

SUPPLEMENTARY REPORT.

SIR,—

New York, 16th May, 1902.

In my report to you of the 17th February of this year there was one matter to which I thought it desirable to give more attention, but which it was not possible to go over in detail without delaying my return to the United States until another steamer. I refer to the working-cost, my estimates of which were made in the rough; and, although the results were substantially correct, it has seemed to me best to make a detailed analysis, based upon the most recent data obtainable, and submit the same in full to you, in order that this branch of the subject may be thoroughly understood. With this end in view I sought, and have obtained, from the Southern Pacific Railway Company and from the Denver and Rio Grande Railway Company recent statistics relating to the working of their heavy grades. These data are attached hereto, and should be considered as part of this supplementary report.

I have no change to make in the recommendations of my report of the 17th February mentioned, further study having fully confirmed me in my position. The analysis of the working-cost is given below.

FUEL AND VENTILATION.

The use of petroleum as fuel for locomotives is growing rapidly in the south-western States of this country. It results in an economy of about 50 per cent. in regions not too far from the oilfields. While improvements will continue to be made, tending to render its use more innocuous, I now regard it as doubtful if it will ever prove to be a better fuel than coal for locomotives operating in a long tunnel.

The Great Northern Railway Company uses coal which contains no sulphur in the locomotives of its Cascade Tunnel, which has a length of a little over three miles, with satisfactory results.

I have little doubt that the summit tunnel of either line A, line B, or line B1, referred to in my report, would require ventilating-apparatus if operated with the ordinary locomotive, provided there was a considerable movement of trains. If the train-movement were confined to, say, two trains per day each way, ventilating-apparatus might not be necessary for the tunnel of either of the B lines, but I have included the annual expense of such a plant in the working-cost of line B, as well as line A, but that of line C does not include such expense.

MAINTENANCE OF TRACK IN TUNNELS.

I do not know of any railway in this country that keeps a special account of track-maintenance of tunnels, but all testimony goes to prove that such cost exceeds that of outside track, both because of rapid deterioration and because men in tunnels receive higher pay.

The Hoosac Tunnel, length about four miles and a quarter, is the longest tunnel in this country. It is on one of the lines of the Boston and Maine Railway, whose chief engineer, in a letter to me, states that the cost of track-maintenance in that tunnel is double that of outside track. I have assumed, however, in the estimate of working-cost, that the cost of maintenance of track in tunnels would be the same as that of outside track. The surveys I have recommended will disclose the aggregate length of tunnels for each line, and a more exact comparison of the maintenance of track between the several lines can then be made.

The statement referred to counts against long-tunnel projects, where traffic, in the nature of things, can never be very heavy. I am satisfied that in mountainous regions of this country line C would be thought somewhat the best, although it might be modified a little as a result of the surveys I have recommended.

Considering the conditions existing in New Zealand, and from a broad point of view, I am still most in favour of line B or line B1, with the reservation, however, that surveys should be made of both lines B and C, in order that the feasibility and data of each may be more correctly determined.

Analysis of Working-costs.

A comparison of the operating costs for the various lines considered will be greatly facilitated by separating the variable items from those that would be practically the same for any line, and then treating these variable items separately with respect to their ratios and amounts as influenced by the characteristics of the several lines.

Of the items which go to make up the total cost of the train mile, those affected by the physical characteristics of the line are motive power, maintenance of way, and carriages and wagons.

Motive Power.

For locomotives of given tractive power, assuming that the train-loads are, as nearly as practicable, made to develop the full economic power of the machine, the cost per engine mile for engines of the same power will not vary materially on any one of the lines considered. The cost per assistant-engine mile would be the same as the cost per road-engine mile if the traffic were sufficient to give the assistant engine all the work that it ought to do. An assistant engine ought to run eighty or one hundred miles per day, but between Otira and Bealey, with 500 trains each way per annum, it would run only about thirty-two miles; with 700 trains, forty-five miles; and with 1,000 trains, sixty-four miles per day. The mileage that it fails to make, less than eighty miles per day, will cost one-tenth of the engine-mile cost, plus nine-tenths of the cost of wages per engine mile. Then, if the assistant engine runs m miles per day, the cost per assistant-engine mile run will be the cost per road-engine mile multiplied by $1 + \left(\frac{80-m}{m}\right)p$, where p = cost standing, divided by the cost per engine mile.

Hauling-capacity, or Locomotive Rating.

The cost per road-engine mile and per assistant-engine mile being known, the motive-power costs for the various lines and given traffic depend upon the capacity of each engine, and how much additional power must be attached to the train hauled up to Otira by the road-engine to get it over the summit of the grade.

The formula adopted to determine the weight of the train any given engine will haul up the various grades has been carefully verified by actual experiments on various railways, and with the results of the work done by engines every day in the year on the heavy grades between Thistle Junction and Helper, on the Denver and Rio Grande Railway.