

more accurately to the natural features of the ground without impairing its character or standing. But I observe that a considerable portion of that saving, as I judge, is stated thus: The hon. gentleman read an extract from Mr. Fleming's report, suggesting that in certain portions of the road, where it was practicable, resort might be had to trestle-work and piles. The hon. gentleman continued: That, I need hardly say, is a very material modification in design, and it would be well to know to what extent that is to be applied, what is the extreme length of the piles to be used, what is the saving to be accomplished by this particular modification of design? The general result, leaving out the question of rolling stock, leaving out the question of the reduction in building, has been that 1879 says \$18,000,000; April, 1880, says \$17,000,000; and December, 1880, says \$15,615,000. Of course, these various alterations in cost must have been accomplished largely by modification of design, and it is natural that we should see particularly what these modifications are. Now, turning to the prairie section, I will refer to the Report of the Engineer for 1877, showing what the work of 1876 was on that part. He says:

"The gradients and alignment will nowhere be less favorable than on the railway now in operation in the old Provinces. The maximum gradient between the Yellow Head Pass and Selkirk will be 58.80 feet per mile. Up to a point 468 miles west of Red River no gradient ascending eastward in the probable direction of heavy traffic need exceed 26.50 feet per mile."

Speaking of the result as to a good line there, the engineer, in the report the same year, goes on to say:

"It has been held from the first, that the successful occupation of the prairie region, and the extent to which it may become thickly populated, will, in a great measure, be governed by the capacity of the line to Lake Superior to carry cheaply the products of the soil. The success of the railway itself must be determined by the number of inhabitants which can be established in the country; and the degree of prosperity of the population will be influenced in no narrow limit by the character of the outlet for the products of their industry. The more, therefore, that the eastern section of the railway can be rendered available for cheap transportation, the more rapidly will the prairie region become populated, and the more speedily will the land become self-sustaining. I have felt it my duty to regard these views as of paramount importance in the location of the line between the prairie region and Lake Superior. Accordingly, every effort has been made to discover the shortest line with the lightest possible gradients and easiest curvature, especially in the direction which heavy traffic will take—towards the Atlantic sea board."

After giving the results achieved from Selkirk to the east he goes on to remark:

"Thus, there will be no impediment to the Pacific Railway carrying products from the heart of the continent to Lake Superior at a lower rate per mile than those now obtaining on the leading railways already in operation."

Then, proceeding to discuss the subject of the line further west, he says:

"I have described the efforts that have been made to obtain a line with the easiest possible gradients from the prairie region to the navigable waters of the St. Lawrence, and the paramount importance of this feature. Reference to a table in the appendix, which gives a summary of gradients for each hundred-mile section of the railway, between the Lake Superior terminus and Tête Jaune Cache, shews that there is no gradient ascending in either direction exceeding 1 per 100 or 52.8 feet per mile, and with one single exception, viz.: at the crossing of the South Saskatchewan, the heaviest gradient ascending outwards from a point near Battleford to Fort William is only 0.5 per hundred or 26.4 feet per mile. I feel satisfied that a revision of the location at the one exceptional point will, with but trifling cost, result in obtaining the desired gradient there also."

"Assuming the gradient at the South Saskatchewan to be amended, I am enabled to report a location on which, for fully a thousand miles west of Lake Superior, the easterly ascending gradients can be kept down to half the maximum gradients on the Grand Trunk and other railways in operation in the older Provinces. Cheapness of transportation in thus, to a certain extent, assured—an important element in facilitating the prosperous settlement of the fertile territory in the interior."

"The following will show the remarkably favorable gradients secured on each 500 mile section of the line, west of Lake Superior; and the

accompanying diagrams (Sheets, Nos. 6 and 7) will clearly illustrate this feature of the line.

		Under 16 ft. per mile.	Above 16 ft. and under 26 1/2 ft. per mile.	Above 26 1/2 ft. and under 53 ft. per mile.	Total.
Ascending West.	Under 16 ft. per mile.	61.24	27.71	63.77	151.72
	Above 16 ft. and under 26 1/2 ft. per mile.	94.77	43.01	43.64	181.42
	Above 26 1/2 ft. and under 53 ft. per mile.	38.17	43.12	108.07	189.36
	Total.	194.18	113.84	214.48	522.50
Level.		143.00	170.50		
		61.24	27.71	63.77	151.72
Ascending East.	Under 16 ft. per mile.	74.97	68.24	205.28
	Above 16 ft. and under 26 1/2 ft. per mile.	38.76	46.55	79.84	148.08
	Above 26 1/2 ft. and under 53 ft. per mile.	93.76	179.09
	Total.	181.99	256.70	93.76	532.45
Sections of 500 miles each West of Lake Superior.		First 500	Second 500	Third 500	Total miles, 1,500.

"Thus on that portion of the line located and established for a distance of 1,500 miles, there will be close on 1,300 miles level, or with gradients under 26 1/2 ft. per mile, and no portion of the balance will rise more than 53 ft. per mile."

That was to be the character of the line, according to the report of 1877, for the whole distance of 1,500 miles from Lake Superior; but it was, of course, modified by the circumstances to which I have alluded as having occurred in April, 1880. The Report of the Engineer for the year 1880 proceeds as follows:—

"The importance of securing cheap transportation between the Prairie region and the eastern markets has been kept prominently in view in establishing the railway between Selkirk and Lake Superior. I have in previous reports described the efforts made from the beginning of the survey to attain this object."

"In my report of last year (p. 18), I referred at some length to the subject, and drew attention to the fact that the Government had placed under contract the whole distance east of Red River on a location definitely established with gradients so light and favorable that cheap transportation is assured for all time to come."

"This important condition is not attained without difficulty. At some points it has involved heavier works than would have been rendered necessary had steeper gradients been employed; but these points are remarkably few, and the increased expenditure, compared with that of the whole line, is small. The advantage gained will amply compensate for the extra expenditure incurred; and the results to be attained can be easily understood by reference to the Report on Rolling Stock appended. It can there be seen that the same engine which would transport 19 cars with a paying load of 190 tons, over a line with the ordinary gradients, would take 37 cars with 376 tons load over the Pacific Railway with the gradients obtained. Moreover, it is calculated that the 'consolidation' class of locomotives proposed to be brought into use ultimately, will be capable of hauling, from Manitoba towards Lake Superior, on the gradients established, as much as 765 tons of paying load."

But these results, although obtained, and we hope yet to be obtained—as far as the capacity of the line to transport