web site at www.cti.uconn.edu and the CHSSA web site at www.chssa.org.

Please join us at Technology Transfer EXPO 2003, rain or shine. It's free and open to all.

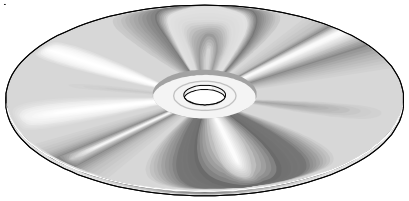
Public Works Management Software

The Road Surface Management System (RSMS) and Sign Inventory Management System (SIMS) software programs are now distributed together in a single compact disc by the New Hampshire Technology Transfer Center. The "Public Works Management Software (PWMS) Distribution" package contains the latest RSMS software and manual, the latest SIMS software and manual, a distress manual, a sign handbook, and other information. An additional Drainage Inventory Management System software component is under development.

The Connecticut Technology Transfer Center will no longer distribute individual copies of the RSMS or SIMS software upon request. If you would like a copy of the software, please request the PWMS Distribution CD from:

UNH Technology Transfer Center
33 College Road
Durham, NH 03824

Enclose a check for $25 and include your name, affiliation, address, phone number and email address. The New Hampshire Center will register you as a user and provide technical support and notices of updates to any of the PWMS products.



From Our Resource Library

To request any of the following materials, please contact us by phone at 860-486-5400, by fax at 860-486-2399, or use our on-line information request form www.cti.uconn.edu/ti/Technology/Info_request.htm.
Publications and CDs are free while supplies last.
Videotapes may be borrowed free of charge for two weeks.

PUBLICATION

Basic Traffic Control for Utility Operations: Guide to Temporary Traffic Control for Utility Operation
American Traffic Safety Services Association and Federal Highway Administration

This 49-page guide provides a quick reference to utility companies working with temporary traffic control. It is based on the standards and guidelines found in Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and the requirements of the Americans with Disabilities Act. The guide contains essential information for utility workers working near moving traffic, on sidewalks and at crosswalks, close to open lanes, or beyond the shoulder.

VIDEOTAPES

CCC: Making the Effort Works!
Federal Highway Administration and American Association of State Highway and Transportation Officials (19 minutes)

This videotape is designed to inform transportation agencies and utility companies of actions they can take toward avoiding delays and reducing or eliminating unnecessary project costs. It shows how good communication and strong coordination between the highway agency pre-construction staff and utility company engineers with planning, budgeting and utility relocation responsibility for a project can better understand competing needs, recognize the actions to avoid construction delays, and be motivated to work in partnership.

Safety Starts with Crash Data
International Association of Chiefs of Police, National Sheriffs' Association, Federal Highway Administration, National Highway Traffic Safety Administration and Federal Motor Carrier Safety Administration (15 minute comprehensive segment/8 minute summary)

This video emphasizes the role of law enforcement officers in improving highway safety through crash scene investigations and submission of accurate, complete, and timely crash reports. It is designed to provide officers with additional training in their role as data collectors, and can be used at basic and unit training and during formal crash investigation training.

CD-ROM

Culvert Management System (CMS)
Federal Highway Administration

This CD-ROM contains a culvert management system program and a CMS Users Manual. The system is divided into five modules:

- *Inventory Module* includes information about each of the culverts under the agency's jurisdiction.
- *Condition Module* maintains a record of the condition of each of the culverts.
- *Work Needs Module* allows the agency to define the allowable maintenance and rehabilitation options that can be performed on the culverts, applies costs to the work needs identified in the condition inspection, and ranks the work by work type and priority.
- *Work Funding Module* develops the long-term (up to five years) work program required for the work identified through the use of economic analysis.
- *Schedule Module* allows the development of an annual schedule of the work to be done.

Conference Calendar

Public Works: Planning for and Responding to Terrorism/Weapons of Mass Destruction

A Connecticut Road Scholar Program Elective Workshop

• May 20-22 in Storrs • May 28-30 in Bloomfield

Design for Pedestrians and Bicycles in Connecticut

A Connecticut Road Scholar Program Elective Workshop

• June 10 in Storrs

Managing the Small Highway Department

A Connecticut Road Master Program Elective Workshop

• June 3 in Rocky Hill • June 4 in Waterbury • June 5 in Storrs

Competent Person Training

A Connecticut Road Master Program Elective Workshop

• July 8 in New Britain • July 9 in Waterbury • July 10 in Torrington

Flagger Certification

A Connecticut Road Master Program Elective Workshop

• August 27 in Colchester • August 28 in Storrs • October 1 in Storrs • October 2 in Storrs

For more information on training programs, call the Connecticut Transportation Institute at 860-486-1384. Please visit our on-line Workshop Schedule information for updates and take advantage of our on-line workshop registration form at www.cti.uconn.edu/ti/Technology/Workshopsched.htm