



U.S. Department of Transportation  
Federal Highway Administration

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connected to our customers.

# Lab Clips

A brief overview of laboratories at the Turner-Fairbank Highway Research Center



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# Lab Clips

## *Introduction*

As the research facility for the Federal Highway Administration, the Turner-Fairbank Highway Research Center (TFHRC) coordinates an ambitious program of innovative research and development, and technology and innovation deployment that addresses the safety, infrastructure, and operational needs of the National Highway System.

These Lab Clips provide a brief overview of individual TFHRC laboratories, their current activities, and laboratory managers. Laboratory fact sheets, available separately, describe each facility in more technical detail and include information such as research purpose, resources, current projects, accomplishments, and partnerships.

For the most up-to-date information about our research, please visit the TFHRC Web site at [www.fhrc.gov](http://www.fhrc.gov). To schedule an onsite tour of our laboratories, e-mail us at [TFHRC.tours@fhwa.dot.gov](mailto:TFHRC.tours@fhwa.dot.gov).

# Lab Clips

## Aerodynamics Laboratory

The Aerodynamics Laboratory is the only wind tunnel facility in the United States dedicated solely to studying the complex interactions between wind and bridges or other highway structures. This laboratory explores wind effects and aerodynamics to ensure the performance and safety of long-span bridges in strong winds and to advance our understanding of wind effects on transportation structures. The laboratory recently completed a study that aids in understanding and retrofitting stay cables on bridges to mitigate wind-induced vibrations.

### *Keywords:*

Aerodynamic stability, long-span bridges, transportation structures, wind effects, vibrations, fluid mechanics, numerical modeling, structural analysis.

### *Laboratory Manager:*

Harold Bosch, [harold.bosch@fhwa.dot.gov](mailto:harold.bosch@fhwa.dot.gov), (202) 493-3031

### *Activities:*

- » Conducting wind force measurements on tapered hexagonal cylinders.
- » Conducting wind force measurements on a model of the Deer Isle-Sedgwick Suspension Bridge in Maine to study curb grate blockage.
- » Setting up an instrumentation package for monitoring wind and cable vibrations on the Bill Emerson Bridge in Missouri.
- » Maintaining instrumentation systems and analyzing data from several field installations.
- » Performing vibration tests on cables of the new Prospect-Verona Bridge in Maine to establish baseline dynamic properties.
- » Performing flow visualization studies around bridge cross-sections using particle image velocimetry (PIV) in a small wind tunnel.
- » Archiving field data, developing several unique databases, and establishing an online technical reference library.

# Lab Clips

## Arens Photometric and Visibility Laboratory

The Arens Photometric and Visibility Laboratory (PVL) conducts evaluations of the photometric and colorimetric properties of traffic control devices, including signing and pavement marking materials and traffic signal lights, to establish the required levels that meet the visual needs of drivers. In addition to basic photometric and colorimetric measurements, the PVL evaluates fluorescence and retroreflective properties of materials. Results of these evaluations support Federal guidelines issued in the Manual on Uniform Traffic Control Devices (MUTCD) as well as the development of consensus standards promulgated by the American Society for Testing and Materials (ASTM) International. The PVL directly conducts or supports additional human-factors studies on roadway visibility issues, such as the impact of roadway lighting on driver performance.

### *Keywords:*

Photometry, colorimetry, retroreflective.

### *Laboratory Manager:*

Carl Andersen, [carl.andersen@fhwa.dot.gov](mailto:carl.andersen@fhwa.dot.gov), (202) 493-3366

### *Activities:*

- » Recommending photometric and colorimetric specifications for traffic control materials.
- » Evaluating proposed changes to transport-related lighting and signaling systems, including automotive headlamps, and new technologies in traffic signals and dynamic message signs.

## *Asphalt: Binder Rheology Laboratory*

The Binder Rheology Laboratory studies the flow and deformation of paving materials. Laboratory activities include Superpave® performance-based binder specification testing, research and development, and advanced rheological research in asphalt, modified asphalt, and mastic (binder and rock dust) binders to improve the durability, longevity, quality, and life-cycle cost of asphalt pavements.

### *Keywords:*

Asphalt pavements, binder, mastic, life-cycle costs, rheology, Superpave.

### *Laboratory Manager:*

Nelson Gibson, nelson.gibson@fhwa.dot.gov, (202) 493-3073

### *Activities:*

- » Developing an asphalt mastic test to predict pavement performance by comparing the predictions from the binder tests with those from the mastic tests.
- » Establishing a procedure to estimate the rheological properties of aged asphalts and unaged asphalts without using the laboratory aging simulation.
- » Establishing a proper procedure for fatigue testing of binders using the dynamic shear rheometer.
- » Testing binders for the polymer-modified program currently underway as part of the Accelerated Loading Facility (ALF) activities.
- » Characterizing the various chemically modified crumb rubber asphalts developed by the chemistry group.
- » Providing rheological data for validating the Laboratory Asphalt Stability Test for modified asphalts currently under evaluation.

# Lab Clips

## Asphalt: Bituminous Mixtures Laboratory

The Bituminous Mixtures Laboratory develops and improves bituminous mixture design technology and performance-based tests and evaluates aggregates, binders, additives, and new materials. Researchers study asphalt pavement mixtures, consisting of asphalt binder and specially sized stones, to optimize asphalt mixtures for specific highway applications, extend pavement life, improve asphalt pavement performance, reduce vehicle wear-and-tear, and shorten construction delays.

### *Keywords:*

Asphalt pavement mixtures, binder, aggregates, rutting, fatigue, Superpave.

### *Laboratory Manager:*

Nelson Gibson, [nelson.gibson@fhwa.dot.gov](mailto:nelson.gibson@fhwa.dot.gov), (202) 493-3073

### *Activities:*

- » Validating Superpave asphalt binder tests and specifications, Superpave mixture tests and performance models, and other laboratory tests used to predict the performance of asphalt mixtures.
- » Determining if asphalt binder performance is captured correctly by the Superpave asphalt binder specification developed under the 1987–1993 Strategic Highway Research Program and post-program modifications.
- » Evaluating the Simple Performance Test for asphalt mixtures. This test was developed to measure rutting and fatigue cracking resistance.



## Asphalt: Pavement Testing Facility

The Pavement Testing Facility consists of 12 pavement test lanes and 2 Accelerated Loading Facility (ALF) machines that simulate traffic loading at controlled loading and pavement temperatures. In only a few months, the ALF machines can evaluate pavement specifications, designs, test procedures, and durability of both new and existing pavement materials by applying wheel loads corresponding to many years of truck traffic. Two machines allow simultaneous testing of two pavement lanes under the same ambient temperature and moisture conditions or at the same pavement materials' age.

### *Keywords:*

Pavement materials, traffic loading, controlled loading, accelerated pavement testing.

### *Laboratory Manager:*

Nelson Gibson, [nelson.gibson@fhwa.dot.gov](mailto:nelson.gibson@fhwa.dot.gov) , (202) 493-3147

### *Activities:*

- » Testing 12 new full-scale, hot-mix asphalt lanes. The lanes include seven polymer-modified asphalt binders and one unmodified binder in an experiment designed to improve the Superpave binder specification.

# Lab Clips

## *Asphalt: Simulation, Imaging, and Mechanics of Asphalt Pavements Laboratory*

The Simulation, Imaging, and Mechanics of Asphalt Pavement (SIMAP) Laboratory relates the internal structure (such as size, location, and orientation of aggregates and air voids) of asphalt mixes and pavements to their mechanical properties and performance. SIMAP uses a three-pronged approach of imaging, simulation, and micromechanics to provide a complete description and understanding of pavement performance, including the design, construction, and properties of asphalt pavements with long service lives.

### *Keywords:*

Asphalt pavements, properties, design, construction, performance.

### *Laboratory Manager:*

Ernie Bastian, [ernest.bastian@fhwa.dot.gov](mailto:ernest.bastian@fhwa.dot.gov), (202) 493-3075

### *Activities:*

- » Analyzing asphalt specimens routinely sent from across the United States.
- » Developing indices for measuring various types of aggregate inhomogeneity, air void distribution, and aggregate orientation.

# Lab Clips

## Bridge Management Information Systems Laboratory

The Bridge Management Information Systems Laboratory identifies and analyzes causes and trends of deficiencies within the Nation's bridge inventory. Tools support sophisticated analytical research on existing disparate data sources through a geographical information system platform combined with relational database management systems software and advanced mathematical and statistical software. Data acquired include the time-series National Bridge Inventory, climatological data distributions, seismic point-source information and strong-motion data, hydraulic and hydrologic information, geotechnical distributions, transportation network coverages, and base political data sets. This synthesis of data and advanced tools is not available at any other facility in the world.

### *Keywords:*

Climatological data distributions, seismic point-source information and strong-motion data, hydraulic and hydrologic information, geotechnical distributions.

### *Laboratory Manager:*

Hamid Ghasemi, [hamid.ghasemi@fhwa.dot.gov](mailto:hamid.ghasemi@fhwa.dot.gov), (202) 493-3042

### *Activities:*

- » Conducting studies to correlate spatial deterioration patterns and bridge deficiencies with environmental variables.
- » Assessing life cycle costs to enhance decision-support models for bridge management systems.
- » Developing a methodology for sampling candidate bridges for the Long-Term Bridge Performance Program.

## Chemistry Research Facility

Researchers at the Chemistry Research Facility advance the understanding of material failures and potential performance enhancements, help develop state-of-the-art characterization tools, and test and foster new materials development. The facility validates FHWA-sponsored offsite research and assists industry and State and Government agencies with forensic analyses and unbiased support.

There are three main laboratories in this facility. The Chemistry Laboratory provides capabilities for synthesizing and modifying highway materials. The Material Characterization Laboratory evaluates highway materials and their components—in particular their susceptibility to oxidation, moisture damage, and the harmful effects of deicing chemicals. As well as developing forensic test methods, the Analytical/Spectroscopy Laboratory conducts detailed chemical analyses to determine the effect of environmental conditions on a variety of paving materials.

### *Keywords:*

Materials science, composition analysis, moisture susceptibility, material chemical analysis.

### *Laboratory Manager:*

Terry Arnold, [terry.arnold@fhwa.dot.gov](mailto:terry.arnold@fhwa.dot.gov), (202) 493-3305

### *Activities:*

- » Investigating the effects of acid modification on asphalt binder chemistry and performance.
- » Investigating the material science of cementitious systems.
- » Developing tools to identify deleterious materials in aggregate and asphalt supplies with particular emphasis on the components responsible for pavement moisture susceptibility.
- » Investigating the phase behavior of conventional and polymer modified asphalt binders.
- » Evaluating the resistance of alternative paving materials to environmental factors.
- » Evaluating highway materials to determine the materials' susceptibility to moisture damage and understand the harmful effects of deicing chemicals.
- » Investigating asphalt embrittlement.

# Lab Clips

## Coatings and Corrosion Laboratory

The Coatings and Corrosion Laboratory (CCL) provides technical support to the Office of Infrastructure Research and Development. Using both accelerated laboratory tests and natural outdoor exposure, researchers develop and analyze the effectiveness of test procedures for bridge coating systems and evaluate the durability of new cost-effective and environmentally compliant coating systems that protect steel bridges from corrosion. CCL also helps State Department of Transportations solve a variety of bridge coating problems and recommends appropriate coatings for different environmental conditions.

### *Keywords:*

Bridge coatings, durability, environmentally compliant materials, corrosion protection.

### *Laboratory Manager:*

Seung-Kyoung Lee, seung-kyoung.lee@fhwa.dot.gov, (202) 493-3077

### *Activities:*

- » Characterizing paint composition using various chemistry methods and scanning electron microscopy/energy dispersive analysis, electrochemical impedance spectroscopy, and other spectroscopic techniques.
- » Applying forensic analytical techniques to identify bridge coating type and determine causes of field coating failures.
- » Evaluating more economical coatings of one-coat and rapid deployment two-coat systems compared to conventional multi-coat systems.
- » Evaluating conventional and newly developed metallic alloy coatings.
- » Developing and evaluating durable coating systems that can last for 100 years.

# Lab Clips

## Concrete Laboratories

Researchers in the Concrete Laboratories evaluate new test methods, conduct concrete materials research, develop mixture design and analysis procedures for concrete pavements, and provide concrete forensics. The six Concrete Laboratories are Aggregate and Sample Preparation, Concrete Curing/Maturity, Concrete Durability, Mechanical Properties, Plastic Concrete, and the Petrographic Laboratory.

### *Keywords:*

Concrete materials, concrete forensics, portland cement concrete, PCC, materials selections, concrete pavement, hydraulic cement concrete, HCC.

### *Laboratory Manager:*

Richard Meininger, richard.meininger@fhwa.dot.gov, (202) 493-3191

### *Activities:*

- » Investigating the properties and performance of portland cement concrete (PCC).
- » Evaluating and developing new or improved equipment and procedures for assessing PCC properties and performance.
- » Examining practices for PCC materials selection, mixture proportioning, mixture analysis, and construction for concrete pavements.
- » Mixing, casting, and testing PCC test specimens for both concrete pavement and concrete structures research.
- » Conducting specialized tests and forensic investigations on PCC to help State Departments of Transportation (DOTs) troubleshoot problems with concrete pavements and structures.

# Lab Clips

## Digital Highway Measurement System

FHWA's Digital Highway Measurement System (DHMS) is an instrumented vehicle that uses multiple technologies, sensors, and computer analysis capabilities to collect raw highway data and to process that data into readily useable, electronic data files. Information is collected on, above, and below the ground.

The vehicle enables engineers and maintenance personnel to collect information and to perform roadway inspections at highway speeds; the synchronized and continuous sensors collect information at extremely precise levels. The vehicle keeps pace with traffic and gathers all necessary data in one pass without causing traffic congestion or placing surveyors at risk. The combination of the global positioning system (GPS) and inertial navigation system allows for continuous accurate location information for all roadways, regardless of satellite coverage. Stand-alone GPS introduces significant error on many roads.

The information and knowledge collected with the system provides accurate data needed to improve highway safety, engineering, inventory, maintenance, and research.

### Keywords:

3-D ground-penetrating radar, inertial navigation, scanning laser, macrotexture laser, accelerometer, Laser Imaging Detection and Ranging (LIDAR), Nationwide Differential Global Positioning System (NDGPS), High-Accuracy NDGPS

### Laboratory Manager:

Kunik Lee, kunik.lee@fhwa.dot.gov, (202) 493-3491

### Activities:

- » Collecting and analyzing surface and subsurface geometry and characteristics of the Cumberland Gap Tunnel using the DHMS prototype in combination with the proposed 3-D ground penetrating radar unit.
- » Conducting an industry briefing about DHMS technologies to prepare for use in the safety component of the SHRP-2 program.

## Federal Outdoor Impact Laboratory

The Federal Outdoor Impact Laboratory (FOIL) is a research facility used to support FHWA's Safety Research and Development (R&D) programs and other Federal security initiatives. Researchers use this facility to extend their understanding of crash events by staging controlled, high-speed motor vehicle collisions into roadside structures in close proximity to the Nation's roadways. Typically, researchers use this facility to confirm the accuracy of prior computer-generated crash predictions. Routine certification or compliance testing, including testing performed to ensure compliance with existing safety standards, is not conducted at the FOIL.

As a result of the September 11, 2001, terrorist attack on the World Trade Center in New York City, building security has become a focus and a priority for the U.S. Government. The FOIL is being used to develop perimeter security devices to prevent the unwanted intrusion of speeding motor vehicles into areas adjacent to government buildings and other critical facilities.

### *Keywords:*

Crash testing, roadside safety, building perimeter security.

### *Laboratory Manager:*

Martin Hargrave, [martin.hargrave@fhwa.dot.gov](mailto:martin.hargrave@fhwa.dot.gov), (202) 493-3311

### *Activities:*

#### Roadside Safety Structures

- » Optimizing placement of cable median barriers in sloped roadway median areas to contain motor vehicles and prevent crossovers.
- » Redesigning the connections between portable concrete barriers to ensure that they do not disconnect during a motor vehicle collision.
- » Determining the tolerance range for W-beam guardrail heights to ensure proper functioning during a motor vehicle collision.
- » Redesigning mailbox and small sign mounting supports to mitigate windshield penetration during a motor vehicle collision.

#### Perimeter Security Devices

- » Positioning fixed and removable roadside bollards with the associated reinforced concrete foundation.
- » Installing energy-absorbing fencing and the associated reinforced concrete foundation.
- » Constructing high- and low-rise reinforced concrete walls and the associated reinforced concrete foundations.
- » Constructing high- and low-rise walls and the heavily reinforced foundations.
- » Using large planters used to restrict motor vehicle access, including collision resistant roadway or sidewalk attachments.



# Lab Clips

## FHWA/NHTSA National Crash Analysis Center

The National Crash Analysis Center (NCAC) is a cooperative venture of FHWA and the National Highway Traffic Safety Administration (NHTSA) for automotive and highway safety research. The program is unique in its comprehensive and cutting edge approach to improving safety. The focus of the program is the advancement of computer modeling and crash simulation technologies to permit the effective development of improved vehicle and roadside structure design to reduce highway crashes and the resulting injuries and fatalities. The NCAC program is conducted under a cooperative agreement with The George Washington University. The program includes a range of concurrent research activities ranging from detailed analyses of empirical crash data and the development and refinement of computer models and crash simulation tools, to the biomechanics analyses of occupant risk. The cooperative agreement also covers the operation and maintenance of a national library of more than four decades of crash-test films and documentation, the operation of a Vehicle Modeling Lab, a High-Performance Computing Lab, and the Federal Outdoor Impact Laboratory (FOIL). The Vehicle Modeling Laboratory is used to create vehicle models through reverse engineering that involves completely disassembling an object (i.e., a vehicle), digitizing and characterizing each part, entering the parts into the computer, assembling the parts into a composite of finite elements, and validating the completeness and accuracy of the computer representation. The FOIL facility provides the capabilities for full-scale crash testing to validate crash simulations and a pendulum for dynamic loading of vehicle and roadside hardware components to acquire data for subsequent use in the models.

### *Keywords:*

Crash simulation, finite element modeling, roadside hardware evaluation, biomechanics, impact testing and analysis, vehicle rollover analysis, occupant risk analyses.

### *Program Managers:*

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Martin M. Hargrave; [martin.hargrave@fhwa.dot.gov](mailto:martin.hargrave@fhwa.dot.gov); (202) 493-3311

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# Lab Clips

## FHWA/NHTSA National Crash Analysis Center —continued

### Activities:

- » Analyzing cable median barrier designs and placement within the median.
- » Analyzing the safety performance of w-beam guardrails, sign supports, mailboxes, portable concrete barriers, and other roadside hardware.
- » Developing vehicle and roadside hardware finite element models to promote the use of crash simulations in design and safety evaluation.
- » Analyzing vehicle-to-vehicle compatibility in frontal, side, and rear collisions, and developing assessment techniques under the NHTSA New Car Assessment Program (NCAP).
- » Analyzing the effectiveness of child safety seats in side impact crashes by using crash simulation.
- » Researching the causes of vehicle rollover and the effectiveness of mitigation measures.
- » Designing, analyzing, and testing barriers to provide physical security of buildings and facilities.
- » Analyzing occupant risk, ranging from efforts to develop finite element models of the human body to the analysis of data from crash dummies.
- » Improving the accuracy of computer models through the use of crash testing, and validating crash simulation results.

# Lab Clips

## Geometric Design Laboratory

The Geometric Design Laboratory helps establish the standards and procedures for Interactive Highway Safety Design Model (IHSDM) software development. IHSDM is a suite of tools that helps highway planners and designers evaluate the safety of highway geometric design alternatives. It contains six modules: Crash Prediction, Design Consistency, Driver/Vehicle, Intersection Review, Policy Review, and Traffic Analysis.

### *Keywords:*

Safety, roadway design, geometric design alternatives.

### *Laboratory Manager:*

Ray Krammes, ray.krammes@fhwa.dot.gov, (202) 493-3312

### *Activities:*

- » Preparing functional specifications for IHSDM.
- » Verifying and validating the modules that will become core IHSDM components.
- » Conducting alpha testing of IHSDM software.
- » Coordinating beta testing of IHSDM software by potential end-users, which include State Department of Transportations and their consultants.
- » Providing technical support to IHSDM users.

# Lab Clips

## Geotechnical Laboratory

The Geotechnical Laboratory studies the interactions between soil and structural elements for bridge foundations and retaining wall systems. Researchers test new materials, designs, and construction methods to determine acceptability and identify opportunities for improvement.

### *Keywords:*

Bridge foundations, retaining-wall systems, shallow-foundation systems, deep-foundation systems, abutments.

### *Laboratory Managers:*

Mike Adams, [mike.adams@fhwa.dot.gov](mailto:mike.adams@fhwa.dot.gov), (202) 493-3025

Carl Ealy, [carl.ealy@fhwa.dot.gov](mailto:carl.ealy@fhwa.dot.gov), (202) 493-3035

### *Activities*

- » Developing foundation systems for rapid bridge construction, including testing full-scale bridge piers, abutments, and retaining-wall structures at outdoor test sites.
- » Developing a new indoor laboratory facility to specialize in the characterization of geosynthetic reinforced soil systems.

# Lab Clips

## Highway Safety Information System Laboratory

The Highway Safety Information system is a multi-State database in which crash, roadway inventory, traffic, driver, vehicle, and other information can be linked into analysis files for a range of safety studies. The database contains roadway, traffic, and crash information from nine States and two urban centers. The availability of these data allows researchers to evaluate roadway and traffic variables in relation to crash risk.

### *Keywords:*

Roadway design, roadway inventory, roadway and traffic variables, crash data, safety

### *Lab Manager:*

Carol Tan, carol.tan@fhwa.dot.gov, (202) 493-3315

### *Activities:*

- » Developing speed-related crash typology.
- » Studying the safety effects of rumble strips at stop-controlled intersections.
- » Developing new geographical information system safety analysis tools.

# Lab Clips

## Human Centered Systems Laboratory

The Human Centered Systems (HCS) Laboratory analyzes road user behaviors using a variety of laboratory methodologies that employ the Highway Driving Simulator, a field research vehicle, and video data collection in the real world. The HCS team analyzes a broad spectrum of geometric, traffic control, and operational issues to help design safe and efficient roadway infrastructures. Specialized controlled environments in the laboratory help researchers examine driver and pedestrian preferences, gather baseline data, analyze complex roadway issues, and test hypotheses in a safe, controlled setting.

### *Keywords:*

Roadway infrastructure, behavior, geometric issues, traffic control devices, operational issues, roadway conditions and environment.

### *Laboratory Manager:*

Paul Tremont, paul.tremont@fhwa.dot.gov, (202) 493-3338

### *Activities:*

- » Investigating the effects of speed limit sign spacing on memory retention in drivers.
- » Using simulation and visualization techniques to develop and refine the diverging diamond interchange and the continuous flow intersection designs.
- » Analyzing drivers' navigation patterns and sign comprehension for double-lane roundabouts.
- » Developing and testing subjects in a series of low-cost safety improvement design or traffic control configurations in support of the Safety Countermeasure Evaluation Pooled Fund Project.

# Lab Clips

## *Intelligent Intersection Traffic Control Laboratory*

The Intelligent Intersection Traffic Control Laboratory is a world-class facility with the capacity to integrate and operate various advanced Intelligent Transportation Systems (ITS) technologies. The facility is equipped with a full-range of traffic control devices, fiber-optic communication networks, dedicated short-range communication (DSRC), and state-of-art vehicle-infrastructure interfaces (VII).

The laboratory provides the U.S. Department of Transportation (DOT) with a test ground for VII and Cooperative Intersection Collision Avoidance System (CICAS) research programs and a test facility for ITS and signal control technology integration and evaluation. The laboratory has hosted ITS and CICAS demonstrations with national and international media coverage.

### *Keywords:*

Intelligent Transportation Systems, ITS, traffic operations, signal control, vehicle infrastructure integration, VII, DSRC, Cooperative Intersection Collision Avoidance Systems, CICAS.

### *Laboratory Manager:*

Peter Huang, [peter.huang@fhwa.dot.gov](mailto:peter.huang@fhwa.dot.gov), (202) 493-3484

### *Activities:*

- » Supporting research activities for DOT ITS programs, including VII and CICAS programs.
- » Demonstrating various VII and CICAS operations and technology integrations.
- » Showcasing and evaluating various VII, CICAS, and signal control technologies.

# Lab Clips

## *J. Sterling Jones* *Hydraulics Laboratory*

Hydraulics Laboratory researchers identify research needs, test the hydraulic performance of highway drainage structures and stream crossings, solve hydraulic and stream stability problems, and support operational engineers with design guidance and tools. The laboratory has small scale physical modeling and computational fluid dynamics (CFD) modeling components that work in tandem; results are extrapolated from one and verified and calibrated by the other. The physical modeling components include a tilting flume, force balance flume, a special designed particle image velocimetry (PIV) flume, and a junction loss testing facility that utilizes 3-dimensional PIV. The computational fluid dynamics (CFD) modeling capability features FLUENT flow modeling software on a high performance computing system located at Argonne National Laboratory that can reproduce sediment flow interaction results as well as flow field studies that can be extended to field conditions.

### *Keywords:*

Scour technology, bridge hydraulics, culvert hydraulics, highway drainage, environmental hydraulics, fluid mechanics, hydro dynamics, CFD modeling.

### *Laboratory Manager:*

Kornel Kerenyi, kornel.kerenyi@fhwa.dot.gov, (202) 493-3142

### *Activities:*

- » Conducting Junction Loss Experiments.
- » Performing bottomless culvert tests.
- » Examining fish passage in large culverts with low flows.
- » Testing pressure flow scour for inundated bridge decks.
- » Analyzing hydrodynamic forces and moments on inundated bridge decks.
- » Using fluidic devices for pier scour countermeasures.



# Lab Clips

## *Nondestructive Evaluation Center*

The Nondestructive Evaluation (NDE) Center develops and tests nondestructive evaluation technologies that assess the condition of in-service highway bridges. Researchers evaluate existing technologies and develop new tools to improve the state-of-the-practice for bridge (and pavement) inspection. The center is dedicated to advancing NDE technologies for highway bridges and works closely with State Department of Transportations (DOTs) to identify and solve difficult inspection challenges.

### *Keywords:*

Bridge inspection, nondestructive evaluation, NDT/NDE, human factors, visual inspection, scanning, imaging.

### *Laboratory Manager:*

Frank Jalinoos, frank.jalinoos@fhwa.dot.gov, (202) 493-3082

### *Activities:*

- » Evaluating NDE technologies for the detection of growing fatigue cracks in steel bridges.
- » Developing an advanced bridge deck NDE imaging technologies for detecting delamination/corrosion in concrete bridge decks.
- » Developing technologies for rapid load rating of highway bridges.
- » Implementing field validation of sensor and NDE methodologies.
- » Developing nonlinear dynamics (chaos theory) analysis for the condition assessment of highway bridges.
- » Exploring the development of a specification for using automated ultrasonic testing in fabrication of steel bridge.
- » Developing and deploying a Web-based manual related to NDE applications and capabilities.

# Lab Clips

## Saxton Highway Electronics Laboratory

The Saxton Highway Electronics Laboratory provides electronic engineering design and support services to the Offices of Research, Development, and Technology and other FHWA offices. In addition to repairing and maintaining laboratory equipment, researchers consult on electronic instrumentation requirements, prepare electronic project specifications, and help design and fabricate electronic systems.

### *Keywords:*

Electronic engineering.

### *Laboratory Manager:*

Masoud Nasabzadeh, [masoud.nasabzadeh@fhwa.dot.gov](mailto:masoud.nasabzadeh@fhwa.dot.gov), (202) 493-3047

### *Activities:*

- » Designing and installing sensors and data acquisition systems for highway research vehicles.
- » Designing and fabricating unique, precise, state-of-the-art electronic instruments and systems for highway research conducted within other Turner-Fairbank Highway Research Center laboratories.

# Lab Clips

## Structures Laboratory

The Structures Laboratory is a world-class facility in which full-scale bridges can be erected and tested with the latest technology. The laboratory's primary mission is to conduct experimental studies to determine the behavior of bridge components and full-size bridges. Laboratory researchers evaluate the strength and mechanical properties of structural materials and instruments and perform field evaluations of in-service bridge structures. Data from these studies are used to improve National bridge design specifications, as well as the safety, reliability, and cost-effectiveness of bridge construction in the United States. The laboratory also conducts forensic investigations of bridge failures with National significance.

### *Keywords:*

Structural materials, bridge structures, bridge components, bridge design specifications.

### *Laboratory Manager:*

Fassil Beshah, [fassil.beshah@fhwa.dot.gov](mailto:fassil.beshah@fhwa.dot.gov), (202) 493-3041

### *Activities:*

- » Developing improved specifications to design and analyze horizontally curved steel bridge structures.
- » Evaluating ultra-high-performance concrete bridge girders.
- » Developing modular steel bridge systems for rapid construction.
- » Investigating the fatigue resistance of galvanized steel pole and sign structures.
- » Evaluating the strength and creep resistance of epoxy chemical anchor bolt systems under sustained loads.
- » Developing design and performance specifications for the structural use of lightweight concrete in bridge decks and components.

# Lab Clips

## Traffic Research Laboratory

The Traffic Research Laboratory (TRel) assesses and evaluates the impact of various combinations of advanced technologies, strategies, and policies before they are applied in the field. The advanced hardware and software systems available in TRel help researchers visualize and simulate traffic engineering scenarios. TRel staff also continues to support the Traffic Software Integrated System, a suite of traffic analysis tools that assess the impact of transportation improvements to a network. TRel provides the simulation tools needed to test and evaluate real-time adaptive traffic control systems algorithms under a range of geometric and traffic conditions.

### *Keywords:*

TRel, Advanced Traffic Management Systems (ATMS), Traffic Software Integrated System, Adaptive Control Systems (ACS), ACS-Lite.

### *Laboratory Manager:*

Randall VanGorder, randall.vangorder@fhwa.dot.gov, (202) 493-3266

### *Activities:*

- » Applying hardware-in-the-loop concepts, allowing traffic controllers to be physically connected with simulated traffic in real time.
- » Developing and evaluating dynamic traffic assignment systems.
- » Evaluating and demonstrating adaptive control prototypes.





## Turner-Fairbank Highway Research Center

