Tracks, Tunnels and Trestles: An Environmental History of the Construction of the Canadian Pacific Railway, 1883-1885

By Heather Longworth, University of Victoria

Abstract: The construction of the Canadian Pacific Railway (CPR) was a spectacular achievement but it came at a significant environmental cost. An environmental examination of the railway demonstrates that the relationship between the people and the environment was two-fold: people had a noticeable effect on the environment through deforestation, blasting, and tunneling, and the environment likewise had a taxing effect on railway labourers and the operation of the line through the challenges of weather and geography.

The two and a half year period of construction through the mountains between Calgary and Craigellachie presented Canadian Pacific Railway (CPR) workers with daunting challenges in the human effort to dominate nature. This paper investigates the experiences of construction workers as well as the impact construction had on the environment. The CPR achieved no permanent control over nature, especially during the winter, and decisions made during construction would have implications for workers as well as for the environment. The CPR created problems for itself during the construction and early years of operation by taking shortcuts which lessened its control over the landscape. These shortcuts were necessary because of the poor placement of the route, financial problems, and the haste to build the line. By taking shortcuts, the CPR finished the line by November 1885 and did not go further in debt. However, these measures came at the cost of the workers' lives, accidents that would damage trains and injure workers, and labour and expenses to repair the lines. These shortcuts and repairs took an ecological toll on the resources in the mountains through removal of dirt and rocks, and excessive deforestation. During construction and the early years of operation, the CPR learned that it needed to work with the environment if it was to operate year-round.

The construction through the Rocky Mountains and Selkirk Mountains was organized into sections, each with a portion of track or a particular task such as bridge building to complete. James Ross was in charge and the contractors under him were assigned sections of the line between one and five miles long depending on the task they were performing.[1] Contractors often hired sub-contractors to carry out certain tasks such as cutting ties. The task of building the railway roughly followed this order: survey teams marked out the exact route of the line,

[1] Granville Carlyle Cuningham, "The Rocky-Mountain Division of the Canadian Pacific Railway" in *Construction and Working*, ed. James Forrest (London, 1886), 52-53.

gangs made a wagon road to transport supplies, teams cleared and graded the line for the track, work gangs laid the track, and other gangs were used to build bridges in advance of the track or to work on tunnels.

The environment had an impact on workers through living conditions which varied greatly from camp to camp throughout this region. Camps were constantly moving, both as the End of Track progressed further into the mountains and as men moved ahead to work on bridges and tunnels. "As contractors and engineers got finished with the work on their particular sections," wrote engineer Peter Turner Bone, "they moved their camps again and again on new contracts. The way this moving worked out was like a game of leapfrog over all; for the camp which was to the rear... was moved on ahead of all the others."[2] Men lived in tents, boarding cars, or bunkhouses. The head contractors and bosses lived on the other side of road of the camp in log buildings. Food was brought to the End of Track by train and then carried by pack horses to camps beyond that.

Given the temporary nature of camps, little was done to clean up after the men had left. Rubbish and useless items were left behind. Professor G.G. Ramsay, a visitor to the End of Track, described the remains of a construction camp at the Kicking Horse flats: "there are manifold traces... that man has been here encamped: the oozy ground reeks with garbage, broken plates and meats; above all, with innumerable empty cans – 'tins,' as we should call them – which are the universal token of man's presence in these western regions."[3] This improper disposal of waste led to health problems for workers. Camp conditions could have an impact on the environment which also came back to create problems for the workers. Due to the poor sanitation of hastily built camps, typhoid, also known as mountain fever, was common.[4] Undisposed sewage and feces seeped into the drinking water and made many workers ill with fever and diarrhoea. Typhoid was most prevalent in the mountainous sections because construction camps there were larger and crews remained at one site longer due to the bridges or tunnels which had to be built. Missionary Father Coccola wrote that "small hospitals were crowded here and there, giving patients all possible help. The Medical Department [tried]... to keep down disease caused by

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[2] Peter Turner Bone, *When the Steel Went Through: Reminiscences of a Railroad Pioneer* (Toronto, 1947), 88.
[3] G.G. Ramsay, "Over the Rocky Mountains by the Canadian Pacific Line in 1884," *Macmillan's Magazine*, December 1884.
[4] Samuel B. Steele, *Forty Years in Canada: Reminiscences of the Great North-West, with Some Account of His Service in South Africa* (London, 1915), 191.

dampness and bad sanitation."[5] Cases of typhoid were also imported by diseased workers coming to Calgary. Despite the efforts of the doctors, several workers died of typhoid.[6]

The working conditions in these camps varied greatly depending on the type of work performed. A typical daily schedule for the track layers was as follows: awakened at dawn, the men had breakfast while the horses were fed, then they worked five hours until noon and after dinner they worked five more hours until supper and then went to bed exhausted.[7]

The mountains provided new challenges for the workers, fresh from the prairies, from weather-related obstacles to the need to use dynamite to tunnel through rock. In September 1883, snowstorms came early and "imbued the new men of the country with horror and dread. They argued, if the winter is like this in September, what must it be like when the winter months set in."[8] Hundreds of men left the country and the crews were crippled until new men were sent in from Winnipeg and the United States. The winter of 1883-1884 was long-lasting and was followed by a wet summer. Mounted Policeman Sam Steele recalled that "rain fell nearly every day for at least two months," yet work progressed whether it was wet or dry. Steele noted from company books that "the men averaged more than ten hours per day per month; some of them had thirteen or fourteen hours per day to their credit... If it rained too hard for an hour or two they made up for it when it slackened."[9] In 1883, the lowest temperatures recorded were -40 Fahrenheit at the Kicking Horse Pass on December 30. The following winter saw temperatures of -42 Fahrenheit in the Columbia Valley on December 24, and -48 Fahrenheit in the Rocky Mountains.[10] Extreme winter weather easily complicated the construction process as ice piled around the piers of bridges, streams flooded their banks, and ice and snow accumulated on the peaks, eventually triggering slides. Workers had to learn to carry out their construction tasks cautiously through all weather in order to complete the track quickly while ensuring their own survival.

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[5] Father Nicolas Coccola, *They Call Me Father: Memoirs of Father Nicholas Coccola* (Vancouver, 1988), 100.
[6] "Died at the Hospital," *Calgary Herald: Miner and Ranche Advocate and General Advertiser*, August 6, 1884.
[7] J.M. Gibbon and Stephen Pardoe, "The Construction of the Canadian Pacific Railway," in *Engineering Wonders of the World*, vol. 1, ed. Archibald Williams (London, n.d.), 265.
[8] William McCardell, "Reminiscences of a Western Pioneer: Explorations through the Rocky Mountains," unpublished manuscript, William McCardell Fonds, Glenbow Archives M4056, 345.
[9] Steele, *Forty Years in Canada,* 190.
[10] Cuningham, "The Rocky-Mountain Division," 51.

Working on tunnels and bridges were some of the most dangerous tasks. Morley Roberts, who worked in the Corry Brothers' Tunnel in the Rocky Mountains, recalled, "I never felt safe, for every minute or so would come the cry, 'Look out below!' or 'Stand from under!' and a heavy stone would come thundering down the slope right at us."[11] Roberts injured his knee on a wheelbarrow when he jumped out of the way of an eighty pound stone and was unable to work for five days. Others were not so lucky. James Ross recalled that men refused to work in the Corry Brothers' Tunnel when two men were killed by falling debris when the ends of the tunnel met.[12] Working on bridges high above the water also posed dangers as they were slippery in winter and could flood or get washed away in storms or in the spring thaw, presenting bridge gangs with the challenge of avoiding the dangerous waters below.

Luckily, there were relatively few accidents in dealing with explosives. Steele noted that only two mishaps occurred.[13] The first accident occurred when a rock from a distant blast landed on a shack, killing a man. The second accident was due to the carelessness of a worker who used a steel drill to remove a rock that had fallen into a drill hole containing dynamite; it struck a spark and several people died in the resulting explosion.[14] However, the use of dynamite created many other dangerous conditions. It was sometimes blamed for causing avalanches, the force of the blast triggering loose snow which would pick up more snow as well as trees and rocks as it moved down the mountain. Father Coccola wrote about an avalanche at Rogers Pass: "The continual blasting was the cause of it. Glaciers which never moved... came down with a tremendous roaring... [crossed the valley and]... rose up many hundred feet on the other side burying a construction train with 19 men."[15] Avalanches were a scary experience for all workers. James Ross wrote that avalanches stripped trees, and that some of the workers were "caught in the tail of the storm and were blown off their feet and could not draw their breath for some little time afterwards."[16] Three bad slides occurred in February 1885, creating problems for the CPR workers who were trying to finish the track that year. One, six miles west of the summit of the Selkirks, killed a cook at McKenzie's camp. A second buried three men alive at McDermott's camp, and the third swept Hill's

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[11] Morley Roberts, *The Western Avernus* (London, 1887), 76.
[12] Quotes from T.D. Regehr, "Letters from the End of Track," in *The CPR West: The Iron Road and the Making of a Nation*, ed. Hugh A. Dempsey (Vancouver, 1984), 42.
[13] Steele, *Forty Years in Canada,* 191.
[14] Gibbon and Pardoe, "The Construction of the Canadian Pacific Railway," 274-275.
[15] Coccola, *They Call Me Father,* 100.
[16] In Regehr, "Letters from the End of Track," 45.

store off the summit of the Selkirks.[17] These slides persuaded the CPR to move the line closer to the mountain side instead of in the centre of the valleys with "rock being scooped out to afford some shelter to the trains."[18]

Railways inevitably took a toll on surrounding forests, but the CPR's need to build quickly and cheaply added to their destruction. Clearing brush and trees to make a wide path for the railway was the first step of construction. Axemen cleared a small path for the surveyors but this path needed to be widened either by axes or burning. Fires were the fastest way to accomplish this task and fit with the CPR's plans for hasty construction. Surveyor Charles Shaw recalled a fire at the Great Divide started by "some of the men who were clearing the right of way... It had been a very dry season, and there were piles of brush and timber all along the line; the whole valley was soon in a blaze."[19] The fire burned out of control for several days and "some of the men and teams working on the line were burned," Shaw wrote.[20] These fires harmed the habitat along the track, destroyed some of the natural beauty of the region, and endangered the lives of the workers themselves.

After the track was cleared, the next task was to level it so that the train would travel more smoothly and quickly along as flat a grade as was possible through the mountains. Then the track was laid. Supplies were laid on a hand-truck but ties, the pieces of wood that went horizontally under the rails, were sent ahead by horse teams and were thrown by the side of the grade and then put into position and spaced.[21] Fifteen ties went to each rail and the rails were spiked to the ties. Deforestation occurred at a rapid rate because enormous amounts of lumber went into the fabrication of ties and bridges and later snowsheds. Using three sawmills and a grant from the Canadian government enabling the company to use whatever resources they needed along the line, at no cost, the CPR consumed the forests along the track at a remarkable rate. According to British Engineer Cuningham, eight-foot-long, six-inch-thick ties made from spruce and jack pine were laid three thousand to the mile.[22] With 290.3 miles between Calgary and

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[17] "Avalanches in the Mountains," *Calgary Herald: Miner and Ranche Advocate and General Advertiser*, February 19, 1885.
[18] "The C.P.R. in the Rockies," *Calgary Herald: Miner and Ranche Advocate and General Advertiser*, February 26, 1885.
[19] Charles Æneas Shaw, *Tales of a Pioneer Surveyor*, ed. Raymond Hull (Don Mills, 1970), 147.
[20] Shaw, *Tales of a Pioneer Surveyor*, 148.
[21] Gibbon and Pardoe, "The Construction of the Canadian Pacific Railway," 267.
[22] Cuningham, "The Rocky-Mountain Division," 61. 2 640 ties to the mile is the number given by Pardoe and Gibbon a few decades later but they give no information on size and

Craigellachie, that meant 870 900 ties were used on this section of the railway.

Numerous wooden bridges required along the route through the mountains further deforested the hillsides and valleys. The CPR built trestle, truss, and pile bridges throughout the mountains from readily available wood. Long delays occurred in building trusses. Temporary pile bridges were often constructed so the track laying could pass through and then the trusses were erected at greater leisure after the track had passed by; however, it was not possible to do this in high places.[23] Ideally, the bridges along this part of the line should have been made of iron or steel, as wooden bridges had a lifespan of approximately twelve years and were a constant fire hazard whereas iron and steel were much less destructible. However, iron was expensive and would have had to be shipped out west. James Ross sometimes requested permission for iron bridges at certain locations but Van Horne would reply that iron bridges would "add enormously to the expense of the structures."[24]

The most complicated and highest bridges on the line were between the town of Donald and the summit of the Selkirks. Mountain Creek Bridge was the first and largest of these bridges encountered travelling west, but had an easy approach on both sides. It was 1200 feet long and 150 feet high and required the most timber of any bridge.[25] At 164 feet high, Surprise Creek Bridge was the highest bridge of the line. The crossing of the Illecillewaet River near Albert Canyon proved troublesome. As Bone recalled, "The river bed at this crossing was full of large boulders, which made the driving of piles almost impossible... wet weather had set in, and the Illicilliwaet [sic] became a raging torrent. Just as the bridge was about to be completed, it was swept away."[26] Once again, the CPR found it difficult to exert control over nature. The bridge had to be entirely rebuilt, but this second bridge withstood the river and the track was able to pass over. Wooden bridges would become a problematic shortcut for the CPR in its first twenty years of operation as they were fire hazards and unable to handle storms as well as iron bridges. Eventually, the CPR would have to take costly measures to replace them all.

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spacing of rails. Gibbon and Pardoe, "The Construction of the Canadian Pacific Railway," 266. According to this estimate, the number of ties used would be 766 392 between Calgary and Craigellachie.

[23] Gibbon and Pardoe, "The Construction of the Canadian Pacific Railway," 279.

[24] William Van Horne, letter to James Ross, October 20, 1884, Canadian Pacific Railway Fonds, Library and Archives Canada MG28-III 20.

[25] Bone, *When the Steel Went Through,* 103-104.

[26] Bone, *When the Steel Went Through*, 110.

Another problematic section in the mountains was the Big Hill between the towns of Hector and Field, a steep incline by which the CPR eliminated Major Rogers' proposed tunnel through Mount Stephen. The grade along the entire line was 2.2 percent but in the case of the Big Hill line it was increased to 4.5 percent. The Canadian Government approved this temporary shortcut. Thus, the CPR contained the "steepest grades for any standard-gauge railroad." [27] The CPR installed a system of safety switches to prevent accidents and allow runaway trains to enter side spurs and not run off the tracks or into other trains. In time, this shortcut would come back to create problems for the CPR. Even during construction there were runaway trains on the hill. In 1884, visitor Professor G.G. Ramsay wrote of a runaway train carrying 270 construction workers where everyone jumped off and "the train, rushing at forty or fifty miles an hour down the new-laid track... 'jumped' the rails at the curve close to the second crossing over the river, and dashed straight on into a precipitous face of rock."[28] The Big Hill, which was supposed to be a temporary measure, lasted twenty-five years. The shortcut saved the CPR money during construction but proved costly in future years not only in the construction of the spiral tunnels to make the tracks safer, but in human lives and loss of locomotives.

Digging tunnels was the most time consuming process of construction. Workers dug seven tunnels from the summit of the Rocky Mountains west totalling 2,152 feet in length.[29] The second tunnel, known as the Corry Brothers' Tunnel for the engineers in charge of its construction, was the most difficult and longest at 470 feet. Morley Roberts recalled that the hill contained three different layers of material: "gravel on the top, then a thick stratum of extremely tenacious blue clay, and beneath that lay a bed of solid concrete [boulders] which required blasting."[30] The work, carried out from both entrances, was extremely hard. As Engineer Cuningham recalled, "springs from the mountain slope make their way down through the soil... between the boulder-drift and the blue clay, cause deep excavations, which result in sudden and disastrous 'slides.'"[31]Although it had been timbered, the east end of the Corry Brothers' Tunnel collapsed on July 23, 1883 "tearing out 30 lineal feet of timber lining and bringing down about 15,000 cubic yards of material" and had to be dug out all over again.[32] Yet again in October,

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[27] Pierre Berton, *The Last Spike: The Great Railway, 1881-1885* (Toronto, 1971), 293.
[28] Ramsay, "Over the Rocky Mountains," 126.
[29] Cuningham, "The Rocky-Mountain Division," 56.
[30] Roberts, *The Western Avernus,* 76.
[31] Cuningham, "The Rocky-Mountain Division," 57.
[32] Cuningham, "The Rocky-Mountain Division," 57 and Roberts, *The Western Avernus*, 76.

when the track was about to be laid, a second slide occurred at the east end bringing down approximately nine thousand cubic yards of material.[33] The tunnel was then completely timbered with 780 board feet of lumber for each foot of the tunnel.[34] Once again, the CPR had not managed to control nature.

The CPR's shortcuts meant that in the first decade of the operation of the CPR, many sections of the line had to be rebuilt which further strained the local ecology. However, without these shortcuts the CPR could have gone bankrupt and the line may not have been completed in a timely matter if at all. Thus, the CPR really had no choice but to build the line cheaply at a high environmental cost, a cost which was not taken into consideration by the nineteenth century mindset which placed profit above preserving nature. The last spike was not a conclusive victory of man over nature. The CPR closed its lines for the first winter, unwilling to begin operations in the harshest season. Throughout the construction, the workers and the environment had an impact on each other. It was only though adapting to the environment that the CPR would learn how to get trains through the mountains in a timely manner.

[33] Cuningham, "The Rocky-Mountain Division," 57.
[34] Cuningham, "The Rocky-Mountain Division," 57. As the tunnel was 470 feet long, this would mean that 336,600 board feet of lumber were used to timber the entire tunnel. A board foot is 144 cubic inches of wood.