

TECHNOLOGICAL INNOVATION: 2003

The Mount Macdonald Tunnel

What started out as a shortcut through the Selkirks yielded a mountain of headaches for Canadian Pacific Railway (CPR) and produced the longest railway tunnel in the western hemisphere — CPR's Mount Macdonald Tunnel.

What was then an ingenious shortcut through the mountains is now the most costly pass on the line. CPR spent over one million dollars in the 1880s building snowsheds, loops and trestles in the pass. And in the 1910s, CPR spent \$60 million tunneling under the pass. To cap it all off CPR spent a further \$500 million in the 1980s. But the most horrendous cost came in lives. In the first 30 years, when trains went through the pass instead of under it, more than 200 people lost their lives. Mostly from avalanches.

The fact that the western hemisphere's longest railway tunnel pierces through British Columbia's Mount Macdonald is mostly due to the dogged determination of a scrawny but crusty American major. Major A. B. Rogers got his title in the 1862 Sioux uprisings in the United States. He got his engineering degree at Brown University and then went on to Yale. He got his practical experience surveying the Milwaukee Road. And he got his reputation by swearing like a sailor and eating like a bird. He wasn't a mountain man. He lived and worked on the American Prairies. And yet CPR commissioned him to survey a shorter route through the Rockies and Selkirks. And, CPR hoped, he would find a pass through the Selkirks.

Major Rogers pored over Walter Moberly's accounts. Moberly discovered Eagle Pass in the Gold Range in 1865. Albert Perry, Moberly's assistant, found the beginning of a pass from the Columbia River up the Illecillewaet River. So Major Rogers rediscovered it, in 1881, and went further upriver. He confirmed there was a pass. But it was only half a pass. True to form, Rogers ran out of food. He went back the way he came, looped around the Selkirks through the United States and finished surveying a line through the Rockies. He settled on the Kicking Horse Pass. CPR head office, with Rogers' assurance of a pass through the Selkirks, decided on a more southerly route for its main line. And the mandated-by-charter route through the Yellowhead Pass was abandoned. Keeping closer to the US border was not only politically correct, but it was shorter. The trick now was to save even more time and distance — and find a shortcut through the Selkirks. The railway wouldn't have to skirt north along the "big bend" of the Columbia River. So, in 1882, Rogers set out to find his pass from the east. After a false start, again due to a lack of food, he found the other half of his pass through the Selkirks in July.

And what did Major Rogers get for his trouble?

CPR named the pass after him — Rogers Pass. CPR also gave him a \$5000 bonus. But he didn't cash the cheque. Instead he framed it and hung it on the wall at his brother's house for his nieces and nephews to see. So then he got another reward. CPR's William Van Horne enticed him with a suitably engraved gold watch — if only he would cash the darned cheque! So Rogers cashed the cheque, picked up his princely sum, and a fine gold pocket watch in the bargain!



The line was built through Rogers Pass in 1885. It looped back and forth along the sides of mountains, crossing creeks and ravines on massive wooden trestles, and passing under no fewer than 31 snow sheds. The line often fell victim to avalanches.

In 1916, CPR opened the double-track, eight-kilometre Connaught Tunnel, which avoided the worst of the avalanche paths, eliminated more than 2300 degrees in track curvature and reduced the rail summit by 168 metres. In 1958, CPR converted the tunnel to a single-track down the center to accommodate higher loads.

But there was still a tough climb along the Beaver River Valley to the Connaught Tunnel. The line rose 275 metres in just 13 kilometres — a steep climb for freight trains. The steep grade called for six additional locomotives, called pushers, to be added to westbound freight trains.

To alleviate this, CPR started constructing a second line through the pass in 1984. The project was the largest CPR undertaking of its kind since the completion of the transcontinental rail line in 1885. The project reduced the overall westbound grade to one per cent, and eliminated the need for pusher locomotives.

The \$500-million, 34-kilometre Rogers Pass project includes 17 kilometres of surface route, six bridges totaling 1.7 kilometres in length, and two tunnels. The centrepiece of the project is the Mount Macdonald Tunnel. Stretching 14.7 kilometres, it is the longest railway tunnel in the western hemisphere. It is driven under Mount Macdonald and Cheops Mountain. There is a second tunnel, 1.9 kilometres long, under Mount Shaughnessy and passing under the Trans-Canada Highway.

Preparatory project work began in 1982, but work on the Mount Macdonald Tunnel started in mid-1984. Crews blasted from west end and bored from the east, using a huge boring machine called the “mole”, meeting in the middle on October 24, 1986. The Mount Macdonald Tunnel is equipped with a ventilation system with four 1.68-megawatt fans, a ventilation shaft to the summit of Rogers Pass, complete with building, gates, controls and monitoring system. The tunnel has a 0.7 per cent grade and crosses over the old Connaught 91 metres below it and 259 metres below the original mainline through Rogers Pass — enough height to fit Chicago’s 60-storey Bank One building between Mount Macdonald Tunnel and the original mainline through the pass.

Completed in 1988, the tunnel features the first use in North America of a concrete “Pact-Track” floor system, eliminating the need for wooden railway ties and crushed rock ballast — greatly reducing maintenance costs. The tunnel interior is 5.1 metres wide and 7.8 metres high, surveyed using laser and satellite technology, and built to accommodate, should the need ever arise, an electrified railway.

The first revenue train went through the tunnel at noon on December 12, 1988.

The Ocean Limited

In July 2004, VIA Rail Canada’s Ocean — operating six days per week between Montréal and Halifax — will celebrate its one-hundredth anniversary as the longest-running regularly scheduled and named passenger train in Canadian history. Created in 1904, the name for the



train was arrived at by way of a public contest. The original Ocean Limited was intended to be a summer supplement to the old Intercolonial Railway's Maritime Express.

The Ocean has survived wars, disasters, and significant changes in economic conditions surrounding passenger rail. The Ocean continues to effectively serve many communities in eastern Quebec and the Maritimes operating over the Canadian National Railways and two regional railways that are part of the Quebec Railway Corporation group. In 2003 VIA introduced upgraded "Renaissance" equipment on the Ocean.

Serving Montréal, Québec City, Matépédia, Campbellton, Mirimachi, Moncton, Truro, and Halifax, as well as communities in between, the Ocean provides six-days-per-week service in each direction and offers coach and sleeping car accommodations.

On the occasion of its centennial of continuous operations, the Canadian Railway Hall of Fame is pleased to recognize the contribution of the Ocean to the history of eastern Quebec and the Maritimes, and the role it continues to play as a safe and efficient form of public transportation service.

The Quebec Railway Bridge

The massive Quebec Railway Bridge is a splendid example of Canadian railway engineering that today continues to play an important role in moving Canadian National freight and VIA Rail Canada Inc. passenger trains across the mighty St. Lawrence River, connecting Quebec City with the south shore. Rising some 46 metres above the St. Lawrence River, the Quebec Bridge measures 987 metres long and its cantilever span is the longest in the world.

The National Transcontinental Railway, which later became part of the Canadian National Railways family, had began its efforts to cross the St. Lawrence River near Quebec City in 1907 in order to complete its Moncton to Winnipeg mainline. The bridge was only partially complete when on August 29, 1907 a large portion of the bridges recently completed superstructure collapsed — tragically killing 84 workers. This disaster would prove as one of the worst ever in Canadian railway history. In 1914, a second attempt was made at construction, however on September 11, 1916, while attempting to connect a 195-metre steel span to the newly completed north and south cantilever spans, a support on the lifting apparatus fractured, plunging this new span into the river. This accident would claim a further 13 lives.

Finally, on September 17, 1917, a replacement span was secured in place and on December 3, 1917 the structure was opened for service — finally giving the NTR its completed mainline route. The structure was later formally christened by His Royal Highness the Prince of Wales in 1919. It is estimated that the cost of completion was in the order of \$21.6 million, and tragically nearly 100 lives.

In memorium of those who lost their lives in the quest to construct a bridge at this location across the St. Lawrence River, and in celebration of the continued importance of this remarkable engineering feat to Canada's railway network, the Canadian Railway Hall of Fame has inducted this structure into its Technology category in 2003.