

Roads Paved with Ice

As the climate changes, a crucial lifeline becomes more precarious. BY JOHN CRAWFORD

At first, the idea of heavy tractor trailers driving on roads made of ice doesn't sound very sane, or very safe. "As trucks go by, the ice cracks," says Michael Goldstein, professor of finance. "It's a little nerve-racking."

But these ice roads, thick enough to support a truck's weight, are a critical lifeline in the remoteness of Canada's Northwest Territories. One of these roads, featured on the History Channel's *Ice Road Truckers* TV show, stretches 360 miles, much of that over frozen lakes, to reach three diamond mines. More than 150,000 metric tons of supplies

will travel the road during the two months or so it's open.

Another road reaches several indigenous communities and allows for the delivery of critical heating oil. It also gives the residents a chance to leave the seclusion of their villages. Without the roads, these communities, as well as the mines, are accessible only through the air. "The roads

are very important to people," says Goldstein, the Donald P. Babson Endowed Chair in Applied Investments.

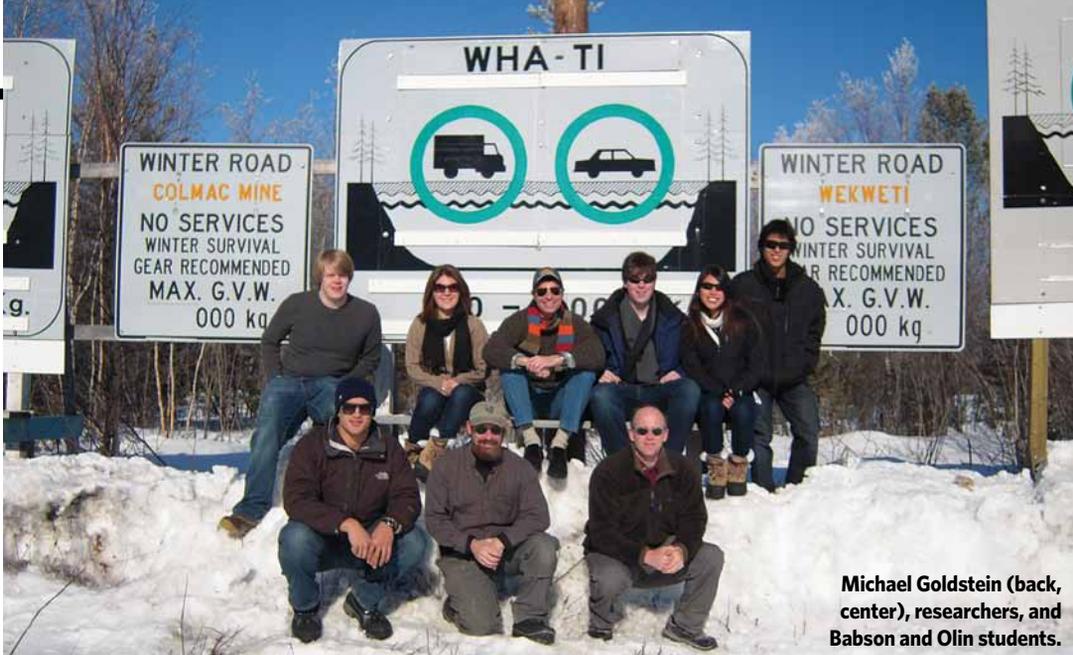
Goldstein is examining the ice roads with a grant from the U.S. National Science Foundation. His research focuses on the changing of the seasons, once relatively consistent but now becoming more altered, and how that's creating more variable weather that affects the transportation essential for economic activity and human survival in and near the Arctic Circle.

What he's finding is a precarious road system dependent on optimal weather conditions. If snow falls at the wrong times, for instance, it can inhibit the growth of the roads' ice, since snow acts as insulation. Unfortunately, as climate change turns weather increasingly unpredictable, the reliability of the roads has been called into question. "How close to the knife's edge is the [road] system?" Goldstein asks.

Such unpredictability isn't good for business. If the weather forces the roads to close early for the season, that means necessary supplies, unable to be trucked to the mines, must be transported by plane instead, which is much more expensive. That happened in 2006, when thin ice forced the

Michael Goldstein (left) and his fellow researchers wear survival suits for off-season riding on the ice road.



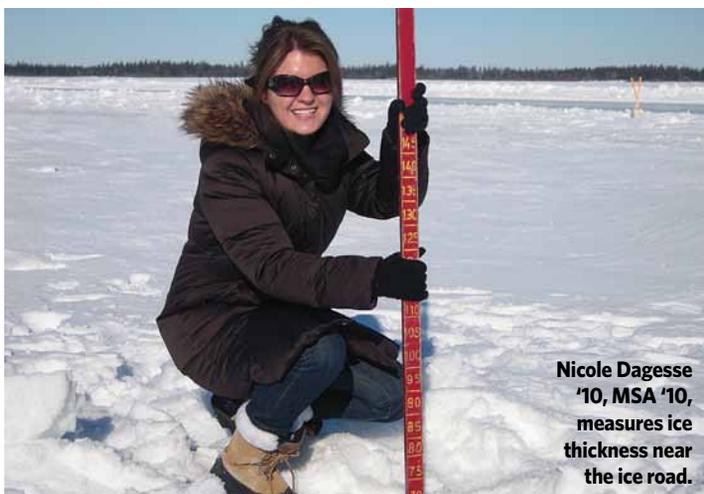


Michael Goldstein (back, center), researchers, and Babson and Olin students.

mine owners to fly in about 1,200 truckloads of materials.

If the roads become increasingly unreliable, then the mine owners, whose operations account for about 30 percent of the Northwest Territories' GDP, may take drastic measures. Goldstein says they may decide to close the mines altogether, or if the changing climate opens up the Northwest Passage sea route through the Arctic, the owners may choose to bring supplies that way and then truck them down from the north. As for the indigenous people dependent on the ice road, the Canadian government may one day decide that their situation is untenable and offer to relocate them.

Goldstein first visited the ice roads in January 2010. Because the roads weren't officially open yet for the season, he and his fellow researchers were required to take precautions. They rode the roads with doors unlocked and seat belts unfastened, so in case their truck sank through the ice, they could exit quickly. They also wore survival suits which could keep them alive for up to two hours in icy water. Without



Nicole Dagesse '10, MSA '10, measures ice thickness near the ice road.

the suits, they would last only about five minutes.

Goldstein returned two months later, bringing five students from Babson and one from Olin College for a course called Arctic Economics. "It wasn't a typical class," Goldstein says. John Chartier '11 recalls the flight into Yellowknife, the Northwest Territories' biggest city with nearly 20,000 people, located about 300 miles south of the Arctic Circle. "Flying in, you just see white, white, white, and then the city," Chartier says. "It was beautiful. As far as you could see, it was flat white."

Helping with research, the students measured ice depth and

interviewed local business owners, air-charter companies, and ice-road drivers to understand the roads' economic and human impact. They also traveled to the isolated indigenous community of Wha Ti, home of the Tlicheo. The students saw firsthand how, for just a short time every winter, the ice road expands the world of the Tlicheo. "When it's cold, they can go places," says Nicholas Pineda '11. "When it's warm, they're trapped."

One wonders what the future holds for all those dependent on the ice roads. That's something that Goldstein, whose NSF grant runs for at least another year, will continue to ponder.

Michael Goldstein

Education

He has been told he's the only person to receive all four degrees (BS, MA, MBA, PhD) offered by the University of Pennsylvania's Wharton School.

A Favorite Place

Santorini, Greece. "It's warm and gorgeous. The colors are beautiful."

A Favorite Place on Campus

The sight of the Pacific Ocean on the Babson globe, as one comes around the east side of Coleman Hall. "When you first see it, when you turn the corner, it's all water. It's not a view Americans are used to seeing."

How He Begins Class

For the first 10 minutes, Goldstein gives a market update and an overview of that day's *The Wall Street Journal*. "We're putting people out into the world. They need to know what's going on."