RESEARCH & TECHNOLOGY
TRANSPORTER

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U. S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

SAFETY

FHWA Introduces Informational Guide on Roundabouts

A comprehensive informational guide for roundabouts is about to be published. The report, *Roundabouts: An Informational Guide* (RIG) covers all aspects of the practice from planning to landscaping. The table of contents is as follows:

- Chapter 1—Introduction.
- Chapter 2—Policy Considerations.
- Chapter 3—Planning.
- Chapter 4—Operation.
- Chapter 5—Safety.
- Chapter 6—Geometric Design.
- Chapter 7—Traffic Design and Landscaping.
- Chapter 8—System Considerations.

Objectives of the RIG are both educational and prescriptive. The guide provides background information on roundabouts, such as definitions and characteristics of safety and traffic operation issues. The bulk of the safety and operational benefits are based on studies conducted in Europe and Australia. It also includes information about all roadway users—automobile drivers, bicyclists, and pedestrians—with equal attention.

The guide is prescriptive in that it includes all pertinent policies and criteria by the American Association of State Highway and Transportation Officials (AASHTO), in addition to acceptable international practices. Researchers extensively and critically reviewed European and Australian practices and research publications to combine and create the best recommendations. Although guidelines and practices may vary from one country to another, a certain consensus or trend is common to most countries. When researchers could not

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Roundabouts: An Informational Guide **provides background information and discusses the safety and operational benefits of roundabouts.**

RESEARCH & TECHNOLOGY
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The *Research and Technology Transporter* communicates FHWA research, development, and technology accomplishments, findings, information, and technology transfer opportunities. Its audience is transportation engineers and professionals in State and local highway agencies, State DOTs, Local Technical Assistance Programs, Divisions, Resource Centers, Core Business Units, academia, and the research community. The eight-page newsletter is published monthly by FHWA's RD&T service business unit. Editorial offices are housed at the Turner-Fairbank Highway Research Center. Comments should be sent to the editor at the address below. Field offices are encouraged to submit articles for publication via the appropriate agency technology leader from the editorial board listed below. The newsletter can be viewed online at www.tfhrc.gov. Subscriptions to the *Transporter* are free. Send your request to Judy Dakin at the address below, or send email to judy.dakin@fhwa.dot.gov.

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INTERNATIONAL

Study Group Investigates Sustainable Transportation in Other Countries

Sweden, Germany, the Netherlands and the United Kingdom are known as nations that have been actively addressing sustainable transportation issues for several years. In order to more closely examine these countries' experiences and consider their applicability in the United States, a study group traveled to the four counties in the period September 17 through October 3, 1999. The study group included representatives from the U.S. Department of Transportation (US DOT), AASHTO, metropolitan planning organizations, city and county governments, and academia. In each country, the group met with officials engaged in sustainable transportation efforts.

In the United States, the transportation community has an increasing interest in sustainable transportation and its links to land use and urban development patterns, economic growth, environmental impacts, and social equity. Federal, state, and local agencies as well as private organizations are working to translate the broad goals of sustainability into specific transportation policies, objectives, and programs.

A variety of specific strategies are being pursued in Europe to increase the sustainability of the transport system.

Land use-transportation strategies are used to reduce trip lengths and facilitate the use of transit, biking, and walking. Specific actions include revitalizing existing centers, historic preservation, infill and brownfields redevelopment; focusing high-density development near transit; encouraging development in and contiguous to existing centers already served by transit; and planning for compact, mixed-use suburban development, which is both walkable and sufficiently dense to support transit services.

Transit improvements include developing extensive systems of priority lanes for buses, high-quality architecture, and landscaping at transit stations and stops; planning for door to door service (including walk- and bike-access planning as part of transit planning); improving intermodal transfers; and developing high-quality customer information services.

Extensive systems of bikeways and bike parking exist in each of the countries visited, and bikes can be taken on many transit systems. High quality pedestrian spaces are plentiful and more are being created by widening sidewalks, calming traffic, creating vehicle-free or vehicle-restricted zones, and bulbing out intersections to facilitate pedestrian crossings.

Biodiversity is being protected through practices like providing animal-crossing corridors and

maintaining shoulders and medians as habitat. Bioengineering is used to create environmentally sound, aesthetic structures, and recycled materials are selected to reduce environmental impact.

Logistics and operations improvements and ITS technologies are being applied to maximize the capacity of existing facilities, thereby reducing congestion, improving safety, and cutting down on the need for new facilities.

Fuel taxes in these countries are already several times that in the United States, but are not earmarked for transportation; instead, general funds are allocated to transportation and other programs to reflect government policies and priorities. Because transportation agencies must demonstrate results to compete effectively for funds, performance measurement and evaluation are important elements of European practice.

All of the specific measures being used in the countries visited were thought to have potential applicability to the United States, recognizing the wide range of conditions among the States and metropolitan areas. Of particular interest to team members were car sharing and eco-driving projects, as well as the possibilities for joint development to help pay for expensive, but socially and environmentally attractive, project designs. A final report on the group's findings will be issued in late 2000.

The downtown commercial district in The Hague, Netherlands, accommodates pedestrian sidewalks, bike lanes and parking, a light rail tram, and cars.

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INFRASTRUCTURE

University of Michigan Student Wins LTPP Contest

Christopher Byrum, a civil engineering student at the University of Michigan at Ann Arbor, was awarded the grand prize of the International Contest on LTPP Data Analysis, at the American Society of Civil Engineer's (ASCE) 1999 Annual Meeting in Charlotte, NC.

Designed primarily for engineering students and sponsored by the American Society of Civil engineers (ASCE) and FHWA, the contest involved using data from the Long-Term Pavement Performance (LTPP) studies. Students, who were encouraged to team with a highway agency or a consulting firm, determined the research objective, conducted the research, and analyzed the data.

Byrum was awarded top honors for his research and paper, entitled, "The Effect of Locked-in-Curvature on PCC Pavement." The paper shows how slab curvatures can be analyzed using the LTPP data. Warped slabs have long been recognized as a performance problem for concrete pavements. The paper explains how slab curvature can be measured using the available LTPP high-speed profiles and how apparent locked-in slab curvature affects jointed concrete pavement performance.

A second International Contest on LTPP Data Analysis is currently underway. Papers for the current contest are due June 1, 2000. Additional information on the contest is available at the DataPave website *(datapave.fhwa.dot.gov)*.

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FHWA's NDE Validation Center and Partners Perform Tests on Prestressed Concrete Box Beams

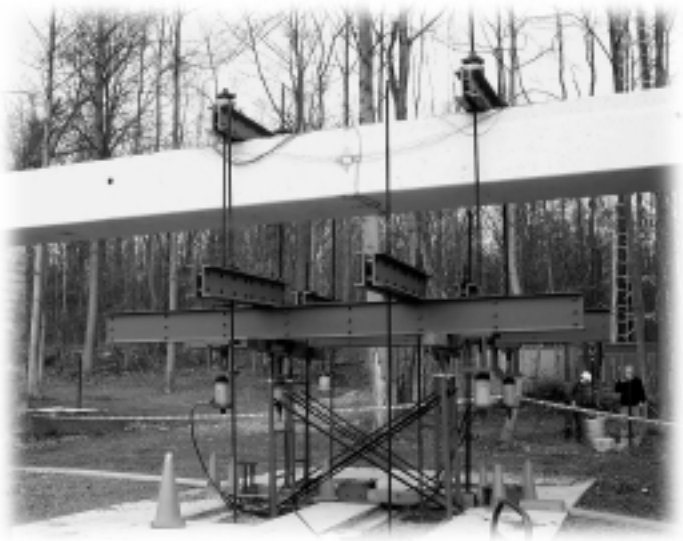
On October 19, 1999, the Nondestructive Evaluation (NDE) Validation Center in collaboration with the New York State DOT performed the first test in a series of four tests. This first test was performed on a severely deteriorated full-scale prestressed concrete box beam and was set up to verify and validate a model that predicts the behavior of a severely deteriorated beam to initial cracking.

The second test in the series was conducted on December 9, 1999. A moderately deteriorated beam was tested to ultimate failure.

This project will allow researchers to investigate the feasibility of strengthening prestressed concrete beams using composite laminates. The objectives of the project are:

- To investigate the behavior of deteriorated prestressed concrete box beams at the AASHTO service-load level and ultimate-load level.
- To improve the understanding of bonded composite laminates in retrofitting deteriorated prestressed concrete beams.
- To develop design and construction guidelines for using composite laminates to strengthen prestressed concrete box beams, whether for rehabilitation or rating improvement.

To achieve these objectives, five deteriorated prestressed box beams were removed from the Kayaderosseras Bridge located on Interstate 87 over the Kayaderosseras Creek, near Malta, NY. The bridge consists of twin structures, which supports two lanes of northbound and southbound traffic, respectively. The original bridge was constructed in 1961, but due to extensive deterioration, the bridge was removed from service in 1998. The original design was based on the 1957 NYSDOT Standard Specification for Highway Bridges and a modified H20-S16-44 loading. During demolition of the existing bridge, the five beams were identified and transported to TFHRC for testing.



Testing of a box girder at the Turner-Fairbank Highway Research Center (TFHRC).

The next test, Test 3, will be conducted in March 2000. This test will evaluate the effectiveness for the bonded laminate for use as a strengthening tool for prestressed beams. The test will also be used to validate design procedures and models and to develop guidelines for use in the State of New York. The use of active thermography for evaluating composite laminate bond will be evaluated. As part of the composite installation, specimens of laminates containing defects are planned for use in developing NDE procedures for quality control. For this test, appropriate composite laminates and installers have already been identified.

Test 4 will be conducted following Test 3. The test will evaluate the load carrying capacity of the TFHRC test bridge and provide loading for a test of abutments made of geosynthetic reinforced soil (GRS). The test will also be used to evaluate load-rating tools developed through the NDE program. Three beams will be placed on the GRS abutment and left in place for future testing. A shear transfer system will be installed to insure the beams act as a single unit. The beams to be used for Test 4 are identified and are onsite at TFHRC.

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FHWA Researchers Conduct Drilled Shaft Experiments at TFHRC

Researchers at TFHRC performed laboratory load tests on large-scale drilled shaft models in partnership with the Association of Drill Shaft Contractors and its contractor for the experiments, the University of Houston (UH).

A drilled shaft is a type of deep foundation commonly used to support bridges or other structures along roadways. The shafts are constructed by augering a hole into the earth to a specified depth, then lowering a steel rebar cage into the hole and filling the hole with concrete. In some instances, the concrete does not completely fill the hole and voids are created along the length of shaft. Such defects make the shafts susceptible to failure during an extreme event such as an earthquake or truck/ship impact.

The purpose of the large-scale load tests was to quantify the effect defects have in reducing the resistance to lateral loads. Several teams at TFHRC combined resources to assist visitors from UH in performing the experiments. FHWA's Structures Laboratory at TFHRC was one of the few places in the United States with the necessary equipment and space to perform the large-scale experiments.

The experiments involved load-testing two 0.76-m (30-in) diameter by 4.5- m- (15-ft-) long reinforced concrete drill shaft sections. One of the shafts had a large defect cast into the concrete to model the loss in resistance to lateral load.

By comparing the results of the experiments, researchers found that the shaft with the defect had about a 20 percent reduction in capacity. The results of these experiments will be correlated with similar test to formulate a model to aid designers in selecting a realistic lateral capacity reduction factor.

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The shaft was supported on each end and loaded along the middle section. Deformation was monitored and cracks were mapped during the course of the experiments.

A close up of the defect showing the exposed rebar bending at the onset of failure. The steel balls attached to the rebar were targets for the NDE team's laser device that provided useful information about the bending of the rebar.

FHWA Makes Progress in Protecting Wildlife Along Highways

To counteract habitat loss and fragmentation and to help prevent roadkill, teams of transportation specialists and wildlife experts are using strategies ranging from site-specific projects like creating bear underpasses to developing regional models that combine conservation biology, landscape ecology, and human safety concerns with long-range transportation planning.

Every year, millions of vertebrates are killed by vehicles traveling on roads in the United States. More than 200 motorists die in these animal-vehicle collisions and thousands more are injured.

Highway collisions resulting in roadkill have significantly reduced the populations of the Florida panther and other Federally listed threatened and endangered wildlife species. Two other phenomena—habitat loss and habitat fragmentation—threaten an even larger number of species.

Permanent habitat loss has resulted from highway construction, dams, urban development, agricultural conversion, and other factors. For example, the Federally threatened grizzly bear now roams in less than 2 percent of its former range south of Canada.

Habitat fragmentation, which divides populations into smaller, more isolated units, threatens the survival of wildlife species that have to cross roads to fulfill their biological needs Eleven of these success stories are highlighted in a new FHWA brochure called *Critter Crossings: Linking Habitats and Reducing Roadkill*. For details on these exemplary projects and processes, visit *www.fhwa.dot.gov/environment/wildlifecrossings.* The site is an online version of the brochure, *Critter Crossings: Linking Habitats and Reducing Roadkill.*

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Populations of Florida panthers are dwindling because of animal-vehicle collisions on the Nation's highways.

FHWA Continues Successful Environmental Excellence Awards Program

Organizers of FHWA's biennial awards program will release the call for entries for the Environmental Excellence Award Program at an Earth Day Celebration on April 21.

The Environmental Excellence Award Program recognizes those outstanding transportation projects, processes, and people who incorporate environmental stewardship into the planning and development stages of a transportation project. This program, which began in 1995, illustrates FHWA's commitment to honoring partners who take the extra effort to achieve environmental excellence.

In addition, three new categories have been added to the 2001 Environmental Excellence Awards Program. The categories will recognize contributions to enhance the environment in the following areas: Environmental Streamlining, Environmental Research, Environmental Leadership, Wetlands, Water Quality and Ecosystems, Nonmotorized Transportation, Cultural Resources, Vegetation Management, Noise Abatement, Air Quality Improvement, Livable Communities, Scenic Byways, and Recycling. These winners will be announced at the 2001 Earth Day Celebration in Washington, D.C.

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develop a convincing recommendation, the decision was left to the discretion of the highway planners and engineers.

Well-designed roundabouts have considerable safety benefits. They reduce the number of potential traffic conflicts and reduce drivers' speed. Based on studies from other counties and the United States, there are 40 to 50 percent fewer injuries or fatal crashes reported in roundabouts than in conventional stop-controlled or signalized intersections. The safest roundabouts are those with single-lane entries.

Highway planners and designers can learn from these studies and work to reduce crash records at conventional intersections in the United States. Twenty to 25 percent of fatalities and about 35 to 45 percent of crashes involving injury occur at conventional intersections. About 100 roundabout sites have been built in the United States and roughly 150 sites are under design or construction. In comparison, the United Kingdom has built approximately 8,000, and France has 17,000 sites. Other countries, including Australia, Germany, the Netherlands, have also constructed numerous roundabouts.

Roundabouts: An Informational Guide (FHWA-RD-00-067) will be published on FHWA's website, *http://www.tfhrc.gov.* You can order a copy of the report in advance by sending a fax to FHWA Report Center at (301) 577-1421, or by e-mail, *marl.green@fhwa.dot.gov.* FHWA's Report Center voice number is (301) 577-0818. FHWA Divisions and Resource Centers will be receive copies directly without having to order them.

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National Work-Zone Safety Awareness Week is April 3–7

Don't forget April 3–7, 2000 has been designated as National Work-Zone Safety Awareness Week. Safety is the number one transportation priority in the Department of Transportation. Safety should also be an individual priority. Get involved with work-zone safety activities in your State or local area.

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PROFESSIONAL DEVELOPMENT

Dwight David Eisenhower Transportation Fellowship Applications Due

Application submissions for Dwight David Eisenhower (DDE) campus-based fellowship awards are due to Universities and Grants Programs on April 1.

The DDE campus-based transportation fellowship awards afford opportunities to students at Minority Institutions of Higher Education (MIHEs) to pursue careers in transportation. MIHEs are comprised of Historically Black Colleges and Universities/HBCUs (accredited institutions of higher education founded prior to 1964 that had the principal mission of educating African Americans); Hispanic Serving Institutions/HSIs (colleges and universities whose undergraduate full-time equivalent student populations are at least 25 percent Hispanic); and Tribal Colleges/TCs (tribally chartered colleges or federally chartered Indian colleges).

Participating colleges and universities in this award category assemble panels on their respective campuses, which evaluate and rank applicants and forward ranked lists and applicant credentials to the Director of Universities and Grants Programs for consideration.

Since inception in 1991, 22 HBCUs, 8 HSIs and 1 TC have nominated students to the Eisenhower Transportation Fellowship in the campus-based award category; 491 students have received fellowships. Additional MIHE students and faculty have applied to and been accepted in the Eisenhower nationally-competed award categories—Grants for Research, Graduate and Faculty Fellowships.

Copies of activities reports on each of the campus-based award categories from 1991-1998 as well as a retrospective of the DDE Transportation Fellowship Program during the Intermodal Surface Transportation Efficiency Act (ISTEA) years are available by contacting Angela Ford at (703) 235-0538 or *angela.ford@fhwa.dot.gov.*

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