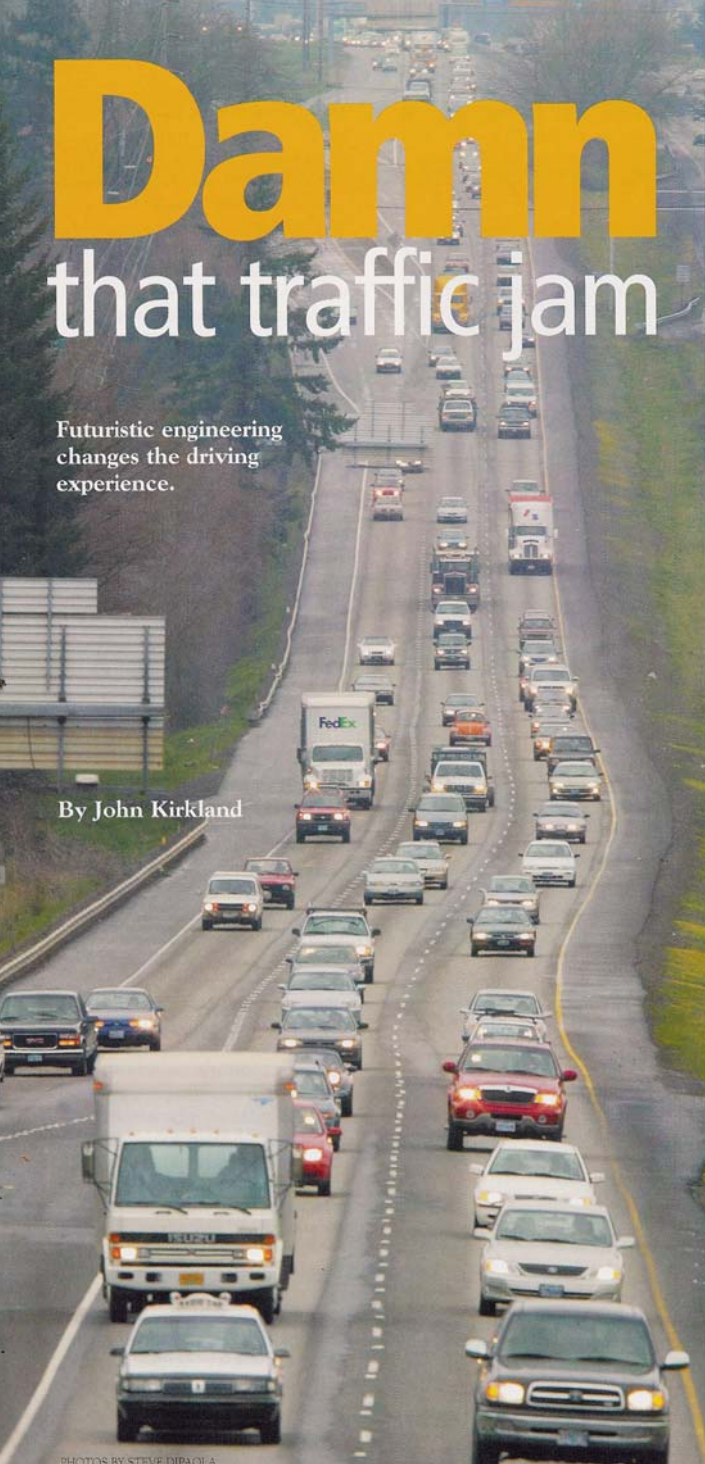


Damn that traffic jam



Futuristic engineering changes the driving experience.

By John Kirkland

The image appearing on the graduate student's computer monitor is like the schematic of a beating heart, fed by veins and arteries, full of multicolored blood cells speeding along in a purposeful frenzy.

A valve closes and the cells in one of the minor blood vessels back up one after the other. Then the valve opens, and the cells rush into the main artery to be carried along in the fast-moving current.

But these aren't blood cells, and the schematic isn't of a heart and arteries. It is the outline of the Interstate Highway 5 interchange at Wilsonville, the cells are cars and trucks, and the valves are traffic signals. Every move by every car is an actual recorded event—wires imbedded under the asphalt picked up data, which was later archived at Portland State and used in this computer model.

The graduate student pulls down a menu at the top of the screen and asks the computer to simulate what the situation would look like with 20 percent more traffic. As if fatty deposits are suddenly plastered along the walls of arteries, the cells back up in longer and longer lines, increasing pressure on the system, threatening an aneurysm.

This is vital information to have if you are a transportation planner, the mayor of Wilsonville, or a real estate developer. What if a proposed housing development in Wilsonville added another 1,000 cars a day to the local traffic? Would we need to widen roadways and add lanes? If so, who pays for it?

This is just one of many projects under way at PSU's Intelligent Transportation Systems (ITS) Laboratory in Science Building 2. "Intelligent Transportation" is the use of surveillance and communications technology by government and other agencies to make traffic flow faster, smoother, and safer. You see it in action when you wait for a green light to let you onto

The data collected every 20 seconds from sensors imbedded in Oregon's Highway 26 is studied by students in PSU's Intelligent Transportation Systems Laboratory.

the freeway, or when a warning sign tells you to use an alternate route because of an accident up ahead.

But mostly it's invisible.

Using technology to improve the nation's roads is essential when you take a look at the statistics of what's happened in the last 20 years. During that time, traffic nationally has increased 72 percent, but only 2 percent more lanes have been added for those vehicles to drive on. At the same time, there has been a 33 percent increase in the number of registered vehicles, according to Robert Bertini, civil engineering assistant professor and head of the ITS lab.

These are used to monitor traffic flow, but are particularly useful in managing emergency response to accidents.

- "Inductive Loop Detectors," a fancy name for wires imbedded in the pavement to detect the presence and speed of passing vehicles. These detectors tell traffic signals when to switch. They're also used to detect when a vehicle is waiting to get on the freeway, and to measure how slow or fast traffic is flowing on that freeway.

If all this sounds like Big Brother, Bertini encourages you to think about what life on the road would be like without it. Buses would not stay on schedule, ambulances would be slower to arrive at an accident, chaos would abound at freeway entrances.

If there is a flaw in the system as it now stands, it is that not enough is being done with the information collected. Take the inductive loop detectors, for example. Each of the 400 or so loops in the region registers three pieces of data every 20 seconds. That's more than 5 million bits of information a day. This mountain of data belongs to the Oregon Department of Transportation (ODOT), "but they don't use it to its full capacity," Bertini says.

Bertini is archiving the data and developing fascinating ways to unlock its potential. For example, he's putting together a mock transportation management center in the ITS lab that uses color coding to show the speed at which traffic is moving through the main arteries. Ultimately, this could be a Web-based program that could be used by the public to plan alternate routes. Many cars are currently equipped with navigation systems that will map out a travel route, but those routes don't show traffic jams, accidents, or road construction. The Web program could interface with the car's own system, letting the driver know the most hassle-free route from home to work or visa versa.

Bertini also is talking with Intel, ODOT, and others organizations to put together a demonstration project to improve the nation's "telematic" response system. In this system, cars

can be linked to a service such as OnStar, which can detect if a car is in an accident. When a car's air bag is inflated, a cellular phone imbedded in the car automatically calls OnStar. The phone is wired into the car's stereo system through which an OnStar operator attempts to talk to the driver to ask if anyone is injured. The driver simply speaks, and the phone picks up his voice. But if there is no response, the operator uses GPS technology to accurately locate the car, then calls the nearest 911 center for that location.

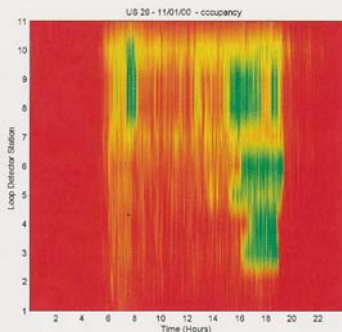
The problem is, the data received by OnStar is limited. What Bertini proposes is a way to incorporate other data into the mix. For example, relaying how fast the car was going before it made impact, the amount of force against the shoulder harness, and the traffic conditions for that particular location. With this information, OnStar would be better able to assess the severity of the accident and the best way to reach it.

In all, four students are working in the lab on research funded by various agencies, utilizing a wealth of information fed from the area's under-pavement sensors and extensive fiber-optic network. Eventually, the lab will be relocated to the new engineering building on Fourth Avenue. The lab will be paid for in part from a generous gift by engineering firm CH2M Hill. The company employs more than 50 PSU graduates.

"Transportation is the most significant issue facing economic development in the state," wrote CH2M Hill representatives when the gift was announced.

Intelligent Transportation is only one element in the University's Transportation Research Group, a multidisciplinary group involving about a dozen faculty from civil engineering, business administration, and urban studies and planning.

James Strathman, director for the Center for Urban Studies, says he and his students are working on a project involving sensors in the road that can detect whether a passing truck is carrying a legal amount of weight. Currently, the technology can notify a



The loop detector stations—imbedded sensor stations—from Helvetia Road (1) to Skyline Road (11) show that eastbound traffic on Highway 26 is heaviest from 4 to 7 p.m.

"We've undergone a shift in transportation from the glory days of designing the interstate highway system. We're no longer building our infrastructure. We're operating and managing it," he says.

Some of the examples in which agencies are using technology to manage transportation—and have been for years—include:

- Global positioning systems (GPS)—satellite communications devices—installed on Portland-area Tri-Met buses so that central dispatch knows exactly where all buses are located at all times.
- Video cameras positioned at about 60 locations throughout the metropolitan area, primarily on freeways.

driver traveling at highway speed whether she is required to pull off at the next weigh station. PSU is studying the practice to see if it's accurate enough to use in issuing citations if overloaded trucks refuse to stop.

PSU also helped Tri-Met evaluate the effectiveness of its technology, including GPS and automated passenger counters that measure how well buses stay on schedule, and how smoothly they keep passengers boarding and unboarding. As with other information generated in the region, PSU archived the data. A recent report for Tri-Met showed that it had saved more than \$50 million over the past five years by using this technology, says Strathman.

PSU is now using that same data to help Tri-Met write new schedules to make the agency even more efficient than before.

How well is all this technology working to improve traffic in and around Portland? It depends on how you look at it. A study by the Texas Transportation Institute at Texas A&M University ranked Portland/Vancouver ninth out of 68 metropolitan areas in the country in roadway congestion. That's better than some of the more predictable traffic heavyweights such as Los Angeles, San Francisco, Washington, D.C., and Seattle, but worse than Detroit, New York City, and Houston.

"Where Portland leads the nation is in the way it's deployed its Intelligent Transportation System in such a collaborative manner," says Bertini. That collaboration involves ODOT, the city of Portland, Tri-Met, county governments, state and local police, Washington state agencies, and 911 responders, all of whom meet on a regular basis to stay on top of traffic issues.

And with PSU playing such a major role, further "intelligent" solutions to the area's traffic congestion are limited only by technology and imagination. □

(John Kirkland, a Portland freelance writer, wrote the article "Thinking Small" in the winter 2002 PSU Magazine.)



In addition to controlling signals, underground sensors at freeway entrances generate information about a highway's use.