University Transportation Center (UTC) designations have become increasingly competitive; a record number of 142 universities applied in this year’s open merit-based competition. Only five of 35 total grants available were slated as national centers. The UTC program is administered by USDOT’s Research and Innovative Technology Administration (RITA).

Senator Robert Menendez (D-NJ) stated in his press release, “As the federal budget has become tighter, the competition for these grant dollars has intensified and it is a real credit to the quality of Rutgers’ program that these federal resources continue to be provided to New Jersey.”

This is the fourth time CAIT has successfully competed for a UTC grant but the first time winning a national slot. “CAIT is proud that USDOT has recognized the program we’ve been building for more than 15 years,” said CAIT director Dr. Ali Maher. “It validates the track record the center has established since we first became a Tier I UTC in 1998.

“The distinguished universities in the CAIT consortium are second to none for productivity...
when it comes to practical research,” Maher said. “We have an accomplished, geographically diverse group of collaborators and a network of labs that can represent and respond to multi-regional interests.”

CAIT will lead consortium members Columbia University, New Jersey Institute of Technology (NJIT), Princeton University, University of Delaware, University of South Florida (USF), University of Texas at El Paso (UTEP), Utah State University (USU), and Virginia Polytechnic Institute. Within Rutgers, CAIT also collaborates with the Edward J. Bloustein School of Planning and Public Policy and many other academic partners.

You would be hard pressed to identify one task in the course of your day that doesn’t involve infrastructure. “We are primarily concerned with issues that affect people’s everyday lives,” said Maher. “This funding will help us address common, pressing needs; whether it’s increasing safety, reducing congestion, improving the environment, finding better ways to fix bridges, or developing tools that ensure money invested yields maximum benefits—all these things are directly tied to a healthy economy and good quality of life.”

CAIT supports agencies and industry with scientific research that leads to new technologies, methods, and products. The center’s core activities
focus on maintaining and improving U.S. infrastructure, what USDOT identifies as its “state of good repair” strategic goal. The physical and economic health of roads, bridges, transit systems, railways, pipelines, and port and freight networks are all under that purview.

The CAIT consortium also prepares students to run the transportation industry tomorrow and trains around 13,000 of today’s workers annually in classes that keep them up-to-date on emerging technology, safety best practices, changing regulations, and efficiently managing budgets and grants. (See “Training for Disaster” on page 10 and “Boot Camp” on page 19.)

“CAIT gives our engineering students a chance to participate in the highest level of transportation research and keeps those already in the workforce current on new technologies and standards,” said Dr. Thomas N. Farris, dean of Rutgers School of Engineering.

Janet Leli, director of New Jersey’s arm of the National Local Technical Assistance Program (LTAP), runs programs and training for local agencies in CAIT’s home state. But Leli also serves on the National LTAP executive committee and the TRB Technology Transfer Committee. “NJ LTAP has been engaged nationally for years. Utah LTAP might develop roadway drainage training that can be applied in New Jersey or vice versa. We all learn from each other,” Leli said. “I imagine this official National UTC designation will reinforce our existing relationships and open doors to new ones too.”

Regarding how being a national center is different than CAIT’s previous Tier I UTC position, communications director Allison Thomas used a baseball analogy: “It’s like a ballplayer getting called up from the minor leagues to the ‘big show.’ He’s doing the same work—hitting the ball, catching the ball, running the bases—but in a bigger arena. We’re officially on the national stage now; there’s more responsibility and higher stakes, but also broader opportunities.” Thomas said.

Maher shared his vision of what the national designation means to the organization: “With this new award, we see it as our job to encourage and facilitate seamless collaboration among agencies, industry, and universities all over the country.

“We’ve already taken the first step to achieve this by gathering previously disparate individual centers of excellence into a cooperative ‘critical mass’ that leverages a wealth of talent, leadership skills, and facilities and resources,” added Maher. “In theory, bringing groups with a common interest together may sound simple, but in practice it’s very challenging.”

“The consortium partners absolutely make our national center what it is,” CAIT associate director Patrick Szary said. It makes sense to combine the intellect, experience, capital and physical resources—such as labs—of other great research universities, “so we’re not reinventing the wheel,” Szary said. “Plus, when it comes to identifying common problems and what our stakeholders really need, our partners give us an advantage similar to that of a journalist embedded with the troops; we’re getting a first-hand perspective,” Szary added.
“A national presence also gives us even more chances to test and implement our research products.”

The consortium embraces an approach that recognizes significant crossovers between modes, assets, and research topics. Every partner is involved in multiple modes and topics that collectively contribute to the center’s main theme: state of good repair.

As an example of multimodal benefits: Rutgers, NJIT, USF, and UTEP each has significant research capabilities in freight and goods movement by road, sea, and rail. But USF has public transit expertise, as well, so now the consortium can expand its efforts to include both passenger and freight rail.

Columbia, Princeton, Rutgers, USU, and Virginia Tech all have expertise in structural health monitoring, which is key for maintaining highways, railroads, pipelines, airports, and marine ports.

Specific assets share common problems as well. For example, bridges are elements in both highway and rail networks, and if they have footings in water, both those types of bridges are subject to scour (erosion around supports caused by moving water). A solution for scour that emerges from research on highway bridges would also be useful in combating the same problem for railroad bridges.

USU shines in advanced materials, bridge construction, and structural forensics. Dr. Paul Barr is director of the Utah Transportation Center and its Systems, Materials, and Structural Health Lab (SMASH Lab). Barr says, “Capitalizing on commonalities and connections among modes and assets makes perfect sense. It maximizes efficiency and broadens the applications for what we learn from research. This pool of multimodal experts can have a much bigger impact than any one of us could have alone.”

“For years CAIT has concentrated on knowledge that can be applied right here and now to help solve complex issues for stakeholders who are facing real challenges in the real world. We offer insight or products that have immediate effects on the operation and management of bridges, roads, freight terminals, energy networks, and so forth. We will continue to do that, but now we’re going to take it to the next level and find new ways we can contribute to making this nation’s infrastructure better and stronger,” said Maher.
Think of all the things we take for granted that were nearly science fiction just 20 years ago—commercialized GPS, large-scale solar plants, mobile broadband, MP3 players, and even email—all brought to you by imaginative people with STEM skills. Without bright, well-trained, energized young people, the boom of technological innovations we’ve seen in the last several decades will slow to a trickle.

To sustain that progress, CAIT knows it has a responsibility to go beyond just providing education; we need to infuse excitement in young people and do everything we can to help them succeed. One way to do that is by partnering with multiple organizations on and off campus to promote STEM to learners of all ages.

NEXGEN, not Gen X

Rutgers’ School of Engineering (SOE), CAIT, and the Office of Student Development together organize activities and lectures for Rutgers’ Academy for Next Generation Engineers (NEXGEN), a five-week summer residential program. NEXGEN is part of the National Summer Transportation Institute (NSTI), a federal program that exposes disadvantaged or at-risk young people to transportation careers.

Rutgers’ NEXGEN exclusively serves incoming first-generation college students from low-income backgrounds. About 60 students identified by SOE’s Engineers of the Future (EOF) program come and stay on campus a month before their first semester to acclimate to college life. They get individual attention, shadow faculty mentors, and are exposed to a wide range of subjects like urban planning, highway construction, and environmental engineering. Andrés Roda, P.E., Rutgers NSTI manager and head of the Bridge Resource Program (BRP) at CAIT, coordinates NEXGEN. “CAIT engineers bring our practical, applied research experience to this program—we can show these kids the connection between theory and real-world issues better than just about anyone on campus,” said Roda. “I love seeing them gradually become more comfortable in an academic setting and gain confidence.”

Dr. Eric Gonzales, a civil engineering professor and CAIT researcher, gave a presentation on traffic engineering. When students realize highways, traffic lights, signs, etc., are relevant to their daily lives, a light bulb goes on. “[Then they are] genuinely interested,” Gonzales said. “They asked a lot of questions about how we
design them, how we maintain them, and how we repair systems that are falling apart.”

NEXGEN students are shown, not told, what research entails. They build model bridges, dams, rockets, and compact solar panels or design a rescue rover that has to prove it’s viable by “saving” a doll trapped in a confined space. Activities like this help them understand the research process by walking them through the steps required: establishing a team, getting funded, conceptualizing a solution, testing ideas, and presenting research findings.

Gonzales believes NEXGEN has value beyond imparting core knowledge and skills. “You create friendships and support networks in college that last a lifetime. There’s nothing more fulfilling—in work or life—than having people you can count on,” Gonzales said. “I saw many of the NEXGEN students beginning to form strong connections that will help them tremendously throughout their careers.”

**Governor’s School students rule in STEM**

Many of the same key points of NEXGEN also are taught to outstanding soon-to-be high school seniors at the New Jersey Governor’s School of Engineering and Technology at Rutgers, an exclusive four-week summer immersion program.

Governor’s School students have already chosen to concentrate on math or science and been identified as the most motivated and accomplished among their peers. Each New Jersey high school can nominate only one for every 325 students who have completed their junior year to attend the program. If a school has 649 or fewer juniors, it still can nominate just one student. Generally, of the 300 to 400 nominees each year, less than 25 percent are chosen. The competition is fierce, in part because the entire cost of the experience—more than $3,000 including tuition and room and board—is entirely covered by corporate, foundation, and individual donations.

CAIT develops an advanced transportation elective as part of the Governor’s School curriculum. This year’s elective examined infrastructure health assessment and monitoring. CAIT research project manager Brian Tobin coordinated life-skills workshops and hands-on demonstrations that introduced students to professional etiquette and helped them connect with faculty and professionals, as well as the kids from other schools.

“When I ask researchers and staff at CAIT if they will volunteer their time to work with these talented kids, no one bats an eye,” Tobin said. “It’s great to be able to show them the wonders of civil engineering.”

CAIT experts—all licensed professional engineers or engineers in training—presented on topics relating to the course theme: assessing the condition of critical infrastructure.

Students heard about roadway safety, the life cycle of bridges, public transit, geospatial information systems (GIS), the complexities of pavement design and construction, and the robotic system CAIT developed for FHWA that uses multiple high-tech tools to diagnose hidden deterioration within bridge decks.

After the lectures and demos, students split into small groups to work on research projects alongside these professionals. The Governor’s School culminates in a formal research symposium where students showcase their project in a final paper and presentation in front of hundreds of family members and guests.

**On TARGET**

Women have come a long way, but even in the 21st century men still dominate in STEM. CAIT wants to change that via specialized programs that cater specifically to young women.

The Academy at Rutgers for Girls in Engineering and Technology (TARGET), sponsored by Rutgers’ SOE, is a six-week summer program designed for female students in grades 8 through 12 to increase their awareness of technology careers and inspire them to make one their life’s calling.

TARGET program coordinator Candiece White says the program definitely helps attract girls to Rutgers engineering. “We’re proud to say that female enrollment in Rutgers engineering programs is at 18 percent, our highest number yet. We still have a long way to go, but that’s progress.” White said.

TARGET aims to dispel negative stereotypes that women engineers are geeks and outsiders. Smart, established professional women share
their career experiences with the girls and guide them through workshops and hands-on labs that reveal engineering possibilities within their reach.

Team activities this year encompassed civil, industrial, materials, and biomedical engineering. Students built solar-powered model cars, did chemical analysis of \textit{in vitro} wound healing, and fabricated structural support beams from concrete they mixed themselves.

Now in its sixth year, the program has proven its value. Peggy Devitt, mother of TARGET participant Nicole Devitt, said her daughter was greatly influenced by it. “Nicole is interested in pursuing chemical engineering. She loved the labs,” Devitt said, because they gave her a clearer picture of the research and career she’s considering. “She especially enjoyed being with girls who have similar interests and talking about the future and how they are preparing for it,” said the proud mom.

“Lunch and learn” roundtables gave the girls the inside scoop about life as a female engineer—the successes and the obstacles—from women who come from top consulting firms, state and regional transportation agencies, and some of the largest engineering construction companies in the country.

“I used to hear, ‘Girls can’t be engineers, that’s a man’s job,’” said roundtable speaker Jennifer Marandino, P.E., a traffic safety engineer with the South Jersey Transportation Planning Organization. “My response to that was, ‘Well, I’m good in math and science, and I can do this—don’t tell me I can’t.’”

Inspired by her father, also a civil engineer, Marandino overcame the biases and now analyzes traffic impacts and manages federal funds for safety projects throughout New Jersey.

“Women have come a long way in engineering. Girls have many more options than when I was first coming out of high school,” said Patricia Ott, P.E., owner of MBO Engineering, a safety consulting firm. “[The girls] were particularly interested in how engineers move up the ladder into leadership positions. TARGET is a terrific way to engage young women and show them that the definition of ‘engineer’ doesn’t include a gender.”

It’s true “engineer” is not a gender-specific title, but women do bring something different to the table. TARGET coordinator White says, “[We] have a different perception of the world than men. … That’s not a bad thing.”

**NASA program (not for space cadets)**

In early August, CAIT hosted the New Jersey Space Grant Consortium’s (NJSGC) Annual Summer Research Conference, a program that aims to broaden and enhance the backgrounds of STEM students entering their first or second year of college. NJSGC is part of a national program sponsored by NASA that organizes several innovative educational initiatives for K through 12 and university studies.

Sixteen summer research fellows from Rutgers, Rowan University, and Stevens Institute of Technology gathered at the conference to present the research they conducted under NJSGC. Some examples of the diverse projects these bright young engineers and scientists shared with faculty, family, and guests are: “Aerial Firefighting: Today’s Design, Tomorrow’s Future,” “Manipulating Cold Molecules,” and “Determination of Single Nucleotide Polymorphism in miR-9 Regions in Humans with Alcoholism.”

Where are they now?: Elizabeth Awad, F.E.

**Former CAIT intern is making her mark in Sussex County**

Sussex County assistant engineer Elizabeth Awad pores over plans for a major long-term county road rehabilitation project. The recent Rutgers School of Engineering graduate plays an integral role in construction management and quality control for Sussex’s road improvements—a natural progression for a young woman who favored structural engineering courses and supplemented them with hands-on practical research experience at CAIT.

Awad earned her bachelor’s degree in civil and environmental engineering in May 2012. In her last two years at Rutgers she interned with CAIT’s Transportation Safety Resource Center (TSRC), geocoding for its crash analysis software, Plan4Safety. This entailed entering exact location coordinates into a database for each of New Jersey’s three million official crash records. Crash records typically are filed without this information, which is needed for filtering and accurately mapping crashes. About 600 public safety professionals use Plan4Safety to plan enforcement, crash reduction, and engineering solutions and strategies.

Awad thrived in the geocoding project because of her precision and work ethic. “This work requires a high degree of focus,” said Janet Hansen, TSRC program coordinator and geocoding supervisor. “Elizabeth performed her job very well and was quite reliable.”

Soon Awad’s leadership skills became apparent, and she was promoted to manage and train incoming geocoding interns. After she felt she fully understood the program, she even provided input to developers on how it could be enhanced.

After her internship at CAIT, the ambitious, detail-oriented engineer earned her Fundamentals of Engineering (F.E.) license and has been involved in several major contracts, including a $5.6 million project under Sussex County’s Annual Resurfacing Program.

“I’m working with the North Jersey Transportation Planning Authority on their high-risk rural road program,” Awad said. “These projects involve low-cost safety enhancements like sign replacements and pavement markings. I also work with NJDOT and the county planning board to implement overlay projects, microsurfacing, intersection redesign, and other safety enhancements.”

With that range of experience, she imagines taking on a managerial role, not unlike the one she had as a CAIT intern. “In 10 years, I see myself in a supervisory or senior engineering role with Sussex County,” Awad said. “There’s a wealth of [experience to tap] out there; I’m fortunate enough to learn under intelligent and competent engineers.”

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Women on the verge
CAIT helps young women on the threshold of their careers go forward with confidence. For three years, CAIT has sent two female students to the Women in Transportation Seminars (WTS) Annual Meeting, a three-day conference for transportation professionals.

The majority of WTS attendees are established in their careers, but the conference features many technical sessions and business leadership panels that can enrich and inspire young women just about to enter the engineering workforce.

CAIT selects students based on an application and essay contest that is open to junior- or senior-year females studying transportation-related engineering or planning. The contest winners have their WTS registration and travel expenses paid by CAIT.

This year, CAIT asked its UTC consortium partners to extend this opportunity to even more young women. Columbia, Princeton, University of Delaware, University of Texas at El Paso, Utah State University, and Virginia Tech each selected one or two outstanding female students to represent their school. In total, 12 women from the Tier I UTC Consortium led by CAIT attended the WTS meeting in Philadelphia May 15–17.

One of the most valuable aspects WTS holds for these young women is the opportunity for mentorship and support. Mahour Rahimi, a civil engineering major from Rutgers, said a panel discussion on this topic and the importance of role models was among her favorites. “I learned that mentorship is a toolbox of opportunities. … You have to establish trust with a person that you know can answer your questions and even provide emotional support,” Rahimi said.

The conference always features technical tours that crystallize concepts and theories into reality. Tours this year included visits to the Benjamin Franklin Bridge, Philadelphia Regional Port Authority facilities, I-95 Girard Avenue Interchange construction site, Philadelphia International Airport, and the SEPTA multimodal network.

Attendees like Rashmi Gangaram, a Rutgers construction management major, gained a lot from the tours. “[When I graduate], I want to work on maintaining existing infrastructure systems. … to reach new heights in transportation engineering and to make this industry more environmentally friendly,” Gangaram said. “I enjoyed being out there and seeing construction of I-95, a major regional highway, firsthand. This kind of work is going to improve the lives of countless people.”

A highlight of the conference was the keynote address by women’s rights activist and journalist Gloria Steinem, which explored psychological factors that cause negative perceptions about women and how to overcome them.

“Women are not better people than men,” Steinem said. “Culturally speaking … we need to advance women in leadership because we tend to put a premium on prevention and [looking to] the future, rather than crisis management for immediate problems.” Steinem also described goals women should focus on for career success, including a life integrating work, community, family, and friends.

WTS exposes young women to heroes like Dr. Mae Jamison, a NASA astronaut who defied the odds to achieve personal and professional success. “Dr. Jamison’s story really struck me. She was the first woman of color to become an astronaut, and it really reinforced the idea that there is no bar of gender, age, nationality, or race to learn and work,” Gangaram said. “What one needs to succeed is zeal, enthusiasm, a hunger for knowledge, and determination.”

A worthwhile investment
Academic theories and “book learning” can seem a bit esoteric to kids who are anxious to jump in and do things. CAIT’s contribution to Rutgers’ many excellent programs that promote STEM education is inspiring students by showing them what happens in a university setting can have real, immediate impacts on their day-to-day lives and those of family, friends, and the whole country.

In the years ahead, these young people will develop solutions for the economic, social, safety, and environmental needs of the world and make what’s impossible today, commonplace tomorrow. We know they are well worth our time.

Below: One of the WTS Conference technical tours was to the Benjamin Franklin Bridge between Philadelphia and Camden, New Jersey. WTS essay winner Ellen Tung from Princeton University said it was a great experience. Photo: Courtesy Branko Glisic/Princeton University

p7 Back to school
In the last issue of *Transportation Today* (May 2013) we described some projects related to recovery, emergency planning, and resilience that Rutgers researchers are tackling. Here’s an update on some of the contributions CAIT and its partners have made in the past months.

**What do dunes do?**

If we didn’t know before Superstorm Sandy that protective infrastructure—particularly beach dunes—can help blunt a hurricane’s impact, we do now.

New Jersey has the most developed and densely populated oceanfront in the country. Of 130 miles of coast between Sandy Hook and Cape May Point, only 31 miles of beach have no human development.

To put a barrier between the sea and buildings is a simple concept, but sadly many shore communities have no such protection. And it isn’t only the presence or absence of dunes that matters. How wide do dunes have to be to be effective? How high? How steep? How far from structures?

October 29 marked the one-year anniversary of Superstorm Sandy. For the millions of people seriously affected by the storm, it’s been a trying year. Recovery is ongoing; progress feels slow in some cases, but remarkable in others. Where is CAIT one year later?

To answer some of those questions, CAIT researcher Dr. Birnur Ozbas and Dr. Michael Greenberg from the Bloustein School of Planning and Public Policy did an assessment and statistical analysis to estimate the relationships between dune and beach characteristics (height, width, proximity, spacing, steepness), land use (types and height of structures), and dunes’ ability to reduce negative impacts of storms.

The study supports a larger Federal Emergency Management Agency (FEMA) project on flood modeling and mitigation being done at Bloustein. The assessment can be used to highlight problem areas where dunes are needed—or where current dunes are likely to fail from “mega-storms”—and evaluate effectiveness of previous dune construction and maintenance.

Ozbas used studies by the Coastal Research Center at Richard Stockton College conducted between 2002 and 2009, findings of the Geospatial Research Lab at Rowan University in 2013, and new data from site visits and LiDAR surveys to identify eight zones in Ocean County that sustained low, moderate, or severe damage. They were then evaluated weighing whether or not they had dunes, and statistically analyzed to prove the benefits of dune systems.

Above: Sandy leveled much of Seaside Heights and Seaside Park, home of an iconic Jersey Shore boardwalk and amusement pier. 
*Photo: ©2013 John Huntington/Shutterstock*
After initial comparison of the eight selected zones, they examined the five zones that had dunes and looked at specific characteristics of each zone including beach width; dunes’ crest height, width, and foredune scarp slope; gaps between dunes and proximity to back-beach structures; and the type and height of back-beach structures. The researchers then used models to analyze the correlations between all the variables.

In the end, this study concluded the most influential characteristics for reducing storm impacts were dune width and height, proximity to back-beach structures, and the type/height of those structures.

However, models and analysis indicated that the relationship between all the environmental and physical variables are even more complex than expected, so a more detailed model should be developed before we can fully understand the best design and placement of beach dunes to protect coastal communities.

Even so, having this kind of information helps decision makers plan more effective and efficient use of taxpayer and municipal resources, as well as keeping citizens safe.

For example: Long Beach City, which opted not to make an initial $7 million investment in a dune project, suffered at least $200 million in property and infrastructure losses according to preliminary estimates. On the other hand, Bradley Beach constructed 15-foot-high dunes in the 1990s, inexpensively using storm fencing and discarded Christmas trees topped with dune grass. Sandy-related damage in that area was estimated at around $3 million. Perhaps if Long Beach City had information similar to that provided in this assessment, they may have made a different decision about investing in dune protection.

**Training for disaster**

No one was completely prepared for Superstorm Sandy. In the wake of the storm, CAIT began putting together information and instructive sessions that would help people navigate the recovery process and better plan for nature’s next assault.

**FEMA construction updates**

With funding from FEMA, CAIT offered a course on coastal foundation design and construction for contractors, architects, engineers, code inspectors, plan examiners, permitting administrators, and other professionals involved in construction.

Wave action, high-volume flooding, debris, high winds, erosion, and scour experienced in shore communities are often different than those forces inland. The coastal foundation design sessions centered on FEMA Publication P-550, which outlines these unique loads and stresses that building foundations need to withstand in coastal and near-coastal areas.

The course covered requirements of the National Flood Insurance Program (NFIP), the assumptions used in developing the FEMA designs, and how contractors can customize the foundation designs for specific homes. It also presented information on how to improve hazard resistance for both retrofit and new construction of residential buildings.

Updates have been made to several FEMA guides since Sandy, and the changes can be hard to keep up with. CAIT’s coastal foundation course also consolidated new information in the FEMA publications Coastal Construction, Engineering Principals and Practices for Retrofitting Flood-Prone Residential Structures, and Wind Retrofit Guide.

**Extra challenges for people with disabilities**

Looking at a completely different aspect of preparedness training, CAIT hosted another FEMA event September 25: the Region II Disability Community Stakeholders Meeting.

FEMA’s senior natural hazards program specialist Patricia Griggs and other FEMA experts in public safety, risk assessment, and disability integration presided over the first part of the meeting. They discussed the potential hazards of various natural and man-made disasters, how they classify disaster levels, what “mitigation” means, and how to promote equal access for people with disabilities and include their needs in mitigation planning. They also reviewed flood insurance, what it covers, and how to apply and file a claim.

The second half of the meeting was led by Madeleine Goldfarb, executive director of Noah’s Ark Institute, a nonprofit advocacy group for people with autism. She presented on universal design—a broad-spectrum approach to making buildings, products, and environments that are inherently accessible to all people, including those with disabilities.

Goldfarb outlined how people with disabilities can get involved in local mitigation planning and once they get a seat at the table, what expectations are reasonable regarding changes they can affect.

She also gave an overview of the FEMA/New Jersey Office of Emergency Management grant to Noah’s Ark Institute for doing spatial mapping of four northern New Jersey counties: Bergen, Essex, Hudson, and Passaic.
Unexpected applications for Sandy research

Back in late 2012 and the first months of 2013, Dr. Jie Gong—a Rutgers civil engineering professor and CAIT researcher—tooled up with Woolpert, Inc. to do ultra-high-resolution ground-based mobile LiDAR surveys of structural damage and the general devastation caused by Sandy. LiDAR is a remote sensing/mapping technology that is similar to radar, but uses laser light beams instead of radio waves. (See Transportation Today, May 2013 issue.)

Based on his previous experience using LiDAR technology in building and highway mapping projects, Gong believes the perishable hurricane damage data should be collected to support future studies, but Hurricane Sandy’s destruction was so widespread that it overwhelmed the capacity of traditional surveying methods. Using mobile LiDAR in a post-disaster scenario like this is a logical choice.

CAIT saw the value in his idea and funded the work using resources from its USDOT University Transportation Center grant. The data Gong collected from Queens, New York, to Ortley Beach, New Jersey, are currently being used to support several studies that will have significant influence on modeling, resilience visualization, and post-disaster damage assessment practices for catastrophic events.

Following his work surveying storm damage, Gong had another opportunity to apply his LiDAR expertise. He contributed to winning a $687,000 U.S. Department of Housing and Urban Development (HUD) grant awarded to Rutgers Center for Green Building at the Bloustein School for Planning and Public Policy. The 2013 HUD Healthy Homes Technical Studies initiative is funding the project with the broad goal to protect the health of families living in HUD-assisted and other lower-income housing.

We Americans spend an average of 70 percent of our time in our homes. Of course we want our homes to be safe; we certainly never expect they will make us sick. But millions of U.S. homes have hazards like deteriorated lead-based paint, elevated radon levels, or pest infestation that put their occupants at risk for poisoning, respiratory ailments, and a host of airborne and contact viruses and other diseases. Too many people suffer from preventable injury and illness due to unsafe conditions in their homes. Children and seniors are particularly vulnerable to residential hazards, and low-income families are least equipped to deal with getting rid of the culprits.

Laser scanning and infrared imaging technologies collect data that can potentially be used to detect structural deficiencies, moisture, mold, insulation breaches, insect harborage, and vermin tracks in “high-definition” detail. For the HUD project, the team will use these tools to scan two or three multi-family housing sites. Building information models will be created as a data platform to support analyses for gaining a systems-level view of building deficiencies and health- and safety-hazard patterns.

Although this grant is focused on affordable housing, the results will have immediate impacts on post-hurricane housing safety and health hazard inspection practices. Given the amount of residential houses that can be damaged or contaminated by floodwaters, such a tool would be invaluable in assisting rapid recovery efforts.

Clinton J. Andrews, professor of urban planning and director of Rutgers Center for Green Building is the PI. Gong and Gedi Mainelis, an environmental sciences professor from Rutgers’ School of Environmental and Biological Sciences, are co-PIs.

The work continues

Thankfully, Superstorm Sandy is behind us, but there is much we can learn from our experience that can help us stay safe and bounce back from the next storm … and the one after that. We will keep you posted on projects in the works and future discoveries.
On a sizzling July day when the dam’s massive surface reached more than 125 degrees Fahrenheit, CAIT and a team from University of Texas at Austin demonstrated capabilities of some sophisticated nondestructive evaluation (NDE) tools including impact echo, electrical resistivity, and MoistScan technologies.

The teams gathered detailed data on about 1,000 square feet of searing concrete. The researchers were primarily looking for areas of corrosion and delamination (internal cracks caused by corrosion of the steel rebar in the structure).

The project was coordinated by the Electric Power Research Institute (EPRI), a nonprofit organization that brings together experts from academia and the industry to research, develop, and demonstrate technologies and methods to improve generation, delivery, and use of electricity.

Dr. Nenad Gucunski, director of CAIT’s Infrastructure Condition Monitoring Program (ICMP), praised the team: “These guys worked nearly 11 hours in extreme temperatures, and they did an outstanding job. The majority of the testing we do is on bridges, so we were happy for the ‘change of scenery’ and the opportunity EPRI gave us to demonstrate the benefits of NDE to the power industry.”

Maria Guimaraes from EPRI explained, “Concrete could be damaged by corrosion of the reinforcement; it could be water seeping through it, it could be a delamination, so the way of sensing is different.” Guimaraes said a main objective of the day was to bring different advanced testing techniques to demonstrate their usefulness in detecting critical—and often invisible—issues in concrete structures.

The University of Texas and their partner International Climbing Machines (ICM) demonstrated a robotic crawler that could lessen the danger inherent in condition assessment of large structures such as cooling towers, hydro dams, and reactor containments.

The crawler, about the size of an electric lawn mower, adheres to vertical surfaces using vacuum suction and carries around 40 pounds of onboard systems, mainly sound wave and mapping technologies. The potential for the robot to carry a wider range of tools that collect condition data, like those deployed by the CAIT team, is promising.

Said George F. Wong, NYPA senior civil engineer, “In the traditional method we have to send inspectors up on swing stages or scaffolding. We even had people rappelling off the dam once to do the inspection. When this technology has been perfected, it will eliminate [the potential dangers] in the performance of routine structural evaluations.”

Wong continued, “The benefit [of NDE] to NYPA is quicker inspection, less downtime of our asset, and also a more cost-effective way of doing the assessment.”

The generating stations at the Robert Moses-Niagara Dam supply at least 25 percent of all power used in New York State and Ontario, around 2.4 million kilowatts worth. It epitomizes the term “critical infrastructure.” A team of CAIT experts traveled to the dam to demonstrate nondestructive evaluation technologies to the New York Power Authority (NYPA). Knowing the condition of their facilities is key as authority prepares for a multi-year rehabilitation effort of hydroelectric facilities in the state.
Opposite page: Dwarfed against the dam’s 327-foot-by-3,200-foot concrete face, the CAIT team gathered important data about the structure’s health for the New York Power Authority.

Below (top to bottom): NDE technician Ken Lee tests near the base of the dam with an air-coupled acoustic array developed at Rutgers as part of the ANDERS project (cait.rutgers.edu/anders). Team member Brian Pailes measures electrical resistivity, which detects the presence of and characterizes corrosive substances in concrete that indicate deterioration.

University of Texas and ICM’s robotic crawler could lessen the danger of doing condition assessment on large structures such as cooling towers and dams. The potential for the crawler to carry NDE tools like those deployed by the CAIT team is promising.

Photos: ©2013 Nenad Gucunski/Rutgers’ CAIT

Going nowhere without transportation

Transportation assessment project to improve mobility for adults with autism

Adults with autism spectrum disorder (ASD) need the same basics we all do—a well-rounded mix of social, recreational, and work activities and access to friends, family, and services like health care, shopping, and education. What ties these together? The ability to get from point ‘A’ to point ‘B,’ a factor that is often overlooked and surprisingly understudied.

Last year the national Interagency Autism Coordinating Council found that less than 2 percent of both public and private research dollars for autism address life-span or adult issues. “One private school in New Jersey that has an adult program told me they receive six times the funds for a school age client as they receive for an adult,” said CAIT project manager and principal investigator Cecilia Feeley.

CAIT received a $321,250 grant to assess transportation needs, examine barriers, and provide recommendations to develop procedures and policies that will improve mobility for adults with ASD. It is part of a $4.5 million research program from the Governor’s Council for Medical Research and Treatment of Autism to improve the quality of life for these individuals. For more than three years, CAIT has been involved in the transportation aspect of that commitment.

The Governor’s Council was formed in 1999 under the Autism Biomedical Research Act. The council is furthering its mission bolstered by the Combating Autism Reauthorization Act championed by Senator Robert Menendez (D-NJ), a longtime advocate for autism awareness and research funding.

At a press conference announcing the governor’s $4.5 million commitment, Health Commissioner Mary E. O’Dowd said, “This new funding furthers Governor Christie’s ongoing commitment to support children and families affected by autism. This round of awards focuses both on scientific research as well as developing tools for screening and intervention.”

Feeley is spearheading the effort with partners from Rutgers’ Alan M. Voorhees Transportation Center and Autism Family Services of New Jersey. They are analyzing travel patterns, transportation needs and impediments, and opportunities lost due to lack of transportation. Feeley, the mother of a 14-year-old with ASD, hosted Menendez and other advocates and families in her home last October shortly after the Combating Autism Act was renewed.

Adults with ASD have diverse skills, abilities, and characteristics that are as far ranging as the spectrum itself. Their individual capabilities impact what type of transportation is viable for them as much as where they live and transit options available in their area.

Mindful of this diversity, the project will cover all 21 New Jersey counties and examine multiple modes including driving, public transit, paratransit, and walking. The study will include a review of existing surveys and publications, interviews with transportation and ASD experts, and a statewide scientific survey and series of focus groups of adults with ASD and their guardians.

Although the study will be research-based and data-driven, results will be presented in clear terms that can be understood by lay people as well as experienced transit agency personnel, transportation planners, and policy makers.

“Gathering and analysis of this data will rigorously follow scientific protocols, but what good are the findings if only ‘insiders’ understand them?,” asks Feeley. “Our goal is to ensure that what we learn can be integrated in the development of transportation strategies that help adults with ASD lead more independent and fulfilling lives.”
Janet Leli, director of CAIT’s New Jersey Local Technical Assistance Program (NJ LTAP) and head of technology transfer at the center, had an idea: Wouldn’t it be great if NJ LTAP could provide a few complimentary sets of work zone safety equipment to communities in need? Thanks to support from the New Jersey Division of Highway Traffic Safety (DHTS), NJ LTAP was able to procure five sets of work zone safety equipment and then invite towns to apply to “win” them by sending in a short description of what they were coping with since the disaster.

Public works departments in Union Beach, Margate, Roxbury, Ridgewood, and Newark were chosen based on their applications, which were reviewed by a panel of work zone and technical assistance professionals. “When we reviewed the contest applications, we saw that many public works agencies were affected by Sandy,” Leli said. “However, some agencies—especially those in urban areas—simply could not afford work zone equipment needed for crucial roadway repairs. We chose winners based on the best possible impact statewide.”

Most neighborhoods in Union Beach, near Raritan Bay in Monmouth County, were devastated by the 2012 superstorm. Municipal road crews there are still dealing with the consequences, reports the borough’s public works director John K. Haines. A majority of the department’s buildings flooded; the worst was the mechanic’s building, which filled with four feet of water. Many of their vehicles and equipment were a total loss. “The men struggle every day looking...
for items that are no longer here, or work despite equipment no longer being operational,” he wrote in his application.

In Margate, three feet of water from the storm surge destroyed the safety equipment stored in a public works garage. Other towns, like Roxbury, saw equipment worn out from constant use in areas without operational traffic signals and damaged from downed trees.

“We’re pleased to get this equipment out to crews before winter,” said NJ LTAP’s Leli. “Work zone safety is a priority for road workers and drivers alike, and even more imperative when resources are stretched.”

Statistics show that 80 to 85 percent of victims in work zone fatal crashes are drivers or passengers, while only 10 to 15 percent are workers. “Proper equipment protects workers and the public as well. All road users are at higher risk when driving conditions are out of the ordinary,” Leli said.

For some municipalities, such as Ridgewood and Newark, budget constraints prevented their crews from being fully and properly equipped. “Budgetary limitations have always pushed safety equipment to the bottom of the list,” said Jovan Mehandzic, assistant engineer for the Village of Ridgewood. Having the equipment will benefit the towns around Ridgewood as well, he said. “We’re sharing more and more resources to be more efficient,” said Mehandzic, citing plans to store everything in a specially designated truck to make it easy to transport and share with neighboring towns such as Glen Rock, Waldwick, Midland Park, Wyckoff, Ho-Ho-Kus, and the Ridgewood Water utility. “Thanks to NJ LTAP and DHTS, work zones will be a little safer for everyone in our area,” said Mehandzic.

Opposite page: David Pagan (left) and Charles Hill (right) from the City of Newark Public Works Department were happy to get shiny new work zone safety gear. Below: Jovan Mehandzic (right) said his town, Ridgewood, would be sharing the equipment with surrounding communities. Christopher J. Rutishauser (left) and Peter Affuso (center) came to help pick up the gear.

Photos: Allison Thomas/Rutgers CAIT

CAIT lends an eye to transit security project

Passenger safety is the most important duty of a transit operator. Every day, on top of their routine responsibilities, they must constantly be on the lookout for potential security risks.

The Center for Transportation Safety, Security, and Risk at the Edward J. Bloustein School of Planning and Public Policy—in coordination with Dallas Area Rapid Transit and CAIT—has developed a set of educational materials designed to teach bus operators how to identify and report potentially dangerous items or individuals.

Safe and Secure: Security Awareness for Bus Operators is a 15-minute video that highlights bus security procedures before, during, and after a shift—like checking under seats and in wheel wells for suspicious items, and being aware of unusual behaviors. A complementary poster, “Security Awareness is Everyone’s Responsibility,” outlines the video’s major themes, including a security checklist. The poster and video will be distributed to bus transit companies throughout the nation.

More on the web: Information on the Center for Transportation Safety, Security, and Risk at policy.rutgers.edu/ctssr
Hitting the streets
CAIT safety program that makes a local difference gets a national honor

CAIT’s free safety evaluations have helped identify and resolve high-risk road issues since 2010. In just three years, our road safety audit (RSA) team—supported by FHWA and NJDOT—has recommended improvements to reduce crashes and steered New Jersey municipalities and counties to nearly $4 million in funds to implement them.

Road Safety Audit chronicles: Bergen Street in Newark, NJ

CAIT engineers lent their safety expertise in New Jersey’s biggest city and one of its busiest emergency services corridors.

University Hospital in Newark serves about 400 citizens each day. It is located on Bergen Street, one of the city’s major thoroughfares, in a neighborhood also packed with fast food restaurants, stores, transit stops, and highway ramps. Because the hospital is a renowned regional trauma center, emergency vehicles race down four-lane Bergen Street several times a day amid normal city traffic and pedestrians crossing to catch a bus or grab a meal.

In 2012, Newark passed a Complete Streets policy requiring that traffic safety improvements consider all road users—not just vehicles. The City of Newark and regional agencies like the North Jersey Transportation Planning Authority (NJTPA) have made significant strides in areas where motorists, pedestrians, and bicyclists are more likely to conflict. CAIT contributes to their efforts through its award-winning RSA program, a data-driven approach to identify and analyze high-risk crash sites. (See “Roadway Impacts,” opposite page.)
Earlier RSAs CAIT has done in Newark resulted in more than $1 million awarded to projects, including traffic signal overhauls at Park Avenue and 4th Street, Martin Luther King Jr. Boulevard and 7th Street, and other pedestrian improvements to Martin Luther King Jr. Boulevard and Crane Street.

CAIT recently reviewed Newark crash data with NJTPA and found two intersections along Bergen Street where 40 crashes occurred from 2010 to 2012—nearly double the city average. At 12th Avenue and Bergen Street alone, there were nine pedestrian crashes in that period.

“The data clearly shows crashes are happening and no one wants that, but we can’t recommend specific improvements from an office looking at numbers,” CAIT safety engineer Andy Kaplan, EIT, said. “Our RSA team needed to go out and apply their knowledge and experience to come up with recommendations. Based on the data, we decided that Bergen Street between 12th Avenue and West Market Street was the area that needed a closer look.”

Kaplan built a team of partners to conduct a full-day site visit. Representatives from the Newark Police Department, the city council office, NJ Transit, La Casa de Don Pedro, the hospital’s pedestrian injury prevention program (PIPP), emergency responders, and local residents participated.

Jack Nata, manager of the city’s traffic and signals division, said that the collaborative nature of the site visit added value to the safety audit. “The City of Newark is committed to providing safe streets for [everyone],” Nata said. “[This RSA] brought together various areas of expertise to ensure that we identified all safety issues.”

The site visit pinpointed 28 safety issues that could be addressed with short- and long-term countermeasures, for example, longer pedestrian signal times—especially for elderly or disabled hospital patients—and updating crosswalk and pavement markings.

“We’re hoping this will encourage pedestrians to use crosswalks since so many of the issues we observed involved pedestrian behavior,” Kaplan said. “We’re looking forward to working more with the City of Newark to improve safety all along Bergen Street.”

The RSA final report will feature a list of medium- to high-risk safety concerns, recommended countermeasures, and avenues for funding. Once the City of Newark has a chance to implement some recommendations, CAIT will evaluate the impact on traffic safety and quality of life.

Roadway impacts

When we say CAIT is having an impact on road safety, rest assured it’s a positive impact.

The Federal Highway Administration (FHWA) and the Roadway Safety Foundation (RSF) agree. This year, CAIT was selected from a competitive pool of applicants for the FHWA-RSF Roadway Safety Award for the RSA program it developed and now facilitates across New Jersey.

RSAs combine crash data analysis, multidisciplinary site evaluations, and recommended countermeasures to examine and make improvements in high-risk areas. According to the Federal Highway Administration (FHWA), RSAs can reduce crash rates by up to 60 percent.

RSAs almost always involve multiple stakeholders—law enforcement, municipal engineers, and/or community groups—who all have an interest in improving safety in their town or neighborhood.

CAIT uses data to select RSA sites proactively. First, the team focuses network screenings with Plan4Safety crash analysis software (which was developed at CAIT) to identify high-crash locations. After establishing crash history, the team supplements data with insight from roadway owners to quantify the “perceived risk,” and an idea of what types of safety issues deserve special attention.

Once an RSA site is selected, CAIT coordinates with engineering, planning, enforcement, and education safety experts from FHWA, NJDOT, the New Jersey State Police, metropolitan planning organizations (MPOs), local governments and police departments, and community action boards to conduct field observation. Based on what’s observed during the site visit, CAIT develops a range of possible countermeasures and advises roadway owners on appropriate safety funding programs to help them implement the recommended improvements.

CAIT’S Transportation Safety Resource Center and New Jersey Local Technical Assistance Program (NJ LTAP) have conducted safety audits in Newark, New Brunswick, Salem County, Morristown, and other sites in New Jersey.

NJ LTAP director Janet Leli says that the award will help spread a message of safety. “Being recognized with a national award will help us further our safety efforts in New Jersey,” Leli said. “We know that RSAs are effective—now everyone else will too.”

CAIT will be honored at an award ceremony on November 6, in Washington, D.C. The FHWA-RSF Roadway Safety Award is given every two years to recognize exceptional safety efforts around the country. This was the third consecutive time CAIT was honored. Previous awards were in 2009 for its Plan4Safety crash analysis software and in 2011 for the center’s work zone safety education program.
When FHWA designated New Jersey a pedestrian and intersection “focus state” in 2011, state public safety agencies immediately started dedicating resources to reduce those types of crashes. Among these efforts, NJDOT asked CAIT to help revitalize the 12 Months of Safety campaign.

New Jersey sits in the middle of the nation’s most dense, complex transportation corridor. With the number of cars, trucks, cyclists, and pedestrians on its roads, it’s no wonder the state sees higher crash rates than most other parts of the country.

The 12 Months of Safety campaign includes a series of publications that address areas outlined in the New Jersey Comprehensive Strategic Highway Safety Plan. Working with NJDOT, CAIT started with the pedestrian and intersection brochures.

Acting manager of NJDOT Division of Transportation Data and Safety Robert DeSando, says the updated brochures will draw public attention to serious safety issues and complement other crash reduction efforts by engineers and law enforcement.

CAIT used a quantitative data-driven approach to reboot the campaign. “We often use crash data to direct roadway repairs and implement safety countermeasures and enforcement campaigns,” DeSando said. “This is the first time we’re using crash data to devise an educational campaign.”

CAIT’s methodology used Plan4Safety data to identify areas with the highest rates of pedestrian and intersection crashes and factored in influences like geography and population. They mined crash data for age and gender information to identify target audiences, tailored colorful graphics and language to that demographic, and emphasized the emotional and economic consequences of crashes.

The brochures employ what advertisers refer to as “gain messages,” which stress positive outcomes for desired actions. Marketing research shows gain messages—like, “if you drive the speed limit, you will get to your destination faster”—are more effective in changing behavior than loss messages—like, “if you don’t wear your seat belt, you could lose your life.”

CAIT’s data-driven development also informed a distribution plan to get the brochures directly into the public’s hands. (The old materials were primarily distributed at professional safety events.)

The decisions on where to distribute the brochures incorporated a proven strategy based on psychological research that suggests “frame of reference” makes information more impactful. That is, people pay more attention to messages related to the situation they are in at the moment. For example, the average person is more likely to pay attention to a message about pedestrian safety when they are somewhere they will need to cross the street. The brochures also feature true local stories that illustrate the consequences of both good and bad behaviors on the road.
the other side of the road before moving forward. Pedestrians must cross in designated crosswalks or at intersections, not midblock or over highway barriers. These pedestrian brochures communicate those requirements very effectively.”

Currently, 12 Months of Safety brochures can be found in businesses in Atlantic City, Wildwood, Long Branch, Seaside Heights, Point Pleasant, New Brunswick, Piscataway, Passaic, Essex Fells, and Weehawken. Select NJ Transit rail stations along the North Jersey Coast Line also display the brochures.

12 Months of Safety was developed with support from FHWA and NJDOT. All data was from Plan4Safety online crash analysis software developed by CAIT.

More on the web: Download copies of the brochures at cait.rutgers.edu/tsrc/traffic-safety

Below: Screenshot of Plan4Safety crash map. CAIT used data analysis to hone in on locations with the most pedestrian and intersection crashes and tailored the language and look of the brochures to specific demographics.

14th Annual Work Zone Safety Conference

In April 2013, NJ LTAP and the New Jersey Work Zone Safety Partnership hosted a work zone safety conference for 300 construction, maintenance and operations, public works, and law enforcement workers focusing on this year’s National Work Zone Awareness Week theme: “We’re All In This Together.” The event is held each year to help improve safety for workers and motorists in construction areas.

FHWA New Jersey Division Administrator Ernie Blais opened the conference, sharing the history of National Work Zone Awareness Week.

Next, Richard Shaw, assistant commissioner of NJDOT Operations offered insight on road workers’ day-to-day life and emphasized the importance of proper work zone protection, citing his experiences working alongside speeding motorists.

Ken Wood, FHWA Resource Center’s traffic operations engineer, gave the keynote, which covered safety practices and driver perceptions. “Work zone congestion is the second leading cause of public dissatisfaction with transportation,” Wood said, adding that open communication is necessary. He urged the audience to become more customer focused and said “the way we always do it” may not be sufficient.

Robert Kulick from the Occupational Safety and Health Administration (OSHA), outlined the recently issued OSHA Work Zone Compliance Directive that standardizes sign, signal, and barricade placement, enforcement guidelines, violation citations, and other safety best practices.

Lou Ricca, a safety consultant with the American Road and Transportation Builders Association (ARTBA) shared simple solutions to prevent runovers and back-overs.

Leah Picone, a government transportation specialist with 3M, outlined retroreflectivity standards for construction drums (aka barrels) and demonstrated how retroreflective striped equipment is significantly more visible than traditionally striped drums. Picone stressed the right equipment is essential to help motorists recognize work zones and the workers in them.

Capping off the day, OSHA response coordinator John Mazur moderated a panel of experts from OSHA and the New Jersey State Police.

Boot camp training for new NJDOT recruits

Boot camp. Recently, the term is associated with exercise classes for people who want to get physically fit super fast, but for five days in August 2013, it meant getting in shape for something completely different. More than a dozen NJDOT new hires responsible for overseeing federal-aid highway projects learned the rules, policies, and laws required to properly oversee significant funding that supports county and municipal officials in improving the state’s transportation system. Instructors from CAIT’s New Jersey Local Technical Assistance Program (NJ LTAP) and the Federal Highway Administration (FHWA) guided them through an obstacle course of federal regulations and inspection procedures.

Topics covered during the oversight compliance orientation included: “cradle to grave” stewardship of the Federal-Aid Highway Program, highway inspection procedures, grant management, curb ramp design, and work zone safety. This program, the first of its kind, also included a visit to Rutgers’ Asphalt Pavement Laboratory for an inside look at proper asphalt mix design and measuring optimum pavement performance.

Instructors included training manager Ted Green, P.E., and Lloyd Jacobs, P.E., both from NJ LTAP; CAIT’s Pavement Resource Program director Dr. Thomas Bennert; and Ronald W. Bersh and Keith Skilton from FHWA.

“The aim of these classes is to prepare new NJDOT personnel with the tools to guide local public agencies with the federal-aid oversight process,” said NJ LTAP director Janet Leli.

While the classroom aspect of boot camp is complete, their training continues with field visits to in-progress projects so they can perform sample inspections and become proficient in record keeping. Jacobs will continue to provide support to the new personnel with the field exercises.

Above: Attendees at the 14th Annual Work Zone Safety Conference. Photo: ©2013 Nick Romanenko/Rutgers
“Living” asphalt binders

Pavement Resource Program director Dr. Thomas Bennert received a research contract from the NJDOT Bureau of Materials to catalog, evaluate, and model the performance of various microbial additives in asphalt binders.

These “living, breathing” additives diminish greenhouse emissions and make pavement mixtures more flexible and more resilient, increase state of good repair, and reduce maintenance costs. Bennert will collaborate on the work with CAIT’s UTC consortium partners University of Delaware and University of Texas at El Paso. The team will investigate the behavior of bio additives in different critical scenarios, how they perform against petroleum-based additives, how well they strengthen soil below the pavement, and how they influence overall pavement roughness and resilience.

When the evaluation is complete, the final report will outline mixture formulas and expected outcomes. The team will also compile a list of approved microbial additives that can be used by road owners and state agencies for pavement construction and management.

CAIT’S crash reduction software draws international interest

In 2012, safety professionals from China’s Anhui Province Department of Transportation approached CAIT to help address traffic issues in their country by creating crash analysis software similar to the Plan4Safety program developed by CAIT’s Transportation Safety Resource Center. (See cait.rutgers.edu/tsrc/plan4safety.)

The partnership that started then was solidified this past July when CAIT hosted 15 Anhui Province delegates for a full-day goodwill meeting. CAIT faculty and staff presented on New Jersey’s safety and mobility efforts, with topics including intelligent transportation systems, infrastructure sustainability, and data-driven traffic safety. The Rutgers team also discussed CAIT’s mission and its successful research history with sponsors like the National Science Foundation (NSF), the United States Department of Transportation (USDOT), and other key agencies.

CAIT will move on to the active phase of the Anhui Province software development project by the end of 2013; team members expect that the system architecture will be finalized by then. CAIT also is discussing the possibility of creating a crash analysis framework for Qatar—the host country for the 2022 FIFA World Cup. The software would help Qatar’s transportation professionals improve road safety in advance of that international event.

NSF advanced materials grant advances U.S.-China research relationship

A National Science Foundation grant could be the basis of a new, long-term collaboration between American and Chinese researchers. CAIT-affiliated civil engineering professor Dr. Hao Wang is working with Dr. Shaopeng Wu of Wuhan University of Technology in Wuhan, China, on a project investigating development of a multifunctional high-performance asphalt material with self-sensing abilities.

Self-sensing advanced materials alert infrastructure managers to damage or the start of deterioration so they can take remedial action before a small issue turns into a big problem. Asphalt that combines superior mechanical properties with early damage detection would be more sustainable and reduce life-cycle costs.

This has obvious economic and environmental benefits. Wang says, “Developing materials that last longer and are easier to maintain means they will save time and money in the long run. That principle is a perfect foundation for building a long-term collaborative relationship and a terrific concept to engage students in infrastructure engineering.”

This initial collaboration is hopefully the first of many joint proposals in which Rutgers and Wuhan University will share resources, information, and facilities, with a broader objective of building a framework to support exchange and research opportunities for undergraduate and graduate students from both institutions.
CAIT NDE expert tapped for TRB “SHRP2 Tuesdays” expert panel

Dr. Nenad Gucunski was a panelist for the Transportation Research Board (TRB) “SHRP2 Tuesdays” May 21 webinar. TRB—with partners FHWA and AASHTO—launched the “SHRP2 Tuesdays” series in 2010 as a convenient way for a wide audience to share the latest research developments.

This webinar explored a Strategic Highway Research Program II (SHRP2) Renewal Project report on using nondestructive testing to identify deterioration in concrete bridge decks.

Gucunski was PI on a $750,000 SHRP2 project to audit nondestructive evaluation (NDE) technologies, evaluate their capabilities and limitations, and create NDToolbox, an online source for this information.

During the webinar he discussed available NDE technologies, benefits, and capabilities. He also provided visual examples of subsurface deterioration data and spoke on the value of partnerships. Co-panelists were Shane Boone of FHWA, Kelley Rehm of AASHTO, and Monica A. Starnes of the National Academies.

Gucunski’s extensive research in condition monitoring spans more than two decades, and he has been engaged in several nationally significant projects continually for more than half that time.

In December 2009, Gucunski won a $17.9 million “high-risk/high-reward” research project from the U.S. Commerce Department’s National Institute of Standards and Technology (NIST) to develop a NDE and rehabilitation system for bridge decks that would automate condition assessment, identify and characterize localized deterioration, and eventually develop materials and robotic equipment to deploy small early-intervention repairs on areas where problems were detected.

He has played a major role in the FHWA Long-Term Bridge Performance (LTBP) program since CAIT won that $25.5 million contract in 2008. As part of LTBP, he led the team that developed the RABIT™, a robot that simultaneously deploys multiple NDE technologies to gather comprehensive data for bridge-deck health assessments faster, more efficiently, and with more detail than ever before. (See Transportation Today, January 2013 cover story).

Gucunski is the chair of the civil engineering department at Rutgers School of Engineering and directs the Infrastructure Condition Monitoring Program (ICMP) at CAIT.


Rolling out research on wide-base tires

Rutgers civil and environmental engineering assistant professor and CAIT researcher Dr. Hao Wang presented in a two-hour TRB panel webinar discussing the impacts of wide-base truck tires (WBT), or “super single” tires, on pavement performance.

In recent years, trucking companies have adopted WBT in place of dual-tire configurations to reduce emissions, improve fuel efficiency, carry more load, and extend mechanical health of their fleets. The TRB webinar explored the history and future of WBT, how they interact with the pavements they drive on, and modeling those impacts to predict degradation in pavement performance.

Wang—whose research focuses heavily on tire-pavement interaction—presented on possible pavement failures that can occur from a variety of loading scenarios, including axle load, tire inflation pressure, and vehicle maneuvers like braking. Wang also presented the results of a recently completed research project for the South Dakota Department of Transportation on the environmental and financial impacts of WBT as it relates to pavement wear.

The TRB webinar took place on September 10. Other webinar speakers included FHWA highway research engineer Eric Weaver, Illinois Center for Transportation director Dr. Imad Al-Qadi, and University of Illinois graduate research assistant Jamie Hernandez. The webinar is part of an ongoing pool fund study: TPF-5(197)–The Impact of Wide-Base Tires on Pavement Damage: A National Study.

More on the web: TRB description of the webinar at trb.org/Main/Blurbs/169238.aspx
What goes up, must come down ... on pavement

FAA turns to CAIT with two airport pavement questions

Except for seaplanes, every airplane starts and ends on the ground, and the vast majority of those flights take off and land on a paved surface. Airport pavements need to withstand loads and forces very different from the asphalt we drive on, so the safety and durability requirements—and economics—for paved airfields and runways are unique to their setting.

The Federal Aviation Administration (FAA) asked CAIT to investigate two pavement issues: the effects of high tire pressure (typical of larger, heavier aircraft) on runways and if stone matrix asphalt will hold up better than FAA’s standard P401 asphalt mix.

Principal investigators Dr. Thomas Bennert and Dr. Hao Wang will work with Dr. Navneet Garg, pavement R&D project manager at the National Airport Pavement Testing Facility (NAPTF), FAA’s main pavement research headquarters outside of Atlantic City.

Bennert, CAIT’s Pavement Resource Program director, will be comparing a stone matrix asphalt (SMA) mix design to the current FAA standard, P401.

SMA is known as a “premier” asphalt that outperforms regular hot-mix asphalt when it comes to rutting and fatigue resistance. This is due to the “stone-on-stone” aggregate skeleton of SMA, which provides load bearing strength, and a higher asphalt content (used to fill spaces between the aggregates), which greatly improves resistance to fatigue cracking. Even though state transportation agencies have had great success using SMA on highways, it has yet to catch on for runways and taxiways, partially because of its initial cost.

For the study, Bennert and his team will design SMA mixes and the current P401 dense-graded mixes using local materials, then conduct a battery of tests to compare the two. Bennert anticipates this performance comparison will help clarify whether or not the extra investment to pave airfields with SMA is cost effective. Also, the study will help the FAA determine if future research on SMA should be done under full-scale loading conditions at their advanced testing facility.

Wang, a civil engineering professor and CAIT researcher, is the principal investigator on a second FAA project to study how high tire pressure—typical on new larger, heavier aircraft such as the Boeing 787 and Airbus 350/380—affects airport pavements.
Exhibit melds music, history, and transportation

Music lovers of a “certain age” (and ilk) miss pouring over the cover art and liner notes of their favorite record—a 12-inch vinyl record—when music wasn’t just background for multitasking; listening to it got your full attention. If you’re a historian, you appreciate that album covers archive social and pop culture—as well as, if not better than, any other media. If you don’t fit either of those descriptions but you’re a transportation enthusiast, chances are you’d still enjoy Album Tracks: Subway Record Covers, an exhibit at the MTA’s New York Transit Museum in Brooklyn.

The show’s mix of history, art, and transportation features cover art photographed in or related to the New York subway and elevated system—a powerful icon for the city it moves. The exhibit encompasses jazz, pop, funk, early hip-hop, rock, and everything in between from the 50s through the 80s. For Simon and Garfunkel’s debut album, Wednesday Morning, 3AM, they posed at the 5th Avenue-53rd Street station. The Velvet Underground’s Loaded donned a “psychedelic” rendering of a subway entrance by famed album illustrator Stanislaw Zagorski. On Turnstiles, Billy Joel posed with straphangers at the Astor Place station. The Ramones and Kool and the Gang—on record covers a decade apart—prominently featured graffiti-clad subway cars despite NYC authorities’ efforts to eradicate tagging in those years or, perhaps, because of them.

Album Tracks is on exhibit through January 12, 2014. We recommend you make tracks to see it.

More on the web: mta.info/mta/museum

Airport owners are concerned that during takeoff and landing the added stresses of larger wheels, “harder” tires, and greater loads will cause more rutting and cracking and accelerate the breakdown of acres of asphalt, sending the costs for pavement maintenance and rehabilitation soaring.

Wang will develop an advanced three-dimensional finite element model that will predict critical responses of airport pavements under moving aircraft loading.

The project also will help verify results from the full-scale tests previously done at NAPTF. For instance, Wang will investigate if the method used to induce accelerated environmental thermal changes in the lab (via heated pipes embedded in the pavement) is a suitable way to simulate temperature increases caused by heating from the sun in real situations.

Results of the research will provide valuable suggestions for pavement design in airports that need to accommodate the new generation of wide-body aircraft.

Opposite page, bottom: The FAA National Airport Pavement Testing Facility is located near Atlantic City. It houses a fully enclosed test track 900 feet long by 60 feet wide with embedded sensors that measure pavement strain and deflection, among other responses from induced loading. The testing vehicle can simulate aircraft weighing up to 1.3 million pounds. Photo: Courtesy FAA/NATPF
CAIT publications are printed on paper that contains a minimum of 30 percent post-consumer waste recycled content.