

ENGINEER'S REPORT.

To Thomas A. Begly, Esq., Secretary, Department Public Works.

SIR—I have the honor to report, for the information of the Commissioners of Public Works, the result of a Survey of a line or Road, from the Port of Belleville, to the Iron Works at Marmora.

As the Survey, the Commissioners were good enough to put under my charge, was for the purpose of establishing the shortest feasible route between the above points, for the purpose of constructing a Railway, Tramway or Macadamized Road. I have after a careful examination, selected a line, of which the Plan and Section, together with the estimates accompany this Report.

The distance between the Port of Belleville and the Iron Works at Marmora, by the route laid down, is $32\frac{3}{4}$ miles. Its southern terminus connects with the Bay of Quinte, at Belleville, where there is a secure Harbor, and depth of water sufficient for any vessels navigating the Lakes. From the Harbor, the line runs for one mile in length, through Pinnacle Street, one of the principal Streets of the Town, (which course is approved of by the Corporation,) and crosses the River Moira, at its junction with that street. From this point the road runs in a northerly direction, keeping the valley of the Moira River, and passes through the Village of Smithville, to the Oak Hills, which is a continuation of the same range,

that is crossed by the Cobourg and Peterboro', and also by the Port Hope and Lindsay Railways. I have taken advantage of the course of a stream, which is supplied by the water shed from the hills, and have obtained a tolerably good crossing. The summit level at this point, is 262 feet above the Bay of Quinte. The ascent will be accomplished by means of two inclined planes, one of 1474 yards in length, with a rise of one foot in each one hundred and sixteen feet, or forty-five feet to the mile; and the other of 1540 yards in length, with a rise of one foot in each ninety-one feet, or fifty-eight feet to the mile. From the Oak Hills the line diverges to the eastward, to secure favorable gradients, and passes through the Township of Huntingdon, crossing the Macadamized road, from Belleville to Madoc, at a point about 8 miles distant from the Village of Madoc. From this latter point, the direction is north westerly, through the Townships of Rawdon and Marmora, to the terminus at the Iron Works, situated on Crow River, which river is navigable to Marmora Lake, on the shores of which the ore beds are situated.

The summit level is 29 miles from Belleville, and is 400 feet above the Bay of Quinte, which gives an inclination from north to south, or in the direction of the movement of the bulk of the traffic, of one foot in each three hundred and eighty-two feet, or fourteen feet to the mile, a circumstance favorable for the transport of heavy freight. There are but two exceptional gradients; one of one foot in each ninety feet, for 880 yards, and one of one foot, in each eighty-six feet, for 726 yards in length; the gradients going south, with the exception of the two just mentioned, would compare favorably with any existent line of Railway; while those going north, with the exception of that at the Oak Hills, in no case exceeds one foot in each one hundred and six feet.

The cuttings are through clay and limestone rock, of the latter there is not much, and in most cases it would be easily moved, the total quantity is 439,025 cubic yards, or an average quantity of 13,405 cubic yards per mile. I have in some instances curved to avoid as much as possible heavy cuttings.

The width of cuttings and embankments at formation level, is sixteen and one half feet, a slight increase to the width in cuttings would be advantageous, as it would render them less liable to the effects of snow drifts and ice in the winter season. I have in this case, as well as every other portion of the work connected with the line, avoided as much as

possible, increasing the construction estimate, as I trust the returns from the road will warrant any slight additions that may be found requisite.

In no case is there a curve with a less radius than 2,015 feet, which only occurs once, there are two with a radius of 2,605 feet each, but they are immediately adjoining the Town of Belleville, and being near a terminus, even with a less radius would not be objectionable, the usual curvature is from 3,000 to 4,000 feet radius.

It will be necessary to construct a Wharf at Belleville, as those at present in use are too slightly constructed to bear the great pressure exerted by a quantity of Iron Ore or Pig Iron. I have estimated for one of 600 feet in length, and 24 feet in width, to be formed of Timber Crib work, and filled in solid with stone. It would be advisable to adopt measures to facilitate the loading of vessels with Ore, either by forming an inclined plane or a travelling crane, by which means the box could be at once lifted from its truck, and its contents deposited in the hold of a vessel, thereby effecting a saving of both time and labour.

I have estimated for a sheet iron girder bridge over the River Moira, the total length to be 200 feet, divided into three spans of 60 feet each. The difference in cost between a wooden and iron superstructure is more than compensated for by the durability and safety of the latter over the former. No other streams of any magnitude have to be crossed, and but one road crossing will require a bridge.

The culverts will not be more numerous than is usually required for such works.

The Station buildings are of the plainest description. Those at Belleville to be of Brick, and the others, that is to say at Smithville, Madoc Road and Marmora, to be mere temporary sheds, sufficient to protect goods or passengers from the inclemency of the weather. The engine stable is sufficiently large to accommodate four Locomotives, and is provided with a Turntable. As the great bulk of the traffic of the line is expected to be in Iron Ore, Pig Iron, Marble and Lumber, extensive sheds or station accommodation is not required.

The estimate includes ballasting to a depth of eighteen inches, and as some of the cuttings are through gravel hills, it can be done at a reasonable cost.

Ties of Cedar, Tamarac or Oak, can be procured at short distances from the proposed line, and at a reasonable cost. It is proposed to place them 2 feet 6 inches apart, from centre to centre.

It would not be advisable to lay rails weighing less than 50 lbs per yard, of a T pattern, secured to the ties with cast iron chairs weighing from 18 to 20 lbs each, and spiked down with 6 inch spikes. The cast iron chair, although more expensive than the wrought iron one, is better adapted for a light rail and a heavy traffic. Although a rail weighing 50 lbs to the yard, is lighter than is generally adapted now, yet I consider they will be sufficient for the light Engines, and the slow rate of speed required for the purposes of the Road. The general surface of the Road being a descendant gradient in the direction of the movement of the major part of the traffic, but a small expenditure of locomotive power will be required, therefore light Engines may be adopted, and a saving effected in the wear of the permanent way.

Sufficient allowance has been made for Sidings.

The rolling stock will be of the cheapest description, being for the most part mere Trucks; the body of the Truck should be made of Boiler plate, with handles attached for the purpose of lifting the box on or off the Truck, by the assistance of a Crane, the bottom to drop down by means of hinges, similar to the shovel of an excavating machine. By this means but little time would be lost in loading or unloading, and an Engine would not be kept standing with steam up. The estimate does not include the wrought iron boxes, but merely the carriages for them. It would be the duty of parties supplying the Ore to furnish their own boxes.

The opening up of the northern part of the County of Hastings, would be not only a Sectional, but a great Provincial benefit. Situated as Marmora is, 32 miles from any port, without any means of communication, except that afforded by a cheaply constructed and insufficient Macadamised road; the expense of hauling over which, prevents the possibility of a remunerative trade being established, and that which might be made to form a large source of revenue to the Province, is rendered comparatively valueless.

The cost of carriage by waggon, from Marmora to Belleville; is at present about nine pence per ton per mile, while by a properly constructed

Railway, the cost would but little exceed one penny and three farthings per ton a mile. The time occupied by waggon, is 24 hours in going and returning, while by Railway it would be but 4 hours.

The Manufacture of bar iron which is now successfully carried out, and specimens of which have been converted into Steel in Sheffield England, and pronounced equal to either Swedish or Russian iron, which commands in the English market from £30 to £35 per ton, is at a cost which must prevent its ever becoming as it should be, one of the staple commodities of the country, from the great expense attending the hauling of bituminous coal from Belleville, its nearest Port.

The capabilities of the Marmora and Madoc Ores, for the manufacture of superior Iron and Steel, has now become a matter of certainty. Mr. Hunt, Chemist and Mineralogist, to the Geological survey, in his report for the year 1855, addressed to Sir W. R. Logan, speaks of the Ores lying north of the St. Lawrence, as being of the purest and richest description. Many of the magnetic and hematite Ores of Canada, are almost chemically pure, such are those of Marmora, Madoc, &c. He also states, that with the new and economical processes of 'Chenot,' a valuable Steel Ore will be sought for, even in a distant country, and may be advantageously transported in a crude state, to the localities where fuel and labor are most available. Mr. Evans, one of the Directors of the Marmora Iron Company, on a recent visit to England, had some Steel manufactured from Marmora Iron, and states that 35,000 tons of Pig Iron would be annually consumed in Sheffield alone, if it were possible to supply them with that quantity.

The encouragement of the Ore trade, would be the means of enabling the Company to manufacture more largely, and all that is required, is facility of transport of the raw material, for the establishing of Blast Furnaces in any frontier Town in the Province, which manufacture if encouraged by a protective duty, would become a source of industrial wealth, and afford employment to numerous operatives. Mr. Evans, also states in a communication to me on the subject, I speak advisedly when I say that we could sell in the United States alone, 50,000 tons of Ore yearly, and I have now before me applications from several parties, both in England and France, for Ore, which if a Railway were in operation, connecting Marmora with the navigable waters of the St. Lawrence at its nearest point, we could with profit supply, and the demand in England alone,

would I believe only be limited by our means of exportation, and the parties in France who are in correspondence, are those who have the monopoly of 'Chenot's' patent so favorably mentioned in the last Geological report; they cannot use any other than the rich Ore of Marmora, or Ore of a similar quality, and they write me they are willing at once to contract for 14,000 tons a year, at a fair price, and that their wants will increase yearly. It will thus be seen that the traffic for the road is not a speculative one, and that the Ore business alone, would warrant a fair return for the capital invested in the construction of the Road.

I would not wish to be considered as drawing an invidious comparison between the proposed Marmora Road, and other feeders of the Grand Trunk already constructed, but if those lines calculated as they all are, to open up and develop the resources of their several localities, have claims, which are considered of sufficient importance to bring them under the favorable notice of the Government, this line has still stronger claims, from the fact of its being the first steps towards the establishing of a most important manufacture, which is intimately connected with the well being of the Province.

The absence of Bituminous or Anthracite coal, may be fairly considered as a serious drawback; but when it is taken into account, that the Marmora Company have the right to cut wood on twenty thousand acres of land, and that each acre produces, on an average 35 to 40 cords of wood, and that each cord of wood will yield about 45 bushels of charcoal, each ton of Iron requiring 135 bushels of charcoal or 3 cords of wood in its manufacture, it would require 70 years to exhaust the present stock of fuel, manufacturing at the rate of 10 tons per day, a length of time to warrant the assumption of the regrowth of the forest. The Ore of Marmora being much superior in quality to any found in connection with the coal measures, will insure its being an article of commerce, and will facilitate the importation of coal, as a return cargo.

The suggestion of rolling Railway Bars by convict labor at Kingston, which I suppose has already been brought under your notice, is entitled to consideration. By a mixture of about equal parts of Marmora Iron and old rails, very superior bars may be produced. The quantity annually required for the Railways in operation in the Province, will be very great, and would not only form a source of Revenue, but would employ

convict labor in a manner not at all interfering with existing interests, and would remove a cause of serious discontent among the operatives of the different mechanical arts.

The Townships of Thurlow, Sidney, Huntingdon and Rawdon, through which the proposed line passes, are well settled, and good agricultural Townships; their assessed value, together with Marmora, amounted in 1856, to two millions six hundred and sixty-three thousand three hundred and twenty-four dollars. There are in Belleville and its environs six large Flouring Establishments, which are supplied with wheat principally from those Townships; in addition to which there are similar establishments at Stirling, Madoc and Marmora, and Wallbridge's Mills, the latter having been erected at a great cost, is evidence of the importance of the trade. The quantity of Flour exported from Belleville in 1855 and 1856, was nearly 100,000 barrels, each year, besides 10,000 bushels of coarse grain.

The Lumbering establishments situated at Belleville, and on the River Moira are very numerous; they, as well as the Trent Mills, are supplied chiefly with logs from the country lying north of Marmora and Madoc, and as there are great facilities for manufacturing lumber at Marmora, a large business for the road in that article, can confidently be calculated on.

The amount for passenger traffic will exceed that of my return; there are at present, five daily stages employed in this business; the new Hastings Road Settlement, the villages of Madoc, Marmora, Stirling, Smithville, and Canifton, affording remunerative employment to each, in addition to which, the impetus given to the Iron Trade, by the construction of the Road, will have the effect of increasing the number of passengers, so that the present number of persons traveling, is no criterion of the future amount, as facilities for traffic always increase traffic.

There is certainty of a large business being created by the carriage of Marble, with which that region abounds and a building recently constructed in Belleville, of that material, is satisfactory evidence of its adaptability to the purposes of ornamental architecture.

In the selection of the route above described, I have carried out as nearly as possible, the instructions I was honoured with by the Commissioners; namely, to select the most eligible track for a Railway, Tramway or Macadamised Road, suitable for the traffic contemplated between the Village of Marmora and the Bay of Quinte, at Belleville. By referring

to the estimate it will be seen that there are no engineering works of any magnitude, and that I have carried out the strictest principles of economy, consistent with the effective working of the line.

To secure local advantages and to give facilities for the developing to the mineral resources of a greater area of Country, a line might be adopted, keeping to the eastward of the present one. By following up the valley of the Moira River, and passing through the Village of Tweed, in the Township of Hungerford, from thence passing as close as practicable to Mr. Flint's new Village of Troy, (where I am given to understand there are valuable Marble Quarries) to Madoc, where there are extensive beds of Iron Ore, and also Marble Quarries which are at present, partially worked, from Madoc the line might be taken as direct as possible to Marmora. Of the engineering features of the route, I am not in a position to give an opinion, as I have not made any surveys. The distance, by this route, would be increased by about ten miles.

The construction of two branch lines, from the one at present selected, would add materially to the resources of the Road, one to Stirling, of about five miles in length, and one to Madoc, of about eight miles in length, the latter branch would not only develop the Mineral resources of the Township of Madoc, but would be a great assistance to the settlement of the Country, along the line of the now Hastings Road, recently constructed by Government. The increase of the estimate by the building of these lines would be about fifty thousand pounds, but the traffic returns, would be materially increased particularly in passengers and light goods.

The working expenses of a line of the character of the proposed Belleville and Marmora one, will be small when compared with others, which derive their chief support from passenger and goods traffic. It will be necessary to keep but few officials, and the slow rate of speed required, and the facility of obtaining fuel, will enable it to be worked, at a comparatively trifling cost. I have estimated the working expenses at 33½ per cent. of the gross earnings.

Of the extent of the traffic of this line, it is difficult to form even an approximate estimate, as the quality of the Ore is such, as to warrant its becoming an article of export, and the supply being as it is, practically

speaking unlimited; the assumption that fifty thousand tons of Ore will pass annually over the road, is rather under than over the quantity that may fairly be calculated on.

In the foregoing remarks I have been induced to dwell at some length on the importance of the undertaking, from a firm conviction that it is one fraught with much ultimate benefit to the Province.

A properly constructed Macadamised Road, would no doubt prove very beneficial, but yet I trust the importance of the trade, may lead the commissioners to the consideration of the advantages to be obtained by the construction of a Railway or Tramway, as the only means of establishing a trade in Iron Ore, and of developing the the vast Mineral resources of this favored locality, and the opening out of a new branch of industrial wealth.

I have the honor,

to be Sir,

Your obt. servt.,

ROBT. L. INNES,

Civil Engineer.

Belleville, May 1st, 1858.