SPARKING INNOVATIVE TRANSPORTATION SOLUTIONS

Issue 5
Winter 2004

HIGH-SPEED RAIL
HIGHWAY SYSTEMS
TRANSIT &
TRANSPORTATION SAFETY

Ignition

News from TRB's IDEA Programs

INSIDE:

- Is Steven Turner on Track for On-Board Rail Flaw Detection? Read 'Catching a Break.'

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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News from **TRB's IDEA** Programs

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THE IDEA PROGRAMS
Innovations Deserving Exploratory Analysis

IDEA programs provide start-up funding for promising but unproven innovations in surface transportation systems. The programs' goal is to foster ingenious solutions that are unlikely to be funded through traditional programs.

Managed by the Transportation Research Board, IDEA programs are supported by the member state departments of transportation of the American Association of State Highway and Transportation Officials (AASHTO), the Federal Transit Administration (FTA), the Federal Railroad Administration (FRA), and the Federal Motor Carrier Safety Administration (FMCSA).

The Transit IDEA program, which receives funding from FTA as part of the Transit Cooperative Research Program, is guided by a panel chaired by Fred Gilliam, President/CEO, Capital Metropolitan Transportation Authority in Austin, Texas. Harvey Berlin is the TRB program officer.

High-Speed Rail IDEA is funded by the FRA as part of its next-generation high-speed rail research. A committee chaired by William J. Harris, Consultant, has oversight. Charles Taylor is the TRB program officer.

The NCHRP Highway IDEA program is supported by the member state departments of transportation of AASHTO through the National Cooperative Highway Research Program (NCHRP). It is guided by a panel chaired by Carol A. Murray, Commissioner, New Hampshire DOT; Inam Jawed is TRB program officer.

Safety IDEA is jointly funded by FMCSA and FRA. The committee is chaired by Ray Pethtel, Virginia Tech Transportation Institute. Harvey Berlin is TRB program officer.

Visit the IDEA web site:
www.trb.org/idea

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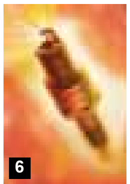

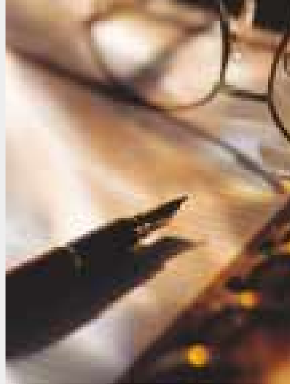

From the **Director's** Desk

What's Ahead

Our cover shot of a locomotive approaching Natural Tunnel, Virginia, makes a point about heading into the unknown that is valid even without the drama of a mountain tunnel. Much of the time, train operators can't be sure what the tracks are like ahead. About half of the railroad mileage in the United States has signal circuits that can usually detect broken rail and change signals to alert train operators. That means, of course, that about half of the track is *not* equipped with a rail detection system. The Federal Railroad Administration has listed an on-board detection system among its research priorities and is participating in trials of various techniques at the Transportation Technology Center in Pueblo, Colorado. In neighboring Wyoming, a different approach is being tested through the High-Speed Rail IDEA program. In this issue of Ignition, we talk with the investigator about his project and his experience with the IDEA process.

In the New IDEAs section, an eclectic array of projects demonstrates the range of program sponsors' interests. The interface of a driver's seat and a vehicle's seat is where research on driver fatigue begins in work under way at Virginia Tech. In Ottawa, researchers from Carleton University put a twist on testing fresh pavements for shear properties with their mobile testing facility. In Bethesda, Maryland, investigators are developing innovative cleaning methods and materials that could be the way to cut costs and improve service for rail rapid transit systems across the country.

It's bound to be good for business when a national guide for traffic safety standards includes your product. That's why we are happy to report in the Business section that a safety signal developed through a 1999 IDEA project is an accepted option in the latest edition of the Manual of Uniform Traffic Control Devices.

The investigators couldn't have known what was ahead for them.

Neil F. Hawks
Director, Special Programs
Transportation Research Board
of the National Academies

Your comments
are welcome
and may be sent
to the editor at:
lmason@nas.edu.

Steven Turner

Catching a Break

A new method for detecting broken rail could be a lucky break for IDEA investigator Steven Turner of Analogic Engineering, Inc., in Guernsey, Wyoming. At the IDEA Exhibit during TRB's Annual Meeting in January, Steven talked about the confluence of factors that seem to be bringing him to new beginnings.

If there is a Wyoming accent, it's probably a bit different from yours. Where are you from and how did you make your way to Wyoming?

I started out in Western Australia and my work, which is developing ultrasonic test equipment for the railroad industry, eventually took me all over my own country, which was a great way to see it. Then in 1990, I was in Wyoming with a demonstration for Burlington Northern, now BNSF, of non-stop testing for their high-tonnage coal lines. We set up an office in the small town of Guernsey, right on a main coal line and that's where I met my wife, Georgia.

Your IDEA project is investigating equipment that detects broken rail and occupied tracks ahead of a train and warns the driver in real time of the exact distance to the hazard. Is this a problem that you've been working on for a long time?

The technology, time domain reflectometry, has long been used in the communications industry to find line breaks. The innovation in this project is applying an established technology on a larger scale for a different purpose, but it's not something that I had been working on.

This project actually came about through the problem statements of TRB committees that identified broken rail detection as a priority for research. After reading that, I started thinking about how to solve the problem. Really this would not have been done if not for the prompting of those problem statements.

Type 1 IDEA projects such as yours are funded to explore the feasibility of a concept. What did that involve and how has it turned out for you?

Our research involved extending existing electrical models for how the railroad track acts as a transmission line. We allowed for variables, such as rail weight, tie type and ballast moisture content, rail break types, and train speed to predict the range of detecting broken rails and other trains ahead of the equipped locomotive. We were able to determine the optimum pulse frequency and duration to test various distances ahead of the train. We also checked for RF radiation hazards, at the suggestion of our advisory panel, and the effects of bonded and insulated joints, turnouts, and other track disruptions. The findings are encouraging and we plan to apply for further IDEA funding to build and test a prototype.

What is your plan for testing a product like this, which seems a bit problematic?

Yes, it could be tricky for such a small company to cope with liability, mechanical requirements, and other issues of testing with full-size locomotives. Through the Type 1 research, however, we identified two additional applications that would be easier to develop and probably could be brought to market earlier, assuming prototypes are successful. Since the same technology should be able to measure the exact speed and distance of an approaching train, we hope to apply that to accurate train arrival predictors for grade crossings and to a small portable version that clips onto the rail and becomes a sort of "gang nanny" for work gang protection. Either of those products would be easier to test and ultimately easier to demonstrate and market, which gives us a really nice development path.

"Some real synergy is building...It's been a lucky break for us."

You're going to market a "gang nanny?"

Yes, if a device proves out in field testing. Georgia's idea for marketing is an image of a mop-topped granny in steel-toed boots shaking her finger in that admonishing way that grannies have. Perhaps a caption like: "The train will be here in two minutes and I want you all clear of track-NOW." In reality it would be a portable detection unit to notify work crews and signal maintainers exactly how far away an approaching train is and how long before it will arrive at their location. Of course, work crew safety is really a very serious concern and such a device could provide a useful additional level of protection.

Was it difficult to find funding for this investigation?

The Department of Transportation is interested in the problem, but its funding source is very limited. Fortunately, there was a link from their SBIR website to the IDEA programs, and that's where I found the opportunity to follow through on this idea.

What has your experience been with the IDEA process?

Maybe we've just been incredibly lucky in the way that things have fallen into place, but it certainly has been a positive experience for our company. The fact that these programs look for unconventional approaches to solving problems was a positive for us. The proposal process was less daunting than some others and it was easy to justify investing time to write an IDEA proposal because the format requires just a basic outline to get across the innovation. We also found the program manager to be accessible, interested, and encouraging throughout the process. The project advisors made available to us were from very relevant research and government agencies and they provided a good 'reality check' as well as many useful contacts. It seems that the IDEA program is set up very well to encourage innovation and then provide a path for follow through.

And being here at the Annual Meeting has been a great boost. We've made so many good contacts, which is exciting because we will be looking for other companies to partner with, and other researchers who want to incorporate this product into ideas they're working on. Some real synergy is building and we hope it all comes together. It's been a lucky break for us. ❖

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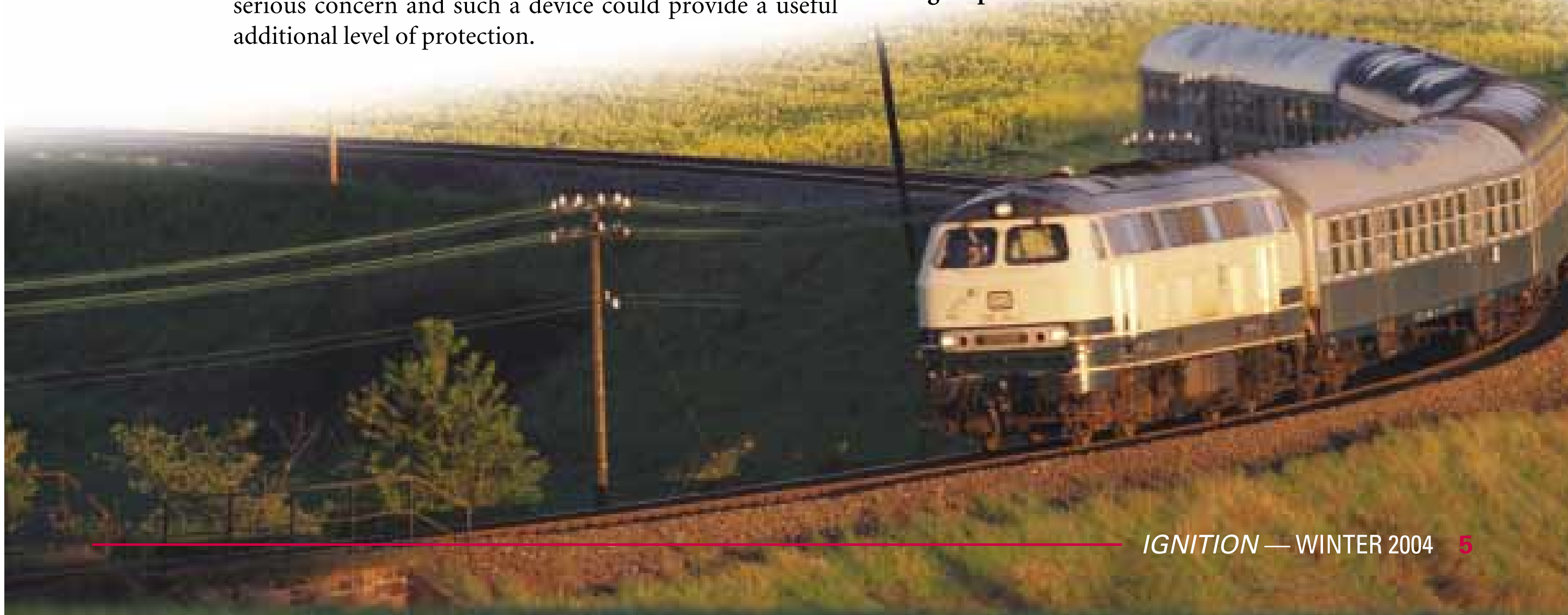

Getting to the Bottom of Driver Fatigue

Serious safety and health issues have been related to driver fatigue. Slowed responses, run-off-road crashes, chronic back pain and various illnesses, and decreased productivity have all been attributed to driver fatigue.

In Safety IDEA Project 4, principal investigator Mehdi Ahmadian of Virginia Tech is studying the relationship between vehicle seat design and driver fatigue. By testing two objective methods of assessing how seat design affects driver fatigue, the investigators hope to provide guidelines for designing vehicle seats that are less fatiguing over time. The approach is to establish a set of physical measurements to produce data that define driver fatigue, which has long-lasting physical effects and is distinguished from the short-term sensation of comfort.

Working in cooperation with a trucking company and with seating and equipment manufacturers, Dr. Ahmadian's team will collect data by conducting a series of road tests. Trucks with customary foam cushion seats will be fitted with instrumentation to capture physical measurements of comfort and fatigue including cab vibration, seat pressure distribution, and head movement. Driver surveys will assess subjective fatigue throughout testing. After four weeks the seat cushions will be replaced with air-inflated cushions and the tests, using the same drivers, will be repeated. The findings will be the basis for design guidelines that would promote seat designs and driving practices that lessen driver fatigue and increase vehicle safety. ❖

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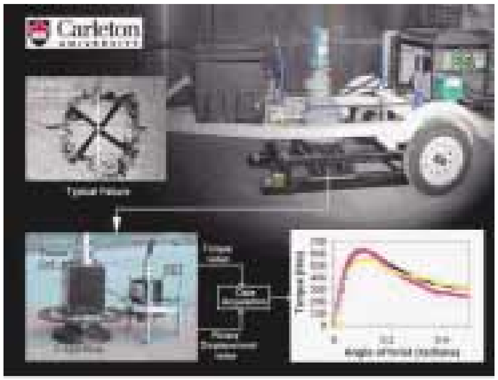

They InSiSST

The ability to assess the engineering properties of pavement as it is being constructed and while opportunities exist for correcting problems could save millions of dollars annually. Toward that end, a team of researchers from Carleton University in Ottawa has developed a mobile test facility to measure the shear properties of asphalt concrete pavements in the field. Through the NCHRP IDEA Program, Dr. A.O. Abd El Halim and his team are testing a prototype they call InSiSST, which stands for in situ shear stiffness testing.

The InSiSST facility is based on the innovative idea of applying a torsional moment to the surface of the pavement, resulting in pure shear stresses. All three primary areas of pavement engineering—design, quality control/assurance, and long-term pavement performance—could benefit from such testing.

Developed through an earlier Type 1 IDEA project, the current project aims to establish that the tester measures a shear property that can be related to elastic shear stiffness, which can then be correlated to axial stiffness at the same temperature and loading rate. The tester has attracted interest from government and industry and has also received funding from the Ontario Ministry of Transport. ❖

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Keeping It Clean

Rail rapid transit systems rely on insulators to keep the electricity that powers trains running through the third rail where it belongs. The high-voltage third rail sits on insulators typically spaced about 10 feet apart, which means there are more than 500 insulators in just one mile of track. Keeping so many insulators clean enough to prevent third rail grounding is an expensive challenge to safety and reliability for rail transit systems.

Dirty insulators can cause short circuits, arcing, smoking, and occasionally explosions, set wood ties on fire, and shut down train operations. They are among the most frequent causes of downtime in many rail rapid transit systems around the country. Carbon dust, rust particles, grease, grime, and dripping water in subways all contribute to the problem.

Developing an array of efficient techniques for cleaning third rail insulators that would make the process safer and less costly is the focus of Transit IDEA project 36. Principal investigator Arun Vohra is testing prototype devices and methods that don't require shutting off power to the third rail and are effective for the various insulator types. The Metrorail transit system in Washington, DC and the Baltimore subway system will test the devices and six other rail transit agencies are participating in this project as well. ❖

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IDEA Product Accepted in National Guide

A pedestrian safety device that received funding through the IDEA programs in 1999 has been included in the newly released 2003 edition of the *Manual of Uniform Traffic Control Devices* (MUTCD), published by the Federal Highway Administration. The MUTCD is used nationally by state and local transportation agencies in designing and placing traffic signs and signals and pavement markings.

The "animated eyes" signal was developed by Dr. Ron Van Houten of the Center for Education and Research in Safety in Gulfport, Florida, with cooperation from Relume Corporation of Troy, Michigan. The signal technology displays a pair of eyes that scan back and forth when a pedestrian is present at a signalized crosswalk, alerting drivers and pedestrians of potential conflict. Studies conducted through the IDEA project found significantly fewer conflicts between people and vehicles at intersections where the signals reminded those approaching intersections to glance in the direction of the moving eyes before entering crosswalks.

In 2002, an estimated 5,700 pedestrians died and 65,000 were injured in motor vehicle accidents, the National Safety Council reports in the 2003 edition of Injury Facts. About 45 percent of these deaths and injuries occur where pedestrians cross or enter streets. ❖

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