

NHI Real Solutions

Raising the bar for excellence in training



The National Highway Institute (NHI) is pleased to announce the first edition of *NHI Real Solutions*—a collection of articles that highlight real-world applications of NHI training. The articles demonstrate how transportation professionals are applying the tools, strategies, and lessons learned during NHI training to improving the planning, construction, and operation of the national highway system. We hope these stories peak your interest in how NHI training can positively impact the valuable work you do every day.

Improving Program Delivery at NHI

Throughout our 37-year history, NHI has strived to provide high-quality training that addresses the full life cycle of the highway transportation system. Based on customer feedback, and using the latest technologies available, we continue to improve our offerings and delivery mechanisms. Below we highlight some key program improvements.

Improving courses and instruction. In 2006, NHI adopted scannable evaluation forms and online host surveys to enable course participants and hosting organizations to provide feedback on NHI courses and instructors. We continually monitor this valuable feedback to stay abreast of customer satisfaction and identify opportunities for improvement, whether updating courses or working with instructors to improve delivery. We are proud to report that in fiscal year 2007, customers rated NHI an average of 4.31 on a 5-point scale for satisfaction with NHI courses and 4.42 for satisfaction with our instructors.

Offering low-cost training. One of the most common reasons transportation professionals cite for why they are unable to attend an NHI course is because of travel costs and scheduling issues. To reduce costs and save time, NHI now is using Acrobat

Connect and Adobe Presenter to expedite development of course content and expand the number of distance learning opportunities available.

Improving communication about new and updated courses. In 2006, NHI launched 24 new courses and updated 5 existing offerings. To alert the transportation community about new and updated trainings, we now list these courses prominently on our homepage, distribute course summaries to the transportation training community, and place course announcements in transportation-related publications.

Providing new tools and resources via the NHI Web site. Based upon customer and partner feedback, NHI recently modernized its Web site. Customers now can purchase materials via the NHI store using their credit cards. Hosts now have the option to sell “public seats” so customers can enroll in sessions and pay online. In addition, new “advanced search” features enable site visitors to search the NHI catalog by State, session location, knowledge level, and date ranges.

Providing recognition for customers’ professional development. In 2006, NHI began offering Certificates of Accomplishment to support transportation professionals as they learn, build, and refine their skills in specific topic areas. The Certificates of Accomplishment represent “suites” of complementary NHI courses—bundled together—that enable participants to enhance their depth and breadth of knowledge and expertise in specific disciplines.

TO LEARN MORE ABOUT ANY OF THESE TOPICS, PLEASE VISIT WWW.NHI.FHWA.DOT.GOV.

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Participants are attending a session of NHI training in West Virginia.

Photo: West Virginia Division of Highways

Using SAFETEA-LU Funds for Training

West Virginia charts the way

State departments of transportation (DOTs) across the country are in a tight spot.

An impending wave of baby boomer retirements coupled with shrinking budgets are putting the squeeze on highway agencies. But there is a light at the end of the tunnel. With passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in August 2005, States are no longer required to match Federal funds to finance staff training.

This was welcome news to Gary Lanham, P.E., engineering programs coordinator for the West Virginia Department of Transportation (WVDOT). "We've been restricted for the last 8 to 10 years in training funds because we were 100 percent State funded," Lanham says. Although the previous transportation

legislation offered an 80-20 Federal/State match, WVDOT officials were reluctant to exercise that option, preferring to devote the majority of the State's funding to capital projects.

According to Section 5204e of SAFETEA-LU, States have discretionary

authority to commit a portion of federally allocated core program funds to workforce development, which the act defines as "activities associated with surface transportation career awareness, student transportation career preparation, and training and professional development for surface transportation workers, including activities for women and minorities."

Although the amount committed to training reduces a State's core program funds, many States regard investing in workforce development as necessary to the success of capital programs and their overall transportation missions.

"Training is becoming critical," Lanham says, "especially at the intermediate level." He estimates that 40 to 50 percent of the current WVDOT workforce will retire over the next 10 years. Already West Virginia has used SAFETEA-LU funding for everything from in-house conferences and training to National Highway Institute (NHI) courses. Recently, West Virginia hosted sessions of NHI courses on right-of-way issues, a topic that Lanham describes as critical to West Virginia's highway workforce—Appraisal for Federal-Aid Highway Programs (FHWA-NHI-141043) and Appraisal Review for Federal-Aid Highway Programs (FHWA-NHI-141044).

How does a State take advantage of this new funding opportunity? Lanham says the first step was obtaining buy-in from West Virginia Secretary of Transportation Paul A. Mattox, who readily agreed. The next step, and perhaps the most critical, was having a detailed annual training plan and budget in place before approaching the Federal Highway Administration (FHWA) State division office for approval. "West Virginia already had a good training plan and budget developed over the last 15 years," Lanham says. "We just had to meet with FHWA to see how to modify the plan to meet SAFETEA-LU requirements."

Though it took 8 to 10 months to finalize the approvals and begin accessing the funding for training purposes, Lanham says the timeline may be shorter now that a few States have gone through the process and helped FHWA work out the kinks. In fact, FHWA recently released guidance on using Federal-aid funds for training, education, and workforce development (www.fhwa.dot.gov/opd/qanda.htm). In addition, Lanham says he will gladly offer advice to other State officials. "We're all in this together," he says, "cooperate and graduate."

FOR MORE INFORMATION, CONTACT GARY LANHAM AT (304) 558-9773 OR GLANHAM@DOT.STATE.WV.US.

States are no longer required to match Federal funds to finance staff training.

Partners In ITS Training

NHI and CITE offer online and classroom versions of key courses

From electronic tolling and traffic cameras to 511 traveler information and road weather management, intelligent transportation systems (ITS) encompass a broad range of technologies that together help relieve congestion and improve safety on U.S. roadways. Recognizing the role that these technologies would play in enhancing mobility on the congested East Coast, the I-95 Corridor Coalition—an alliance of transportation agencies, toll authorities, and related organizations from Maine to Florida—established the Consortium for ITS Training and Education (CITE) in late 1998. The purpose of CITE was to educate transportation engineering students and professionals on the applications and management subjects associated with ITS technologies.

Today, managed and administered by the University of Maryland, CITE includes more than 100 universities and industry associations focused on providing comprehensive advanced transportation training and education. Its curriculum features graduate- and undergraduate-level courses, as well as skills-based training and technology transfer, covering transportation engineering, computer science, systems engineering, and project management. The courses are all delivered in an interactive Web-based format and are available 24 hours a day, 7 days a week, which eliminates the cost and inconvenience of attending a course away from the office.

Through an innovative partnership between CITE and the National Highway Institute (NHI), transportation engineering students and professionals have the option to enroll in several courses that are offered both as Web-based training through CITE and instructor-led training through NHI. Further broadening the menu of choices, CITE and NHI both offer a collection of additional courses that are unique in each organization.

CITE offers certificate programs that participants can use to hone their skills in the following three areas: ITS Project Management, Traffic Engineering and Operations, and ITS Systems. Each certificate program requires participants to complete three core courses, two electives, and one bonus course. And CITE requires that all six be completed in 1 year to earn a certificate.



The CITE Web site.

Upon completing the program, participants receive a certificate and continuing education units certified from the University of Maryland. Where courses overlap with those offered through NHI, CITE offers credit for successful completion of the NHI courses toward participants' certificate programs.

FOR MORE INFORMATION, VISIT WWW.CITECONSORTIUM.ORG.

Key NHI and CITE Courses on ITS Topics

Course Title	Course Number	Instructor-Led Training (NHI)	Web-Based Training (CITE)
Managing High Technology Projects in Transportation	FHWA-NHI-137026	✓	✓
Introduction to Systems Engineering for Advanced Transportation	FHWA-NHI-137024	✓	✓
Configuration Management (CM) for Traffic Management Systems	FHWA-NHI-137042	✓	✓
ITS Awareness Seminar	FHWA-NHI-137001	✓	✓
Deploying Integrated ITS – Metropolitan	FHWA-NHI-137002	✓	
Rural ITS Toolbox	FHWA-NHI-137007	✓	
Integrated Transportation Management for Small- and Medium-Sized Communities	FHWA-NHI-137043	✓	
Improving Highway Safety with Intelligent Transportation Systems (ITS)	FHWA-NHI-137044	✓	
Advanced Systems Engineering	FHWA-NHI-137045		✓



A team of transportation professionals confers during an RSA on a stretch of U.S. 97 in Oregon.

Road Safety Audits

Saving lives, one roadway at a time



An estimated 43,000 people die on U.S. roadways every year. That means, on average, 117 traffic fatalities occur every day, including one road departure fatality every 21 minutes, one intersection fatality every hour, and one pedestrian fatality every 2 hours.

"These numbers are unacceptable," says Elizabeth Alicandri, director of the Federal Highway Administration (FHWA) Office of Safety Programs' Road Safety Audits Implementation Team. Alicandri's team works closely with FHWA's Highways for LIFE (HfL) program, which aims to advance longer lasting highway infrastructure using innovations to accomplish the fast construction of efficient and safe highways and bridges (thus spelling out "LIFE"). HfL uses the broad term "innovations"

to cover technologies, materials, tools, equipment, procedures, specifications, methodologies, and processes or practices used in the finance, design, or construction of highways.

One promising technology is a Road Safety Audit (RSA), which is a formal examination of the safety performance of an existing or planned road or

intersection by an independent, multidisciplinary team. An RSA offers a low-cost means to identify and prioritize safety issues and proactively reduce deaths and injuries on roadways.

Although most highway agencies already have established safety review processes, RSAs involve people from diverse

disciplines who have not been involved in the project's design or implementation and focus specifically on safety issues—for motorists as well as pedestrians, bicyclists, elderly road users, and others with special needs.

RSAs can help produce designs that limit the number and severity of crashes, promote awareness of safe design practices, and reduce costs by identifying and correcting safety issues before projects are built. Highway authorities formally respond to the RSA team's suggestions and either implement the recommendations or document the reasons for not doing so.

Experiences reported by a number of States confirm that RSAs are saving lives and money. "RSAs helped our engineering team develop a number of solutions incorporating measures that were not originally included in the projects," says Terecia Wilson, director of safety for the South Carolina Department of Transportation (SCDOT). "The very first audit conducted saved SCDOT thousands of dollars by correcting a design problem."

To teach transportation professionals how to conduct an RSA and encourage more widespread use of this practice, FHWA and the National Highway Institute (NHI) developed the course Road Safety Audits and Road Safety Audit Reviews (FHWA-NHI-380069). The course covers how to perform an RSA as a member of a multidisciplinary team and how to assess the benefits of an audit on a statewide basis.

"A major effort has been underway to raise awareness of RSAs," says Kathleen Bergeron, program coordinator for HFL, "but hands-on training courses, such as those offered by FHWA, can take the individual beyond mere awareness to comprehension and a conviction for the dramatic benefits the RSA approach offers."

FOR MORE INFORMATION ABOUT RSAs, VISIT [HTTP://SAFETY.FHWA.DOT.GOV/rsa](http://SAFETY.FHWA.DOT.GOV/rsa). TO READ THE FULL DESCRIPTION OF THE NHI COURSE ROAD SAFETY AUDITS AND ROAD SAFETY AUDIT REVIEWS (FHWA-NHI-380069), VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV.

"The very first audit conducted saved SCDOT thousands of dollars by correcting a design problem."

– Terecia Wilson, SCDOT



Designing for Pedestrians and Bicyclists

NHI targets safety and mobility for other system users

In 1990, former Federal Highway Administrator Thomas Larson described walking and bicycling as “the forgotten modes” of transportation. But much has changed since then. The Intermodal Surface Transportation Efficiency Act in 1991 underscored the important role walking and bicycling play in creating a balanced, intermodal transportation system. Subsequent legislation, specifically the Transportation Equity Act for the 21st Century in 1998 and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users in 2005, continued building State and local commitments to devoting staff and financial resources to the creation of infrastructure that is friendlier to pedestrians and bicyclists. In fact, Federal funding for these facilities has risen from \$22.9 million in 1992 to \$395 million in 2006.

Current Federal Highway Administration (FHWA) policy encourages the inclusion of pedestrian and bicycle facilities on all transportation projects. And the Americans with Disabilities Act (ADA) requires that sidewalks—both newly constructed and existing facilities—be accessible to people with disabilities. To help transportation professionals comply with these Federal requirements, the National Highway Institute (NHI) offers courses to help practitioners meet the growing demand for more and better walking and bicycling facilities.

NHI developed Pedestrian Facility Design (FHWA-NHI-142045) and Bicycle Facility Design (FHWA-NHI-142046) to provide participants the tools to address the needs of pedestrians and bicyclists in their plans and designs for

Participants in a session of the NHI Bicycle Facility Design Course in Frankfort, KY, are working on group designs.

Photo: Theo Petritsch, Senior Transportation Engineer, Sprinkle Consulting

infrastructure improvements. Participants learn to apply planning concepts, practice designing facilities, and become familiar with key references for working on real-world projects.

Both 1.5-day courses rely on traditional instructor-led segments, large and small group exercises, and, most importantly, participant feedback. “NHI instructors recognize that course participants have a huge amount of experience and knowledge, and the instructors encourage them to share that knowledge,” says NHI Instructor Theo Petritsch, who teaches the Pedestrian and Bicycle Facility Design courses.

Participants receive copies of the American Association of State Highway and Transportation Officials’ guides for designing pedestrian and bicycle facilities as reference documents, which include cutting-edge studies and excerpts from other manuals. The courses target transportation planners, roadway designers, and traffic operations engineers who are involved in developing pedestrian and bicycle facilities.

Petritsch adds that for each course NHI provides two instructors, one of whom is a professional engineer. “Our instructors have decades of experience working with elected officials; regional planning agencies; and State, county, and city design departments, safety offices, and developers. These individuals not only write comprehensive plans and prepare design drawings, but they also are nationally recognized researchers in the area of nonmotorized transportation and frequently develop planning tools for Federal, State, and local agencies.”

TO READ THE FULL COURSE DESCRIPTIONS, VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV.



Linking Land Use and Transportation

Improved coordination leads to better planning



West Sacramento's Triangle Waterfront plan proposes a vital business district and a pedestrian-friendly bridge connected to Sacramento's R Street.

Photo: City of West Sacramento



This illustration of the proposed West Capitol Corridor in Sacramento shows mixed-use development combining broad sidewalks, a bicycling lane, and landscaping features.

Photo: City of West Sacramento



Gridlock. The word itself calls to mind gnashed teeth, lost time, and wasted fuel.

According to experts at the Federal Highway Administration (FHWA), there is no silver bullet to solve the Nation's congestion problems. Instead, a variety of approaches offer the promise of reducing its impact on our lives. One solution, already making a splash in communities across the country, involves linking transportation and land use planning.

"We're starting to get a better understanding of how land use affects transportation and how transportation affects land use," says Robert Ritter, team leader for the Planning Capacity Building Team in the FHWA Office of Planning.

Transportation planning is led by State departments of transportation (DOTs) and metropolitan planning organizations (MPOs). Land use planning, on the other hand, is determined by local officials and influenced by private developers. Because of a disconnect between the disciplines, the two types of planning may not be as integrated or coordinated as they could be.

To bridge this gap, the National Highway Institute (NHI) partnered with the FHWA and Federal Transit Administration Offices of Planning, the U.S. Environmental Protection Agency, and the National Transit Institute to create the 3-day course Transportation and Land Use (FHWA-NHI-151043). Developed in cooperation with State DOTs, MPOs, academia, and the transit industry, the new course is designed to encourage a more holistic view of development.

"The goal is to integrate planning by looking at how transportation relates to the needs of the broader community,

including schools, economic development, freight issues, and resource protection," Ritter says.

The course draws on recent research by experts across the country and uses real-world case studies to spur class discussions. Course materials include a glossary of key terminology and definitions to help land use planners and transportation planners understand a common vocabulary.

"Getting the right people to the table and letting them know why it's important for them to be there is critical," Ritter says, "as is ensuring that each player understands the roles and responsibilities of the others, as well as the value of public participation."

Course participants can expect to learn how transportation decisions affect land use and growth patterns on both regional and local scales, how local comprehensive planning and land use regulatory activities can support local and regional transportation objectives, and how land use considerations can be integrated with various transportation planning processes, including statewide and metropolitan planning, corridor planning and alternatives analyses, and the National Environmental Policy Act process. The course also covers the various analytical tools that are available for measuring and forecasting the impacts of transportation and land use decisions, including geographic information systems.

"People are tired of congestion," Ritter says, "and better planning is one way we can deal with it."

THE NHI COURSE, TRANSPORTATION AND LAND USE (FHWA-NHI-151043), SHOULD BE AVAILABLE FOR SCHEDULING BY LATE 2007. VISIT WWW.NHI.FHWA.DOT.GOV FOR SCHEDULING INFORMATION. FOR MORE INFORMATION ON TRANSPORTATION AND LAND USE PLANNING, PLEASE VISIT WWW.FHWA.DOT.GOV/PLANNING/PPASG.HTM OR CONTACT JODY McCULLOUGH AT (202) 366-2825 OR JODY.MCCULLOUGH@DOT.GOV.



Managing Noise From Highway Traffic

In the photo above, a noise barrier is under construction along Route 30 in Lancaster County, Pennsylvania. The barrier will mitigate both construction noise and subsequent traffic noise.

Photo: Mark Ferroni, FHWA

Ever wonder what heavy truck traffic sounds like to a homeowner living near a highway? What if trees were planted or a noise wall was installed? Would that help? Ever wonder how traffic noise is measured, predicted, and controlled? Were you aware that traffic noise is regulated at the Federal and State levels? These questions and more are at the heart of a new course developed by the National Highway Institute (NHI).

The Federal Highway Administration (FHWA) recognizes that traffic noise can be a contentious issue during public involvement hearings for highway construction and rehabilitation projects. Quite often, businesses and residents near proposed projects raise concerns about the impact of highway noise on work, sleep, or recreation in the area. NHI's new 3-day course, entitled Highway Traffic Noise (FHWA-NHI-142051), will help educate engineers, environmental specialists, designers, planners, and consultants about traffic noise and ways to reduce the impacts.

Shaped by a technical panel of FHWA noise specialists, environmental specialists at State departments of transportation, and the chair of the Transportation Research Board's Committee on Transportation-Related Noise and Vibration, the course is an introductory, yet comprehensive, overview of highway traffic noise. Topics covered include the basic principles of acoustics, how to determine when a noise analysis is required, and typical strategies to mitigate noise in highway projects. The course also provides an overview of the FHWA Traffic Noise Model (FHWA TNM), which was developed to predict noise levels and evaluate mitigation options.

In addition to a presentation on Federal noise regulations and policies, the noise specialist from the host State is invited

to present his or her State's policies and procedures to ensure that this training is relevant to those attending. Participants also will learn about noise-compatible planning, which encourages State and local governments to prohibit noise-sensitive land uses adjacent to highways. And participants will become familiar with the reference documents, tools, and models for assessing noise and implementing countermeasures.

NHI commissioned a customized version of the Interactive Sound Information System (ISIS) as part of the course design. ISIS is a noise simulation software program that employs high-quality digital recordings, precise sound control, and graphic imagery to present noise from various traffic loads, and demonstrates the noise-reducing impacts of various barriers.

According to FHWA Noise Team Leader Mark Ferroni, "ISIS is a unique tool that enables course participants—and ultimately communities and decisionmakers—to experience first-hand the effects of noise and assorted countermeasures, giving them valuable information to guide the choices they make about projects."

He adds, "Highway traffic noise is a complex and very scientific discipline. This training is cutting edge and a nod to the 21st century, with an array of information tailored to address a variety of highway traffic noise issues."

FOR MORE INFORMATION ABOUT THE COURSE, PLEASE CONTACT MARK FERRONI AT (202) 366-3233 OR MARK.FERRONI@FHWA.DOT.GOV.



"This training is cutting edge and a nod to the 21st century, with an array of information tailored to address a variety of highway traffic noise issues."

— Mark Ferroni, FHWA Noise Team

Training on Your Terms

NHI offers both in-person and online educational opportunities



Screenshots from WBT courses.

Internet-based technologies continue to offer new and affordable opportunities to connect people, across town, across the country, and around the world.

The National Highway Institute (NHI) continues to modernize to deliver world-class training to the transportation community. Among the latest developments at NHI are Web-based training (WBT) and Web-conference training (WCT), which enable participants to train without leaving their offices.

WBT consists of self-study course modules that attendees complete via the Internet. Self-paced and available 24 hours a day, WBT offers attendees the freedom to complete the training whenever and wherever they choose.

For an online option with instructor support, WCT events are scheduled at a specific time. Participants join a virtual classroom online to view course materials and visuals. Attendees hear the audio portion through an ordinary phone line, enabling presenters and participants to communicate with each other during the conference.

WBT and WCT offer many advantages, but perhaps most appealing is the fact that no travel is required, saving agencies and individuals both time and money. Another key benefit is that WBT and WCT sessions can be designed to comply with Section 508 of the Americans with Disabilities Act. The Federal Highway Administration provides closed captioning for Web conferences, so the training is accessible to attendees who are deaf or hard of hearing. And wheelchair users, who may find it challenging to travel to a training venue, can participate without leaving their work environment.

NHI recently piloted the course Principles and Practices for Enhanced Maintenance Management Systems (FHWA-NHI-131107), which is typically offered as an instructor-led training (ILT), in a blended approach incorporating elements of WBT and WCT courses. "One of the main features that people liked best was the ability to access the content material at their own pace," says NHI Training Program Manager Thomas S. Elliott, "while benefiting from the collaborative discussions fostered between the class participants."

NHI offers a growing list of WBT and WCT training in addition to its traditional catalog of more than 200 ILT offerings. In the coming years, NHI expects to grow its catalog of online training, giving transportation professionals the flexibility to choose the type of delivery method that best suits them or their agencies.

Select Listing of NHI WBT and WCT Courses

Course Number	Course Title	Type of Course
FHWA-NHI-141045	Real Estate Acquisition Under the Uniform Act: An Overview	WBT
FHWA-NHI-142052	Introduction to NEPA and Transportation Decisionmaking	WBT
FHWA-NHI-380079	AASHTO Roadside Design Guide	WBT
FHWA-NHI-131112	Principles and Practices for Enhanced Maintenance Management Systems	WCT
FHWA-NHI-420046	Developing High-Impact Training	WCT

FOR A COMPLETE LISTING OF NHI COURSES, VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV.



Training the Trainers

NHI supports the professional development of its instructors

NHI instructors bring years of technical expertise and solid skills in adult learning principles to the classroom.

Think back to the last time you attended training. Whether you enjoyed or benefited from the course was likely dependent upon the instructor and how effectively he or she delivered the material.

The National Highway Institute (NHI) recognizes that its 500-plus instructors are crucial to the success of NHI courses. Therefore, as we strive to continuously improve training delivery, we are taking steps to not only enhance information exchange between NHI and the instructor community but also afford our instructors opportunities to continue their professional development.

Instructor registration. We now require that all NHI instructors register online. Each instructor is assigned an ID, which is then used on the course evaluation forms distributed to participants at the end of each session. By assigning all instructors an ID, NHI is better able to track customer satisfaction with course content and instructor performance. In addition, registration offers a number of benefits to instructors, including support in developing expertise in training delivery, opportunities for professional development, and recognition for excellence within the NHI instructor community.

Quarterly Web conferences. In November 2006, NHI began holding quarterly Web conferences to update instructors on new initiatives and solicit feedback on our performance. This year, we covered topics such as instructor registration, changes to session ID forms, course evaluation forms, and new course offerings for instructor development.

Instructor certification. NHI recently reintroduced its Instructor Certification Program, which guides instructors in learning and applying the latest skills and adult instructional techniques to ensure a high-quality training experience for course

participants. NHI requires that all instructors pass its highly rated Instructor Development Course (FHWA-NHI-420018 or FHWA-NHI-420018A).

Distance learning. Another way that NHI is pursuing continuous improvement is by preparing instructors to use distance learning technologies. In the past year, NHI developed and piloted training for instructors regarding Web conference facilitation techniques. The course, Instructor Development for Web Conference Training, will launch later this year. In addition, NHI experimented with offering some traditional classroom courses via video conference. We plan to identify additional courses for video conference training.

Instructor Advisory Council. NHI also formed an Instructor Advisory Council to help ensure the quality of instruction in all FHWA courses. We offer special thanks to the following council members for their support and guidance:

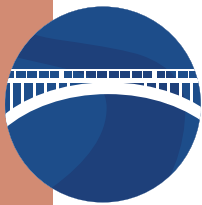
- Jerry DiMaggio, Principal Bridge Engineer, Geotechnical
- Michal Culp, Environmental Protection Specialist
- Patrick Hasson, Safety and Highway Design Technical Services Team Leader
- Peter Osborn, Geotechnical and Hydraulic Technical Services Team Leader
- Firas Ibrahim, Senior Bridge Engineer
- Ron Giguere, ITS Professional Capacity Building Program Coordinator
- Rick Barnaby, Training Programs Team Leader
- Bud Cribbs, Training Program Manager
- Carolyn Eberhard, NHI Instructor Liaison

“Having top-notch instructors is extremely important to the delivery of NHI courses and ensuring that the transportation community has the knowledge and training to effectively deliver the U.S. transportation program,” says Training Programs Team Leader Rick Barnaby.

INSTRUCTOR RESOURCES ARE AVAILABLE ON THE NHI WEB SITE UNDER THE INSTRUCTOR REGISTRATION AND ILT INSTRUCTOR TABS. PLEASE VISIT WWW.NHI.FHWA.DOT.GOV FOR MORE INFORMATION.

Building and Maintaining Tomorrow's Infrastructure

NHI offers world-class training in geotechnical engineering



From bridges and tunnels to pavements and retaining walls, geotechnical engineering plays a prominent role in a broad range of transportation infrastructure.

By definition, geotechnical engineering encompasses all civil engineering features constructed on or from soil and rock materials. The geotechnical discipline influences the development and delivery phases of many highway projects, through planning, environmental reviews, design, construction, quality control, and asset and risk management.

Constructing and maintaining geotechnical features also shape the performance and service life of highways and structures, directly affecting project costs and time to completion. Recent demands for transportation infrastructure to withstand earthquakes, hurricanes, and other hazards are challenging highway professionals to look more closely at materials and methods that will strengthen and ensure the long-term durability of transportation infrastructure. For example, engineers are shifting from a design platform based on allowable stress to a limit-state design approach known as load and resistance factor design (LRFD).

"The transition from allowable stress design represents a significant change for the U.S. design community, which will not only learn a somewhat different language [LRFD terms are very different than allowable stress] but adopt a somewhat more complex design specification," says Jerry A. DiMaggio, principal bridge engineer-geotechnical in the Office of Bridge Technology at the Federal Highway Administration. "In the long term, the change will result in significant benefits by providing more efficiently designed structures that are designed by procedures that allow a measurable assessment of risk and reliability."

Keeping today's engineers abreast of the latest and most effective strategies is a primary goal of the National Highway Institute's (NHI) training curriculum in geotechnical design



Geotechnical applications in the field. Workers are driving open-end piles with a double-acting hydraulic hammer on the new Woodrow Wilson Bridge near Washington, DC. Photo: Jerry DiMaggio, FHWA

and construction. NHI offers a diverse inventory of 25 courses in geotechnical engineering and geoconstruction. The overall curriculum serves technicians, inspectors, geotechnical specialists, structural and construction engineers, contractors, and civil engineers.

Applying best practices, such as appropriate construction monitoring techniques and implementing application-based design and analysis computer software, as demonstrated during NHI's geotechnical courses, saves time and money, DiMaggio says. In addition, using best practices could help avoid contract disputes due to out-of-date materials or construction specifications.

The following new courses will help meet these and other changing needs of highway professionals.

- **Driven Pile Foundations – Design and Construction (FHWA-NHI-132021)**—This course and companion reference manual *Design and Construction of Driven Pile Foundations* are internationally recognized as the most complete guidance on driven piling.
- **Soils and Foundations Workshop (FHWA-NHI-132012)**—This course provides the core curriculum of design and construction for all geotechnical features. "This is the granddaddy of FHWA's geotechnical courses and has been presented more than 300 times both nationally and internationally under the NHI banner," says DiMaggio.
- **LRFD Seismic Analysis and Design of Geotechnical Highway Features (under development)**—NHI is developing a course featuring best practices and guidance from the American Association of State Highway and Transportation Officials. The course may be available by mid-2008.

"NHI's technical training inventory is by far the most comprehensive and extensive offering of geotechnical-related design and construction training in the world," DiMaggio says.

FOR MORE INFORMATION ON NHI'S GEOTECHNICAL-RELATED CLASSES, PLEASE VISIT WWW.NHI.FHWA.DOT.GOV.

Flume Model Puts Hydraulics In Perspective

NHI instructional tool helps illustrate road water management

Inclement weather can interrupt our daily lives in many ways. Snow and rain complicate driving and cause traffic delays, and without proper drainage, roads can become slippery and

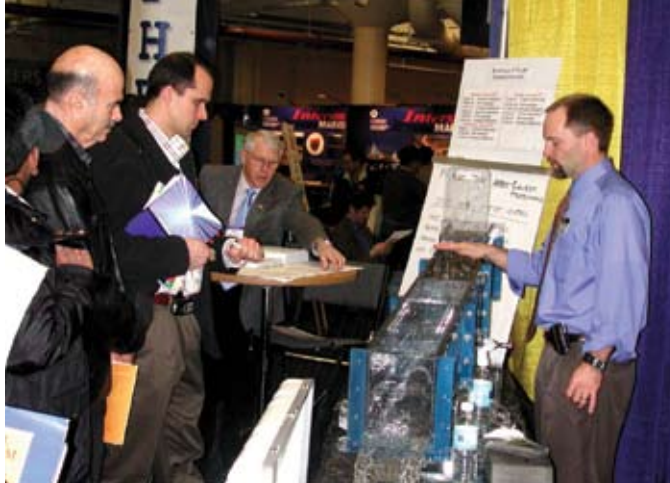
dangerous. Through the study of hydraulics, highway engineers look for ways to direct rainfall and melted snow off and away from roadways to help avoid incidents due to hydroplaning. From gutters and inlets to culverts and pipes, highway engineers have at their disposal a variety of tools to improve safety on the Nation's roads.

To help engineers and designers better understand various strategies to remove water from roadways, the Federal Highway Administration (FHWA) developed a model flume, which is an innovative design tool that uses laboratory-style exercises to demonstrate basic hydraulic principles. Measuring 6 inches wide and about 6 feet long, the flume model is small enough to be portable and easy to set up on a standard folding table. As a learning tool, the flume model enables training participants to witness firsthand the details of flow movement that may be difficult to grasp through lectures or problem-solving exercises.

"Culverts are one of the most common hydraulic appurtenances in highways, so proper understanding of culvert hydraulic design and performance is critical to ensure good state-of-practice," says Joe Krolak, a senior bridge engineer on the Hydraulics Team in the FHWA Office of Bridge Technology.

To capitalize on this advancement in teaching methods, the National Highway Institute (NHI) uses the flume in two of its courses, Introduction to Highway Hydraulics (FHWA-NHI-135065) and Culvert Design (FHWA-NHI-135056).

Instructors set up the portable flume in the classroom so participants can observe hydraulic principles and the effects of culverts, improved inlets, pipe slopes, material roughness, and various end treatments. The participants measure velocity,



Scott Hogan, a hydraulics engineer with FHWA, demonstrates principles of culvert hydraulics with a portable flume at the Transportation Research Board's 85th Annual Meeting in Washington, DC. The flume is used to reinforce learning objectives in NHI courses.

Photo: Deborah Vocke, FHWA Resource Center

discharge, and headwater in the flume under various conditions and use the information to make actual design calculations.

According to Cynthia Nurmi, a highway hydraulic engineer at FHWA, the flume is integral to helping participants work out problems and understand the principles of water mechanics. "The flume demonstrates how water flows and what happens when it hits something," Nurmi says. "Participants have the opportunity to learn applications through lectures, questions and answers, and the observation of water and grate demonstration principles. The courses really capture the interests of different types of learners."

Both courses address real-world scenarios such as the consequences of improperly designed highway culverts and the resulting flooding of upstream properties, erosion of downstream channels, and obstruction of fish passages. By using the flume, instructors are able to demonstrate principles of open-channel flow and culvert hydraulics, including how various design criteria—culvert inlet condition, barrel slope and roughness, and tail water elevation—affect performance.

"One of the benefits of using the flume is that it really gets the participants talking and working with each other and the instructor, which then carries over to the classroom during workshops and question and answer sessions," adds James Schall of Ayres Associates, who is an NHI instructor for the courses. "Overall, the flume has been a valuable part of the instructional design and success of these two popular NHI courses."

FOR MORE INFORMATION, VISIT WWW.NHI.FHWA.DOT.GOV. TO LEARN MORE ABOUT INTRODUCTION TO HIGHWAY HYDRAULICS, PLEASE CONTACT VERONICA GHELARDI AT (720) 963-3240 OR GHELARDI@DOT.GOV.

FOR MORE INFORMATION ABOUT THE CULVERT DESIGN COURSE, PLEASE CONTACT ERIC R. BROWN AT (410) 962-3743 OR ERIC.BROWN@FHWA.DOT.GOV.



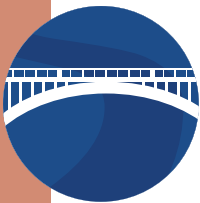
The flume is integral to helping participants work out problems and understand the principles of water mechanics.



Prefabricated Bridge Elements and Systems

Workers look on as SPMTs are used to install the new Graves Avenue Bridge in Volusia County, FL, in June 2006. The bridge incorporates prefabricated elements that facilitated a quick replacement of the old span.

A best practice for rebuilding the Nation's surface transportation system



The U.S. transportation system is aging. Built largely in the 1950s and 1960s, approximately one-third of the Nation's 590,000 bridges require rehabilitation or replacement. Transportation agencies are committed to high-quality, longer lasting highways and bridges, but the challenge is minimizing construction time and traffic congestion. To expedite bridge construction, the Federal Highway Administration (FHWA) is promoting the use of prefabricated bridge elements and systems through its Highways for LIFE program, which aims to advance longer lasting highway infrastructure using innovations to accomplish the fast construction of efficient and safe highways and bridges (thus spelling out "LIFE").

Prefabricated elements can be manufactured either onsite in the median or beside the roadway or offsite, under controlled conditions, and brought to the job site ready to install. "The beauty of a prefabricated bridge is that it minimizes traffic impact and improves safety and quality," says FHWA Senior Bridge Engineer Vasant Mistry. "Prefabricated bridges are cheaper, faster, safer, better for congestion, and in many cases better for the environment."

Specifically, prefabrication can reduce traffic impacts by eliminating the time-consuming formwork construction, curing, and other tasks associated with onsite fabrication. Using prefabricated elements can limit the variety of heavy equipment and the length of time it is required at the construction site, thereby reducing the environmental impact of the work. Safety is improved because much of the work is completed beside the roadway or offsite, minimizing the need for lane closures and detours, use of narrow lanes, and exposure of workers to traffic. And because prefabricated bridge elements and systems are

constructed in a more controlled environment, the result is an increase in quality and often lower life-cycle costs.

The Florida Department of Transportation (FDOT) recently used prefabricated elements and self-propelled modular transporters (SPMTs) to replace the Graves Avenue Bridge over I-4 in Volusia County as part of an interstate widening project. SPMTs are multi-axle, computer-controlled vehicles that can move in any horizontal direction while maintaining their payload geometry and keeping equal axle loads. FDOT was able to lift and remove the old bridge in just 22 minutes.

Two new concrete bridge spans were built alongside I-4, rather than over the interstate, reducing the need for road closures and disruptions to traffic. Weighing nearly 1,300 tons each, the completed spans were lifted and moved into place using the SPMTs. "We saved about 4 months over the course of this bridge project, greatly reducing the impact to drivers," says Amy Scales, resident engineer for FDOT's District 5. Rather than weeks or months of lane closures, FDOT detoured I-4 traffic for only two weekend nights and used rolling roadblocks during the overnight hours of two nonconsecutive nights.

Although gaining momentum, the use of prefabricated bridge components has yet to become standard practice. One reason, Mistry says, is because engineers may not be building an entirely new bridge but simply replacing a few parts. In these cases engineers face the challenge of connecting prefabricated components to the existing bridge.

"Training on prefabricated bridge elements is critical," Mistry says. "If engineers put a new bridge in and it fails, the damage to lives and property could be devastating. It is extremely important that engineers become fluent in using the technology." Toward that end, the National Highway Institute is developing a course to train transportation professionals on how to use prefabricated bridge elements effectively. The course is expected to launch in late 2008.

FOR MORE INFORMATION ON PREFABRICATED BRIDGE ELEMENTS, PLEASE VISIT WWW.FHWA.DOT.GOV/BRIDGE/PREFAB.



A Framework for Freight Analysis

Data aids transportation planning and forecasting

According to a preliminary analysis of FAF², in 2002 approximately 11 percent of the National Highway System (NHS) roadways (based on roadway length) approached or exceeded their capacity, and 3.4 percent of roadway links exceeded their capacity. In 2035, approximately 40 percent of NHS roadways and 25 percent of the links will approach or exceed capacity.

Source: FHWA

If you think there are a lot of trucks on U.S. highways today, just wait until 2035.

In 2002, the U.S. transportation system moved 19 billion short tons, worth more than \$13 trillion. By 2035, the volume will nearly double to 37 billion short tons, worth about \$38 trillion. Recognizing the significant direct and indirect effects of freight movement on U.S. roadways and communities, the Federal Highway Administration's (FHWA) Office of Freight Management and Operations developed a tool known as the Freight Analysis Framework (FAF), which provides a comprehensive picture of commodity flows in the United States. The framework covers local and long-distance domestic shipments as well as imports and exports of all commodities—from coal to electronics to municipal solid waste—by all modes of transportation.

The FAF was developed to raise awareness of freight issues and to provide freight forecasts for policy studies of investment needs, truck size and weight limits, and cost allocation. The current version, FAF², includes estimates of value and tons of freight moving among and within regions for 2002, with forecasts through 2035. FAF² also includes estimates of commodity movements by truck volumes over specific highways for 2002 and 2035 and provisional estimates of value and tons for 2006.

To educate freight, transportation, and planning professionals about trends and growth in trucking, the National Highway Institute (NHI) offers two courses, Integrating Freight in the Transportation Planning Process (FHWA-NHI-139001) and Uses of Multimodal Freight Forecasting in Transportation Planning (FHWA-NHI-139002). Both courses employ the FAF as an integral teaching tool.

Integrating Freight in the Transportation Planning Process is a 2-day course designed to guide public sector transportation planners in incorporating freight considerations into their transportation planning processes. "Incorporating the FAF helps

attendees learn to anticipate trends and react accordingly," says Dr. Tianjia Tang, FHWA's program manager for the FAF. "Planners can utilize the FAF database to track the origin and destination of goods, thereby computing and illustrating various modes of transportation. FAF trend analysis determines transportation infrastructure needs in order to accommodate the goods movement."



The 3-day course, Uses of Multimodal Freight Forecasting in Transportation Planning, demonstrates the use and value of various forecasting techniques, discusses economic trends that influence freight growth, and explores the role of intermodal terminals and their impacts on local traffic.

"The FAF indicates the volumes and value of what moves into, out of, and through an area," says Rolf Schmitt, team leader of FHWA's Freight Analysis Team, and "helps course participants, stakeholders, and State and regional planners understand the national and international context of their domains."

Freight planning and forecasting issues can be complex, but by using the comprehensive FAF data in both NHI courses, Schmitt says, "participants learn how FAF trends explain dramatic growth in trucking, with implications for congestion, the economy, and other public concerns. Ultimately, the FAF informs policymaking and planning on the demand that economic activity places on the transportation system, now and in the future."

FOR MORE INFORMATION ON THE FAF, VISIT WWW.OPS.FHWA.DOT.GOV/FREIGHT. OTHER FREIGHT-RELATED COURSES UNDER DEVELOPMENT AT NHI INCLUDE ADVANCED FREIGHT PLANNING (FHWA-NHI-139003), PRINCIPLES OF EFFECTIVE COMMERCIAL MOTOR VEHICLE (CMV) SIZE AND WEIGHT ENFORCEMENT (FHWA-NHI-139004), FREIGHT PLANNING AND ENVIRONMENTAL CONSIDERATIONS (FHWA-NHI-139005), AND ITS/CVO BASIC AWARENESS SEMINAR (FHWA-NHI-137033). VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV FOR THE LATEST INFORMATION ABOUT COURSES OFFERED IN THE FREIGHT CATEGORY.

Life Cycle Cost Analysis

Choosing the best-price alternative with an eye toward the future



“When will the work be done?” Frustrated motorists across the country echo this question as they navigate the growing maze of construction work zones. The answer often

resides in the decisions that highway agencies make when determining which design alternative to pursue. In the face of shrinking budgets, competing demands, and increased public scrutiny, highway agencies increasingly are looking to life cycle cost analysis (LCCA) as an economic tool to help them manage their infrastructure.

LCCA is a process for evaluating competing alternatives for designing or preserving highway infrastructure by analyzing initial costs and discounted future costs over the life of the project. The process includes evaluating agency costs for construction and preservation activities as well as costs incurred by highway users in the form of delay and vehicle operating costs. For example, an LCCA may reveal that it is less costly for an agency and users if a road is temporarily closed rather than left open during construction.

“LCCA helps agencies examine the economic ramifications of their investment choices and make the best use of limited highway funding,” says Nathaniel Coley, an asset management specialist with the Federal Highway Administration’s LCCA program.

The decision to conduct an LCCA hinges on several factors. First, the agency must deem the

project necessary. Next the agency needs to determine if the scope of the project warrants an LCCA. According to Coley, States have established their own guidelines for when to apply LCCA. The New York State Department of Transportation, for

$$\text{Present Value of Costs} = \sum_{k=0}^N \left[(\text{Cost}_k) \times \underbrace{\left[\frac{1}{(1+d)^{n_k}} \right]}_{\text{Present Value Factor}} \right]$$

N = length of analysis period
d = discount rate
n_k = year of expenditure

Formula for calculating net present value.

example, mandates LCCA for all projects greater than 1 mile long, and the Colorado Department of Transportation mandates an LCCA for projects over \$1 million.

Once an agency decides to move forward with an LCCA, here is how it works: First, the project team defines alternative designs or preservation strategies. For each proposed alternative, the team identifies initial construction or rehabilitation activities, the anticipated rehabilitation and maintenance needs, and the timing for these activities. Using this information, the team creates a schedule of activities for each alternative.

Next is estimating the costs of the activities. According to Coley, good practice LCCA calls for including not only direct agency expenditures (for example, construction or preservation activities) but also user costs, such as vehicle expenses and delay due to work zones. A predicted schedule of activities and their associated agency and user costs combine to form a projected expenditure stream for each project alternative.

After determining the expenditure streams, the team then calculates the total life cycle costs for completing the alternatives. To an investor, a dollar today isn’t worth a dollar 2, 10, or 30 years from now, so LCCA uses discounting to convert anticipated future costs to present dollar values. This conversion facilitates direct comparisons of the lifetime costs of the different alternatives, enabling the team to select the most cost-effective design or preservation strategy.

Through the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, the U.S. Congress authorized the Secretary of Transportation to require an LCCA on major projects and directed the U.S. Department of Transportation to develop educational resources on LCCA. In response, the National Highway Institute (NHI) is developing a 3-day course that will be offered through a combination of live instructor-led and self-paced sessions broadcast over the Web. Expected to be available by late 2007, the training targets planning, design, construction, maintenance, and materials engineers.

FOR MORE INFORMATION ON LCCA, PLEASE VISIT WWW.FHWA.DOT.GOV/INFRASTRUCTURE/ASSTMGMT/LCCA.HTM OR CONTACT NATHANIEL COLEY AT (202) 366-2171 OR NATHANIEL.COLEY@DOT.GOV.

Steps in LCCA Methodology

1. *Establish alternative design strategies.*
2. *Determine activity timing.*
3. *Estimate agency costs.*
4. *Estimate user costs.*
5. *Determine life cycle cost.*

Managing Risk at FHWA

NHI course focuses on planning for unknowns



One might say that risk management is the “crystal ball” of the business world.

Lacking omniscience or mystical powers, leaders in the public and private sectors turn to logic, planning, and data-driven conjecturing to help their organizations weather the unknowns of next week or 10 years from now.

The Federal Highway Administration (FHWA) defines risk as a future event that could have a direct impact—positive or negative—on a program or the agency as a whole. Risk management, therefore, is the process of systematically identifying, assessing, and planning to address any threats or opportunities that face FHWA and its programs.

Why manage risk? One reason is to focus use of limited resources to minimize the impact of events that threaten FHWA programs and maximize taking advantage of available opportunities. Another reason is to strengthen the agency’s ability to manage program delivery efficiently by making informed decisions about the scope, approach, and intensity of efforts. By prioritizing events from low to high risk, offices can focus resources on oversight of activities with high-risk events. Another benefit of managing risk agency-wide is improved communication. With everyone on the same page, leadership will be able to make better informed decisions about what the agency should focus on and why.

“[Risk management] is about staying ahead of the curve and acting before we get into a crisis situation,” says FHWA Executive Director Bud Wright.

A formalized, agency-wide policy for managing risks has been a long time coming. Back in June 2001, FHWA issued a policy requiring each office to use a risk/benefit analysis or a similar prioritization process to identify the appropriate level of oversight for its initiatives. In May 2006, the FHWA

Office of Infrastructure issued guidance and a schedule to implement its first agency-wide corporate risk management initiative.

“FHWA’s risk management initiative is a way for us to articulate decisions we are making now in anticipation of what we see coming down the road,” says Connie

Yew, Team Leader for Stewardship and Oversight in the FHWA Office of Infrastructure.

The objective is to establish a common and consistent process by which FHWA can identify and prioritize risk events in program areas. The agency is using a number of strategies to accomplish this objective, including reviewing and evaluating the financial integrity of programs, assessing ways to improve program delivery, and establishing performance measures as business management practices to quantify and improve successes in delivering Federal-aid programs.

“An excellent, low-resource

technique for mitigating risk is to track the implementation of guidance or recommendations from a previous process review,” Yew says. “Following up on work already completed, such as new processes, technical assistance, or even training, demonstrates performance and may reveal whether more work or a different approach is necessary.”

To share best practices in assessing and managing risks, the National Highway Institute (NHI) is developing a 2.5-day instructor-led course tentatively called Risk Management (FHWA-NHI-134065). The course will focus on identifying risks to program areas, clarifying the interdependence of risks, separating causes and effects, and facilitating the development of organizational controls. NHI piloted the course in Georgia and North Carolina in late 2006.

FOR MORE INFORMATION, VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV.



In 2004, the team working on the Woodrow Wilson Bridge Project in the Washington, DC, metropolitan area (shown here during construction) conducted a formal risk management assessment for the entire project. The following were among the critical program elements identified for risk assessment: project-wide security, fabrication and availability of materials, incident management, project schedule, environmental commitments, utility construction conflicts and delays, design management review and oversight, change orders, maintenance of traffic, and work zone safety. Photo: Woodrow Wilson Bridge Project



Acquiring Real Estate for Highway Projects

Appraisers Susan Bauer and Dave Heinmiller of the Maryland State Highway Administration are reviewing a project sketch of the Hughesville Bypass project in Charles County, MD. This road realignment project involved relocating three homes and acquiring an American Legion Hall.

Photo: Maryland State Highway Administration

NHI courses cover compliance with the Uniform Act and U.S. Code

relocation courses count toward the International Right of Way Association's (IRWA) recertification for Senior Right of Way Agent (SR/WA) designation and recertification for the Right of Way Relocation Assistance Certification (RW-RAC).

Most States have licensing requirements for their appraisers. Both of the newly developed instructor-led training courses, Appraisal for Federal-Aid Highway Programs (FHWA-NHI-141043) and Appraisal Review for Federal-Aid Highway Programs (FHWA-NHI-141044), have been approved for continuing education credits in several States by their respective appraisal licensing boards and also count toward recertification of IRWA's SR/WA designation and the Right of Way Appraisal Certification (RW-AC). As part of delivering the appraisal courses, NHI will assist with preparing the application package for the State licensing boards.

FHWA-NHI-141043 is a 2-day training focusing on preparing, presenting, and understanding appraisal reports in conformance with the Uniform Act. The course addresses the appraiser's role in the overall project development process and how an appraiser's expertise can assist in completing a transportation project effectively and efficiently.

The companion course, FHWA-NHI-141044, is a 1-day session that focuses on applying the principles of appraisal review and understanding how they fit within the Uniform Act and 49 CFR Part 24. Although other educational institutions and professional associations provide appraisal education to meet the requirements of the Financial Institutions Reform Recovery and Enforcement Act, these NHI appraisal courses are unique in that they specifically cover the requirements of the Uniform Act and 49 CFR Part 24.

TO READ THE FULL COURSE DESCRIPTIONS, VISIT THE NHI WEB SITE AT WWW.NHI.FHWA.DOT.GOV.



Government programs designed to benefit the public as a whole—such as constructing the Nation's surface transportation system—sometimes require purchasing private property and displacing people from their residences, businesses, or farms.

Known as the power of eminent domain, acquisition of this kind is a long-recognized right of government. To protect the rights of property owners and displaced individuals whose properties are acquired for public use, the U.S. Congress passed the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (Uniform Act).

The National Highway Institute (NHI) offers an extensive array of instructor-led and Web-based training (WBT) offerings, specifically designed to conform with the requirements of the Uniform Act and its implementing regulation, the Code of Federal Regulations Title 49 Part 24 (49 CFR Part 24). These training programs address appraisal, acquisition, and relocation, as well as Local Public Agency Real Estate Acquisition (FHWA-NHI-141047), Outdoor Advertising Control: Bonus States (FHWA-NHI-141048), and Outdoor Advertising Control: Non-Bonus States (FHWA-NHI-141049).

NHI's Web-based offerings begin with Real Estate Acquisition under the Uniform Act: An Overview (FHWA-NHI-141045) and include the training focused on local public agencies (FHWA-NHI-141047) and the two seminars on outdoor advertising control (FHWA-NHI-141048 and FHWA-NHI-141049). Each of the relocation courses—Basic Relocation (FHWA-NHI-141029), Advanced Relocation (FHWA-NHI-141030), and Business Relocation (FHWA-NHI-141031)—is a 3-day instructor-led training, with several interactive group exercises and real-world case studies designed to enhance the learning experience. The