Research Exchange gathers brief summaries of ongoing or recently completed research about critical topics in transportation. More can be found in the full compilation at www.intransitionmag.org. We invite readers to suggest studies that merit inclusion.

Reducing Traffic Speeds in High Pedestrian Areas

Roads running through resort areas and towns often carry significant pedestrian volumes and high-speed auto traffic. Researchers from Iowa State University tested speed reduction techniques on several rural-town roadways and used this field data to validate an earlier traffic calming study that used a driving simulator at the University of Minnesota's Human Factors Research Laboratory.

The research team collected speed data before and after speed reduction tenchniques were put in place at sites in Twin Lakes and Bemidji in northern Minnesota. The data included information about long-term, post-treatment effects.

In Twin Lakes, traffic-calming techniques consisted of removable pedestrian islands and crossing signs that concentrated pedestrians looking to cross the street at marked crosswalks

The combination of islands, signage and focused crossing sites created an urban effect that reduced motorist speed.

The change in mean speeds and speed compliance rates was statistically significant in both directions in Twin Lakes. After installation, mean speeds were 30 mph—the posted speed limit. Speed compliance increased more than 15 percent eastbound and 25 percent westbound. The long-term effect was not as marked as the short-term, but still had 20 percent more speed compliance than no treatment.

In Lake Bemidji, a dynamic variable message sign displaying the word "SLOW" to speeding motorists was coupled with police enforcement at installation—but not afterward. Though proven elsewhere, this method failed to lower speeds. The sign's location, its single-word message, and the lack of ongoing enforcement, explained the lack of effect.

— Researchers: Ali Kamyab, Dennis Kroeger

Flexible, One-Destination Approach Can Cut Evacuation Time

Transportation modeling researchers at the University of Tennessee and Oak Ridge National Laboratory have tested a new approach to evacuation planning that they say could cut evacuation time by more than 60 percent.

Conventional evacuation planning and modeling usually assigns evacuees to fixed, nearby destinations. The drawback with this approach is that it often leads to an inefficient evacuation, according to the work outlined in the authors' "Proposed Framework for Simultaneous Optimization of Evacuation Traffic Destination and Route Assignment," published in the Transportation Research Board's Transportation Research Record No. 1964. That's because an emergency itself can cause road hazards and closures that hamper efforts to get people to their pre-assigned destinations.

The researchers' suggested alternative — a "one-destination evacuation" — would assign one destination to large numbers of people based on the specific problems presented by a particular emergency. Modeling done in advance of an evacuation can develop an optimal destination and routes for evacuees based on different emergency scenarios.

The researchers' simulation of a countywide evacuation of Knox County, Tenn., found that this approach reduced the time required for a full county evacuation by more than 60 percent when compared to the simulation based on traditional evacuation planning assumptions.

—Researchers: Fang Yuan, Lee David Han, Shih-Miao Chin, and Holing Hwang

See Transportation Research Record No. 1964, 2006 or go to www.trb.org

Virtual Weigh Station: A Systems Evaluation

In response to an increase of more than 50 percent in commercial truck traffic over the past five years, the California Department of Transportation (Caltrans) is investigating the potential of detection and communication technology at "virtual weigh stations" to streamline enforcement of commercial vehicle regulations, with capacity and cost-effectiveness a primary concern.

Enforcement capability is not expected to keep pace with a projected 80 percent increase in freight volume by 2020. Even now, the number of trucks waiting to be weighed exceeds station capacity, forcing them to queue in lines, costing drivers and shippers time and fuel. That has impacts on air quality, traffic safety, and overall system efficiency. Overflow traffic routinely is allowed to bypass inspection stations, and scofflaw operators alter routes to avoid the process altogether.

The two-year trial effort is assessing a range of possible solutions, such as detectors to weigh trucks in motion, image capturing, and sensing technologies. The analysis also aims to develop a comprehensive understanding of commercial vehicle enforcement problems in California. Key outcomes, based on extensive data analysis, literature reviews, and expert and stakeholder interviews, include:

- An inventory of baseline statistics on the current commercial vehicle compliance and enforcement processes in California;
- Estimates of future demand placed on compliance processes and likely resources to meet this demand;
- Identification of significant commer-

cial vehicle compliance and enforcement-related problems and locations in California (e.g., pavement and structural damage, crashes, air pollution, and security); and
• Assessment of current and emerging technologies and applications including performance, costs, and institutional barriers.

Based on these findings, researchers will recommend alternatives with the greatest likely return on investment.

—Researchers: Samer Madanat, Genevieve Giuliano, Caroline Rodier, Susan Shaheen, Mark Miller, James Misner

Testing Shared Bikes and Segways at BART Stations

Car sharing has provided new mobility options to many urban dwellers. Can similar sharing of "low-speed" vehicles—bicycles, electric bicycles, and Segways—based in lockers at train stations help boost rail ridership and transit-oriented development? The Innovative Mobility Research (IMR) group is testing the concept at the Pleasant Hill BART (Bay Area Rapid Transit) station, near San Francisco.

Inspiration comes from Europe—in particular, the "Station Oxygène" in Lille, France, which opened in 2004. The station offers 16 Segways and 25 electric bicycles for rent. A 10 percent discount is given to anyone with a public transportation ticket.

In the California test, the IMR's EasyConnect II program allows commuters to use bikes or Segways for the last few miles of their commute to the office. For the evening commute, participants ride the shared-use vehicles back to the BART station where the units are stored in electronic lockers overnight. Vehicles can be used during the day for travel to lunch or to run errands.

The secure "eLockers" are accessed using specially designed smartcards. Researchers installed a reservation system to allow low-speed vehicles to be reserved for use during a specific time window. Training in the use of the vehicles is provided.

The project involves a partnership of small technology businesses, transportation agencies, city and county government and academia. IMR is based at California Partners for Advanced Transit and Highways (PATH), and hosted by the University of California, Berkeley.

— Researchers: Susan Shaheen, Caroline J. Rodier

See http://www.innovativemobility.org/index.htm

Design Solutions for Traffic Calming

Traffic calming measures that effectively reduce speeds and volumes also improve safety. Motorists slow in response to vertical and horizontal design changes to the roadway, and to narrowing of lanes. Speed humps force drivers to slow down to avoid abrupt bumps, while road narrowing uses a psychological sense of enclosure to discourage speed.

Studying the "Effectiveness of Certain Design Solutions," researchers at New Jersey Institute of Technology (NJIT) evaluated how traffic calming methods changed motorist speed in commercial and residential areas with posted speed limits under 35 miles per hour. They also evaluated how these methods improve motorist safety, while maintaining or improving pedestrian and bicyclist safety.

Researchers also assessed design preferences and the acceptance of traffic calming through a visual preference survey of motorists, pedestrians and bicyclists. The survey gauged perceptions of safety for pedestrians or bicyclists; reasons for perceived lack of safety; and preferred roadway travel speed. The survey also rated traffic calming measures for pedestrian/bicyclist safety, driver convenience, and aesthetics.

Sixty-seven percent of respondents said their street was not safe for pedestrians and bicycles. Reasons given were: "Too many vehicles" (27 percent); "Speeding" (22 percent); and "Lack of pedestrian crosswalks" (21 percent). Most respondents saw "25 mph" (44 percent) as safe roadway speed.

Speed humps, despite widespread use, were the least preferred design change. Medians with a pedestrian breakpoint were rated highest for improving safety, minimizing driver inconvenience, and for aesthetic value. Results suggest that educating drivers about such safety improvements will help engineers and road users alike. Equally important is a clear understanding of the preferences of road users and factors shaping perceptions of road safety.

— Researchers: Janice Daniels, Steve Chien, Rachel Liu, Nazhat Aboobaker

See http://www.transportation.njit.edu/nctip/final_report/DesignSolutionReducingSpeeds.pdf

New Modeling Algorithm Developed for Evacuations

Practical approaches to evacuation modeling and planning are also under investigation at the University of Minnesota. Researchers under Shashi Shekhar have improved on standard approaches—which rely on mathematical programming or heuristic algorithms—to calculate and model optimal strategies for evacuating large numbers of people from neighborhoods or whole metropolitan regions.

According to the Center for Transportation Studies' Sensor on-line newsletter: "Shekhar's research team focused its efforts on the development of a novel and more practical form of heuristic algorithm for evacuation planning—one that would take into account the capacity constraints built into transportation networks, but would determine a good solution to any large-scale evacuation problem in much less time than a mathematical programming approach would require." The result was the Capacity Constrained Route Planner (CCRP) algorithm.

Looking at a hypothetical disaster at Minnesota's nuclear power plant, researchers found that evacuation plans based on the CCRP algorithm would make use of a larger number of roads than the existing evacuation plan in place for the plant. This would result in less road congestion and significantly reduce total evacuation time relative to the existing plan.

Shekhar's group is working to translate research findings into practice. The

Minnesota Department of Transportation recently used the CCRP algorithm in planning for evacuation of the metropolitan Minneapolis–St. Paul region as a whole.
— *Researchers: Shashi Shekhar, Quingsong Lu, Sangho Kim*
See
http://www.its.umn.edu/sensor

The Efficiencies of Friendly Driving

Passing the vehicle ahead of you on interstate highways is a simple procedure. That is, unless sudden changes in speed disrupt a smooth exchange of position on the roadway. Just as lowered fuel efficiency is one consequence of rapid acceleration and sudden braking, refusing to yield the "car-leading" position or tailgating to gain that position injects inefficiencies into the overall system performance of highways.

Researchers at the University of Missouri—Columbia set out to examine the reverse: Does cooperative driving behavior of leading vehicles in passing maneuvers translate into better highway operating conditions? Using GPS, speed radar, and coordinated in-vehicle video, the team measured how much time was spent overtaking other vehicles on Interstate 70 in Missouri.

On average, each car-leading maneuver incurs a mean delay of 7.75 seconds. Researchers estimate that inefficient car-leading behavior on I-70 costs the overall system about 76 vehicle-hours of delay per day. In short, drivers of lead vehicles that decelerate gradually when passed may feel that they are giving ground to a competing vehicle, but they help the overall system achieve optimal operating costs, measured in time. Everybody gets home a bit sooner. Such courteous drivers also let both vehicles reach optimal fuel economy—rather than forcing the passer to over-accelerate and brake to perform the same maneuver. Similar effects may apply for the passing vehicle.

Cooperation allows both drivers to operate at optimal efficiency in terms of time and energy, while creating a driving environment that benefits every motorist using the highway. Such public benefits are lost when frustration at falling behind or the competitive urge to "get ahead" overwhelms drivers.

Lead vehicles display a wide range of behaviors in the field. Awareness campaigns or signs—`Slower Traffic Keep Right," for example—could improve overall system efficiency.
— *Researcher: Carlos Sun*

Speed Management on Main Roads in Rural Communities

In many small Iowa communities, the town's "main street" is a high-speed rural highway that shifts to a reduced speed limit inside city limits. The main street running through small Iowa communities is often a high speed rural highway that transitions to a reduced speed section once inside city limits. Drivers passing through town often enter at high speeds and frequently maintain those speeds throughout. In response, communities seek traffic calming measures to address high speed driving. Though established in urban areas, the effect of traffic calming is unknown in rural settings. Researchers at the Center for Transportation Research and Education (CTRE) at Iowa State University (ISU) are evaluating different traffic calming treatments in five small rural Iowa communities.

Two of five Iowa towns received full gateway treatments. In one, peripheral transverse pavement markings were applied to slow traffic entering as it enters town. FSpeed feedback signs telling drivers their speed were installed, and the center media was widened with pavement markings to narrow traffic lanes were narrowed by widening the center median using pavement markings. In the second, transverse chevron pavement markingss were applied at the edge of town. Lanes were narrowed by repainting shoulders, and on-pavement speed signs placedstationed throughout the community.

Single treatments were applied in the other three communities. In one, a speed table was installed. The second used a set of four on-pavement treatments combining red pavement markings with an on-pavement speed sign. A center island was widened using tubular channelizers in the last.

Speed data were collected before installation of the treatments, and after at intervals of one, three, six, nine and 12 months 1-month, 3-month, and at 6, 9, and 12-month intervals, to investigate long-term effectiveness. The study is slated for completion in November 2007.
—*Researchers: Shauna Hallmark, Neal Hawkins, Jon Resler, Eric Fitzsimmons, and Eric Petersen*
See
http://www.ctre.iastate.edu/research/detail.cfm?projectID=1126310625

Pedestrians travel farther than expected; walkability factors challenged

How far are people willing to walk? And why? Assumptions about the factors that make a neighborhood walkable are coming under scrutiny, with useful and surprising results. Despite a desire to minimize time and distance, pedestrians walk farther to light-rail stations than previously assumed—and farther than they estimate.

In an award-winning study, Marc Schlossberg of the University of Oregon teamed with Asha Weinstein of San Jose State University to study walking activity around five rail transit stations in Portland and another five stations in the San Francisco Bay Area. It turns out that people are willing to walk a median distance of a half-mile, instead of the quarter to one-third of a mile conventionally viewed as a maximum.

"Despite the seeming simplicity of the goal, we know very little about how far people actually walk or about how street design affects people's willingness or capacity to access their desired destinations by walking," Schlossberg said.

The resulting paper—"How Far, by Which Route, and Why? A Spatial Analysis of Pedestrian Preference"—earned the 2007 Outstanding Paper Award at the Transportation Research Board's annual conference in January.

Researchers also assessed the environmental factors that influence the routes people use in walking. "Perhaps the key to increasing the number of walking trips is not to design pedestrian environments full of amenities such as benches, tree cover, awnings and wide

sidewalks," Schlossberg said. "While there is no doubt those assets can enhance the pedestrian experience, the real key is to have somewhere to walk to and to have an environment that isn't horrible."

In addition to the unexpected finding that pedestrians walk farther to access light rail stations than traditionally believed, the work helped create a better understanding of why this is the case, and how walkers make such decisions. Pedestrians cite the need to minimize time and distance as a primary factor in choosing a route. Secondary factors shaping route choice include safety and, to a lesser degree, attractiveness of the route, sidewalk quality and the absence of long waits at traffic lights. Pedestrians' ability to accurately estimate the distance of their walks varies considerably. Using maps to have survey respondents trace their chosen route is an effective way to eliminate subjective perceptions of distances walked.

"Slugging"— Commuters Find a Win-Win Arrangement

Commuters hoping to use High-Occupancy Vehicle (HOV) lanes—but also lacking the extra passenger or two required to gain entry to the faster lanes—can go "slugging." The practice of spontaneously picking up a fellow commuter to round out a carpool began at bus-stops in the Virginia suburbs near Washington, D.C. Drivers essentially trade a free ride to commuters waiting to use other forms of transportation for the extra body that gets them into the HOV lane. Bus drivers named the practice "slugging," after the slugs dropped into coin slots to get a free bus ride.

Such informal arrangements move up to 6,500 commuters per day, according to the Virginia Department of Transportation. Slugging saves carpoolers 30 to 50 minutes each way over the regular lanes or the bus—and saves transit riders up to $12 in fares and parking fees. Informal rules of etiquette have developed to ensure safety, as well as to maintain courteous relations with that day's host driver. The market for slugging also provides a natural constituency willing to advocate efficient policies for HOV and High-Occupancy Toll (HOT) lanes.

Now; researchers at Texas A&M have evaluated casual carpooling in Houston, producing data that can inform decisions about future lane development and will enable better analysis of HOV/HOT lane use. Researchers observe that as vehicle occupancy requirements are raised during peak periods from two to three, casual carpoolers adapt accordingly, picking up two passengers instead of the usual one extra rider. Greater congestion leads to higher occupancy standards, which in turn generates higher efficiency among auto users accessing this informal market system. However, where a $2 toll gains entry to the high-occupancy lanes, few drivers pick up a slug; the fee is small compared to the time spent finding another rider.

The research found that most informal carpoolers in Houston are commuters. Wait time is low, averaging 144 seconds before pick-up. Time saved is less than in other cities—around 13 minutes.. Motivating factors include monetary costs, trip purpose, and reliability of travel times. About 63 percent of casual carpoolers were doing it to save money, while 53 percent were avoiding slow bus service. Three-quarters of carpoolers used this method three or more times per week.
—Researchers: Mark Burris, Justin Winn