

ITS-Davis e-news is the electronic newsletter of the UC Davis Institute of Transportation Studies. Written for alumni and friends, *ITS-Davis e-news* reports information from ITS-Davis and affiliated campus departments that host transportation-related programs. For previous issues, see the [e-news archives](#).

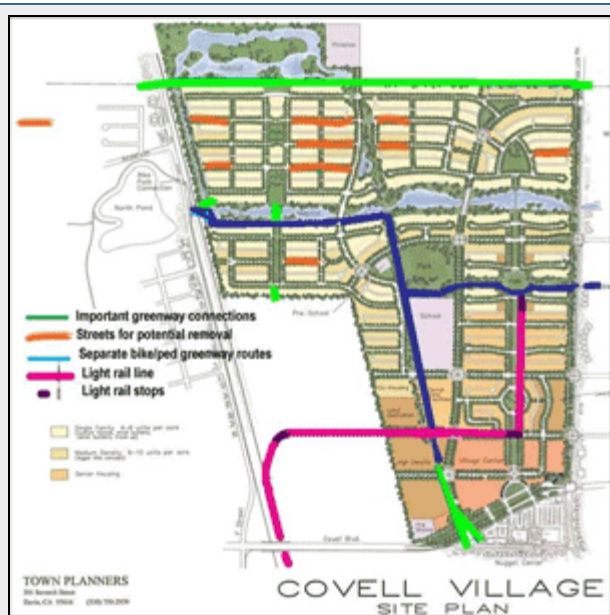


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## Education Highlights

### LEARNING BY DOING: Students Offer Transportation Analysis for Proposed Development



Student-modified Covell Village site plan

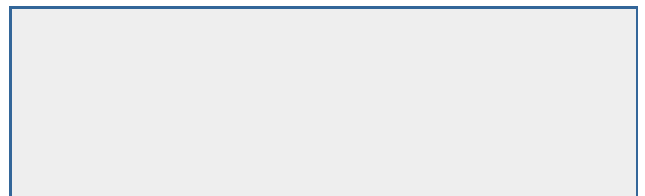
Students in Anthony Palmere's winter quarter Transit Systems Analysis class got a taste of real-world considerations and trade-offs in a class project that developed a transportation plan for Covell Village, a proposed residential development in Davis. The students presented their plan last month to a group of interested community experts, including one of the development partners, a campus planner, and several representatives of Unitrans, the city's transit service operated by UC Davis students.

Palmere, the assistant general manager of Unitrans, said the class project was designed to give students hands-on experience and show them how their research can contribute to their community. "The students have provided another source of information to the city" as it considers next steps for the development, he said. Palmere enjoys teaching an occasional class to expose students to the kinds of issues he faces as a professional transit manager.

"Regardless of how you feel about this proposed development," he continued, "the big issue is transportation. If there's a way for our students to present information that might help reduce the impact, then everyone benefits."

The students, Carrie Ashendel, Ted Buehler, Justin

Kable, Kenneth Kwong, David Kuperman, and Julia Silvis, researched the city's planning process, reviewed stacks of environmental impact and planning review documents for the development, and attended numerous public meetings. They

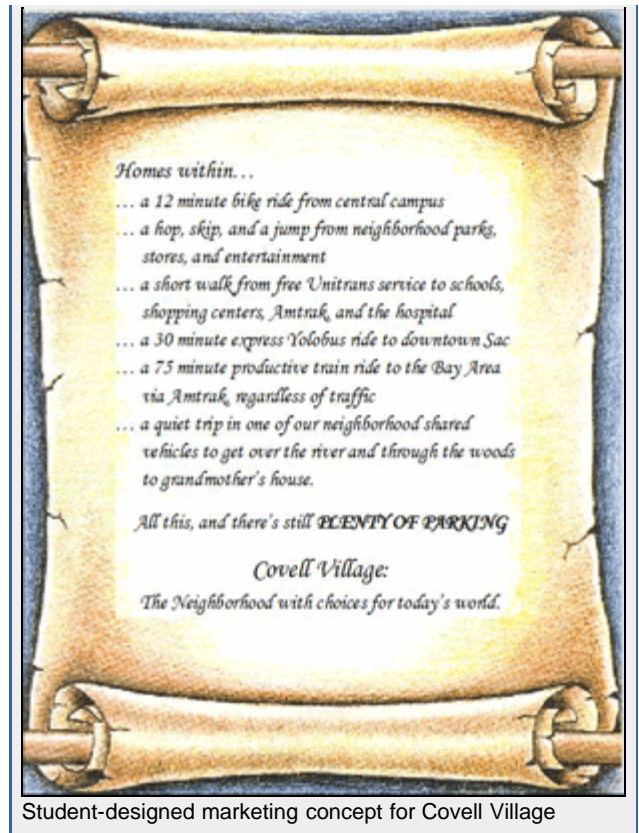


also pored over national government and industry reports that provide scheduling and cost information, and studied Unitrans planning and scheduling documents to support their assumptions as reasonable and feasible.

The heart of the student design is three bus lines that provide residents quick and easy access to downtown and campus. Students estimated that the current development design would generate 1,128 campus-bound bus boardings per day, with the potential to generate 1,445 daily bus-boardings under the development's high-density scenario. This is considerably higher than the roughly 200 boardings per day estimated in the proposed development's environmental impact report.

"Our goal is to provide a system of first-choice for the residents," the students noted in their summary. They sought to offer as many transportation options as possible and to make transit, walking, and biking more attractive in order to reduce automobile use and neighborhood impacts.

Their analysis also factored in capital expenditures for new buses, shelters and equipment, and operating and maintenance expenditures that Unitrans would need to consider in expanding service to meet the new development. Other elements included carsharing, a light rail option, integration with pedestrian and bike travel, and beautification aspects such as attractive bus shelters that fit with the neighborhood. The students also suggested that Covell Village could attract new residents by promoting its transit-friendliness, and could give new residents a "Movin' Package" containing freebies such as a bike basket, canvas grocery bag, bike lock, transit schedule, and coupons to local bike shops.



Student-designed marketing concept for Covell Village

## LITTLE BANG! ITS-Davis Teams Take the Prize



Two teams of ITS-Davis students took first and second prize for their transportation-related technology business plans in the inaugural Little Bang Business Plan Competition in March.

The ITS-Davis competition, organized in partnership with UC Davis CONNECT, the Sacramento Angels investment group, and the UC Davis Graduate School of Management, seeks to strengthen the linkages between UC Davis and the venture capital community in the area of advanced transportation.

Four student teams, three from ITS-Davis, submitted posters describing their transportation-related business ideas, then pitched their plans in short presentations to a panel of local venture capitalists and UC Davis judges. The \$5,000 grand prize was donated by the Sacramento Angels and the Sacramento Area Regional Technology Alliance (SARTA), a local public-private partnership dedicated to entrepreneurial development.

First prize went to Boegeskov Energy, led by ITS-Davis students Kenth Pedersen and Matt Caldwell, ITS-Davis alumnus Nico Bouwkamp, UC Davis management student Derek Larsen, chemistry student Daniel Scott, and law student Andrew Berk. Boegeskov is developing advanced fuel cell catalyst materials based on cutting edge polymer technology. The company hopes to compete against existing providers by offering products that improve fuel cell performance and power density relative to existing materials while reducing overall cost. In addition to the cash prize, Boegeskov Energy advanced to the semi-final round of the UC Davis Big Bang Business Plan Competition where they will compete for an additional \$10,000 grand prize.

Second prize was awarded to an ITS-Davis team, which is developing a dynamic ridesharing business. Students Kevin Eslinger, Darius Roberts, and Jonathan Weinert led the effort along with UC Davis undergraduate Ziv Lang. The team also advances to the semi-final round of the Big Bang Competition.

Reed Benet led the other ITS-Davis student entry, A2B Biofuels, with UC Davis and UC Berkeley students on the team. In addition, students from the California Institute of Food and Agricultural Research submitted a plan for a novel ethanol production process for use in blended transportation fuels.

ITS-Davis Director Dan Sperling praised the effort and creativity of the three ITS-Davis student teams, and recognized student Jonathan Hughes, the principal organizer.

### MAKING CONNECTIONS: Students Tour Local Light Rail Car Manufacturer

What does it take to manufacture, maneuver, and test a 40-ton light rail car? Lots of creative thinking and engineering, a group of about 17 UC Davis transportation students learned during a February tour of the Siemens Transportation Systems light rail car manufacturing plant in Sacramento.

Engineering students and Transportation Technology and Policy students, plus members of the student chapter of the Institute for Transportation Engineers, attended the tour coordinated by the ITS-Davis Student Council and Civil Engineering student Jeroen Van Houtte. Van Houtte worked at Siemens as a system engineer for propulsion and brakes before returning to school in 2003. His Siemens colleagues Konstantin Breucha and Chander Kanna led the UC Davis visitors through the plant.

The Siemens engineers shared their knowledge of project management, communications systems, production planning, and propulsion and brake vehicle integration; their blend of expertise proved invaluable in explaining the complexities and nuances of the design of light rail car systems. They explained the process of getting a light rail vehicle into service, from the initial marketing to the final transportation of the vehicle to the customer.



The ITS-Davis gang at Siemens in Sacramento

Justin Regnier, a member of the ITS-Davis Student Council, said the tour was a real eye-opener. “Our hosts provided tremendous insight into the specific needs of different markets and geographical regions,” he said. “It was particularly interesting for many of us to see the practical aspects of manufacturing these big rail cars.” The students were able to see how the engineers had invented solutions to practical problems in vehicle transport, fabrication, testing, and quality control.

The tour successfully linked students with practitioners. It provided an opportunity for a spirited exchange of ideas and for those all-important student contacts with the real world. “We can surely look forward to continued communication and collaboration between Siemens and UC Davis,” Regnier said.

### ALUMNI PROFILE: Jaimee Hicks, P.E., Civil Engineering, 1999



Jaimee Hicks

Jaimee Hicks grew up in a small town in California’s Central Valley — where traffic wasn’t a big deal. But as an engineering student at UC Davis, she found the study of transportation fascinating.

“I realized that transportation is a problem that’s not going away anytime soon. There was something about being able to affect peoples’ everyday lives that really intrigued me.” That intrigue propelled her to a Master’s in Civil Engineering in 1999, followed immediately by a job with a Bay Area consulting firm.

Hicks has been a Transportation Engineer at Fehr & Peers for almost six years. She conducts transportation studies for master plans, environmental impact reports, and development projects, and prepares signal and lighting design plans for roadway improvement projects throughout northern California. She is a registered civil engineer and traffic engineer in the State of California.

She says her grad school experience with advisor Debbie Niemeier helped her develop the necessary project management, delegation, and oversight skills to tackle her current job. “Conducting in-depth research, and collaborating on a large project in a team with other students over a two-year time period gives important perspective on what you’ll do in the workforce,” she says. “When I look back, I really enjoyed that teamwork component.” She also has fond memories of the “family atmosphere” that Niemeier fostered.

Her experience differed significantly from her current colleagues, many of whom attended UC Berkeley and completed a final exam at the conclusion of their one-year graduate program. “I got more out of it because I was part of a large-scale project.” Writing a thesis, she adds, became an opportunity to turn a research paper into an article for publication.

In the future, Hicks sees herself following the same career path in the private sector, or perhaps trying out the public sector as a local government transportation engineer.

## Research Results

### TRANSPORT TECHNOLOGY: Testing Fuel Cells for Auxiliary Power in Trucks



Chintamani Kulkarni and Matt Solomon bench testing components

For several years, a team of UC Davis researchers has been involved in a multi-million dollar research effort that seeks to determine if fuel cells could be installed in transport trucks to run auxiliary power units (APUs) and transport refrigeration units (TRUs) instead of diesel engines. APUs power accessories, heat, and air conditioning in the driver cab in lieu of engine idling during mandated rest periods. TRUs power the refrigeration unit in the cargo area where perishables are stored during transport.

Currently, most APUs are powered by the truck's engine, which emits pollution and consumes fuel while idling. TRUs almost always run on their own separate diesel engines, which typically use lower-grade off-road fuel and lack sophisticated emissions controls. Some TRUs can be plugged into electrical power. There is significant industry interest in developing and commercializing alternative technologies in order to meet new regulations that limit idling and off-road emissions in the near future.

Having focused on APU design and development the past few years, the UC Davis research team has now turned to studying TRUs. The research effort is

led by Mechanical and Aeronautical Engineering Professor Harry A. Dwyer, Ph.D., and co-directed by assistant research engineer C.J. Brodrick, Ph.D., with substantial involvement and support from associate engineer Marshall Miller, Ph.D., and numerous students. They are currently involved in the second of a two-part study to measure existing in-use emissions on standard TRUs with diesel engines and compare them with a fuel cell unit they are designing and building to power similar TRUs.

To first characterize the emissions associated with traditional TRUs, researchers conducted multiple tests on more than 40 TRUs at a warehouse in Sacramento. Students Pippin Mader and Chintamani V. Kulkarni collected the field samples as part of Mader's master's thesis research.

Operation of TRUs is tremendously complex, Brodrick explains, because each is programmed to meet different "pull-down" and maintenance characteristics with various temperature needs and circulation requirements. Pull-down refers to the time it takes a given TRU to cool a trailer to a specified temperature. Some units are programmed for fast pull-down to protect perishables, others are programmed to accommodate other operating conditions, such as having the door shut all the time, or frequent opening and closing of the door, she notes.

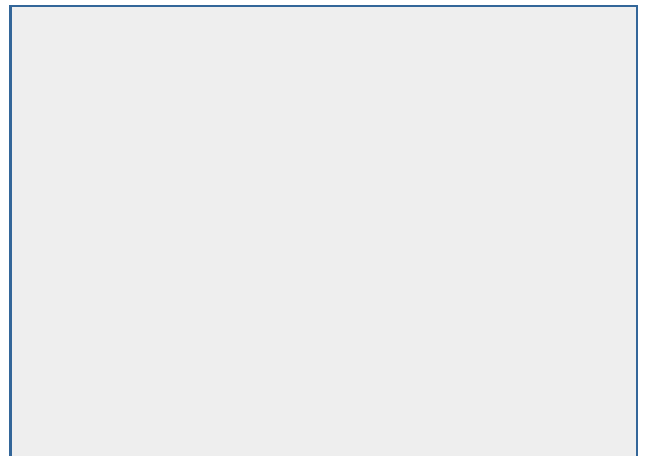
"Thus, the size of TRUs, the size of the cargo compartments, and temperature requirements vary, and we see a corresponding emissions variation," Brodrick explains.

Preliminary findings have implications for the state's emissions inventory for newer in-use TRUs and will likely lead to suggestions on how the inventory may be improved by utilizing age-based emissions factors. The results could be a significant contribution to the state's effort to determine exactly how much pollution comes from this emission source.

"We're the first to do in-use emissions testing of newer TRUs in the field," Brodrick says. "Existing estimates are primarily based on lab measurements and modeling. And we know from vehicles that what happens in a lab is usually quite different from what happens in the field."

The next step in the project is under way in the UC Davis Fuel Cell Lab managed by Miller. Under Dwyer's direction, the team has developed a hybrid fuel cell/battery system using two small Ballard 1.2 kW PEM fuel cells combined with twenty-six 24-volt batteries to power a Carrier Supra 544 TRU. Student David Grupp designed power electronics for the system.

In designing a fuel cell-powered TRU, there are two challenges, Dwyer explains. Pull-down requires the most power, but once pull-down is achieved, the system typically needs considerably less energy. Because fuel cells are expensive and





Transport refrigeration unit in lab

difficult to obtain, the researchers sought to minimize the cost by designing a system that could meet the rapid pull-down requirement without an over-sized fuel cell. "We decided to design this hybrid system with smaller fuel cells sized to work well for maintenance. The batteries provide the additional power needed for pull-down, and the fuel cells can re-charge the batteries efficiently," Dwyer explains.

The research team is conducting full system bench tests this spring. They hope to test the system with other components, such as lithium-ion batteries, later this spring. Over the summer, the team plans to acquire a trailer and install the unit for field-testing. Replacing the PEM fuel cells with solid-oxide fuel cells is another possible research direction.

The team's current work on TRUs follows several years of earlier design, development, and testing of fuel cells in APUs for the driver cab. At completion of the multi-phase project, they will have bench-tested three fuel cell systems and have analyzed costs and benefits of different fuel cell types in both APU and TRU configurations.

## TRANSPORTATION PUBLICATIONS FROM UC DAVIS: Hot off the Presses

Following are new 2005 reports published since the last issue of *ITS-Davis e-news*.

### Research Reports

[An Integrated Hydrogen Vision for California](#). Kammen, Daniel; Lipman, Tim; Ogden, Joan; Sperling, Daniel. A white paper/document prepared with the support from the Steven and Michele Kirsch Foundation. July 2004. UCD-ITS-RR-04-43.

[An Empirical Analysis of Causality in the Relationship Between Telecommuting and Residential and Job Relocation](#). Mokhtarian, Pat, David Ory. UCTC Program. February 2005. UCD-ITS-RR-05-04.

[Smart Parking Management Field Test: A Bay Area Rapid Transit \(BART\) District Parking Demonstration](#). Shaheen, Susan. California PATH Program. January 2005. UCD-ITS-RR-05-03.

[Hydrogen Storage Options: Technologies and Comparisons for Light-Duty Vehicle Applications](#). Burke, Andrew, Monterey Gardiner. Hydrogen Pathways Program. January 2005. UCD-ITS-RR-05-01.

### Reprints

[Heavy-Duty Truck Idling Characteristics](#). Brodrick, Christine-Joy; Lutsey, Nicholas; Oglesby, Carollyn; Sperling, Daniel. Transportation Research Record. December 2004. UCD-ITS-RP-04-38.

[Transportation Control Measures](#). Eisinger, Douglas; Niemeier, D.A. Transportation Research Record. December 2004. UCD-ITS-RP-04-39.

[Effect of Vehicle Operation, Weight, and Accessory Use on Emissions from a Modern Heavy -Duty Diesel Truck](#). Brodrick, Christie-Joy; Burke, Andrew; Deaton, Michael; Farshchi, Mohammad; Laca, Emilio; and Lit, Ling. Transportation Research Record. December 2004. UCD-ITS-RP-04-40 .

[Streamlining the National Environmental Policy Act Process Through Cooperative Local-State-Federal Transportation and Land Use Planning](#). Fell, Michael; Johnston, Robert A.; Kirn, Marjorie; McCoy, Mike. Transportation Research Record. December 2004. UCD-ITS-RP-04-41

[Using Geographic Information Systems to Evaluate Siting and Networks of Hydrogen Stations](#). Handy, Susan; Nicholas, Michael;

Sperling, Daniel. Transportation Research Record. December 2004. UCD-ITS-RR-04-42.

[Policy Considerations For Carsharing and Station Cars](#). Shaheen, Susan; Schwartz, Andrew; Wipywski, Kamill. Transportation Research Record. December 2004. UCD-ITS-RP-04-43.

**Most publications are available online. Publications also may be ordered by fax, e-mail or mail.**

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## ITS-Davis and Campus Highlights

### IN THE SPOTLIGHT: UC Davis Students, Researchers Present at NHA and EVS

UC Davis researchers and students have been traveling nationally and internationally in recent weeks to share their findings with colleagues at two high-profile conferences – the National Hydrogen Association Conference in Washington, D.C., March 29-April 1, and the International Electric Vehicle Symposium in Monaco, April 3-6.

Hydrogen Pathways program researchers presented five papers and six posters at the annual hydrogen conference. In addition, Program Manager Anthony Eggert spoke at one of the closing plenary sessions and led a team of ITS-Davis researchers in one of the “idea forums.” Their talk, titled “Initiating a National Dialogue and Educational Agenda,” was part of a plenary titled “Hydrogen and Fuel Cells – Refining the Message.”

#### **Papers Presented at NHA**

- Hydrogen from Wind in California. Bartholomy, Obadiah.
- Low NOx Operation and Recuperation of Thermal and Chemical Energy through Use of Hydrogen in Internal Combustion Engines. Erickson, Paul.
- Optimal Design of a Fossil Fuel-Based Hydrogen Infrastructure with Carbon Capture and Sequestration: Case Study in Ohio. Johnson, Nils, Christopher Yang, Jason Ni, Josh Johnson, and Joan Ogden.
- A Strategic Approach to Education and Outreach Activities in the Transition to Hydrogen Economy. Turrentine, Tom.
- Development of Hydrogen Delivery Scenarios for Transportation Applications. Mintz, Marianne, Matt Ringer, and Joan Ogden.

#### **Posters at NHA**

- Analyzing Infrastructure Transitions for Hydrogen Production from Natural Gas. Yang, Christopher and Joan Ogden.
- Estimating Hydrogen Demand Distribution Using Geographic Information Systems. Ni, Jason, Nils Johnson, Joan Ogden, Christopher Yang, and Josh Johnson.
- Methodology to Assess the Reliability of Hydrogen Supply Pathways. McCarthy, Ryan and Joan Ogden.
- A Near-term Economic Analysis of Hydrogen Fueling Stations. Weinert, Jonathan and Joan Ogden.
- Rural Needs for Hydrogen Station Coverage. Nicholas, Michael and Nils Johnson.
- From Washington, several researchers crossed the pond to attend the annual Electric Vehicle Symposium, EVS-21 in Monaco.

### VISIT ITS-DAVIS AT PICNIC DAY: Saturday, April 16

ITS-Davis has joined with the UC Davis Challenge X team, the California Fuel Cell Partnership and the California Air Resources Board to host a special exhibit, *Getting There With Cleaner Air: Ride the Future!* at this year's Picnic Day celebration on campus. Come see clean vehicles on display and take a ride in electric and hybrid vehicles, and in hydrogen-powered fuel cell vehicles. The exhibit will be open from 12:30 – 4:30 p.m. in [Parking Lot 44](#).

Alumni and friends are invited to join UC Davis transportation faculty and students at the [Friends of ITS-Davis](#) reception in [Parking Lot 44](#) from 1:30 – 2:30 p.m. For more information and to RSVP, please contact [Alexis Palecek](#) at 530-752-4909 or [awpalecek@ucdavis.edu](mailto:awpalecek@ucdavis.edu).



The campus's Picnic Day Web site, [www.picnicday.ucdavis.edu](http://www.picnicday.ucdavis.edu), provides a complete listing of the day's activities.

### NEW VIEW: Institute Launches New Web Site

If you're reading this issue of ITS-Davis e-news, chances are you've already seen our new look. But if not, check out the Institute's new Web site at [www.its.ucdavis.edu](http://www.its.ucdavis.edu). Special acknowledgement goes to events and outreach coordinator Alexis Palecek and student assistant Andrew Lague for their creativity in designing the new site.

### CAN I GET A WITNESS? Students Launch Davis Bicycle Church



Jenn Arnoth, a senior, works on a bicycle

ITS-Davis Transportation Technology and Policy students Chris Congleton, Ted Buehler, Nathan Parker, and Justin Regnier are founding members and volunteer mechanics of the newly created Davis Bicycle Church. Since its official opening in January, the Church has been filling an important niche for the Davis bicycling community.

Staffed by volunteer teachers who help community members troubleshoot and repair their bike problems, the shop also functions as a tool cooperative for those already proficient in bike repair skills and as a place for cyclists to congregate. In addition to the ITS-Davis participants, Bicycle Church staff include city residents and graduate students in the Mechanical Engineering, Chemistry, Ecology, and Nutrition departments.

"We're always looking for more volunteers who want to help out or apprentice to become a mechanic and we are committed to challenging socially entrenched roles surrounding gender and mechanical repair," explains Buehler.

"This shop is a place where one can practice mastery of the art of bicycle repair as a meditation, provide service to the community, practice financial cooperation, and participate in the reflexive transformation of personal and public mobility in Davis and beyond," Congleton adds.

The shop has already received international attention in Japan's oldest continuing newspaper "Mainichi" the third-largest newspaper in the world with more than 3.5 million daily readers. Volunteers also produced a radio public service announcement that is airing on local community radio stations.

The Bicycle Church is located at 1 Baggins End on Orchard Drive, part of the Sustainable Research Area on the UC Davis campus.



Chris Congleton and Ted Buehler, founding members

### FACULTY ACCOMPLISHMENTS

#### Mokhtarian Speaks at the Capitol

Is there a connection between the obesity epidemic and urban sprawl? In early February, the Institute's Pat Mokhtarian offered her perspective on the complex issue in testimony before the California Senate Transportation and Housing Committee. The hearing, titled "Linking Jobs, Housing and Transportation to Create More Livable Communities," gave Mokhtarian an opportunity to share her recent research findings on the relationship between the built environment and physical activity. While the built environment can facilitate or constrain physical activity, the relationship is complex and evidence of a truly causal link is limited, she told lawmakers. Although more research is needed, she said, she also listed a few simple policy options such as offering more choice in the residential marketplace and promoting pedestrian and transit-friendly environments.

#### Fan Receives Young Author Award

Yueyue Fan, an assistant professor of Civil and Environmental Engineering, won the "Young Author" paper award at the 10th International Symposium on Artificial Life and Robotics, held in February in Japan. Fan's paper was titled "Solving Constrained Motion Problems Using the

GI Method.”

**EXTRA! READ ALL ABOUT IT! ITS-Davis and UC Davis Researchers in the News**

Dan Sperling, in *Forbes*, April 25, in a cover story on GM's research investment in hydrogen fuel cells.

Andy Frank, in *Business Week*, April 11, in a feature on plug-in hybrid vehicle technology.

Dan Sperling, on PBS's *News Hour with Jim Lehrer*, March 28, in a segment on California's climate change regulations for passenger cars.

Hydrogen Pathways Research Program, in *UC Davis Magazine*, Spring 2005 Issue.

Mark Francis, in *Davis Enterprise*, March 20, on student designs for a proposed park in Sacramento.

Pat Mokhtarian, in *Ventura County Star*, March 18, in an article on driver behavior: despite gridlock and climbing gas prices, people stick with their cars.

Andy Frank, in *Christian Science Monitor*, January 27, in a story on hybrids and plug-in hybrids.

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