

He was accompanied by the Hon. G. W. Howlan and by Mr. Francis Bain, whom I understand to be a local geologist of repute.

Mr. Palmer reports that having reference to the opinion of Mr. Bain as to the strata under the bed of the sea on the line of the tunnel, the proposed location under the narrowest portion of the straits between Money Point in New Brunswick and Carleton Point in Prince Edward Island is well selected from both a constructive and a traffic point of view.

The greatest depth of water is shewn as being 96 feet at high water with a rise of tides of 6 feet at springs and 3 feet at neaps, and the speed of the current is not exceeding 3 knots with two hours of slack water each tide.

The distance from shore to shore is given as about 13,200 lineal yards, or say from shaft to shaft 13,500 lineal yards, exclusive of the land approaches on either side of which about 2,000 lineal yards would be in the tunnel.

Mr. Palmer further reports that the shores upon either coast are well adapted for railway approaches varying from 15 to 35 feet in height above high water mark, with a mean altitude of about 25 feet, the soil being of a red clayey nature. It appears also that the higher land on the Prince Edward Island shore falls away towards the interior, which will therefore shorten the approaches on that side.

Mr. Palmer considers that about $5\frac{1}{2}$ miles of railway, including some 2,000 lineal yards of tunnel, as before mentioned, will be necessary beyond the shafts to connect the tunnel with the respective systems of railway which, however, are of a different gauge, viz. :—4 ft. $8\frac{1}{2}$ in. in New Brunswick and the Dominion generally and 3 ft. 6 in. in Prince Edward Island.

Brick clay, free from lime, is said to exist at several points in Prince Edward Island, and a sample brick of good quality has been forwarded to me, together with a report by Mr. Bain thereon, dated the 9th of December, 1890, of which a copy is annexed hereto. (Appendix A.)

Coal of good quality from Pictou, and timber could be delivered at the shafts at moderate prices.

I assume that any materials or machinery required to be imported for the works would be admitted free of duty.

I am informed that ordinary labour is worth about 4s. and skilled labour about 6s. per day.

The ruling gradient on the main lines of New Brunswick is given as 1 in 81 or 65 feet per mile, and that in Prince Edward Island as 1 to 58 or 90 feet per mile. From the approximate cross section of the straits, accompanying Mr. Bain's report herein-after referred to, it appears that no difficulty would be encountered on the question of gradients as the levels of the tunnel could be so arranged, as approximately shown on the cross section (Appendix F) as to give a sufficient thickness of solid strata between the extrados or crown of the tunnel and the bed of the straits, without involving any steeper incline than 1 in 100, or 52.8 feet per mile, whilst the approach tunnel can be laid out with a ruling gradient of 1 in 66 or 80 feet per mile, both tunnels draining into one pumping shaft as shown.

It would be convenient but not essential for constructive purposes that the tunnel alignment should be a straight line from shaft to shaft.

Upon the all important-question of the stratification on the proposed alignment, Mr. Palmer quotes the following opinion given to him verbally by Mr. Francis Bain on the occasion of his visit:

“In his belief a bed of red clay shale varying in thickness from 50 to 80 feet extends right across the straits of Northumberland. It lies almost horizontally upon a carboniferous or grey sandstone base, and is said to contain small occasional lenticular masses of fine red sandstone.”

Mr. Palmer adds as the result of his own investigation, “The geological outcrop on either shore in which the strata are distinctly visible, the formation of the surrounding country, the stratification seen in neighbouring wells, combined with the opinion of Mr. Bain, the geologist, who is a native of the island, and has a knowledge of its entire formation, prove that a most favourable and impervious strata does exist for subaqueous tunnelling.”