

A road is more than a road

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Standing by the edge of a busy four-lane road in Essex, Vermont, Anthony Gervais eyes a line of cars stopped at a light. Like a giant strand of metal beads pulled from one end, the cars start to move and spread when the light changes, accelerating away down the strip.

Aiming his radar gun carefully at an approaching pick-up truck, Gervais stares with a calculating concentration at the read-out on screen. He writes a few figures in his notebook and then prepares for the next surge of cars.

He's not a police officer. He's a freshman at the University of Vermont and this is Civil Engineering 003.

"[This] road has been a big thorn for us," says Dennis Lutz, director of public works for the town of Essex, who is standing nearby, helping the students. "There's a high accident rate. It used to be about 15 to 17 thousand cars passed through here daily. It's 20 or 22 thousand now."

"There are no simple solutions to the traffic," he says, "every time you make a tweak here, there is tweak somewhere else."

That's exactly the point University of Vermont associate professor of civil engineering Nancy Hayden hopes the students learn in her class--and it's the point of an \$860,000 effort at "systems education" she is directing through UVM's department of civil and environmental engineering, funded by the National Science Foundation.

"Over their four years at UVM, we want to turn our students into systems thinkers, to see how things are ultimately connected," she says. "We don't want traffic engineers working in a vacuum saying, 'I'm just going to build the Circ Highway,' because someone told them to go do that. As engineers, they should be concerned about the social, environmental, and economic consequences of their decisions."

Hayden believes the best way to get students to be systems thinkers is to give them real problems working with the public. "Civic engagement is integral to engineering," she says, "and so a major part of this project is service-learning." Like Essex, many towns across the Vermont face increased population--and strain on their infrastructure, including overloaded roads, crumbling bridges, and aging stormwater systems. Hayden's project connects these communities with UVM engineering students who can help them look for solutions.

"We're adopting towns--last week, the other half of this class was counting cars in Monkton--and building a long-term relationship," she says. "This is not just a field trip; we're actually working here, helping Dennis and the town by gathering data they can use."

One car squeezes off left and crosses the double lane of oncoming traffic into a rundown shopping plaza. "Right here, on this parking lot, there may be a big new store soon. On the table is a Lowe's," says Lutz. The information about traffic that Anthony Gervais and his classmates collect may help shape how Lutz and other town officials plan for this new development.

"Whether you're in favor of the Circ [Highway] or not, it's not going to happen anytime soon," Lutz said, "so we're going to be dealing with more cars here. Should we put another signal in up there by the bagel shop?" he asks. "Maybe, but we don't know if it's going to solve any problems. Is it going to move it to somewhere else and create its own

dangers?"

One way to find out, before cars start crashing, is to simulate the intersections on a computer. "The students will build a traffic model that is animated so they can see what happens," says associate professor Adel Sadek, an expert on traffic engineering and one of Hayden's four faculty colleagues on the systems education project. "Right now they're collecting data to build the model: traffic counts, timing for the signals, some speed measurements, cue lengths."

Back in the lab on campus, students can enter the data they've gathered and then manipulate the simulated intersection, changing the length of green lights, say, or adding another turning lane onto nearby Route 15. In other words, they'll be thinking through systems rather than isolated problems.

In the same way, one of the key goals of the new systems education project is integrating three courses that use to be separate: starting in the spring of 2007, sophomores in the university's engineering school will no longer take distinct introductory course on environmental, traffic, and economic engineering. "Many principles are applicable to all these disciplines," Sadek says, "so why should they be kept apart?" Instead, Hayden, Sadek and their colleague Donna Rizzo will teach a three-semester integrated series of classes, Systems 1,2, and 3.

"I think these students now realize there is a lot more to stoplights than they realized," Sadek says with a chuckle, as the students walk (or skateboard) back to their bus after an hour of timing and counting. "We'll teach them to build this model and then they can start thinking about the traffic patterns on their own."

"Ideally, we'll calibrate the model they build to the real intersection--and provide something of use to the town," he says, "obviously with the

caveat that it's students' work, not professionals' work."

The students' model probably won't be the basis for rebuilding Susie Wilson Road, one of the busiest, most complex intersections in Vermont. But what the students can do, through their report and presentation to town officials at the end of the semester, is to "ask questions that get stakeholders thinking and talking," Hayden says.

And as these first-year students progress through their engineering training they'll be building skills that not only may lead them to be ready to redesign a road intersection, but maybe even to solve the underlying problems of an overtaxed and unsustainable transportation system.

"I don't know what's going to happen here," Lutz says, shaking his head as a dozen cars idle at the red light by Bond Auto Parts. "If you build up the density and the [congestion] problem gets bad enough, then some people will be willing to go to public transit."

Or maybe one of Nancy Hayden's students will find another solution. "It's great working with first-years," Hayden says, "they're just figuring out which way to go."

Source: University of Vermont

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