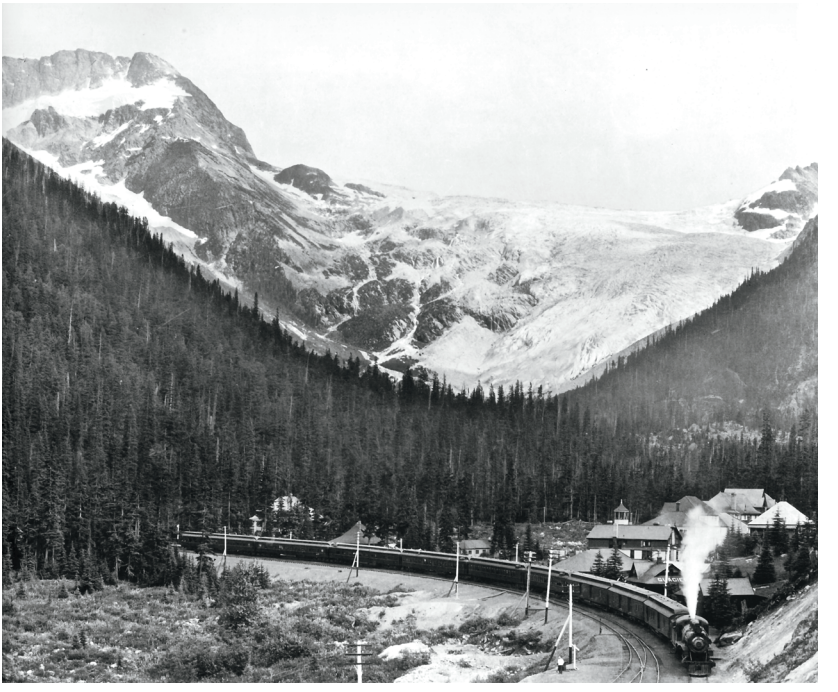

Gravity, Steam, and Steel

An Illustrated History of Rogers Pass on the Canadian Pacific Railway

Graeme Pole

"The question of a proper location on the first 18 miles west of the Summit [Rogers Pass] *has been a most anxious one for me, as I considered the whole success of the line depended upon it..."*

James Ross, CPR Western Construction Superintendent,
in a letter to William Cornelius Van Horne, CPR Vice-President,
June 1885

MV

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Front cover: *With Selkirk-type T1a, locomotive 5912 on the point, an "Atlantic Express" passenger train departs Rogers Pass to begin the descent of the Beaver River valley, with Mount Macdonald in the background.*

Frontispiece: *A "Pacific Express" passenger train waits on the main line at Glacier station, west of Rogers Pass, in the glory days of steam, ca. 1910. The Great (Illecillewaet) Glacier provides the backdrop.*

Contents page: *A construction crew poses inside a partially completed snowshed, ca. 1886. The construction engineer is probably the third man from the left on the top row, with the square in hand.*

The back cover is based on the photograph of Rogers Pass that also appears on page 5, taken by Oliver Buell in August 1885.

Rogers Pass and the surrounding area are situated on the ancestral unceded lands of the Sinixt, the Secwepemc, the Ktunaxa, and the Syilx Okanagan first peoples.

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Contents

3
A Major Undertaking

Between 1871 and 1881, three successive federal governments toyed with the construction of Canada's first trans-continental railway. With the incorporation of the Canadian Pacific Railway Company (CPR) in February 1881, Prime Minister John A. Macdonald gave the project to private enterprise. The CPR was free to choose some of the route, but in other places it was constrained by track already laid by government contractors. In BC, crews led by a US contractor, Andrew Onderdonk, were building the line predominantly from west to east along the Fraser and Thompson rivers to end at Savona's Landing, just west of Fort Kamloops. In Manitoba and northwestern Ontario, contractors were laying track to link Port Arthur (now Thunder Bay) with Winnipeg.

The government's decision to lay track from the west toward Fort Kamloops, along with concerns about US expansion into Canadian territory in the west, factored against using Yellowhead Pass (which was too far north) to cross the Rockies. Eagle Pass was a logical choice for a route across the Monashee Mountains. This meant that the CPR had to locate a pass in the Rockies farther south than Yellowhead Pass, and find a way across the Selkirk Mountains to link that pass with Eagle Pass. The southern Rockies had not been explored since the Palliser Expedition of 1858-59. The Selkirk Mountains were unknown, save for the forays of Walter Moberly, Albert Perry, and a few prospectors – a blank on the railway map.

James Jerome Hill, "The Empire Builder," when 26 years-old

Major Albert Bowman Rogers, "The Railway Pathfinder"

The CPR executive included Canadian-born James Jerome Hill, who had molded himself into the exemplary Yankee industrialist. Known as "The Empire Builder," Hill commanded railways, steamship lines, and coal mines. His net worth eventually reached $60 million. Hill was so pro-American, he had celebrated the signing of the CPR's charter by becoming a US citizen. Hill made finding the route through the mountains of BC the CPR's priority. To head the survey, he hired Major Albert Bowman Rogers, a 52 year-old location engineer, schooled at Brown University and at Yale, who had earned a reputation in the US Midwest as "The Railway Pathfinder." During the Dakota Conflict of 1862, the governor of Minnesota had commissioned Rogers a major – a title that endured as a nickname. Hill instructed Rogers to explore four passes in the Rockies, and to discover a pass across the Selkirk Mountains. If successful, Hill promised to name the Selkirk pass for Rogers, and to reward the surveyor with a cheque for $5,000. (In a curious parallel, the Legislative Council of the Colony of British Columbia and Vancouver Island, in 1869 had voted on a motion to give, "…$1,000 to any party who will discover a suitable pass… through the Selkirk Range at not a higher elevation than 2,500 feet…". No viable pass of such a low elevation exists. The motion was defeated anyway.

Rogers set to work with a brashness that grated on everyone. Portraits show a large-eyed, gaunt-faced man, whose frame barely fills his suit jacket. The wisps of his outlandish mustache touch his shoulders. To hear him speak on almost any subject was to endure a stream of cursing – punctuated with spurts of tobacco juice – traits that earned him other nicknames: "The Bishop," and "Hell's Bells Rogers."

Those who worked with Rogers initially faulted him simply for being an American assigned to a position of importance on a Canadian project. But other complaints soon mounted. Rogers had no mercy on himself. He could cover ground like a wolverine while subsisting on a diet of raw beans, bacon, hard tack, and chewing tobacco. He expected his men to do likewise. Assignments with Rogers became the dread of the CPR surveying corps. Time and again, the Major failed to learn a simple, vital lesson – that sometimes, for people engaged in hard work under difficult conditions, the difference between success and wasted seasons is the quality of their food and shelter.

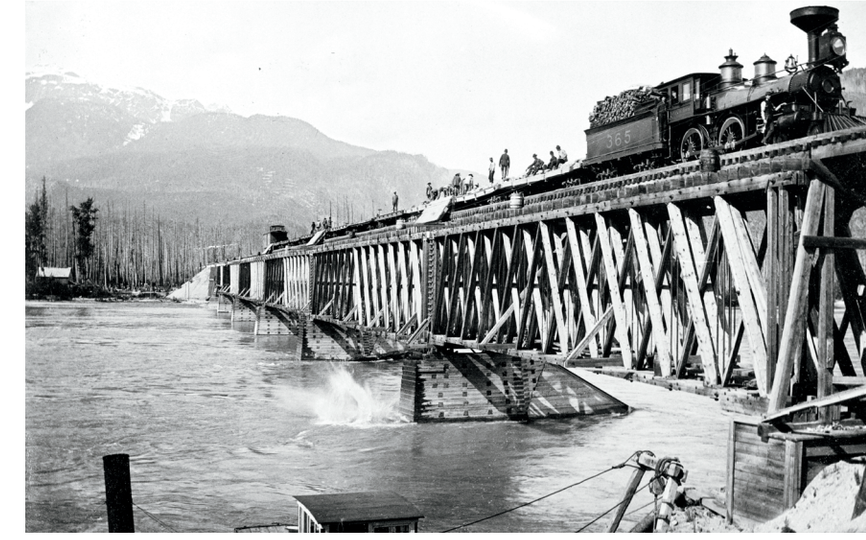
It was typical of the Major that he should tackle first the most difficult part of his assignment – the unknown valleys and peaks of the Selkirk Mountains. In early 1881, after directing the CPR to ship five complete engineering outfits up the Missouri River and overland to the foot of the Rockies west of Fort Calgary, Rogers and his nephew, Albert, set off from Minnesota by rail for San Francisco. From there they took steamers to Victoria and to Emory's Bar (just below Yale) in the Fraser Canyon. Following Andrew Onderdonk's railway grade and tote roads, the pair reached Fort Kamloops 22 days after leaving home. Rogers required another eight days to locate and to hire ten Natives whom he essentially enslaved to pack the gear for the exploration.

Farewell to Farwell

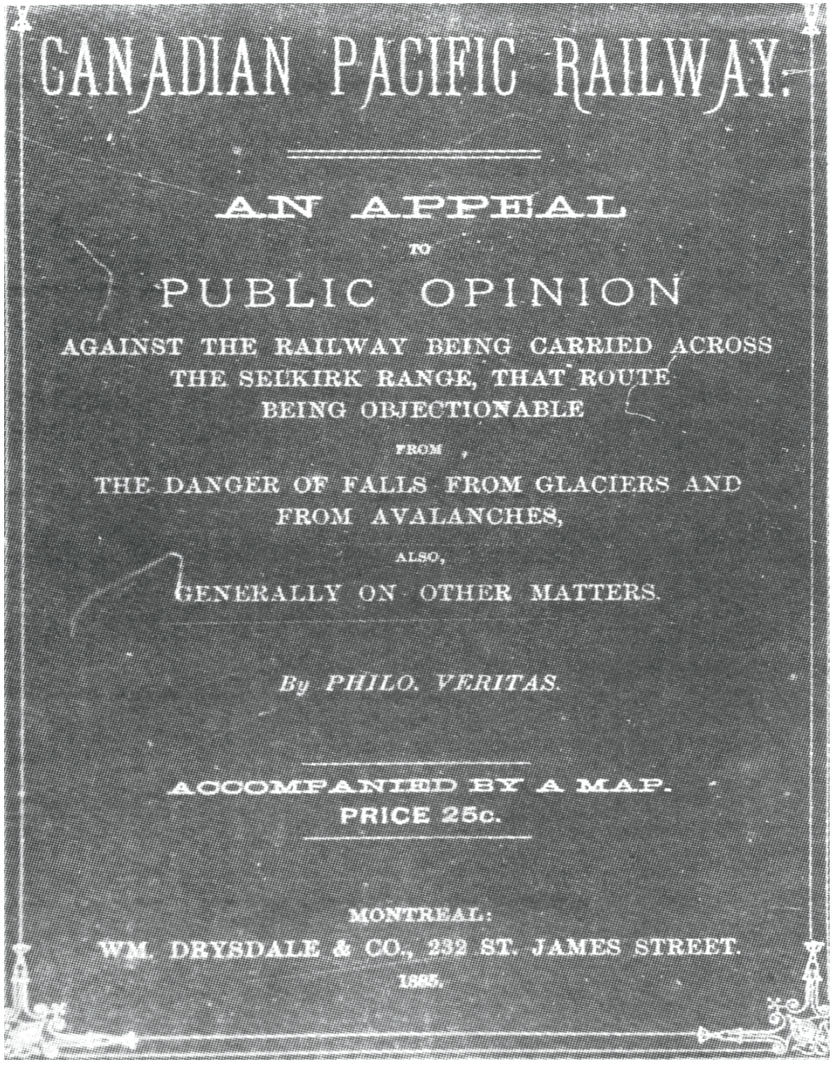
In October 1883, BC Surveyor General, Albert Stanhope Farwell, applied to the BC government for a land grant at the present-day site of Revelstoke. He surveyed building lots and, in the custom of the day, named the paper settlement after himself. Today, A.S. Farwell would have been considered in blatant conflict-of-interest. As a public servant, his employment had provided knowledge that the CPR intended to build its railway line through his land claim. Less than a month after Farwell laid claim, the CPR registered its route with the BC and Canadian governments, creating the "Railway Belt" – a swath of land 40 miles wide, given to the CPR and centered on the railway line. Accordingly, the CPR expected to receive title to blocks of land adjacent to the proposed line at the site that it called "Second Crossing."

When the BC government removed Farwell's lands from those allocated to the CPR, the railway objected, claiming that its charter of 1881 took precedence. Rather than bothering with an appeal or with negotiation, the CPR used the heavy-handed approach for which it would become known. It changed its route and built its station east of Farwell's holdings. Farwell resisted the inevitable. His dispute with the CPR, which lasted almost six years, greatly complicated the development of the town. In 1886, the CPR successfully requested that the Post Office change the name of the town from Farwell to Revelstoke, to honour Edward Baring (whose title was Lord Revelstoke). Baring had been a principal in Baring's Bank when it had saved the CPR from bankruptcy in 1885. The CPR's will fully prevailed with the incorporation of Revelstoke on March 1, 1899. The photo below shows the first station in 1890.

In this view from 1885, locomotive 46, a cordwood-fired 4-4-0, Standard American-type, built in 1882, hauls a flatcar of timbers over the first bridge at the "Second Crossing" of the Columbia River near Revelstoke. The present-day bridge is the fourth at that location and dates to 1968.



The second construction of the "Second Crossing" bridge is nearing completion as cordwood-fired locomotive 365 heads a work train, dumping fill to shore the footings. 365 was also a Standard American-type, built in 1886. Later renumbered 120 when converted to coal, and then renumbered 7073, it saw service for more than 40 years despite being avalanched in Rogers Pass in 1886. (See p. 72.) By 1899, the second span of this bridge had been modified to allow stern-wheelers to pass beneath.


CANADIAN PACIFIC RAILWAY.

AN APPEAL
TO
PUBLIC OPINION
AGAINST THE RAILWAY BEING CARRIED ACROSS THE SELKIRK RANGE, THAT ROUTE BEING OBJECTIONABLE
FROM
THE DANGER OF FALLS FROM GLACIERS AND FROM AVALANCHES,
ALSO,
GENERALLY ON OTHER MATTERS.

By PHILO. VERITAS.

ACCOMPANIED BY A MAP.
PRICE 25c.

MONTREAL:
WM. DRYSDALE & CO., 232 ST. JAMES STREET.
1885.

"Pamphleteering" had been around for more than two hundred years when the Canadian Pacific Railway was being surveyed. This was the social media of its time. Anyone with the money for paper and ink could let the public know about all manner of perceived perils or wonders at hand, and charge them for the privilege. These printed rants were often deposited in the lobbies of various legislatures; an origin of the term "lobbyist." Despite the vitriol in his title, in the case of the Canadian Pacific Railway, Philo Veritas ("lover of truth") was proven correct.

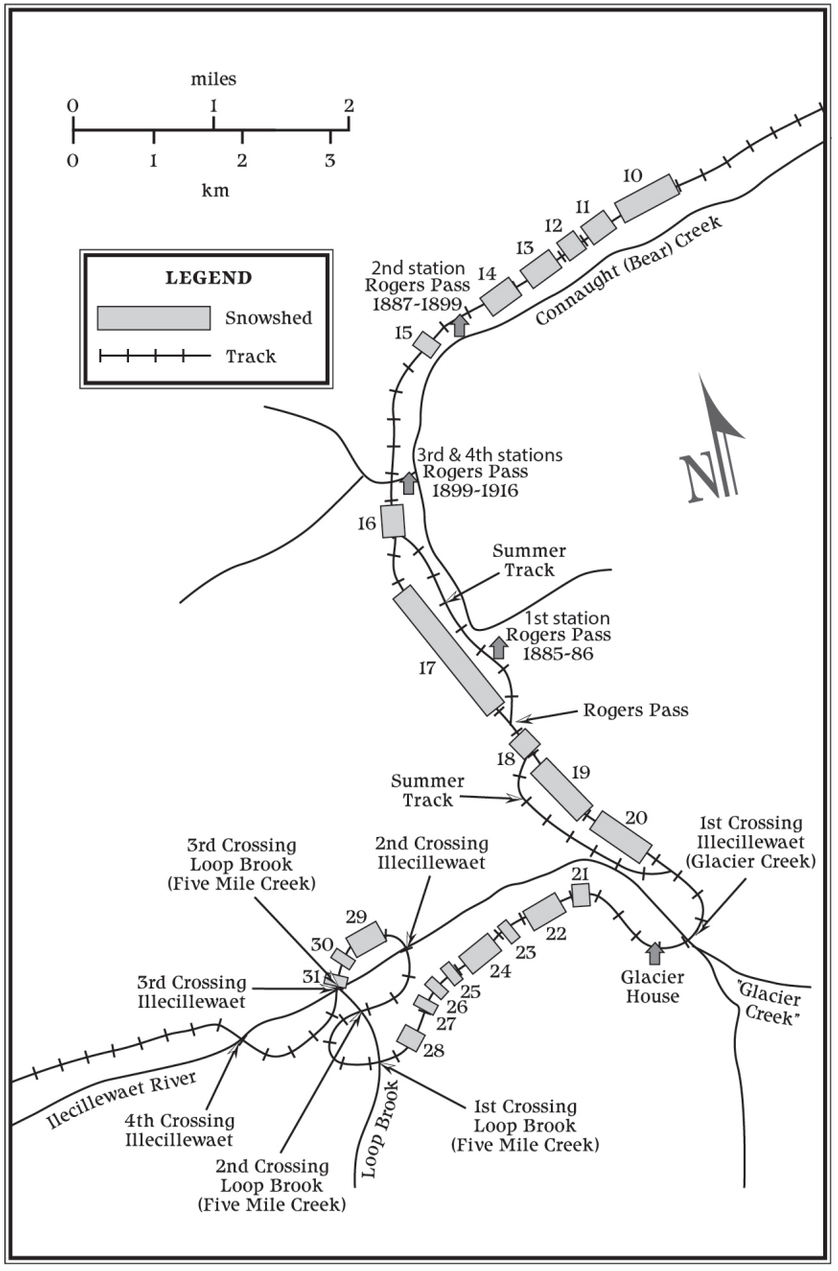
4
Point Man on the Pass

Great enterprises require great leaders. James Jerome Hill of the CPR became patently aware of this late in 1881, a year in which his company had built only 131 miles of the trans-continental railway. Canadians were fast losing faith in the project. Hill fired the CPR's general superintendent, replacing him with American railway wizard, William Cornelius Van Horne. The CPR could have found no better commander. Van Horne soon cleaned house – on one afternoon, he dismissed the entire engineering staff. He developed a reputation for showing up everywhere and anywhere along the line as it was being built, where he badgered, cajoled, and inspired a multitude of workers to lay track quickly, and to solve problem after problem.

Van Horne contracted most work on the prairies in 1882 and 1883 to the Minneapolis firm of Langdon and Shepard. Despite the success of that company in meeting deadlines for completion of work, it came up short on quality. Van Horne's solution was for the CPR to form the North American Railway Contracting Company in December 1882, to take over the remaining work – in central Ontario, along the north shore of Lake Superior, and in the mountains of BC. The company hired James Worthington to supervise the central Ontario segment, John Ross to supervise the Lake Superior segment, and James Ross (no relation) to supervise work in the mountains of the west.

The boss: William Cornelius Van Horne, photographed after he had risen to be president of the CPR.

James Ross faced untold hardships yet, when the CPR was completed, possessed a countenance seemingly untarnished. He later became a noted philanthropist.



Rogers Pass: Stations, snowsheds, and The Loops, 1885-1916

5
The Loops

The principle behind the construction of The Loops was a simple, mathematical relation that had been employed with success on railways in Europe and in the western US – double the length of a section of track to reduce the grade by one-half. Thus, if the grade averaged 4.5 percent over 4 miles of valley bottom – as it did immediately west of Rogers Pass – it would average 2.25 percent if 8 miles of track could be squeezed into that distance. The challenges west of Rogers Pass were finding the space while keeping a consistent grade and protecting the track from avalanches.

Given the overwhelming inflexibility of the terrain, the CPR was fortunate that two valleys offered small bays into which it could loop the line. The first was the upper reach of the Illecillewaet River itself (called "Glacier Greek" in CPR construction days), where it flowed northwest from its source at the Illecillewaet Glacier. The second was the mouth of Loop Brook (then called Five Mile Creek because of its distance from the crest of Rogers Pass), where it entered the Illecillewaet valley from the south. Two sets of curves did not lengthen the line sufficiently. However, taking the track south into the valley of Loop Brook provided room on the north side of the Illecillewaet valley to make a third loop on the valley floor. The combined length of the five trestle bridges involved was 4,108 feet. They were completed at a cost of $182,349.00.

A westbound train plunged 258 feet from Rogers Pass in 1.9 miles (a 2.5 percent grade) to the first crossing of the Illecillewaet River ("Glacier Creek") just before Glacier House. There it made a sweeping turn of more than 180° that had a radius of approximately 600 yards. After passing the hotel, the train was heading northwest. A sharp turn of almost 90° took the train along the southern flank of the Illecillewaet valley for just over 1 mile, through snowsheds 21-28, to approach Loop Brook. The track curved south into the tributary valley, and then west to cross the water; then north and then northeast to cross Loop Brook again – a near complete circle, this time with a radius of only 400 yards. Just after the track had straightened, it began a tight turn north (making its second crossing of the Illecillewaet River), then west through snowsheds 29-31, and southwest (making its third crossings of both Loop Brook and the Illecillewaet River) – tracing a near complete circle with a radius of about 500 yards. The westernmost points of the second and third parts of The Loops were within 300 yards of each other in a straight line, but were 1 mile apart along the track. Overall, the Loops enabled a descent from the pass of 762 feet in 7 miles, creating an average grade of 2 percent.

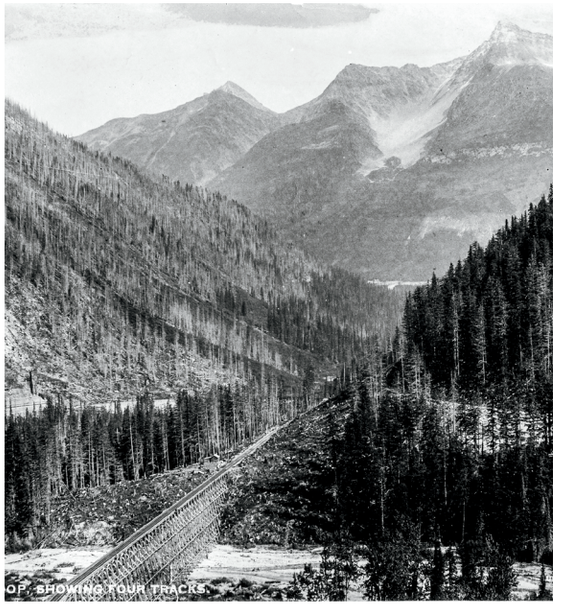
To railroaders and passengers alike, The Loops were an engineering marvel. Because the structures were much photographed, there exists a fairly complete record of their modifications. At first, the principal work was timber replacement on the trestles,

and snowshed reconstruction to repair each winter's damage. As train traffic became more frequent and locomotives more powerful and heavier, the CPR began to fill the trestles to strengthen them. The gradients of Loop Brook and Glacier Creek were insufficient to permit hydraulic filling as had been carried out at Mountain Creek east of Rogers Pass. (See p. 47 and p. 53.) Beginning in 1897, the CPR used pneumatic dump cars, of its own design, to pile mountains of fill beneath the trestles.

This proved insufficient, so the CPR replaced the wooden trestles with steel girders resting on stone and concrete piers and abutments. Masons began work in 1898 and completed the job in 1906 without major closures of the line. It was expensive and innovative industry for its time – being one of the earlier uses of concrete in bridge-work in BC. The replacement of the trestle at the second crossing of the Illecillewaet River cost $76,500. To walk the Loop Brook trail today (see p. 124) is to marvel that the project was conceived, let alone carried out. It is also to marvel at the fortitude of the CPR, which committed to the project even as it was contemplating the construction of the Connaught Tunnel. A decade after the reconstruction of The Loops, that tunnel would relegate all the expense and the magnificent stonework to railway history.

This view of The Loops from Mount Abbot in 1901 shows the second and third crossings of the Illecillewaet River, and the crossing of the mouth of Loop Brook. The scar on the slope of Cheops Mountain, west of 29 Shed and 30 Shed, was probably a borrow pit for trestle fill. It was the viewpoint for the lower photo on page 36.

The second crossing of Loop Brook was the longest on The Loops. This view is west (railway-east) toward Ross Peak, whose slopes were the vantage for the image below. Note the water barrels on the trestle (explained on the following page), and that some of the timbers have not been uniformly milled.

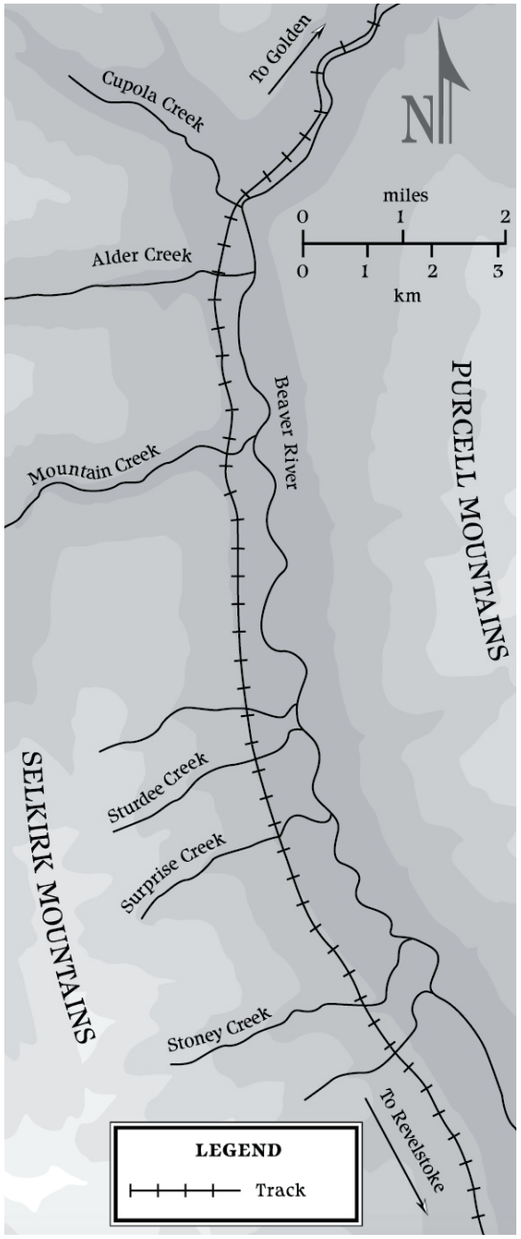


This view from 1887 shows the same trestle as above, but looking east. After photographer William Notman had scrambled onto the lower slopes of Ross Peak in 1887, and titled an image, "The Loop, Showing Four Tracks," many photographers copied him. The light scar on the lower slopes of Avalanche Mountain in the background is 19 Shed, between Rogers Pass and Glacier House. In the mid-distance on the right, the grade above the first crossing of Loop Brook is visible. The roof of 29 Shed is on the left edge of the photo. This was the only place where four elements of the CPR mainline were visible from one viewpoint. No such location exists today.

Mountain Creek bridge ca. 1887

Surprise Creek bridge 1887

Stoney Creek bridge 1890



The Beaver River valley in 1885

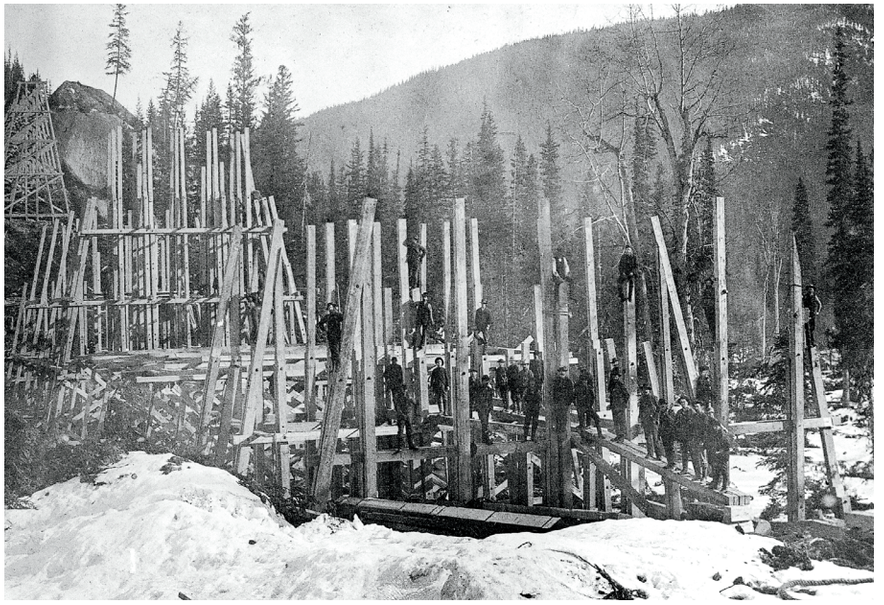
6
Bridges Over Troublesome Waters

Today, Canadian Pacific maintains more than 3,500 bridges, with an aggregate length of 85 miles. In the 46.1 miles between Beavermouth and Albert Canyon in the original alignment over Rogers Pass, the CPR incorporated 207 bridges totalling 19,349 feet (3.66 miles). The company learned much about the science and the craft of building and maintaining its bridges from its early experiences on the eastern approach to Rogers Pass. The lessons did not come easily.

From Golden, the surveyed line of the CPR followed the Columbia River northwest for 28 miles to Beavermouth station, elevation 2,435 feet. At Beaver Bay, 1.5 miles west (the most northerly point on the CPR), the line made a sharp turn southwest into the Beaver River valley. In the ensuing 18.7-mile climb along the west slope of the valley to the railway crest of Rogers Pass (4,351 feet), the line gained 1,792 feet, producing an average grade of 1.81 percent (95.82 feet per mile), with a maximum or "ruling grade" of 2.2 percent that ran for 4.4 miles. Then, as now, this was extreme terrain for a railway.

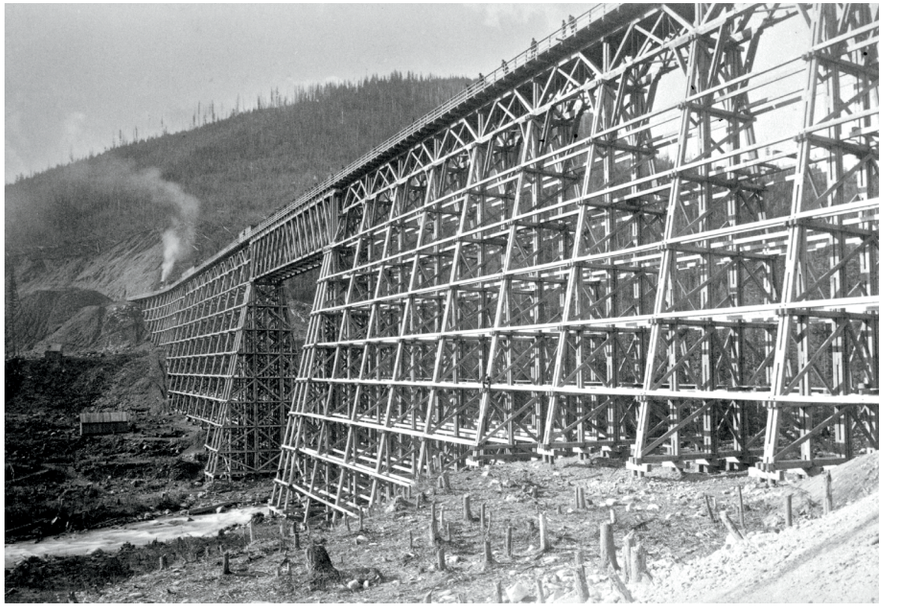
Another aspect of the landscape made this section of track problematic for the CPR. The Beaver River valley occupies a geologic rift between the Purcell Mountains to the east, and the southern Selkirk Mountains to the west. The division between the two ranges is the Beaver Fault or Purcell Fault, in which the bedrock on the west side of the valley has dropped downward relative to the bedrock on the east side. As is often the case, the resulting fault valley has been deeply eroded, creating steep sideslopes, especially on its western flank. This required extensive cutting of embankments and filling of hollows to create the rail bed. But the greatest trials for James Ross, Western Construction Superintendent for the CPR, came where tributary streams, plummeting from slopes to the west, bisected the grade. There were 12 such crossings in 13.8 miles. Three of these in the space of 5.4 miles toward the south end of the climb – Mountain Creek, Surprise Creek (called Cut or Cutbank Creek by old-timers), and Stoney Creek – posed construction challenges of such magnitude, they almost scuttled the railway.

The three creeks were ravine-like where they crossed the grade. The resulting heights of the bridge decks were staggering: 154 feet at Mountain Creek, 180 feet at Surprise Creek, and 273 feet, 2.5 inches at Stoney Creek. There was only one higher railway bridge in the world in 1885. The deck of Gustave Eiffel's, newly completed Garabit Viaduct in France towered 400 feet above the Truyére River. However, none of its six support towers was as high as the central tower of the Stoney Creek bridge (228 feet, 2.5 inches), and the Garabit towers were steel. So CPR workers and construction engineers claimed that their structure was the highest railway bridge in the world, and, if challenged on that assertion, emphasized that it was the highest *wooden* bridge.



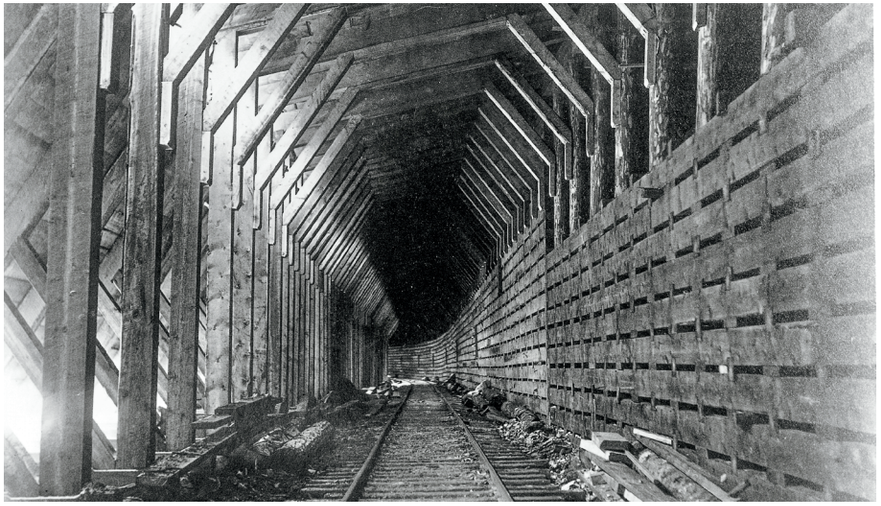
Construction of the Mountain Creek bridge began in the dead of winter, early in 1885.

"Golden City" typified a CPR end-of-steel camp in 1884. These men were captives of the CPR, 171.6 railway-miles from "civilization" at Fort Calgary, with not much chance of hitching a ride out if they lost heart. The company paid them $10.50 per week and deducted $4.50 per week for board and "medical care." When the CPR fell three months behind on pay in March 1885, 300 end of-steel workers at Beavermouth (which had 40 saloons) went on strike, took up arms, and sabotaged bridges.

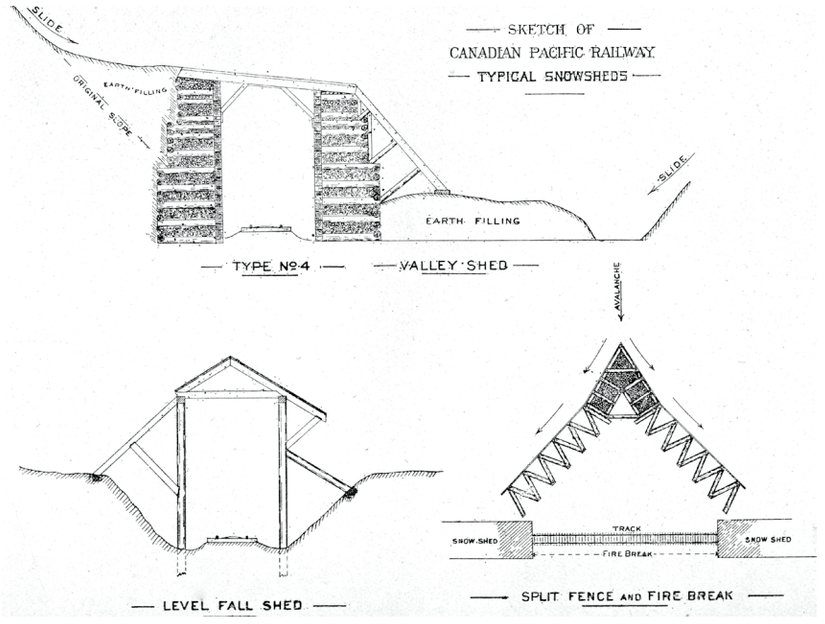


Oliver Buell, the CPR's first official photographer, took this view of the Mountain Creek bridge just after it was completed in May 1885, looking south (railway-west). Containing 2 million board feet of lumber, this bridge was probably the largest wooden structure in the world at the time; perhaps of all time.

Buell also took this view of the Stoney Creek bridge as it neared completion in early August 1885. Note the bracing beneath the bridge chords, and the gap in the centre of the span. Construction of this remarkable structure required only five weeks and three days during a seven-week period, in which eleven work days were lost due to weather and the deaths of two workers.



Landscape features and track routing dictated the styles and the shapes of the snowsheds. CPR engineers developed at least nine shed designs, each specifically designed to withstand an avalanche from one side of the valley, slides from both, or a slide falling onto the shed roof. The CPR tucked some sheds into the valley walls, hoping that most of the sliding snow would overshoot the structures. But at least one shed was 70 feet wide. The 12"x15" shed bents were hewn from Douglas-fir and were typically placed on 5-foot centres. For shed cribbing, the CPR often salvaged lumber that had been sawn out of bridge decks.



At 3,098 feet,17 Shed was initially the longest in Rogers Pass and on the CPR. It was under construction when William Notman took this photograph in the summer of 1886, either standing atop a rail car or on the roof of 16 Shed. Most of 17 Shed had already been buried to strengthen it. You can see the shed curving to the left in the mid-background. Summer track is to the left of the shed. The construction tote road is on the extreme left. Today's Trans-Canada Highway roughly follows the tote road's route. The first Rogers Pass station is in the background on the left.

This is the same scene approximately 18 years later. A jungle-like growth of alder, willow, and other shrubs masks the construction scars. The buildings of the first Rogers Pass station are long gone.

11
Down Under

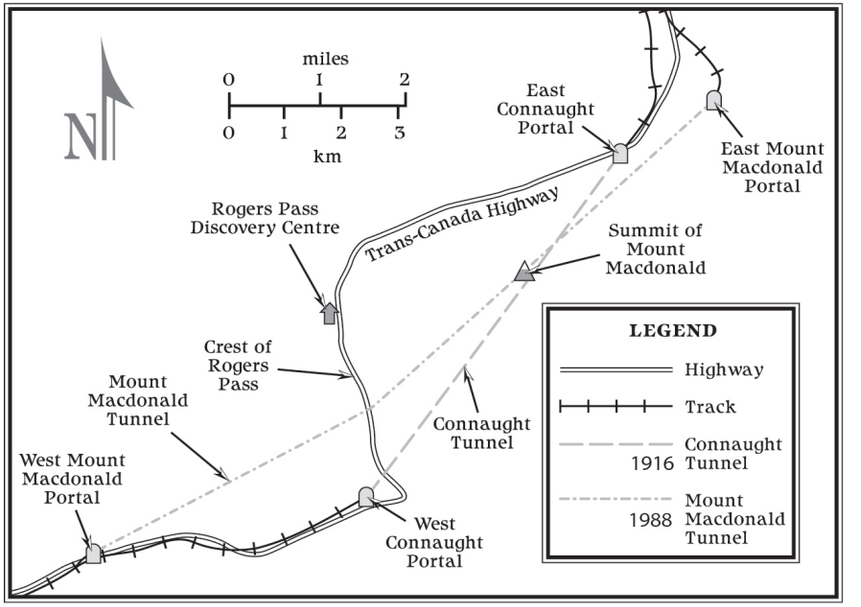
Economics, the propelling force of gravity, and the crushing weight of snow have twice forced the CPR underground to improve operations at Rogers Pass. Van Horne's initial plan had been to double-track the pass to simplify scheduling, given the delays caused by adding and removing helper locomotives. But after a few seasons of experience with avalanches, it was clear that the cost of building and maintaining double-track snowsheds would not be money well spent. Moreover, it would not reduce the steep grades, which were the major impediment to the CPR's efficiency. Only a tunnel would protect the track from avalanches while reducing the grade.

Although Van Horne may have dreamed of a tunnel under Rogers Pass as early as 1888, he knew that the CPR could ill afford the enterprise. So – as it had done on the Big Hill east of Field for 25 years – the railway, at great human cost, toughed it out for 28 years until the money became available. The commitment to build a tunnel marked a transition in the economic rationale of the CPR – from low capital cost/high maintenance cost to the opposite – a principle that endures.

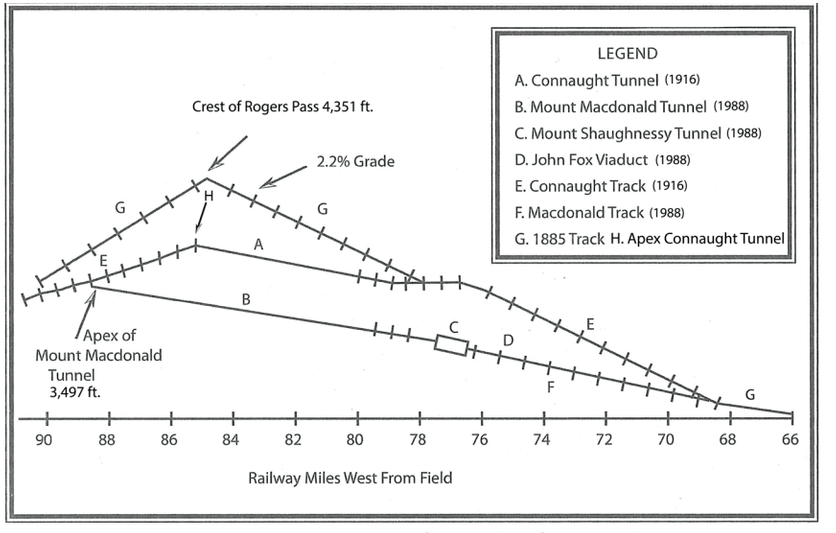
Initial specifications for what would become the Connaught Tunnel included an alignment east of the pass much different from the one eventually constructed. It also called for electrification of rail operations from Rogers siding to a new Glacier station. World War I began during construction, forcing the CPR to adjust its plans due to shortages of materials and workers. Electrification was abandoned.

When the Rogers Pass Tunnel construction tender went out early in 1913, the CPR advised contractors that, "Everything else being equal, the party who will guarantee completion in the shortest time will be the one who will receive the work." The firm of Foley, Welch and Stewart – which had just built much of the Grand Trunk Pacific Railway west of Edmonton – continued its dominance of Canadian railway construction when it secured the contract on July 1, 1913, with terms for just under $8 million.

The contractor proposed an unusual tunnelling method. Instead of excavating a pioneer heading that would subsequently be widened, crews would build two tunnels. An auxiliary tunnel, 8 feet by 8 feet in dimensions, would be driven about 50 feet away from, and 10 feet above the alignment of the principal tunnel. The auxiliary tunnel would carry compressed air, ventilation, water, and track for bringing in equipment and for removing spoil. From the auxiliary tunnel, crews would bore across to the alignment of the main tunnel. From the end of each of these crosscuts, the main tunnel, initially 11 feet wide and 9 feet high, would be advanced in two directions. The CPR agreed to the plan. Twelve such crosscuts were eventually made.



Rogers Pass, showing the alignments of the Connaught Tunnel and Mount Macdonald Tunnel. The 1885 railway grade roughly paralleled the route of today's Trans-Canada Highway.



This elevation view compares the grades of the 1885 surface route (2.2 percent), the Connaught Tunnel (0.98 percent), and the Mount Macdonald Tunnel (0.7 percent). The apex of the Connaught Tunnel (H) is 3,745 feet.