Railway Research Is

A new research program based at the University of Alberta Faculty of Engineering has been established to improve railway safety and efficiency

By Richard Cairney

On The Right Track

In the late 1800s a ribbon of steel first united our country. Canada's first transcontinental railroad was built of blood and sweat and sheer force of will, overcoming political and geographic obstacles. Railways today are less of a symbol of national unity but their role is as vital as ever.

Canada has one of the most extensive railway networks in the world, with 48,000 kilometres of route track—nearly enough to cross the country 10 times. This network is subject to extreme swings in weather and geographic conditions that can wreak havoc with tracks, tunnels and the trains themselves. The economy, the environment and human lives depend in large part on safe, reliable railways.

"Building a railroad isn't driving spikes by hand anymore," says Derek Martin, who has been named the NSERC Industrial Research Chair in Railway Geomechanics. "It's about the technology that keeps it operating 24 hours, the maintenance and the freight. Essentially it's like a pipeline but above ground. For Canada to continue to grow and prosper, it's important that our transportation system evolves to become more innovative, efficient and resilient to our changing environment."

Jason Franson

Michael Hendry, a professor in the Department of Civil and Environmental Engineering and associate director of CaRRL, inspects a graduate student's experiment measuring the effects of freeze-thaw cycles.

The Faculty of Engineering's $4.8-million railway research initiative has two elements: Martin's industrial research chair and the new Canadian Rail Research Laboratory (CaRRL). The research is supported by the Natural Sciences and Engineering Research Council (NSERC), the Railroad Research Advisory Board (RRAB), Transport Canada, CN, Canadian Pacific and the American Association of Railways (AAR)/Transportation Technology Center Inc. (TTCI) through its Technology Scanning Program.

The establishment of the chair was announced in September 2012 and a course for graduate and undergraduate students was quickly implemented to complement a growing body of research projects already underway. Paul Miller, a former vice-president of CN, stepped up to design and teach a course that Martin refers to as "Railwaying 101."

"We wanted a course that our graduate students and some of our undergraduates could take so that they would understand railways and the issues they face," says Martin. Miller, who in addition to teaching the course is serving as an "engineer in residence" in a voluntary capacity, notes that master's and PhD students have valuable but specific and technical areas of research and study, whereas the new course brings together all the pieces of the railway puzzle.

"We wanted to offer a course in the basics of railroading. How does the railway work? Where does the traffic come from? How are all these things linked together? We want the students to have a business context for their technical studies," says Miller.

As part of the course, other experts from industry volunteer their time to deliver presentations to students about all aspects

of railways and how they work: from the complex logistics and planning required to move freight and passengers across the continent to determining the lifespan of the rock ballasts that support train tracks.

Adding more expertise to CaRRL is associate director Michael Hendry. His research with the railway industry started in 2005 as a graduate student collaborating with Northern Ireland Railways on projects relating to slope stability and the cyclic loading of embankments over soft peat foundations. Railways in Canada face the same issues and Hendry's current research is focused on the strength of soft foundation soils under heavy axle loading, the degradation of railway ballast and its effects on the integrity of track structure, and the fundamental soil mechanics of peat and organic soils. He is a strong proponent of field based studies and has an interest in for finding new means to measure soil behaviours in the field.

Understanding railway engineering issues literally from the ground up is vital because the smaller details often have the greatest impact. While events such as derailments or landslides can have catastrophic effects and are enormously expensive, routine maintenance and operational issues are, in fact, more costly.

TOMORROW'S RAILWAY ENGINEERS NEED TO THOROUGHLY UNDERSTAND THE INDUSTRY'S NEEDS BECAUSE THE SMALLER DETAILS OFTEN HAVE THE GREATEST IMPACT.

"Those low-frequency, high-impact events cause quite large costs but those are relatively small when you compare them to just running a railway on a day-to-day basis. There are far more wheel breaks and rail breaks during the winter than the summer, for example. So if you could come up with a way to reduce those or eliminate all of that work—the number of times you have to take wheels off of buggies or take cars out of service—you can see that the incremental improvement factor is what really makes a big difference."

Industry professionals hope Martin's research chair and the establishment of CaRRL will help define those incremental changes in the future. Miller began his 34-year career with CN as an engineer and retired as a vice-president and chief safety and sustainability officer. He feels the programs will help the industry from the field to the boardroom by providing not only highly qualified engineers, but also the next generation of industry leaders.

"One reason I'm interested in working with CaRRL is that railroads are facing the same demographic bubble all other industries are facing," says Miller. "There is a tremendous opportunity for hiring and careers, and the greater an understanding one has of the whole business, the more room one has to branch out into other things beyond."