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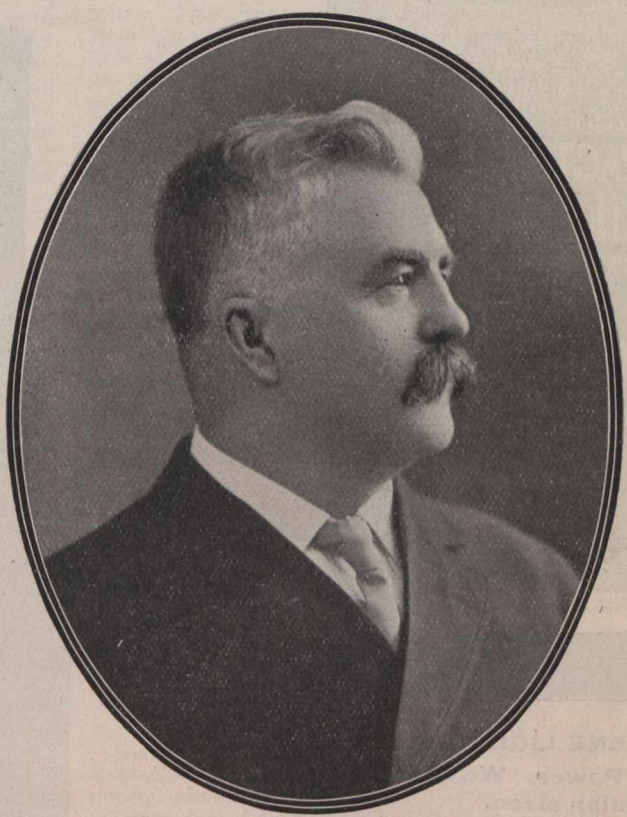
Reduction of the Kicking Horse Pass Grade on the C.P.R.

By J. E. Schwitzer, Assistant Chief Engineer C.P.R. Western Lines.

Two great engineering triumphs have been achieved this year by the C.P.R. Co., in the reduction of the steep grade in the Rocky Mountains, and the construction of a huge viaduct on its Crow's Nest Pass branch. Both are works of considerable magnitude, and both have been successfully completed in a remarkably short time. Although only separated by less than 200 miles as the crow flies, these engineering feats are essentially different in every aspect, even in their surroundings and conditions, the one being located in mountain recesses, and the other on the broad plains of a ranching and grain-growing region.

The original C.P.R. line between Field and Hector, was constructed for about 4.1 miles with 4.5% grade, which was the heaviest grade on the main line of the railway; this, however, answered all purposes until the increasing traffic during the past few years necessitated the consideration of a grade revision at this point, more especially owing to the large amount of passenger traffic and the danger of operating this 4.5% grade, although on this gradient there were three safety-switches, one at mile 10.2, one at mile 11, and the other at mile 12.3. Before passing any of these switches going west on the down-grade, all trains had to come to a stop, when a man threw the switch for the main line, allowing trains to proceed. Under an agreement with the Government, this gradient had to be reduced.

Special surveys were made in 1902 and 1905 of alternative routes. The different propositions finally resolved themselves into the consideration of three lines, as shown on the plan, fig. 21, page 711. The line which is marked A required the abandoning of Field and moving the terminal at this point, besides being very expensive work, running into a series of slides. From the appearance of the ground, the Yoko Valley, or the north branch of the Kicking Horse River, appears to lend itself readily to a location in this direction; but on account of the exceedingly steep banks, and a large number of snow and rock slides, this line was abandoned. It therefore necessitated the consideration of the lines shown in dot and dash line and dotted line on the plan, fig. 21. The dot and dash line required running parallel to the bed of the river at several points in order to secure the gradient; this would require the railway and the river to be carried through the same cuts, and on account of the danger of ice blocking the river, besides being a very expensive project to divert the river, this line was abandoned, and the dotted line adopted as a general location. After having further surveys made, and in order to save length of tunnel, this was changed to the line shown in dot and dash; while this increased the curvature by 102 deg. and lengthened the line by 362 ft., the tunnel was shortened by 1,000 ft. and on account of the cost of the tunnel work it was decided to adopt this line. Before actually starting the work on this line, further investigations were made up the Yoko Valley, and it was decided that it was impracticable to build a line up the valley, as, for a distance of two miles or more, it would be on the face of perpendicular rock slides, ranging from 3,000 ft. to 5,000 ft., besides which there would be several snow-slides to contend with, which would endanger the operation of the line. It was decided by the management to undertake this work in 1907, the contract being let to McDonnel and Gzowski for the construction work.



DUNCAN McDONALD

Manager Montreal Street Railway and President Canadian Street Railway Association.

There was no work of any particular interest outside of the ordinary grading except the tunnels. The tunnel known as no. 1 is 3,255 ft. long, on a reverse curve; tunnel no. 2, 2,921 ft. long, being partly on a 10 deg. curve radius 573.7 and partly on a tangent. Each of these curves have 300 ft. of spiral at each end. The grade is 2.2%, compensated at 0.04 per degree of curvature throughout, except in the tunnel, where 0.06 is used, and on the tangents in the tunnels an allowance of 0.02 was made for slippery rails.

As already stated, the maximum grade on the original line was 4½% for a distance of 3.71 miles, and the balance of 0.2 mile varies from 3.5 to 4%. On the old line it required four engines to handle a train of 700 tons over this grade, while it is estimated that on the new line with two engines of the same class the company will be able to haul 982 tons. The engines used in operating over the old grade are what are known as 180% engines, having a total tractive force of 46,900 lbs., the weight on the drivers being 173,700 lbs., the total weight of the engine and tender loaded being 154 tons.

The amount saved on account of reducing this grade at the time the estimate was prepared was not in itself sufficient to warrant the expenditure; but, taking into account the question of handling passenger traffic so much more safely, as well as allowing longer trains to be operated, besides doing away with the terminal at Laggan, the terminal of the Western division being moved to Field, it was decided to go on with the work.

The work was started on this grade revision in September, 1907, and it was finished in August, 1909. The work on the tunnels was started from both ends, the contractor at first using an old-style Jumbo, but steam-shovels were later substituted in these tunnels, and the work progressed a little quicker. No great difficulty was experienced in the tunnel work, as it is through medium hard limestone, with a dip of about 20 deg. A large quantity of timber was required in both the large tunnels on account of striking slides in the rock, and a little trouble was experienced from water, but this was kept under