UCLA

Civil & Environmental Engineering

HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE | UCLA | FALL 2010/WINTER 2011

CHAIR'S MESSAGE NEW FACULTY NEES@UCLA GULF OIL SPILL

MESSAGE FROM THE CHAIR

Dear friends and colleagues,

It is with great pleasure that we announce the arrival of our newest faculty member Assistant Professor and Edward K. and Linda L. Rice Chair, Dr. Gaurav Sant. Professor Sant's research is in the area of cementitious materials with focus on development and design of sustainable low-CO_2 foot-print materials for infrastructure construction applications. He and his team are working to engineer next-generation concretes that require less cement, yet perform to higher standards. This issue of our newsletter contains a full description of our new colleague's fascinating and challenging work to improve the built environment while protecting our natural environment. We are also pleased to report that our teaching labs have received matching funds from the school for substantial upgrades to improve the quality of undergraduate teaching and learning as we prepare the next generation of America's civil and environmental engineers. Our faculty and students continue to be recognized in the nation and around the world for their research excellence. Professor Eric M.V. Hoek worked in the Gulf of Mexico during the Deepwater Horizon disaster by refining the water/oil separation technology championed by actor Kevin Costner for use in remediating the massive oil spill. Professor Shaily Mahendra has received a major grant from AECOM for her work in bioremediation of groundwater at sites formerly occupied by the Departments of Energy and Defense. Her innovative, data-driven approach to monitoring and accelerating the bioremediation process will surely inspire and inform future research in this critical field. Professor Woody Ju is currently involved in using computational micromechanical models to develop novel materials for road repair that could save U.S. taxpayers and drivers billions of dollars per year. And Dr. Christine Goulet, a 2008 doctoral recipient from this Department, has recently begun work developing seismic ground motion hazard models for the Central and Eastern North America region, a region that includes the New Madrid fault, which was the epicenter of the strongest series of earthquakes ever recorded on this continent, and which remains a hazard for extreme earthquake activity.

As for our student groups, our CalGeo student chapter's Mechanically Stabilized Earth Wall Group has been selected as one of the top ten university groups to compete in GeoChallenge 2011 at the Geo-Institute's annual conference in Dallas. The competetive selection process was based on a design report for a mechanically stabilized earth wall with vertical and horizontal loads. Engineers Without Borders (EWB) placed third at the Rube Goldberg Competition in January, and are currently hard at work on designs for their upcoming field trips to Guatemala and Nicaragua. Chi Epsilon is developing an undergraduate tutoring program and hosting EIT exam review sessions. Associated Students of Civil Engineering (ASCE) continue to work hard on concrete canoe, steel bridge, seismic, environmental and surveying projects in preparation for competitions at their upcoming regional conference.

We are immensely proud of our Department's achievements in recent months, and I invite you to read on to discover the details of the fascinating, important, and influential work we do here.

Sincerely,

J.S. Chen
Chancellor's Professor and Chair

NEES@UCLA

Team Conducts Simultaneous Trio of Global Field Studies

As part of a long-term UCLA-Caltrans collaboration, a team including NEES@UCLA performed load testing to failure of large-scale bridge abutment models at the Caltrans-UCLA field test site near Los Angeles International Airport during the week of December 8th.

After planning and constructing the project (and after working through several setbacks), the team pushed an abutment wall to backfill failure under a total load of 1650 kips while keeping it planar and horizontal. NEES@UCLA was a big part of this test's ultimate success, providing dynamic and static actuators for the field testing, control systems, instrumentation and field support, and assisting with data QA and preparation.

At the same time NEES@UCLA also collaborated with Bogazici University and the Kandilli Observatory & Earthquake Research Institute (KOERI) in Istanbul, Turkey on an NSF-funded project to study the behavior and performance of older reinforced concrete buildings. Dr. Ertugrul Taciroglu, Associate Professor, UCLA Department of Civil and Environmental Engineering, served as PI, with Dr. John Wallace of UCLA CEE as co-PI.

The field testing in Istanbul started in the summer 2010 with the deployment of NEES@UCLA instrumentation and staff to assist with vibration measurements on a 4-story building constructed with a concrete frame and masonry infill. The building was stripped to its frame and rebuilt with improved seismic design. UCLA provided a 24-channel structural monitoring system to conduct ambient vibration testing. From Dec. 13-15, NEES@UCLA assisted in forced vibration testing of the retrofitted building, with Dr. Nigbor in attendance.

Yet another simultaneous test took place in Miko, Japan, at the E-Defense facility there. NEES@UCLA PI John Wallace led a team of UCLA and NEES@UCLA personnel in a project that performed detailed measurement of concrete shear wall deformations

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Cleaning Up the Gulf With Kevin Costner

UCLA Engineering Professor and a team of students work closely with Kevin Costner's Ocean Therapy Solutions to optimize device to remove spilled oil from gulfwaters

As fate would have it, when the BP Deepwater Horizon drilling rig exploded last April, causing the massive oil spill in the Gulf of Mexico, UCLA Engineering's Dr. Eric M.V. Hoek was celebrating a feat achieved at UCLA just a week before.

Hoek, an associate professor of civil and environmental engineering from the UCLA Henry Samueli School of Engineering and Applied Science, had been working for the previous eight months on refining a cutting-edge technology designed to separate crude oil from water.

One week before all eyes in the nation were drawn to the oil-streaked waters off the Louisiana coast, Hoek and his team at UCLA were able to improve the ability of a high-tech, liquid-to-liquid centrifugal separator to remove enough oil to achieve a water purity level of up to 99.99 percent.

The timing couldn't have been more critical for the people who had put their hearts, hope and money into a project that started in 1993 when actor Kevin Costner purchased a patent from the Department of Energy's Idaho National Laboratory that eventually led to the development of a centrifuge now produced by CINC Industries Inc. of Carson City, NV.

"Partly in response to the Exxon Valdez [disaster], I resolved to commit personal resources to engineer a product that would be effective in cleaning up oil spills," Costner told the House Science and Technology Committee at a June 9 hearing.

"Like fire extinguishers, oil-water separators could be stationed on every boat, harbor and port where oil was present. I envisioned the machine as a safety device — compact and portable enough that it could be deployed on a small craft, and rugged enough to operate reliably in rough seas. The CINC oil-water separator can do all this."

Patent in hand, Costner hired researchers, invested more than $20 million in the company and spent the next 15 years improving and refining the centrifuges and trying to garner interest in the technology from oil companies. At the time, not only were oil companies not interested, but government agencies like the Environmental Protection Agency and the Coast Guard often blocked the technology from being tested because of concerns over water purity.

Hoping to change all that, Costner asked Hoek to

evaluate the technology.

"Since Kevin had such a hard time getting his oil-water separator accepted by the oil industry and government officials responsible for oil spill cleanup, we started out looking at different applications — like treating 'produced water,' which is the oily and often brackish water that comes up during oil and gas production," said Hoek.

Working with a laboratory-scale version of the centrifuge, Hoek and his team learned how to optimize the device, which utilizes centrifugal force. By spinning two fluids of different densities within a rotating container, heavier liquids (i.e. water) are forced to the exterior walls of the rotor while lighter fluids (i.e. recovered crude oil) are forced to the center. A novel collection system at the top of the spinning chamber extracts oil and water through separate outlets.

"A distinguishing feature of Costner's centrifuge is that can handle a huge volume of water and wide fluctuations in influent oil/water ratios, which makes it ideal for the variable conditions experienced during an oil spill response. Ocean Therapy Solutions, is a new company formed by Costner and some local Louisiana businessmen to market and deploy the CINC centrifuges in connection with oil cleanup in the Gulf.

The largest of the CINC units can now clean water at a rate of 200 gallons per minute. That means one such centrifuge, which can be taken into the spill area by barge, can clean up 210,000 gallons of polluted water per day. Once separation has occurred, the oil is stored in tanks, and the water is considered clean enough to be returned to the ocean.

Almost immediately after the Deepwater Horizon oil spill occurred, Hoek called together a team of students and postdoctoral scholars "to all pitch in and lend a hand. The team worked diligently day and night for more than a week to figure out how well the centrifuge could separate oil from seawater. It worked great in the lab, but no one really had any idea how it would work in the Gulf."

Two weeks after the Deepwater Horizon platform sunk, Hoek in New Orleans demonstrating the centrifuge with Costner. "No one had ever attempted to do something like this before. The demo went well, but we had to conduct a number of field trials over the next month with BP to learn how to overcome the variable conditions of the oil and to cope with various health and safety issues for the operators."

Following rigorous testing, BP, impressed with the capabilities of the centrifugal separator, decided by mid-June to lease and deploy 32 devices through OTS.

Due to the time required to produce the centrifuges, to modify and outfit the vessels, OTS was able to deploy 21 centrifuge systems on six oil spill recovery vessels in the gulf before the well was capped.

The system developed by Hoek and OTS team partners in the gulf actually went beyond just using the centrifuge on oil spill recovery vessels. The centrifuge was combined with state-of-the-art booming and skimming equipment, as well as membrane technology, to enhance recovery efforts and to further protect the environment, OTS officials said.

"It has been very exciting to be a part of this project," Hoek said. "While I would be much happier if the spill had never happened, it did. This was a team effort involving many talented and dedicated engineering and offshore experts, but, I can honestly say I played a part in the overall response to one of our country's worst environmental disasters. It was great to work with Kevin

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New Faculty Profile:
Assistant Professor Gaurav Sant

PhD – Purdue University
The Edward K. and Linda Rice Term Chair in Cementitious Materials

In the Fall of 2010, the Department of Civil and Environmental Engineering at UCLA was pleased to welcome its newest hire, Professor Gaurav Sant, holder of the Edward K. and Linda L. Rice Endowed Chair in Cementitious Materials.

Professor Sant conducts research and teaches courses in the area of civil engineering materials and structural engineering with an emphasis in cement-and-concrete systems. As he often points out "for every ton of cement produced, around 1 ton of CO_2 is emitted into the atmosphere ensuring that cement production currently accounts for around 8% of global CO_2 emissions"! Professor Sant's research interests are focused on suppressing the carbon foot-print of concrete structures. These efforts take a broad-spectrum experimental and computational materials-science approach to engineer new concretes which contain less cement while performing to a higher standard. His research unifies the development of new materials and conservation of current infrastructure with much-needed aspects of natural resource management and environmental protection to promote sustainable development of the built environment into the future.

Professor Sant's career began in West Lafayette, IN, where he earned his Bachelor's degree from Purdue University. Beginning in his junior year, he worked as an undergraduate research assistant with Professor Jason Weiss, and quickly developed an interest in construction materials research. Professor Sant pursued his graduate education at Purdue University, advised by Professor Weiss, earning his MSCE and PhD in quick succession in 2007 and 2009 respectively. During this time, he was involved in research which demonstrated for the first time, in rigorous detail, the mechanism of action of a specific range of chemical additives (known as shrinkage-reducing admixtures) in mitigating the risk of shrinkage cracking in concrete structures. This research enables the development of crack-resistant concretes for a new generation of long-lasting civil engineering infrastructure. During his time at Purdue, Professor Sant's research was widely recognized through collegiate and national research awards including the Bryant Mather and Fred Burggraf awards through the Transportation Research Board (TRB) of the National Academies and the William Dolch, REACCT and SURF Fellowships through Purdue University.

After completion of his PhD, Professor Sant accepted a position as a research scientist at the Ecole Polytechnique Federale de Lausanne, where with his advisor, Professor Karen Scrivener, he worked to develop a new-class of environmentally-friendly rapid-setting screeds for flooring applications and to better understand and predict the early-age properties of cementitious materials. Since, early-age properties effectively dictate the lifetime performance of cementitious materials, new advances in these areas allow concrete structures to last longer, require less maintenance, and perform to higher standards.

When Professor Sant saw that there was a faculty opening in Civil and Environmental Engineering at UCLA, he was excited to become a part of this Department, as the position had a specific focus on the design and development of new cementitious materials for construction applications. Furthermore, he knew that his research expertise would perfectly complement the current group of faculty. "The Structural Engineering and Mechanics Group has world-renowned experts in experimental and computational aspects of earthquake engineering and solid mechanics—these leading faculty would provide a critical link to my work and allow for collaborative efforts to extend aspects of civil engineering materials science to a practical construction scale," says Professor Sant. In addition, the incredible prospects of working outside civil engineering with materials science engineering, the California NanoSystems Institute (CNSI), and the California Department of Transportation (CALTRANS) made UCLA a tremendous opportunity.

Professor J.S. Chen, chair of the Civil and

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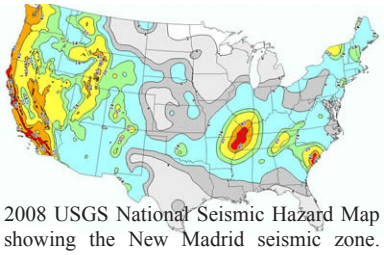
Constraining Seismic Ground Motion Hazard in Central and Eastern North America

Dr. Christine Goulet who received her PhD in 2008 from UCLA recently joined the Pacific Earthquake Engineering Research Center (PEER), based at U.C. Berkeley. She is helping coordinating the NGA-East project, a vast multi-disciplinary and collaborative research project aimed at developing seismic ground motion hazard models for the Central and Eastern North America (CENA) region.



2008 USGS National Seismic Hazard Map showing the New Madrid seismic zone.

Engineers attempting to design against seismic hazards use complex models that include information about the faults and seismicity of a specific region in combination with appropriate ground motion prediction equations (GMPEs), which provide expected ground motions given a specific earthquake event affecting a specific location. GMPEs account for the earthquake magnitude, the attenuation of seismic waves with distance and site effects, or how the ground stiffness may increase or decrease the ground motions at a specific location.

Active seismic regions such as California, where many earthquakes occur regularly, give engineers a better understanding of the tectonic setting and seismic wave propagation processes that drive ground motions. Other regions (such as CENA), for which little data is available, are more problematic. CENA comprises essentially the entire North American continent east of the Rocky Mountains. Yet, large destructive ground motions have the potential to affect these areas. The three largest U.S. earthquakes ever documented occurred in 1811-1812 near New Madrid, MO. "There is a need to better [understand the factors that] constrain the probabilities associated with such large events and also to understand and quantify potential ground motions for more frequent, smaller magnitude events," says Dr. Goulet.

> "WE CAN'T PREDICT EARTHQUAKES YET BUT THEY DO HAPPEN; LET'S JUST DESIGN FOR THEM"

CENA is located in a type of tectonic region called a Stable Continental Region (SCR). How faults rupture and how waves propagate in the earth's crust in SCRs is very different from the behavior observed in Active Regions (such as California) or in Subduction Zones (such as the coast of Oregon). Some of the knowledge is transferable from one tectonic region to another, but the specific properties of each region differ. Dr. Goulet points out that "one key issue is the attenuation of ground motions with distance. In CENA and other SCRs, the waves do not attenuate as fast as in California, so the same magnitude earthquake has the potential to affect a much wider region. One of our goals is to better constrain that attenuation and crustal damping."

NGA-East is a very complex project that involves over 60 seismology and engineering researchers worldwide. Major tasks include the development of an exhaustive CENA earthquake database, using computer simulations of ground motion to supplement the database, and the development of various models for fault rupture, wave propagation, site response, and models for incorporating variability and uncertainty. Ultimately, the project will produce a set of GMPEs and logic trees for engineers to use to compute seismic hazard. "We are using state-of-the art tools for NGA-East as we aggregate information and models that are applicable to CENA," says Dr. Goulet.

Dr. Goulet is co-leading the project with Drs. Norm Abrahamson and Yousef Bozorgnia, the project manager. She plays a technical and managerial role, keeping the project focused on its core mission. "We will keep exposing interesting research topics during this project, but we won't necessarily have the time and opportunity to solve all the issues. We aim to put our energy on the advancement of knowledge for the topics that will affect the final model. Nonetheless, the project should open important new research avenues," says Dr. Goulet.

This multi-million-dollar project is funded by

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NEES@UCLA in collaboration with E-Defense

US Instrumentation and Data Processing of the 4-Story RC & PT E-Defense Building Tests

In December 2010, Professor John Wallace (Principal Investigator, NEES@UCLA) and his team worked in partnership with E-Defense researchers near Kobe, Japan in the testing of two 4-story, full-scale buildings on the E-Defense shake table. The test was a culmination of two years of US-Japan meetings between NEES and E-Defense researchers to identify areas of mutual interest and potential collaboration. One area where there has been a strong desire to collaborate was the behavior of both conventional and high-performance reinforced concrete buildings.

The two buildings, tested side-by-side in mid-December 2010, are of tremendous interest to the US earthquake engineering community. Each of the buildings represents a multi-million dollar test. The final designs for the two buildings were intended to be of interest to both Japanese and US researchers. Although E-Defense installed nearly 700 sensors for the tests, there was a desire to add even more sensors. NEES@UCLA provided additional sensors, cables, and data acquisition systems (DAS), as well as trained staff to enable measurement of more detailed response information during the tests. Alberto Salamanca, Assistant Development Engineer, and Zeynep Tuna, Ph.D. student, traveled to Japan to work with E-Defense staff to ensure proper system operation prior to the test. Instrumentation was needed to measure local response quantities to aid in the development and calibration of analytical models.

The tests presented a unique opportunity for the US earthquake engineering community to learn about the behavior and response of three-dimensional buildings subjected to a range of ground motion intensities, including motions expected to produce near-collapse. Test results are of benefit to both Japan and the United States, as well as the greater earthquake engineering community.

"This is a tremendous opportunity for us to improve our understanding of very commonly used building systems (internationally), and to collect data that very likely will be studied and used extensively over the next decade, and likely longer." John Wallace comments. Joint Japanese/US research result presentations are expected at major international conferences and the NEES annual meeting, including the 15th World Conference on Earthquake Engineering to be held in Portugal in 2012. ❖

Gulf: New Device Helps with Oil Spill

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and the people from the local engineering and offshore service companies. There was a real passion to save the gulf by everyone involved, and I worked with a lot of good-hearted, no-nonsense, talented people."

Hoek will continue working with OTS to further improve their oil spill cleanup technology and "first response" capabilities should future oil spills occur anywhere in the country. Hoek has been invited to participate in many government and industry workshops and conferences to discuss his involvement with the gulf oil spill. At one point during the oil spill, Hoek met with Lisa Jackson the director of the US EPA to discuss best available technologies and the EPA policies regarding oil spill response.

"I have lived with a level of frustration over the past several years that would be hard to explain, knowing that a solution to this everyday occurrence and the technology to combat it was sitting on the shelf," Costner said. "I can only say now that my disappointment is matched by my enthusiasm, and I feel fortunate to have taken on a partner like Eric Hoek. Eric has brought an energy and scientific approach to the problem that the industry will be able to enjoy in the future," Costner said. "He has been a champion of the technology and a champion of the environment and the people it was designed to protect. I thank him and UCLA for moving this dream of protection forward." ❖

NEES@UCLA: From Califronia to Turkey to Japan

Japan

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during shake table testing of a full-scale RC building. Instrumentation from NEES@UCLA was installed to augment the existing Japanese instrumentation.

Working with Japanese colleagues, the UCLA team gathered a rich data set on shear wall performance. This NSF RAPID-funded project opens up new possibilities for collaboration with NEES@UCLA as an instrumentation resource for E-Defense testing.

"With staff and equipment spread literally around the world, December 2010 stretched our capabilities to their maximum," said Dr. Robert Nigbor, co-PI and Manager of NEES@UCLA. "I am especially proud of our professional staff, all of whom worked extreme hours, [often] on tasks not normally theirs, to make all three field testing projects successful." ❖

Goulet: Seismic Ground Motion Hazard

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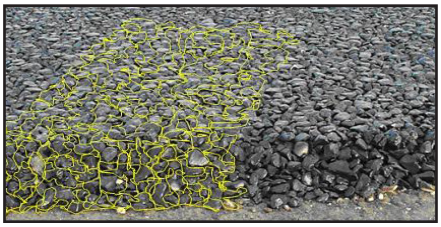
the U.S. Nuclear Regulatory Commission (NRC), Electric Power Research Institute (EPRI), the U.S. Department of Energy (DOE), and the U.S. Geological Survey (USGS). The products from the project will be used to help engineers design nuclear and utility facilities as well as to help the USGS develop national seismic hazard maps. "Our goal is to get a better handle of ground motions. With better knowledge, we can do better designs. The ultimate goal is always there in the back of my mind: to save lives and reduce the negative impacts of earthquakes. ❖

Computational Micromechanical Modeling of Nano-Molecular Resin Reinforced Pavement Materials

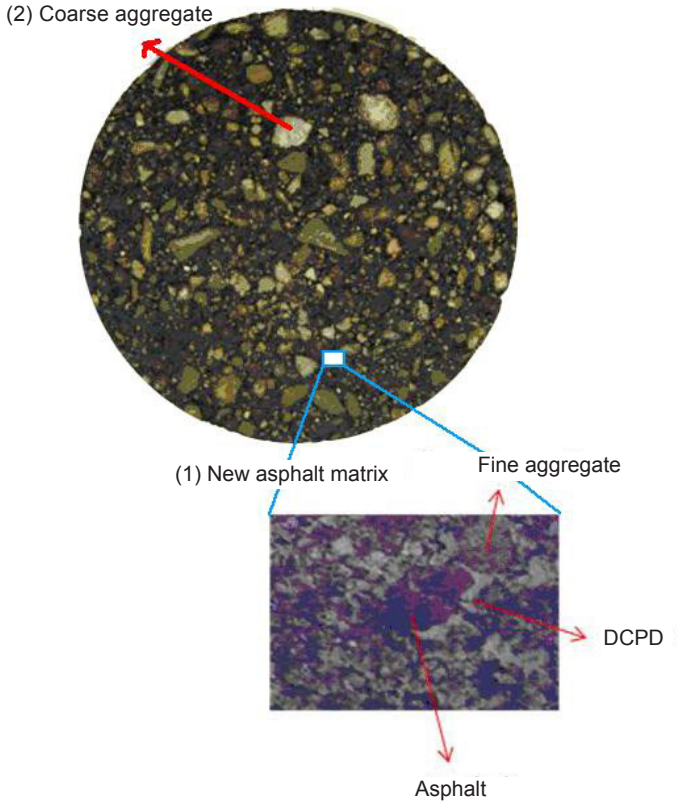
Professor J. Woody Ju, (co-PI) and his post-doctoral scholar, Dr. Kuo-Yao Yuan, in collaboration with Professor Jenn-Ming Yang (PI) and his team members from the Department of Materials Science, recently received a $3M grant from the National Institute of Standards and Technology (NIST) to develop new materials that can be used to enhance the performance and service life of pothole repairs. The research team is adding DCPD resin (dicyclopentadiene, C10H12), along with a catalyst, into traditional asphalt concrete. The resin/concrete mixture forms a network of cages, dramatically improving the mechanical properties, viscosity, moisture and temperature stability of the patches.

The new technology can potentially save billions of dollars in pothole repair cost per year in the US alone. According to Los Angeles City's Department of Public Works, hundreds of thousands of potholes are repaired each year. The cost of repairing each pothole can be as high as $60 and the pothole-induced damage to vehicle is reported to be approximately $671 per vehicle per year. The total cost to US taxpayers exceeds $10 billion dollars per year.

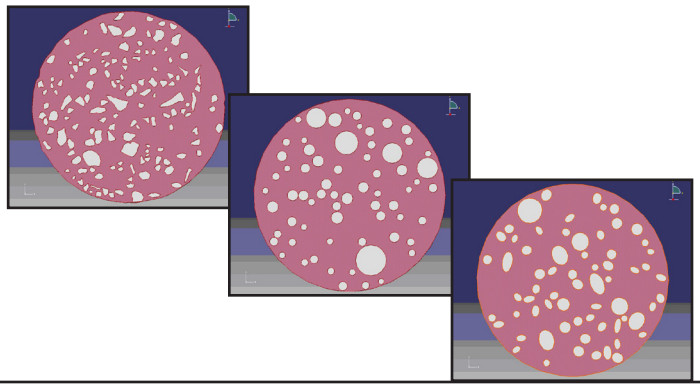


Caged asphalt-aggregates structure with infiltrated compound (yellow). Asphalt-aggreate structure without infiltrated caging compound (grey)

To simulate the elastic and visco-elastic behavior of the new patching materials, the effective (overall) elastic and visco-elastic properties of the asphalt composite matrix, consisting of fine aggregates, asphalt, DCPD and air voids, are derived based on the multi-level homogenization methods of micromechanics and the correspondence principle.



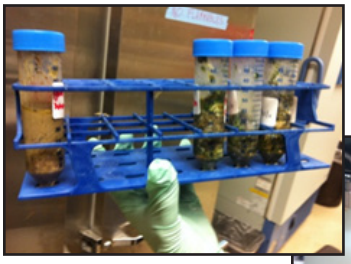
Computational micromechanical simulations of indirect tension tests, indirect tension creep tests, and indirect dynamic tests are performed via ABAQUS. The numerical results are then compared with analytical micromechanical solutions and real experimental data. In particular, mesh generations of coarse aggregates in numerical simulations are produced by the image processing technology for irregularly shaped aggregates and by numerical algorithms for the randomly-dispersed circular and elliptical aggregates. ❖



Major study to IDENTIFY sources of *fecal contamination* in coastal waters

Along the California coast, many beaches suffer from chronic fecal contamination in water and sand. A first step in cleaning up these problem beaches is determining the origin of the contamination – a step not as straightforward as it sounds.

While animal trackers can readily distinguish the scat of one species from that of another, this becomes more challenging once fecal matter is dispersed and greatly diluted in the environment. In fact, while California Assembly Bill 538 requires surveys of contamination at beaches with chronic pollution, implementation of this unequivocal mandate has never been possible because the methods to accomplish this haven't been sufficiently developed.



Fecal samples to be made into mixtures for the methods comparison study (left)

Jay Lab's newest member, Kaitlyn Hanley, filters samples on her first day of work (right)

Currently, laboratory researchers can extract DNA from environmental water samples and test the DNA for certain types of bacteria that tend to originate from the feces of a particular animal. Recently, methods designed to detect feces from humans, farm animals, and wildlifehave appeared in the scientific literature. But before these methods can be applied to the mandated problem solving at California beaches, they need to be rigorously tested for their specificity to the target animal and their reliability when applied in various laboratories.

The State has just awarded five million dollars to the Source Identification Pilot Project (SIPP), a three-year collaborative project. The core laboratories are the Southern California Coastal Water Research Project (SCCWRP, led by Steve Weisberg and John Griffith), Alexandria Boehm's laboratory at Stanford, Trish Holden's laboratory at UCSB, Orin Shanks's laboratory at US EPA, and Jennifer Jay's lab in our department at UCLA.

The goals of the study are to: 1) develop a suite of the best available methods for identifying the sources of fecal contamination in environmental samples, 2) conduct a reconnaissance of fecal pollution along the coast of California, 3) develop methods to conduct upstream source identification in problem watersheds, and 4) transfer technology to other laboratories across California.

Incoming graduate student, Darcy Ebentier, coordinated the collection of samples from area wildlife for UCLA

In January, the five core laboratories kicked off the first phase of the study, a methods comparison to distinguish different types of fecal contamination. First, fecal samples were collected from sea gulls, geese, deer, cows, pigs, dogs, chickens, humans, and others. Over a one-week period at SCCWRP, various mixtures of known concentration were made and sent to the core laboratories, as well as to a number of other participating researchers from outside laboratories to test additional methods. This was an intense week of long hours, copious amounts of coffee, and countless donuts, and many volunteers from UCLA and the other universities pitched in.

Jay lab members are now busily testing these many samples with the large suite of DNA tests being compared. In the spring, data from all participating laboratories will be analyzed to choose the ideal subset of tests to be used in the reconnaissance study.

In the early summer, the core labs, collaborating with Bight '08, will test beaches up and down the California coast to determine the type of fecal contamination that is impacting particular sites. This information will be crucial in the design of solutions.

Also this summer, each core lab will begin to track upstream sources of fecal contamination in one or two watersheds with complex mixtures of pollution inputs.

This work will eventually lead to the adoption of a standardized protocol, based on the latest technology, for the assessment of problem beaches and their watersheds. The ultimate goal is the application of more effective problem solving measures to ensure clean coastal waters in California. ❖

Reconnaissance of the El Mayor-Cucapah Earthquake

Professors Scott Brandenberg and Jonathan Stewart served as co-leaders for a coordinated multi-disciplinary earthquake reconnaissance effort following the April 4th, 2010 El Mayor-Cucapah magnitude 7.2 earthquake in Baja California, Mexico.

The reconnaissance efforts were sponsored by the Geoengineering Extreme Events Reconnaissance (GEER) program. The earthquake was an important one for California because the fault rupture was largely right lateral strike-slip (similar to the San Andreas fault), the ground motions were recorded by an extensive network of sensors maintained by the US Geological Survey, and liquefaction was extensive throughout the Mexicali Valley.

The largest lasting effect of the earthquake was the influence of liquefaction on the irrigation system in the Mexicali Valley. Many canals filled with liquefied sand, and many fields subsided below the groundwater table. The information collected and documented by the reconnaissance team will be very useful for advising future engineering evaluation procedures and policies.

The full report can be found at: http://www.geerassociation.org ❖

Undergraduate Water Quality Laboratory Undergo Upgrades

Laboratory in Boelter Hall were revamped during 2010 with matching grant funds from HSSEAS, with the aim of improving the safety and quality of the teaching environment for the students and instructors.

The Undergraduate Water Quality Laboratories, located on the 7th floor of Boelter Hall, are used for the CEE165A (Environmental Chemistry Laboratory) and the CEE156B (Unit Operations and Processes for Environmental Engineering Laboratory) courses. The laboratories have also been used to support CEE199 students and periodically for demonstrations in the two environmental engineering classes CEE157B and CEE157C.

Initially the laboratory space was designed to accommodate up to 12 students per session, but enrollment has doubled in recent years. In order to increase the maximum occupancy of the laboratory space to 20 students per session and maintain safe working conditions, three additional workstations were added in one laboratory, while another sink and utilities were installed on the unit process bench in the other laboratory. Several A/V upgrades were added to the unit process laboratory, including a pull-down projection screen, a laptop computer and a wall-mounted 46” HD-LCD TV display. Storage space in both laboratories were increased and upgraded as well. ❖

Grants and Awards

Professor Shaily Mahendra received her first research grant ($106,200) from AECOM, Inc. and Air Force Center for Energy and Environment (AFCEE) to develop biological and isotopic tools for environmental remediation and monitoring. Soils and groundwater at several industrial and military sites are contaminated by carcinogens, such as 1,4-dioxane and chlorinated solvents. Prof. Mahendra and her students will develop compound specific isotope analysis (CSIA) methods to validate natural and engineered bioremediation of 1,4-dioxane in the field.

The Mahendra laboratory is already studying indigenous and laboratory-grown cultures of 1,4-dioxane-degrading bacteria. CSIA method will be calibrated with observed biodegradation rates. The potential for accelerating in-situ remediation of 1,4-dioxane by amendments such as biostimulation and/or bioaugmentation will be evaluated. This project will offer the US Air Force innovative and accurate tools to determine the most appropriate and cost-effective amendments to enhance in-situ biodegradation of emerging contaminants of concern. ❖

Professor Jiun-Shyan Chen was invited to deliver a Plenary Lecture at the International Conference on Multiscale Modeling and Simulation, Guangzhou, China, December 17-19, 2010. He is the President of the US Association for Computational Mechanics for a two-year term beginning in July 2010. He was awarded the Tongji Chair from Tongji University in Shanghai, China, effective January 1, 2011. He was also recently appointed Associate Editor of ASCE Journal of Nanomechanics and Micromechanics. ❖

Professor Jiann-Wen Woody Ju recently received numerous honors., including the prestigious IACM Fellow Award from the International Association for Computational Mechanics, as well as the the Kwang-Hua Chair and the Tongji University Chair from Tongji University in Shanghai, China. He was recently appointed Associate Editor for the newly established ASCE Journal of Nanomechanics and Micromechanics, which focuses on advanced nanotechnological structural and functional materials. Professor Ju is also continuing his research collaboration with several universities in China, under the prestigious Chang-Jiang Scholar Chair Professor program with the Ministry of Education, China. ❖

New Faculty: Assistant Professor Gaurav Sant

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Environmental Engineering Department, says, "Dr. Sant's research in cementitious materials provides a critical link between structural mechanics and engineering, as well as geotechnical engineering in our department. He is equipped with all the skills and talents to be a successful faculty member at UCLA and a leader in the field of Civil engineering."

Professor Sant's current research program is directed towards developing new cement-substitutes for concrete production, and on understanding behavior and predicting the properties of these new materials. He is working to identify natural materials which need little processing and that can be used to produce concretes with better properties than traditional cement-based concretes, at an equivalent price. These efforts, which develop fundamental chemical composition-microstructure-engineering property linked descriptors, utilize aspects of chemical kinetics, thermodynamics, and computational chemistry to determine "best-fit" material substitutes for cement in concrete. Professor Sant says: "The construction industry is conservative, in terms of both price points and performance expectations of materials. As such, it is critical that the development of new materials considers these variables adequately, as neither can be compromised on". In consideration of industrial expectations, Professor Sant's efforts provide valuable insights toward developing new construction materials which are priced equivalently and perform to a higher-standard than current concretes, while also providing for environmental protection and reduced CO_2 emissions. Professor Sant is starting to incorporate his research in teaching through a new course on Civil Engineering Materials which will be taught beginning in Fall 2011. ❖

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Civil and Environmental Engineering
The Citadel
Advisor: Scott Brandenberg

Dr. Pai-Chen Guan PhD '09
College of Engineering
National Taiwan Ocean University
(Assistant Professor)
Advisor: Jiun-Shyan (JS) Chen

Dr. Joohyon Kang PhD '05
Civil and Environmental System Engineering
Dongguk University, South Korea
Advisor: Michael Stenstrom

Dr. Annie Kwok PhD '07
Civil Engineering
National Taiwan University
Advisor: Johnathan P. Stewart

Dr. David Naish PhD '10
Civil and Environmental Engineering
California State University Fullerton
Advisor: John Wallace

Dr. Fariborz Tehrani PhD '08
Civil Engineering
California State University, Fresno
Advisor: Jiann-Wen "Woody" Ju

Dr. Dongdong Wang PhD '03
Xia Ming University, China
Advisor: Jiun-Shyan (JS) Chen

Dr. Mike Durand PhD '07
Civil and Environmental Engineering
Ohio State University
Advisor: Steven Margulis

Dr. Bart Forman '10
Civil and Environmental Engineering
Goddard Space Flight Center
Advisor: Steven Margulis

Dr. Antonella Sciortino PhD '99
Civil and Environmental Engineering
Dept. of Civil Engineering and Construction Engineering Management (CSU Long Beach)
(Associate Professor with Tenure)
Advisor: William Yeh