



News from ITS

[Laurent El Ghaoui](#)

joins ITS faculty:
Associate Professor in the Department of Electrical Engineering and Computer Sciences.

ITS Student leads winning team in \$50,000 Urban Land Institute Competition
TE Master's student [Christopher Lollini](#) heads a five-person UC Berkeley Team to the top prize in the 2007 [Gerald D. Hines Student Urban Design Competition](#).

Their proposal, titled "[Tectonics](#)," includes an "urban-scale swath of green space" on a decked-over portion of the Los Angeles River as part of a 16.5-acre parcel in downtown Los Angeles.

[BP Selects UC Berkeley](#) to lead \$500-Million Energy Research Consortium. The funding will create the [Energy Biosciences Institute](#) (EBI), which initially will focus its research on biotechnology to produce biofuels.

Vision Science and Society Symposium [honoring the work of Theodore Cohn](#) in

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[HOV Lanes Work Better Than Motorists Think](#)

A new study disputes earlier findings that examined six freeway sites in the Bay Area and concluded that HOV lanes were responsible for increasing congestion and should be eliminated.



[Software that Speeds Up Pavement Rehabilitation](#)

The Pavement Research Center's Construction Analysis for Pavement Rehabilitation Strategies (CA4PRS) software program saves time and money and cuts congestion on complex freeway paving projects. It is being adopted by other states with support from the FHWA.



[Lost in Translation: an Award-Winning, Provocative Paper on Traffic Safety in Hanoi.](#)

Wendy Tao, a student in the concurrent Master of Science/Master of City and Regional Planning transportation program, won the top prize in the 2007 American Planning Association Transportation Planning Division Student Paper Competition for her analysis of traffic safety in Hanoi, Vietnam.



[Getting Aviation on the Bus](#)

The massive weather-related

[Sibley Auditorium, Bechtel Engineering Center.](#) Cohn died on May 25, 2006.

Order now: [the NEW, 16th Edition of The Fundamentals of Traffic Engineering](#), by ITS's Wolfgang Homburger, et al.



passengers on a bus, using "real-time intermodal substitution" (RTIMS) as developed by ITS NEXTOR.

disruptions this winter that led to profuse apologies (and refund offers) from airline CEOs might have been avoided. All the airlines had to do was cancel some flights into the socked-in airports and put their

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HOV Lanes: A New Study Finds They Work Better Than Motorists Think



An HOV lane with a buffer separating carpools from regular traffic.

High Occupancy Vehicle (HOV) lanes, also known as carpool lanes, have gotten a bad rap according to new research by a team led by ITS professors **Michael Cassidy** and **Carlos Daganzo**.

Their paper, "[Empirical Reassessment of Traffic Operations; Freeway](#)

[Bottlenecks and the Case for HOV Lanes](#)," disputes earlier findings that examined six freeway sites in the Bay Area and concluded that HOV lanes were responsible for increasing congestion and should be eliminated.

"That (earlier) study was very compelling to us," explained Cassidy, Professor of Civil and Environmental Engineering. "If HOV lanes were causing the (congestion) problem, maybe there is a silver bullet: if we got rid of the HOV lanes perhaps we could mitigate a good deal of congestion."

But when the researchers, which also included **Koohong Chung** of Caltrans and **Kitae Jang**, a researcher at ITS, looked at the earlier data and collected more information, including videotapes of the areas to examine how traffic speeds and flows changed over time, they were surprised to find just the opposite effect.

"To the contrary, and quite remarkably, the HOV lane seemed to *increase* the capacity of the bottleneck that was videotaped—even though that lane was underutilized," they wrote. In other words, the HOV lane was helping traffic in all lanes to move more quickly—not more slowly—through the bottleneck.

Misplaced blame

What the researchers found at the sites they examined was that the HOV lanes were not causing delays or queues. Instead, in virtually all cases, traffic backups, or queues formed first at bottlenecks, and almost always for reasons unrelated to the HOV lanes, such as an accident, construction, or increased traffic during the rush hour.

Even at a site on northbound 880 in Alameda where Cassidy and Daganzo were pretty certain that the previous researchers had got it right, a closer evaluation exonerated the HOV lane. Examination of that site over several days and with the benefit of videotape found that slowing travel speeds coincided closely with the activation of the HOV lane at 3 p.m. On closer inspection, however, they discovered that the bottlenecks and congestion formed with the increase of rush-hour traffic, not the activation of the HOV lane.

"In this case, it's like Spiderman showing up at the scene of the crime so quickly that he gets blamed for the crime," explained Cassidy. "Here the HOV lane is going into service right about when you'd want it to—when the bottleneck and congestion forms—and then gets blamed for the congestion. On this particular location the activation of

the HOV lane is just dead perfect. So here Caltrans should be getting kudos.”

Additional solutions

The authors are quick to point out that their research does not mean that HOV lanes never cause congestion. An extremely underutilized HOV lane, one that is virtually empty, would be a disaster, explained Cassidy. But in some—perhaps many—cases drivers in ordinary, or low occupancy vehicles (LOV) lanes, benefit from HOV lanes, even as they curse them.

“An HOV lane, even one that’s somewhat underutilized, can increase bottleneck capacity because it diminishes disruptive lane change maneuvers,” explained Cassidy. “If you don’t have as many people moving in and out of the median lane, that can be advantageous. We call that the ‘smoothing effect’ because it smoothes the bottleneck flow.”

Although the authors found no convincing evidence that the HOV lanes they scrutinized in their research caused backups, HOV lanes can cause congestion at other sites. But even at some of these sites, modest alterations could relieve the problems.

Caltrans should probably change its approach to HOV lanes. “Currently there is a sort of one-size-fits-all approach,” said Cassidy. A closer look at each freeway’s bottlenecks might reveal that the hours of HOV operation could be tweaked to work more effectively.

Another modest alteration involves allowing low-occupancy vehicles to periodically move into the HOV lane near a bottleneck. “You wouldn’t let them in continually, only periodically, so as to maintain a queue of short length of a few hundred or a thousand feet in that HOV lane.” Changeable message signs could be strategically placed to control when and how frequently to let low-occupancy vehicles into the HOV lanes.

This would not penalize the HOVs very much, Cassidy said. Although drivers in the HOV lanes would have to slow down when they hit the queue, it is only a short queue, he explained.

“The advantage might be twofold: you might get this reservoir of demand trying to pump its way through the bottleneck, and you might get the smoothing effect that we saw in the video data.”

The researchers also point out that an underutilized HOV lane will cause queues in the adjacent low-occupancy lanes to grow faster and longer over the freeway. This effect can create congestion problems if the added queue blocks busy ramps. The researchers, however, have formulated theories showing that on freeways where queues have room to expand, these negative effects tend not to be significant. For additional discussion, please see the Cassidy and Daganzo's second report, “[Deploying Lanes for High Occupancy Vehicles in Urban Areas](#)”.

Cassidy and Daganzo's research on HOV lanes is the topic at the April 20 [ITS Friday Transportation Seminar](#).



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Getting Aviation On the Bus



Real-time intermodal substitution (RTIMS) as an airport congestion management strategy: putting passengers on deluxe motorcoaches in periods of airport shutdown.

The massive **weather-related disruptions** this winter that led to profuse apologies (and refund offers) from airline CEOs, including low-cost carrier JetBlue, and calls for congress to pass a

[passenger bill of rights](#) might have been avoided. All the airlines had to do was cancel some flights into the socked-in airports and **put their passengers on a bus**.

That's the conclusion reached by researchers at ITS Berkeley's **NEXTOR** aviation unit, the [National Center of Excellence for Aviation Operations Research](#).

The scheme, known as "**real-time intermodal substitution**" (RTIMS), was developed by NEXTOR PhD student **Yu Zhang** with NEXTOR Co-Director **Mark Hansen**. It is part of Zhang's PhD dissertation.

Under Federal Aviation Administration (FAA) policy, airlines in this age of de-regulation are encouraged to respond to disruptions in the National Airspace (NAS) on their own before the FAA steps in. One response airlines can choose is to cancel flights.

By using RTIMS, Zhang and Hansen explain in their paper delivered to the 2007 meeting of the Transportation Research Board, airlines might find cancellations more affordable and more productive, both by cutting passengers' total travel times, and by preventing hub airports from becoming too congested with incoming planes that can't fly out.

The challenge is to calculate which flights to cancel and the best alternate transportation for the people flying on them. That is where the buses, or luxury motor coaches, as Hansen explained, come in. Short-haul commuter flights would be canceled and their passengers put on motor coaches operated under the oversight of the airline. The goal is to achieve the "optimal" solution, that is, reducing delays to the largest degree at the least "cost" to airlines, airport operations and passengers. (For details on the model and the cost allocations, [download the paper](#) or view a pdf of the [PowerPoint presentation](#).)

A look at the numbers

Consistently over the years, some **70 percent of the total delays** in the NAS are due to **weather**. And a small fraction of the total number of passengers whose itineraries are disrupted suffer disproportionately from weather delays. **Three percent of the total passengers** have their travel disrupted by weather, but they **suffer 39 percent**

of the total delay, with an average of 303 minutes, versus 16 minutes for the passengers whose trips are not disrupted.

The solution is simple: when weather causes traffic to slow at hub airports, canceling the short-haul flights to those airports and putting the passengers on buses gives airlines more flexibility.

Also, Zhang explained, "By focusing on short-haul flights, we are working with the flights that have the greatest ability to adapt to real-time information about weather and the least advanced planning necessary." In some case, even those who end up traveling by bus will end up arriving sooner than if they'd stayed on the plane waiting to take off or while it was diverted.

"There is extra travel time because they are taking the slower mode, but because the slower mode is not subjected to the capacity constraints, everyone is better off," she explained.

Sometimes, of course, bus riders will experience a longer delay than if they'd stayed on the plane, but the rest of the system will benefit.

"We want to use this idea to **improve the stability of the transportation system**," Zhang said, and reduce the vulnerability incurred by its reliance on a single mode, as was the case after the Sept. 11 attacks when the entire air system was shut down.

Zhang proceeded to "solve" the problem of how to assign flights to be canceled in order to reach the optimal level of performance balanced with costs.

Airlines have a financial incentive to avoid delays and unnecessary cancellations, beyond the goal of keeping passengers happy. Although the figures are subject to fluctuation, delaying a flight can cost on the order of \$500 an hour. Canceling a flight incurs costs upwards of \$10,000 for a medium-sized 159-seat plane. Short-haul flights cost less to cancel because less repositioning is required, and fewer passengers need to be re-accommodated. Deploying a motor coach costs about \$100 an hour.

The RTIMS approach focuses on the closest airports that are feeding the hub. The airline that canceled the flight would also operate the motor coaches, so it would not be losing passengers to other airlines, under this scenario.

The choices in the model are: Cancel or fly it? If cancel, is the flight substituted with surface transportation, or do the passengers take a subsequent flight?

Testing the Theory at SFO

Zhang ran her proposal for a typical day at SFO with a feeder airline operating the short-haul segments into the airport, for a total of about 130 flights, when the airline comes close to shutting down because of morning fog.

Three scenarios are compared: one is the "doing-nothing" scenario, that is, no flight cancellations, the second is optimizing flight cancellations by minimizing total disruption costs, but not using alternative ground transportation, and the third one is RTIMS, which is very similar to the second one, but uses ground transportation modes as alternatives. **With RTIMS, disruption costs for the airlines are 50 percent lower** than with the first "doing-nothing" scenario. With the same optimization methodology, RTIMS shows savings of between 8 and 15 percent compared to the second scenario.

The researchers conclude that this approach has "significant promise."

Another application would be to combine the intermodal approach with **a reliever hub network**, where airports in the vicinity of the hub can be used to land planes and connect passengers to their destinations through surface transportation links.



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Software that Speeds Up Pavement Rehabilitation: program developed at PRC poised for national rollout



Replacement of outer lane of I-15 near Devore in 2004: a major freight corridor connecting Los Angeles to the Midwest that also serves many commuters between the high desert and the Los Angeles basin.

A [Pavement Research Center](#) (PRC) software program that

saves time and money and cuts congestion by devising the optimal way to schedule and design **highway rehabilitation projects** is poised for a national rollout, with backing from the California Department of Transportation (Caltrans) and four partner state DOTs, the leading association of state highway agencies and the Federal Highway Administration (FHWA).

The software, **Construction Analysis for Pavement Rehabilitation Strategies** (CA4PRS), was developed by PRC researcher **E.B. Lee** as [Lee's Ph.D. project in the late 90s](#), with major support from Caltrans and the DOTs of Florida, Minnesota, Texas and Washington.

Caltrans designated CA4PRS as its formal design tool for highway rehabilitation projects three years ago, after using it successfully on three projects. In October 2006, CA4PRS received another strong endorsement from the [American Association of State Highway and Transportation Officials \(AASHTO\) Technology Implementation Group](#), which promotes leading edge techniques. The Federal Highway Administration (FHWA) joined with AASHTO and is helping fund a nationwide promotion of the software as well as training sessions.

"The use of CA4PRS helped Caltrans reduce construction time and save several million dollars in agency costs while also significantly reducing road user costs," notes the Caltrans Web site.

The program allows engineers to work together to fashion the least disruptive and most efficient schedule for highway repairs. Additionally, it enables project planners to test different scenarios and present them to decision-makers and affected parties.

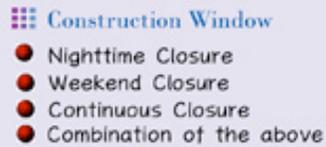
"This software allows the design engineer, the planning engineer, the traffic engineer and the construction engineer to talk to each other. It provides them with the same communication channel," Lee explained.

It does so by using computer models and simulations to rehearse different "what-if" situations involving [all the parameters for a major highway reconstruction project](#). These include factors ranging from the type of rehabilitation proposed (e.g., Portland Cement Concrete (PCC), Crack-seal and AC Overlay (CSOL) or Full-Depth AC Replacement (FDAC)

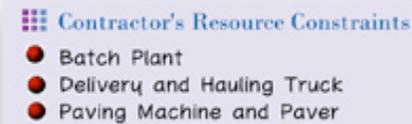
Rehabilitation Strategies

- Portland Cement Concrete (PCC)
- Crack-seal and AC Overlay (CSOL)
- Full-depth AC Replacement (FDAC)

(FDAC)), to the preferred time windows for projects. Other considerations include contractors' access to and ability to use different kinds of materials, lane closure tactics, the thickness of the new pavement, the type of base to be used, the traffic control and scheduling methods, and the curing time and design of the pavement mixes. All these elements interact in complex ways that are nearly impossible to predict and control without the software and computer processing power. Additionally, the program can run different versions of the same project and produce easy-to-understand, highly graphical representations of the conditions that each choice would produce. This is useful for policy makers to share their decision-making with the greater public and other participants.

- 
- Construction Window**
- Nighttime Closure
 - Weekend Closure
 - Continuous Closure
 - Combination of the above

The software program, which is under license by the UC Regents, is already freely available to Caltrans and the four DOTs. The FHWA is working to sponsor licensing for the remaining 45 states, a process that is expected to be completed soon. In addition, a number of universities have acquired an educational license for the CA4PRS software for teaching purposes. Some contractors have also purchased the commercial license to verify their construction staging plans for highway rehabilitation projects.

- 
- Contractor's Resource Constraints**
- Batch Plant
 - Delivery and Hauling Truck
 - Paving Machine and Paver

Caltrans awarded Lee and his team [two 2005 Excellence in Transportation Awards](#) for CA4PRS's deployment on the initial repaving project of I-15 in Devore (pictured above) in [2005](#).

A new version of the software is being rolled out, Lee said. In addition to the projects in Southern California where it has already been used, a major rehabilitation of freeways in and around Riverside County will be guided by the software.

Outside the state, in addition to the four partner DOTs, Michigan and Missouri are in the process of acquiring rights to the program. With the FHWA commitment, the software should be widely adopted in coming months.

Related Links

- [Caltrans' CA4PRS Research Web site.](#)
- ["Accelerating Urban Highway Rehabilitation with Construction Analysis Software,"](#) FHWA's *FOCUS* magazine, June 2006.
- ["Accelerated Reconstruction Of I-15 Devore Corridor,"](#) FHWA's *Public Roads* Magazine, Jan/Feb 2007.
- [Caltrans District 8 Web site describing CA4PRS implementation](#) in the second stage of the pavement rehabilitation project near the junction of I-15/I-215 in the Cajon Pass near Devore.



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Lost in Translation: Student wins top award for provocative paper on traffic safety in Hanoi



A street in one of the older sections of Hanoi, where pedestrian and motorized traffic operate by informal norms.

Wendy Tao, a student in the concurrent Master of Science/Master of City and Regional Planning transportation program, won the top prize in the [2007 American Planning Association Transportation Planning Division Student Paper Competition](#) for her analysis of traffic safety in Hanoi, Vietnam.

In her paper, she questions the approach of imposing new traffic systems in urban areas of developing countries without taking into account the unique cultural and historical traffic sense the population has developed over time.

“These typical top-down approaches employed by governments and traffic safety experts ignore informal norms that guide, in Henri Lefebvre’s words, the ‘spatial practice’ and ‘representations of space’ from local users of the sidewalk and streetscape,” she wrote in her paper, entitled “Structured and Spontaneous: Informal and Formal Influences on Traffic Safety in Ha Noi, Viet Nam.”

As an example, Tao describes how the streets of Hanoi are increasingly awash in motorbikes. The old streets of the city’s French and Ancient Quarters are perceived to be especially chaotic because the streets are narrower and rules are guided by informal norms.

“Foreigners see chaos when they look at these narrow streets filled with weaving motorbikes,” she said in a recent interview. “When I first arrived, I had no idea how to get across a street.”

But those who live there do. Pedestrians do not look both ways before stepping into the street. They walk slowly and steadily while the ubiquitous motorbikes swarm around them, “like a river swirling past a stone,” she explained.

Visitors unaware of this system wait for a gap in traffic then dash across the street, which causes confusion among those on motorbikes who don’t know what to make of someone running erratically across the road.

Tao says the reaction of transportation experts is to say, ‘Let’s put a traffic light there so pedestrians can cross safely.’ She doesn’t think that would work because motorbike drivers tend to ignore lights and pedestrians would tend to jaywalk. Instead, a solution that involves street design and the slowing of overall traffic speeds

would be more effective.

In her paper, Tao concedes that increasing traffic, primarily motorbikes, in Hanoi is undoubtedly causing traffic safety problems. Before intervening, however, she suggests a “community-level approach to the interactions that take place on the streetscape” be explored. This would provide a better understanding of the “characteristics of the road, the historic design, the perception of safety from residents and users of the space, and what the space is actually being used for,” including sidewalk vending or motorbike parking.



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