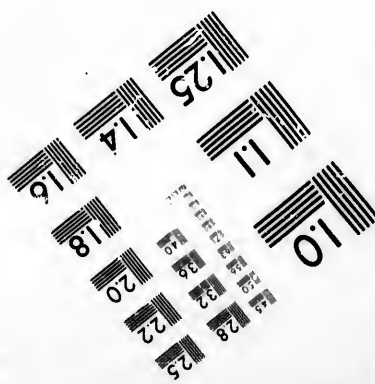
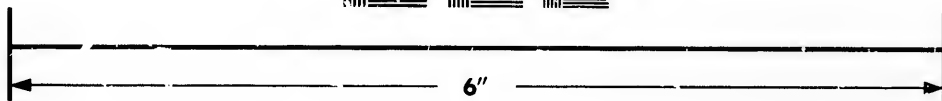
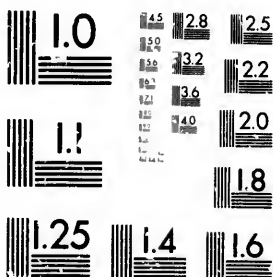


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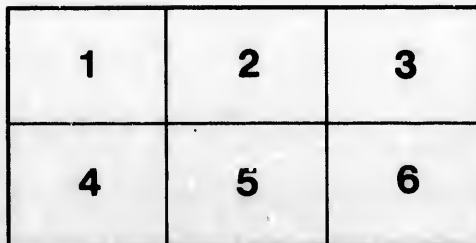
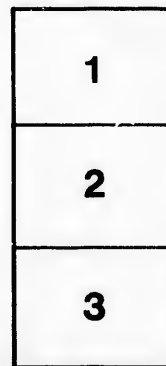
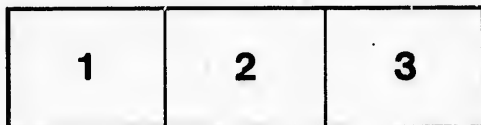
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**NORTH SHORE RAILWAY.**

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**HISTORICAL REVIEW**

**OF THE**

**GOVERNMENT STANDARD**

**BY THE**

**ENGINEER IN CHIEF**



**APRIL 6th, 1875.**

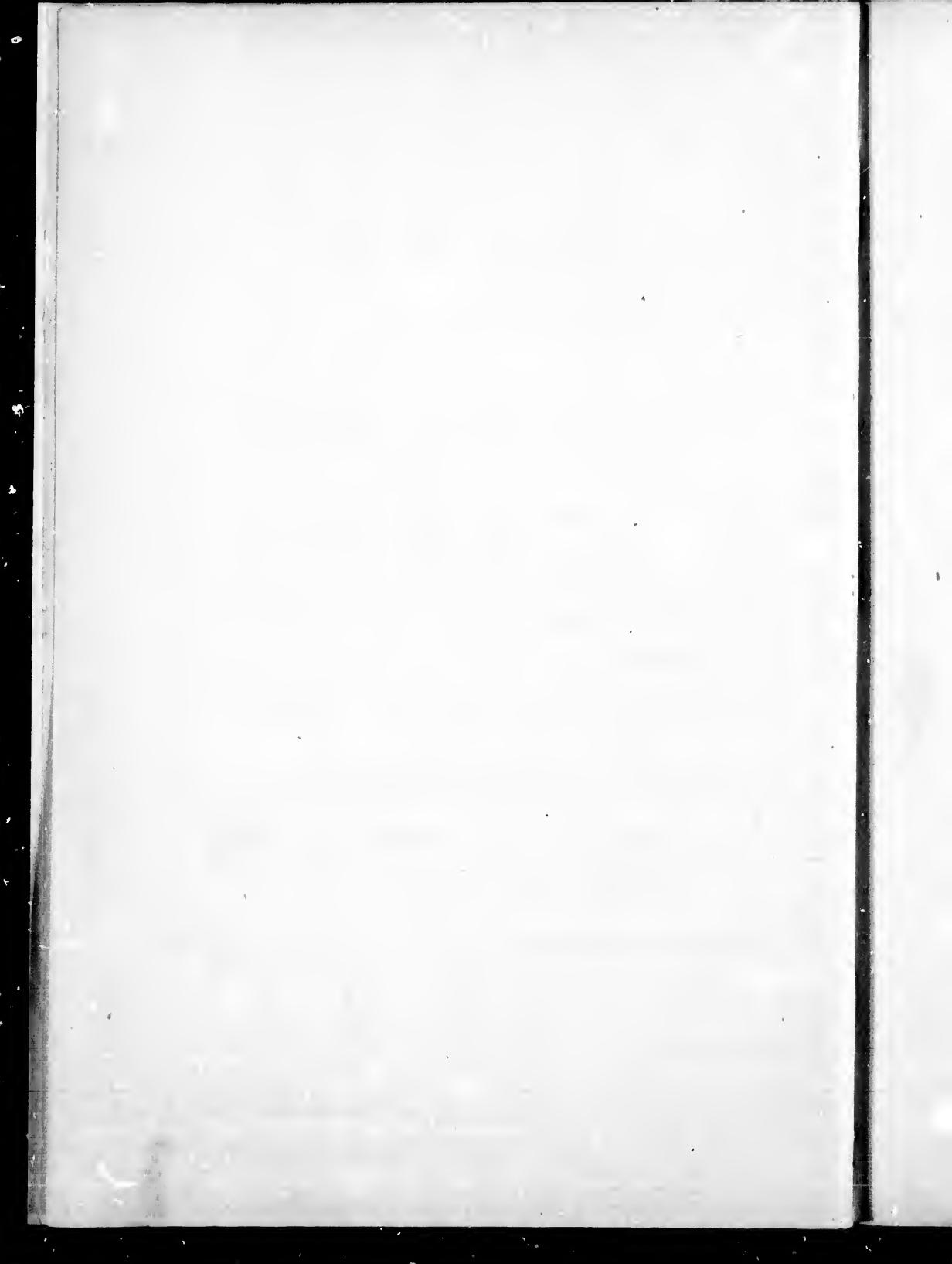
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NORTH SHORE RAILWAY.

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HISTORICAL REVIEW

OF THE

GOVERNMENT STANDARD

BY THE

ENGINEER IN CHIEF.

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OFFICE OF THE ENGINEER IN CHIEF,

Quebec, April 6th, 1875.

Inasmuch as the Provincial Government, through its Engineer, has decided that some of the work already executed upon the Main Line, between the City of Quebec and the St. Maurice River, is not in accordance with the requirements of a *first class Railway*; and also, that the plans heretofore contemplated and in part executed for some of the mechanical structures, are not such as will secure that degree of strength and stability which is considered necessary for a *first class Railway*, such as is contemplated by the charter of the Company, and the subsequent Acts of the Provincial Parliament.

And inasmuch as the Government, through its Engineer, has undertaken to indicate, at various times, and in various reports, during the past few months, the *Exact Standard of Excellence* at which the Railway and its various appurtenances must arrive, before the Railway Company will be entitled to receive the Government aid upon which it so largely depends for the prosecution of the enterprise, I have considered the matter of sufficient importance to justify me in placing before the Board of Directors at the present time, a full statement of the rise and progress of the Government Standard up to its present stage of developement, in order that the Board may be prepared to meet any future emergency which may be entailed upon the Railway Company by the action either of the Provincial Government or the Contractor.

In order that the matter may be fully understood in all its details, I will proceed to give :

*First.*—Such extracts from the different Acts of the Government as may be regarded indicative of the character or *class* of Railway to be constructed.

*Second.*—The views which have been entertained and promulgated by the Government Engineer from time to time through five successive stages of developement, respecting the proper standard for the work.

*Third.*—What all parties have agreed to do, and have done about it.

*Fourth.*—A careful synopsis of the Government Standard.

*Fifth.*—Remarks, explanatory and interrogatory.

*Sixth.*—Further views of Mr. Walter Shanly upon Railway Standards.

*Seventh.*—Remarks in conclusion.

# I

## THE CHARACTER OR CLASS OF RAILWAY ORIGINALLY CONTEMPLATED BY THE GOVERNMENT.

The act of December 24th 1870, granting lands by the Government in aid of the road ; provides that these lands shall be so granted when : "The said railway shall have been completed and put in operation *to the entire satisfaction of the Lieutenant Governor in Council.*"

"The Quebec Railway Aid Act of 1874," provides that the subsidy or loan of one million two hundred and forty-eight thousand, six hundred and thirty-four dollars, shall be granted upon the condition that :

"The Main Line of said Railway *shall be a first class road*, and shall have been accepted as such by the Lieutenant-Governor in Council, on the report of the provincial railway board."

The same act also provides that :

"Notwithstanding anything to the contrary contained in this act, it shall be lawful for the Lieutenant-Governor in Council, on satisfactory proof that the Montreal Northern Colonization Railway Company, or the North Shore Railway Company, have made complete financial arrangements, or entered into contracts in good faith, for the construction of their respective lines of road, and that the work thereon is in active progress, to advance, from time to time unto either or both of such railway

companies, out of the grant or loan, to which they would be entitled under this act, a sum having such proportion to the total amount of the grant authorized herein, *as the progress of the work*, and the security taken by the Companies, for the completion thereof, may then seem to the Lieutenant-Governor in Council to justify."

The following order in Executive Council was passed on June 27, 1874.

"1. That the Government should issue to the said Railway Company the bonds of the Province for one third of the *cash value of the work done on the said Railway as the work progresses*, the other two thirds to be paid by the bonds or stock certificates of the Corporation of Quebec, and the bonds of the said Railway Company in equal proportions.

2. *The amount of such cash value of the work, to be ascertained by the certificate of a Railway Engineer to be appointed by the Government.*

3. The above mentioned advances to be made in proportion of one-third, to the extent of \$500,000, provided the Government continues to be satisfied with the progress of the work, and afterwards to be continued in the proportion which will then be determined upon."

Referring to the foregoing conditions upon which the aid of the Provincial Government is granted to the road, it is important to observe that the only references to the *character or class* of the road, are contained in the act of December 24th 1870, granting *lands*; and in the "Quebec Railway Aid Act of 1874" granting a *money* subsidy, in aid of the road. And that each of these acts clearly indicates that no question will be raised upon that subject until after the road *shall have been completed*, and presented as such to the Lieutenant Governor in Council.

It should further be observed that the only conditions contained, either in the "Railway Aid Act," or in the order in Council of June 27th 1874, respecting the ratio in which the Government aid shall be advanced to the Railway Company, are made to depend entirely upon the "*progress of the work;*" and the "*cash value of the work done upon the said Railway as the work progresses.*" And that nothing whatever is said, or even remotely referred to, respecting the details connected with the character of the work. All these matters having been left for the final determination of the Lieutenant Governor in Council, after the completion of the Railway.



## II.

### VIEWS OF THE GOVERNMENT ENGINEER RESPECTING THE PROPER STANDARD FOR THE RAILWAY.

In October 1874, after the appointment had been tendered to, and declined by Mr. Walter Shanly, on account of its embracing the examination of the "Montreal Northern Colonization Railway," Mr. A. L. Light, a member of Mr. Sandford Fleming's Staff upon the Intercolonial Railway, was appointed by the Government as its "Railway Engineer to ascertain and certify to the amount of such cash value of the work, &c."

Mr. Light started from Quebec on the 16th November 1874, to inspect the work as far west as the St. Maurice River, or the west end of section No. 75, beyond which point no work had been commenced.

Mr. Light was accompanied over the work by Messrs. Lindsay and Hamlin Resident Engineers; and he finished his inspection on the 20th November, and returned to Quebec.

On the 25th November 1874, Mr. Light submitted a report to the Honorable P. Garneau, Commissioner of Agriculture and Public Works, from which the following extracts are given as indicating:

#### *Government Standard No. 1.*

"In accordance with your instructions bearing date 14th November desiring me "to proceed forthwith to

examine the quantity of work done on the North Shore, and Northern Colonization Railways; and also the quantity of materials furnished for the said Railways, and see if the works are well done, substantial and permanent in character, and if they are in accordance with the specification, and progressing in a satisfactory manner."

"I have now the honor to report that I have thus far made a careful inspection of that part of the North Shore Railway, between Quebec and Three Rivers; this being as far as any works are in progress; and have checked over the amounts of work done, and examined the material delivered."

"A return has been made by General Seymour, the Engineer in Chief of the Company, of all work done, materials delivered, and expenses incurred up to the 1st November 1874, the value of which he estimates at \$426,254.00 *in cash*."

Mr. Light then proceeds to analyze the different items making up the total amount of this estimate, in relation to which he makes the following remarks:

"The prices seem equitable at which the foregoing items have been computed; and are in accordance with the *pro-rata* Schedule of the whole work, which has also been prepared by the Engineer in Chief."

"The items in the estimate sheet, are consecutively numbered in the margin from 1 to 28, for further reference."

"To be brief, the calculations of quantities, and examination of materials delivered and vouchers for payments made, verify all items in the aforesaid estimate from number 3 to 25 inclusive. *They may therefore be dismissed from further discussion. They admit of no*



*doubt of the propriety of the Government paying their proportion. They amount to \$201,396.00."*

"The balance of the estimate \$224,858.00 has been expended in five items, viz: Engineering, Right of way, Expenses of Railway Company, General Supervision of Work, and Contingent Expenses. These, *while forming equally portions of the general expenses of constructing a Railway*, admit of some discussion, and it is therefore proposed to examine them more fully."

After analysing the above five items, and explaining the manner and the circumstances under which the expenditure connected with them have been incurred by the Contractor and the Railway Company and fully endorsing the 2d item "Right of Way," amounting to \$18,143.60. Also the 26th item, "Expenses of the Railway Company," amounting to \$23,704 22. Also the 27th item "General Supervision of Work," amounting to \$23,921 14, thus making an aggregate of *unquestionable* items in the estimate of \$267,165 00, Mr. Light closes this branch of his investigation with the following remarks:

"These five items, not being engineering questions it remains to decide what proportion should be now allowed. It is certain that Railways not built upon strictly cash principles, *cannot be constructed without some preliminary expenses of this kind*. The question arises, are they excessive? The engineering has been largely augmented by the length of time the account has been running. It should be remembered, however, that besides work in progress, the line to Montreal has been located. Still, there is not at the present time, work to show so large an expenditure to have been necessary."

"The items, Right of Way, Expenses of Railway Company, and General Supervision of Work, are moderate, and reflect much credit on the economical management of the North Shore Railway."

“The estimate to the 1st November 1874 is \$426,254 at *cash* rates, supposing the whole allowed; but inasmuch as the whole contingent fund, \$38,426 is partly composed of the \$14,534 *refused by the Chicago Contracting Company*, and the balance consisting of their own expenses, and the expenses of others in Europe, which so far has been of little use, the Government may be disposed to object to the item, more especially as the drawback retained by the contract is but 10 per cent upon the last month's work *only*; and not as is usual, on the whole work.”

“The same remark applies to the expenses of the Railway Company.”

“When the works are finished, the Government will doubtless pay the full subsidy, and the Company be reimbursed for all their outlay. *These items at this time, do not seem to come within my sphere to report on; the works not showing these expenditures.*”

The Government Engineer does not attempt to explain why he considered it proper to devote the first half of his report entirely to matters which were not embraced in his instructions; and in relation to which he says; *do not seem to come within my sphere to report on.* Neither does he furnish any valid reasons why the Government should refuse to pay its just proportion of an expenditure which he admits: “forms equally portions of the general expense of constructing a Railway.” Also, that “It is certain that Railways not built upon strictly cash principles, *cannot be constructed* without some preliminary expenses of this kind.”

The inference is quite clear, however, from his report, that the Government Engineer is of the opinion that the amount, \$14,534.00, “which was refused by the Chicago Contracting Company,” should be deducted

from the item of "Contingent Expenses." And also that the amount, \$19,303.28, which was incurred for Engineering expenses in 1871, for which there is in his opinion "nothing to show," although it was subsequently assumed and paid by the Chicago Contracting Company, should be deducted from the item of "Engineering."

These two deductions would amount to \$33,837.28, which being deducted from \$426,254.96, the amount in cash values of the estimate up to November 1st 1874, would leave \$392,417.68, of which the one third, payable by the Government, would amount to \$130,805.89.

If one might be permitted to judge from the language of the "Order in Council," which refers to "the certificate of a Railway Engineer" respecting "the amount of such cash value of the work, &c.," it would certainly appear that the labors of the Government Engineer might very properly have terminated at this point in his report, after having affixed his "certificate" to something like the foregoing statement. And, judging from the nature of the instructions from the Honorable the Commissioner of Public Works, it would also appear that the matters treated of up to the present point in his report, in the terse language of Mr. Light "do not seem to come within my sphere to report on."

But without attempting to explain these apparent inconsistencies, the Government Engineer devotes the remainder of his report almost entirely to the matters especially referred to in the instructions from the Honorable the Commissioner of Public Works, as follows:

"I now proceed to touch upon the second part of your instructions, viz: whether the works are well done, substantial and permanent in character, and if they are in accordance with the specifications, and progressing in a satisfactory manner.

It is proposed to answer the second query first. The works generally are well done, with some exceptions afterwards mentioned and in accordance with the specifications and progressing in a satisfactory manner.

The clearing and grubbing is nearly finished, with the exception of some brush and logs, which in the hurry to keep in advance of the grading has in several places been thrown on to the sides of the road.

Some 9 miles of fencing is in position but it is not yet perfect in its structure.

Roundly, half of the grading or thereabout, such as it is, between Quebec and Three-Rivers is completed.

The foundations of several important bridges are laid, and others in progress to enable the Contractor to commence the masonry early next spring.

The masonry in several of these foundations had been covered up for the winter, so that I could not judge accurately of their character; but a pier and an unfinished abutment on the west side of Jacques-Cartier River, so far as could be judged from the outside, shewed good workmanship, and is built of excellent limestone. Stone delivered for several other structures is of the same durable character.

The question whether the works are substantial and permanent in character in all respects can be answered in the affirmative with two exceptions, viz: the earth works constituting the road-bed are insufficient although in accordance with the profiles.

The bridges are to be of wood, the latter also are agreeable to contract, and the plans prepared for them are generally arranged for good work.

The alignment is good, and will generally admit a high rate of speed.

The *inclination* of the gradients is generally all that can be desired, but they are laid *too low*. The "formation level" or top of road-bed is frequently beneath the surface in shallow cuttings from one to three feet deep, which a gradient on a higher level would entirely pass over, the above occurring in an exceedingly easy and smooth country. This is particularly noticeable between the 30th and 40th miles from Quebec, where the line is in cutting for a considerable portion of the distance.

The "formation level" or top of road-bed is intended to be 1 foot, 10 inches below rail level, and from an average of measurements beginning at the race course near Quebec, it ranges from 11 to 12 and 13 feet wide to about half way to Three-Rivers, from which point west it is generally 15 feet wide.

The cuttings at the same level average from 17 to 18 feet wide, including the ditches where finished.

In a considerable number of these cuttings, the sub-contractors to save hauling the earth into embankment or from having none to haul it into; have wasted the material on the sides of the cuttings, thus virtually increasing their depths. These cuttings will be found perfect snow traps if this waste earth is not removed.

For a first class railroad of 4 feet 8½ inches gauge, the embankment at "formation level" should not be less than 17 feet wide, and in this climate, the cuttings should not be less than 24 feet.

Apart from the question of the minimum width that will just support a properly ballasted track with train upon it, where human life is at stake, a slight margin for safety is generally allowed in additional width of road-bed to resist the wear and tear of time, and prevent trains from rolling over the sides of embankments when they run off the track, as they frequently do on the best constructed Railways.

The "formation level" between here and Three Rivers should generally also be raised up bodily from one to three feet throughout its entire length, with the exception of the river crossings, and at five or six points where cuttings of medium depth occur.

It is perhaps superfluous to discuss here what is generally known to Railway men conversant with this climate, that in a country subject to a heavy snow fall like the region between Quebec and Montreal, a railway laid well above the natural surface of the ground upon embankment, will rarely be impeded with snow and ice, while where cuttings are made, unless especially protected with snow sheds and fences, they will drift in exposed places.

There are some districts where cuttings must of course be made to overcome irregularities of surface, but in the portion of country between Quebec and Three Rivers there are only five or six cuttings of any magnitude, worthy of the name, and these are composed of sand; here the grade necessarily passes beneath the surface, but a large proportion of the smaller cuttings may be passed over at a moderate cost.

As a rule, cuttings in this climate should be avoided as much as possible; and where they must be made, they should be wide enough to admit thorough drainage to prevent the accumulation of ice over the rails, the most fruitful source of danger; this is especially necessary on first class lines intended mainly for passenger traffic.

The length of the North Shore Railway is 158,2 miles. The cash estimate of the Engineer in Chief is \$4,066,660.00 or nearly \$26,000.00 per mile. Of this \$2,112.00 per mile only is appropriated to forming the road-bed, the foundation of the whole, exclusive of masonry and bridging, or about 8 per cent of the average cost per mile.

The value of this grading I would propose to double, certainly 50 per cent at least, should be added to the quantities of earth work.

In the Miramichi district of the Intercolonial Railway, the easiest part of the road, the average cost of grading alone was \$10,000.00 per mile, or about 25 per cent of the total average cost per mile of the road.

In the European and North American Railway and other first class lines of the Maritime Provinces, a very similar amount per mile was spent upon the grading, and the result shows the wisdom of the policy, as those roads are worked with marked regularity, and the wear and tear is trifling, in fact less than other railways in America similarly situated, especially in regard to the snow difficulty.

The appropriation in the Schedule for track, on the other hand is \$7,878,00 per mile, and the rolling stock \$2,720.00 per mile, being good and sufficient prices; it should however be borne in mind that both are very perishable, and the wear and tear upon them is greatly lessened by the perfection of the road-bed; it is safe to say that each will last 25 per cent longer on a good than a bad road-bed.

From the exceedingly easy nature of the country traversed by the North Shore Railway, a first class road-bed can be obtained for \$4,000 per mile, or about 16 per cent of the entire average cost, or less than half what the same would cost in the Maritime Provinces; under those favorable circumstances nothing but a first class grading should be made on a line connecting two such important Cities as Quebec and Montreal, where it is essential that communication should be kept open every day in the year.

Should it be impracticable to make further appropriations to meet this additional expense, it would be



better to make corresponding reductions in the appropriations for buildings and rolling stock ; these items can be increased at any time when the traffic requires ; but an indifferent road-bed, with track and fixtures completed on it, is almost incurable.

With regard to the wooden bridges required by the specifications, though good of their kind, they likewise are perishable, besides being very liable to be destroyed by fire. For these reasons it is desirable they should be of iron.

The bridge openings it is probable can be reduced in width on the portion of the line passed over ; if so, the shorter iron spans will cost but little more than the proposed length of wooden superstructure. The masonry and earth works however would be increased, but this would be on the side of safety and ultimate economy.

Iron bridges as a rule have been adopted in the Dominion, on first class lines ; and wherever from motives of economy, wood has been used, it has been found a constant expense and regret to all concerned, that iron had not been used at first.

The Contractor of course cannot be expected to make radical changes without compensation. Should they however be made, the additional cost will be found inconsiderable, compared with the benefits derived.

Even with these additions, the North Shore Railway will be made, fully 25 per cent cheaper, than any line of the same class in the Dominion ; and there will be none capable of being worked with greater safety, economy and despatch ; and so far as construction is concerned, it will then be, in every respect, a first class Railway."

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The following letter from the Honorable the Commissioner of the Provincial Board of Works, to the President of the Railway Company, enclosing a portion of the foregoing extract, calls the attention of the Company to the defects alluded to in Mr. Light's report, and gives a very clear intimation that if these defects are remedied, it will result in "Making the North Shore Railway what it ought to be, a true first class road."

(Translation)

TO COL. W. RHODES,

President North Shore Railway Company.

SIR,

I have the honor of transmitting you with the present an extract from the Report of an inspection made by Mr. Light, the engineer chosen by the Committee of Railroads, of the Executive Council of this Province, to examine the works in course of construction on the line of the North Shore Railway, and of the materials to be employed for the construction of this road.

In transmitting you this extract, I deem it necessary to draw your attention to certain defects which Mr. Light thought necessary to point out to the government in the works in course of construction between Quebec and Three Rivers.

The earth works or embankments which serve for the Road Bed, are in his opinion insufficient. Moreover the formation level or top of road-bed is not sufficiently raised, and is below the level of the land, in cuttings not exceeding one to three feet in depth. This remark applies especially to the section situated between the 30th and 40th miles from Quebec, where the line crosses smooth land, and where however a continual cutting for a considerable distance was deemed practicable.

And as Mr. Light remarks, that a road built upon such a low level cannot but be subject to many obstructions during winter, caused by the accumulation of snow and ice on the track, and he suggests to raise the surface of the road or road-bed from one to three feet through its entire length between Quebec and Three Rivers, except the river crossings, and at five or six points where the cuttings are of minor importance. The reasons he advances in support of this suggestion will of themselves attract (recommend) your attention.

At many points on the line the sub-contractors, after having made the excavations, instead of employing for the road-bed the earth which they had taken out, wasted it along the line, thus adding unnecessarily to the depth of the cuttings. Of course this waste should be removed.

From Quebec half way to Three Rivers, the width of the formation level or top of road-bed is on an average of 11 to 12 feet and 13 feet, and from this last point it assumes an uniform width of 15 feet. As you shall see by the following extract, Mr. Light openly expresses in his report the opinion that, for a first class railway, with a gauge of 4 feet 8½ inches, the embankment of road-bed should not be less than 17 feet wide at summit, and with our winters, the cuttings should not be less than 24 feet wide. This opinion like the preceding one is very strongly stated, and should be taken into serious consideration.

According to the calculations of the Chief Engineer of the Company, the total cost of the road will be \$26,000 per mile; and on that he appropriates only the sum of \$2,112 per mile for road-bed, which is the base of all the work (not including bridges and masonry); that is to say, about 8 per cent only of the total cost of each mile. This appears altogether insufficient to Mr. Light; and he recommends the employment of at least

\$4,000 per mile on the work of embankment, in order to make it first class work, while observing that in the Maritime Provinces, under less favorable conditions in truth as to the inequality of the land, double that amount is employed in the road bed.

I draw your entire attention, and that of the Directors of the Company, to the several questions raised in this Report, in order to arrive at making the North Shore Railway what it ought to be, a true first class road, and I would be happy to learn, as soon as it is possible, what are the Company's intentions in reference to this matter.

I have the honor to be,

Your obedient servant,

(Signed) P. GARNEAU,  
Com. of A. & B. of W.

Quebec, 5th January, 1875.



Upon being furnished with copies of the above letter from the Honorable the Commissioner of the Board of Works, together with the extract from Mr. Light's Report, therein referred to, the Engineer in Chief prepared the following Review of the report of the Government Engineer, which was submitted to the Board of Directors, on the 14th January 1875.

Review by the Chief Engineer of an Extract from a Report made by the Government Engineer upon the character of the Road, under date of November 25, 1874.

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OFFICE OF THE ENGINEER IN CHIEF,

Quebec, January 14th, 1874.

MR. SECRETARY,

I have this moment received from you, a certified copy of a Resolution adopted by the Board of Directors at a meeting held this morning, as follows :

“ *Resolved*,—That the extracts from Mr. Light’s report placed before the Board, by the Hon. the Commissioner of Public Works, be referred to the Engineer in Chief of the Company, with request to make known to the Directors at their next meeting to-morrow, his opinion on the value of the remarks contained in these extracts.”

I had previously been favored, informally, with a copy of this extract, together with an intimation from the President, that I would probably be called upon by the Board, to express an opinion upon the subject ; and I had therefore taken measures to obtain such reliable information as might be useful in forming such opinion, and placing it in proper form before the Board of Directors.

Having had a somewhat extended experience in operating Railways, during the winter months, in the United States, particularly through the heart of the Rocky Mountains, during the construction of the Union Pacific Railway ; and having located the line, arranged the grades, and prepared the specifications and plans for this Railway with particular reference to avoiding difficulties from this source, so far as it could be done under

the present contract, and with the available means of the Company, I thought it desirable, first, to ascertain from some reliable and practical source, whether my own theory upon this question, as based upon the experience above referred to, could be relied upon, as applying to this climate, and to the circumstances connected with this particular road.

I therefore addressed a letter upon this subject, to Mr. A. L. Smith, of this City, whom I knew to be a very reliable man, as well as a practical Locomotive Engineer, who had had a large experience in meeting and overcoming snow difficulties upon the worst roads in North Western New York; and I also knew him to be entirely familiar with the climate and snow-fall of the country traversed by this road, as well as with the characteristics of the road, so far as they could be affected by this question. I also requested Mr. Smith, to confer with the Locomotive Engineers running upon that portion of the Grand Trunk Railway, between River du Loup and Richmond, and to ascertain whether their experiences coincided with his own.

The following are copies of my letter to Mr. Smith and his reply thereto :

CHIEF ENGINEER TO MR. A. L. SMITH.

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OFFICE OF THE ENGINEER IN CHIEF,

Quebec, January 9th, 1875.

DEAR SIR,

As you have had a large experience as Locomotive Engineer, in running upon railroads that are obstructed by snow during the winter months; and as you are quite familiar with the country, climate and snow-fall

between Quebec and Three Rivers, and also with the location of the line and arrangement of grades for this road between these points; I would thank you to give me your views as to the practicability of keeping the road when completed, open for business during the winter months.

I will also thank you to state whether on a level plain, and through an open country, where the embankment is taken from the sides, you would consider it essential that the top of the rail should be more than two feet above the natural surface of the ground, in order to avoid serious obstructions from snow.

Please state generally the result of your experience, observation, and inquiry with reference to snow obstructions; as to when, and under what circumstances, they are most likely to occur, and the most effective plan for avoiding them.

I would also like your views as to the best width of road-bed, at the base of the cross-tie, having reference to the items of drainage, obstructions from snow, and the safety of the passage of trains over the road.

Also, with reference to comparative safety in case of accidents.

Yours truly,

S. SEYMOUR,

A. L. SMITH, Esq.,

Chief Engineer.

Quebec.

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MEMORANDUM FURNISHED Mr. SMITH.

1st. What height above the natural surface of ground is it safe to put the track, so that an engine will run

through with on ordinary "pilot," and clear the track of snow.

2nd. What depth of cutting (if filled with snow) will an engine go through with an ordinary "snow plough" without getting "stalled."

3rd. What direction does the wind blow when it drifts the snow the worst ; and will "snow fences" prevent the snow from drifting on the track.

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MR. A. L. SMITH TO THE CHIEF ENGINEER.

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Quebec, January 12th, 1875.

GENERAL SEYMOUR,

North Shore Railway Company.

SIR,

In answer to your favor of the 9th instant, requesting me to state my views as to the practicability of keeping the North Shore Railway open for business during the winter months ; and in answer to your various queries, I beg to reply, that where the line of road runs through only small cuttings, fences of from six to eight feet in height generally serve as a sufficient protection to keep the track comparatively clear of snow. Where the cuttings are of greater depth and in exposed situations, it will be necessary to erect fences from six to twelve feet high. In answer to your question as to "whether on a level plain and through an open country, where the embankment is taken from the sides, it would be essential that the top of the rail should be more than two feet above the natural surface of the ground, in order to avoid serious obstructions from snow." I consider that the elevation of



two feet is perfectly safe, and that no greater height is necessary ; because in all my previous experiences, on both American and Canadian Railways, I have never seen an engine or train stalled when on a level plain or open country, simply from the fact that the snow in such places only falls its natural depth ; and it is only in cuttings where the large and obstructive snow drifts accumulate. From the many consultations and conversations that I have had with the practical men of the Grand Trunk and several other Railways, which run through a country precisely similar in climate and character, to the one between Quebec and Three Rivers, I find that their opinions coincide with my own, namely, that the elevation I have already mentioned renders the running of trains and communication perfectly feasible, because the average snow fall in this country is hardly ever more than three feet. Any schemes for the elevation of the rail track above the ordinary snow level, would not only entail enormous expense, but would be quite unnecessary, because any snow plough of the usual dimensions could, without difficulty, throw aside the accumulation of snow when not deeper than stated above.

In answer to the first question, I am of the opinion, as mentioned in the first part of my letter, that a track constructed two feet above natural formation level would meet all the requirements of the case, and afford a clear and uninterrupted passage for engines, provided with such winter pilots, similar to those in use on all North American Lines of Road, during the winter months.

Question No. 2.—What depth of cutting (if filled with snow) will a Locomotive go through with a snow plough (ordinarily) without getting “stalled?” In answering this I presume that ordinary snow-storms are intended ; and I believe that in cuttings of three or four hundred feet in length, the Locomotive could make its way through from four to five feet thick of drift, which height is very rarely exceeded. It sometimes happens that the



wind catches up sand as well as snow; and this, when mixed, forms a conglomerate mass that can only be removed by manual appliances, but this is unusual.

Question No. 3.—What direction does the wind blow when it drifts the worst, and will snow fences prevent the snow from drifting on the tracks? I consider that the wind by which snow drifts attain their greatest volume is the North-West wind, but there are frequently severestorms from the North-East and East; these winds that come from a Northern district naturally bring with them a good deal of snow. Fencing will, I believe, efficiently serve all purposes for the protection of the track, although it occasionally happens, when excessive and protracted snow storms take place, that the fencing gets piled up on both sides, and then the rails gets blocked in spite of all preventative schemes. Two years ago, I went over nearly every inch of the ground between this City and Port-Neuf, and graded between stations 282 and 530, and do not think it would be possible to improve the grades with a view of avoiding the drifting of snow. Between Pont Rouge and Port-Neuf there are a good many heavy cuttings and embankments which it would be impossible to avoid, so hilly is the country in this district, and in these places, special precautions will have to be taken in the winter season. Although I do not think that snow sheds, such as are in use in some of the mountainous districts, where the cuttings are of extraordinary height are at all necessary, the difficulty being met with fences of an extra height. My experience on Railways has been essentially and thoroughly practical, whether as regards the running of Locomotives, or the construction and maintenance of road, more especially in locations where the snow question has always involved serious considerations; and I must conclude this letter by expressing my firm conviction that the line of Railway you are constructing between this City and Three Rivers, can be very easily and economically pro-

ected against all snow drifts and other obstacles peculiar to a Northern winter ; and that this is in a great measure accounted for, by the line of route and location of the road being so carefully chosen.

With respect to your last question asking for my views regarding the proper width of the road-bed at the base of the cross-ties, having reference to the items of drainage, obstruction from snow, and the safety of the passage of trains over the road ; also with reference to the comparative safety in case of accidents. I am of opinion that the bed of the road at the base of the cross-ties should not exceed 10 feet, from the fact that it gives quick drainage and does not permit of soakage ; for a 4 ft. 8½ inch. gauge, the bed should be made very full and round in the centre. In a climate such as this, the last remark is peculiarly applicable, because the snow, when thrown from a bed such as mentioned, is inclined to settle away from the track. It has been my experience to find such beds a success, especially in the Spring and Fall. If this bed is any more dangerous to run trains over than wide beds are, it is something that I am quite unaware of, and I give for a reason that upon wide beds the soakage is so much greater that the ties become loosened from their proper bearings, a fact which is dreaded by all engine drivers. Upon the narrow bed nothing of the kind ever occurs. I would, under all circumstances, prefer the 10 feet bed for safety, convenience and economy.

I am, Sir,

Yours faithfully,

(Signed,) A. L. SMITH.

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Finding that the views of Mr. Smith coincided entirely with my own ; and that these views were confirmed by the experience of the Grand Trunk Railway Engineers, with whom he had consulted ; I next took measures to ascertain definitely the precise characteristics of that portion of this road, situated between the Cities of Quebec and Three Rivers, so far as they should be regarded as influencing this question.

I therefore made a very careful analysis of the profiles of this portion of the line, and obtained the following results :

1. The total distance from Section No. 3, to Section No. 77 inclusive, is 392,300 feet, or  $74\frac{3}{10}$  miles.

2. The distance upon which the top of the rail will be 2 feet and over, above the natural surface of the ground, is 291,480 feet, or 75 per cent, being  $55\frac{2}{10}$  miles.

3. The distance upon which the top of the rail will be 3 feet and over, above the natural surface of the ground, is 180,050 feet, or 46 per cent, being  $34\frac{1}{10}$  miles.

4. The distance upon which the top of the rail will be 4 feet and over, above the natural surface of the ground, is 93,130 feet, or 24 per cent, being  $17\frac{6}{10}$  miles.

5. The distance upon which the top of the rail will be between 2 feet above, and 2 feet below the natural surface of the ground, is 79,890 feet, or 20 per cent, being  $15\frac{3}{10}$  miles.

6. The distance upon which the top of the rail will be from 2 to 5 feet below the original surface, is 13,950 feet, or  $3\frac{1}{2}$  per cent, being  $2\frac{64}{100}$  miles.

7. The distance upon which the top of the rail will be more than 5 feet below the original surface, is 7,000 feet, or 0.18 per cent, being equal to  $1\frac{1}{2}$  miles.

Having obtained the foregoing data, both as to what constitutes snow obstructions; and as to the probable exposure of this road to these obstructions, I feel prepared in some degree, to comply with the instructions contained in the Resolution of the Board, although I can but feel that the time allowed is far too limited for me even to attempt to do the subject justice.

In looking carefully over the extract from Mr. Light's report, I am very happy to find that he gives a substantial approval to the location of the line, the inclination of the grades, the plans of the structures, and the character of the work already done; the latter, however, with two exceptions, viz: "the earth-works constituting the road-bed are insufficient" and the gradients "are laid too low."

Inasmuch as Mr. Light did not see a mile, or even a rod of earth-work that had been completed, either according to the specifications, or the instructions of the Engineer, I do not consider it worth while at the present time, to enter upon a defence of their sufficiency, further than to state generally, that when fully completed according to contract, they will be found quite up to their requirements as exemplified by the best railway experiences in Canada and the United States.

I also desire to state further that, when fully completed according to the specifications, the excavations and embankments will be of the same width, at *formation level*, as are required by the specifications for the Montreal Northern Colonization Railway; and that the top of the road-bed, when ballasted, will be wider at the base of the cross-tie than upon that road; and wider in proportion to the gauge than upon either the Grand Trunk or Intercolonial Railway.

He speaks of the widths, as measured at intervals between the Race-Course, and half the distance to

Three-Rivers, being 11, 12 and 13 feet, and from that point west, as being generally 15 feet.

There will be no difference in the widths at formation level, when the grading is completed ; and the reason for the present irregularity is, that the work, in many places, has not been carried out to the side stakes.

The spoil banks, or " snow traps," of which he speaks, are all to be removed before the work is accepted.

I have not seen the profiles of the Northern Colonization Railway ; but I shall be much mistaken if, upon a fair comparison, it is not found that this line, from Quebec to Montreal, is quite as free as that line, from the liability to obstructions from snow.

Entering now directly upon the question of the gradients being " laid too low," I will submit the following propositions :

1st. That it is impossible, in this climate, and upon the line of this road, to lay these gradients so high that the road will be entirely free from snow obstructions.

2nd. That an Engineer, while arranging his grades with particular reference to the avoidance of these obstructions, must at the same time be influenced to a great extent by his curvature, his maximum grades, and the uniformity of these grades as affecting frequent undulations, which are always very annoying, and quite often very dangerous in operating the road.

3rd. That the Engineer must in all cases adapt his location, profiles, plans and specifications to the conditions of the contract for the construction of the road ; and also, to the available means of the Railway Company, so far as any extra work or materials are involved.

Assuming that the above propositions are assented to,

and that it is safe to rely upon sound practical experiences as a guide, I think it may be safely assumed also, that everything has been done thus far, that could have been done under the circumstances, to make the North Shore Railway as perfect as possible in all respects ; and that the Board of Directors have no reason to doubt, that, with ordinary precautions against snow obstructions, the road, if ever completed, may be successfully operated during every day in the year.

The foregoing analysis of the profiles, taken in connection with the facts contained in Mr. Smith's letter, demonstrate quite conclusively :

1st. That at least 55 miles, or 75 per cent of the distance between Quebec and Three-Rivers, which is elevated 2 feet and over above the surface, can be operated successfully without any protection against, or serious detentions from snow.

2nd. That at least 15 additional miles of the distance may be operated in the same manner, if the shallow cuts of 2 feet and less in depth, are protected in the usual manner by snow fences, as provided for in the contract.

3rd. That 2½ miles of the remaining distance, where the cuts are between 2 and 5 feet in depth, may occasionally require extra power to force the train through ; and,

4th. That upon the remaining 1½ miles, where the cuts are over 5 feet in depth, it may be necessary, in extreme cases, to resort to shovelling.

Entertaining as I do, a firm conviction of the truth of the above conclusions, it is unnecessary for me to extend the discussion further, in order to make known to the Directors my opinion on the value of the remarks contained in these extracts from Mr. Light's report, as required by the Resolution.



I am clearly of the opinion that it is the true policy of the Railway Company, as well as of all other parties interested, to complete the road in the best possible manner in accordance with the terms of the present contract ; and then, if circumstances should require it hereafter, any changes may be made by the use of gravel trains, either in the width of excavations and embankments ; or in the elevation of the track, with much greater facility and economy than it would be possible to do at the present time, when the Company has not even the means at command to secure the right of way for the entire length of the road-bed that it is proposed to construct.

When this time arrives, if it ever shall, the Company will undoubtedly find itself in a much better condition to incur this expense, than it is now prepared to carry out the recommendation of the Government Engineer, by raising the grade bodily from one to three feet, between Quebec and Three Rivers.

The contract and specifications, as well as the profiles of the line, have been before the Board, embracing four and six Government Directors (some of whom are members of the present Government.) during the past three years ; and during that time they have undergone the most searching examination and criticism at the hands of some of the most distinguished Engineers in this country and in Europe, all of which was made known to the Government when the " Railway Aid Act " of the last Session was passed ; and also, when the original contract was transferred to, and a supplemental contract entered into with the present Contractor.

This supplemental contract was also prepared by a leading member of the Government, who was at the time, and had been since 1871, a member of the Board of Directors ; and it was represented by him as embracing all of the items, conditions, and safeguards, amounting

in cost to several hundred thousand dollars, that the pecuniary condition of the Railway Company had rendered it necessary to omit from the original contract.

And yet it strangely appears, that not until the present moment, when the whole success of the undertaking seems to depend upon the aid which the Government has promised to the Company, it has been discovered that the entire system of *earth-works* is defective.

It would therefore certainly appear, both injustice and equity, that not only the Board of Directors, but the Government, are precluded from going back, either upon the contract, the Contractor, or the Engineer, beyond the date of the "Railway Aid Act," and the date of the Supplemental contract, in any criticisms that may be made either in the profiles, or dimensions of "earth-works" as they are specified and provided for in the contract; and inasmuch as the Government Engineer reports distinctly that these works are "substantial and permanent," and "in accordance with the profiles," it is difficult to see why the Government should hesitate in carrying out its agreement with the Company.

I regard it as exceedingly unfortunate, to say the least, that the Government Engineer did not give the Chief Engineer of the road an opportunity of making any explanations to him whatever, before he entered into a wholesale condemnation of this portion of the work. And I shall be very much surprised, if the extravagant statements contained in his report, shall be the means of crippling either the Company or the Contractor, in carrying forward the work to completion, by inducing the Government to with-hold any portion of the aid which it has promised to the enterprise; and upon which the Contractor has relied in good faith to meet his engagements.

Trusting that I may be permitted to supplement this



hastily prepared document hereafter, should circumstances seem to require it,

I have the honor to remain,

Mr. Secretary,

Your obed't Serv't,

S. SEYMOUR,

Chief Engineer.

A. H. VERRET, Esq.,

Secretary of the

North Shore Railway Company,

Quebec.

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*Government Standard No. 2.*

Without having made any further examination of the character of the works referred to in his first Report, the Government Engineer submitted another report to the Honorable the Chief Commissioner of Public Works, under date of 12th January 1875, of which the following is a copy; from which it will be observed that he recommends a *much higher standard* for the construction of the Road than the one contemplated in his first report; and also that he condemns nearly all of the work done upon the road which, in his first report, is characterized as being "*substantial and permanent in all respects*"; and in relation to the items of which he says: "They may therefore be *dismissed from further discussion*. They admit of *no doubt* of the propriety of the Government paying their proportion. They amount to \$201,396.00."

Quebec, 12th January, 1875.

THE HONBLE. P. GARNEAU,

Chief Commissioner of Public Works, &c.

SIR,

In accordance with your letter of this date, I herewith send you the substance of a Report prepared some time ago at the special request of yourself and the Hon. Mr. Church, "that I would state categorically my reasons for considering the North Shore Railway not first class." In this Report I recapitulate, certain objections to the work, which although, not all stated in my first Official Report, have been mentioned to yourself and other Members of the Government, as well as to the President of the Company.

*First*, as most important. — The road-bed between Quebec and Three-Rivers is laid entirely too low and narrow, to be continuously and economically worked in this climate.

*Second*. — The culverts or water passages through the embankments are built upon imperfect plans. The masonry extending but 2 feet below a surface exposed to frost. The rough hammered side and end walls of these structures, being founded on a paving of rough stone averaging a foot thick (which extends over the whole base of the structure including the waterway) instead of being sunk from two to three feet below the level of this paving, as is usually done where permanent work is intended. Paving laid, as in this instance, without apron walls at each end, extending some depth below it, is liable to be undermined, and thus destroy the superstructure. Frost in this climate penetrates from 3 to 4 feet, and upheaves walls on earth founda-

tions not sunk below its influences. Culverts therefore not thus founded, unless with a continuous stream flowing through them, are liable to fail.

*Third.*—The masonry in the bridging although, apparently good of its kind, is generally too small, the piers especially. Those intended to carry spans of 160 feet are but 5 feet thick, or fifty per cent too thin to bear the great vibration caused by trains running at high velocities, over these large spans. The only pier as yet completed, viz : that on the west side of the Jacques-Cartier River, designed to carry two spans or 300 feet of superstructure is but 4 feet, 6 inches thick at under side of coping. This pier is founded on rock, which from its want of elasticity, like the stone sleepers on the old Railways, will augment the shattering effect of passing trains, that will surely wreck it, sooner or later ; especially as there are no through stone (with the exception of the coping) passing from side to side, in the body of the work ; and the cementing matter used in its construction is very weak. The usual thickness of piers, in similar situations, on well constructed works is not less than 7 feet thick.

*Fourth.*—The proposed plan of founding piers on soft bottoms, in the deep waters of the larger Rivers, which in some instances are 25 feet deep at low water, although economical, I consider hazardous. The mode proposed is to build the masonry on a platform placed upon piles driven in 3 feet squares, and cut off 4 feet under low tide level. These piles being enclosed within a crib of round logs, notched, and bolted together, laid partly open, and filled with loose stone. Should the surrounding crib settle, or a jam of ice, or logs break the enclosure, contingencies very probable, the pier would be destroyed.

*Fifth.*—The superstructure of many of these bridges, especially from Quebec to Portneuf, is much longer

than the water-way of these streams require. This, while greatly reducing the permanent items of earth work and masonry, involves expensive periodical renewals, that would otherwise be avoided.

The same objection applies to the trestle-work on which a portion of the Railway is to be laid.

*Sixth.*—The cement and sand being used at Portneuf bridge, the only place I found masonry in progress, were very indifferent. The latter indeed quite unfit for the work, as I pointed out to the Resident Engineer.

These remarks are outside of the question as to whether steel rails are, or are not, at the present day, part of the equipment of first class Railways. They would have been noted in my first official report, but it was preferred to mention some of them verbally, rather than raise so many objections, on a first inspection of the work.

I have the honor to be,

Sir,

Your obedient servant,

(Signed) A. L. LIGHT,

M. Ins. C. E.

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Upon being furnished with a copy of the above report, the Engineer in Chief immediately prepared the following Review of the same, which was submitted to the Board of Directors on Jan. 26th 1875.

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Review by the Chief Engineer, of a Report made by the Government Engineer upon the character of the road, under date of January 12, 1875.

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OFFICE OF THE ENGINEER IN CHIEF,

Quebec, January 26, 1875.

MR. PRESIDENT,

I have the honor to acknowledge the receipt, on Saturday, the 23rd instant, of a copy of a further Report made by the Government Engineer, upon the character of this Road, in which is mentioned several objections to the manner in which it is being constructed, in addition to those referred to in the extract from his original Report, dated November 25, 1874, to which by order of the Board, I had the honor to subrait a reply on the 14th instant.

At the time of preparing the above reply, it was represented to the Board of Directors, and to myself personally, by the Honorable the Commissioner of Public Works for the Province of Quebec, that the extract from the Report of the Government Engineer therein referred to, and then before the Board, contained all the objections made by the Government Engineer to the character of the work, and to the plans of mechanical structures upon this Road; and upon that representation I was directed by the Board to make, and did make, the review of this extract, dated January 14th, 1875.

Upon an examination of the extract, I also found that it contained the following statement: "The question whether the works are substantial and permanent in character *in all respects*, can be answered in the *affir-*

*mative* with two exceptions, viz: the earth-works constituting the Road-bed are insufficient, although in accordance with the profiles,"—and: "The inclination of the gradients is generally all that can be desired, but they are laid *too low*."

Inasmuch as this statement of the Government Engineer fully confirmed the statement made to myself, and to the Board of Directors by the Honorable Commissioner of Public Works, I proceeded at once, and in good faith, to make such remarks upon the objections raised by the Government Engineer, and contained in that extract, as the facts in the case clearly seemed to justify.

But it subsequently appears, that by some extraordinary oversight, the Government Engineer neglected to mention, in his first report, several far more serious objections, both to the character of the work, and to the plans which had been adopted, than any which had occurred to him during the preparation of that report; which from its date, November 25th, 1874, was written immediately after his personal inspection of the work; and while every detail thereof must have been fresh in his memory.

Therefore, on the 12th January, 1875, more than six weeks after the date of his first report, he submitted to the Honorable Commissioner of Public Works, another report, which contains five additional "reasons for considering the North Shore Railway not *first class*."

It is quite noticeable, that this last report of the Government Engineer, is dated *two days previously* to the respective dates upon which the Honorable Commissioner of Public Works made the statement to the Board and myself, above referred to; and also, to the date of my review of the extract from his first report, and its presentation to the Board of Directors.

It will be noticed also, that in this last report of the

Government Engineer, he states that it was written in consequence of a request contained in a letter received by him on the 12th January, from the Hon. Commissioner of Public Works.

By some unaccountable delay, this second report of the Government Engineer, did not reach the office of the Railway Company until the 22nd inst. ; and it was not placed in my hands for examination until the evening of the following day, Saturday.

Leaving the Hon. Commissioner of Public Works, and his Engineer, to reconcile this most extraordinary confusion in dates ; and waiving for the present, all personal considerations, I will proceed, as briefly as possible, to review, in the order named by the Government Engineer, his, "reasons for considering the North Shore Railway *not first class*," as stated in his last report.

"*First*.—As most important, the Road-bed between Quebec and Three Rivers is laid entirely too low and narrow, to be continuously and economically worked in this climate."

*Reply*.—The fallacy of this objection, which is merely a repetition from his first report, is fully shown in my former reply ; and therefore will not be noticed further here, except to remark in passing, that the fact of his stating that it is the *most important* objection, is of itself, sufficient evidence to my own mind, that he is not entirely familiar with the subject upon which he is writing.

It is a self-evident proposition, that the *Road-bed* can be increased, both in width and height, if necessary, with perhaps greater facility and less expense, after the road shall have been fully completed and in operation, than it can now be done. While it is equally self-evident, that *not one* of the remaining five objections, can ever be rectified after the road is completed.



I will also quote the following extracts from a letter which I had the honor to submit to the President of the Company upon this subject, dated June 5, 1873, as showing the views which I then entertained, and still entertain, upon the subject of the *width of earth-works*.

“ The question as to the proper width of earth-works upon a Railway, is one upon which Engineers never have, and probably will never fully agree. All will admit, however, that the chief requirements of a road-bed, whether it be upon an embankment, in an excavation, upon a structure of masonry, or upon a bridge superstructure, are, that it affords a safe and reliable foundation for the permanent way, or track of the railway, and an unobstructed passage for the trains. And, that in earth-works these conditions should be attained with a due regard to drainage and the stability of the slopes.

“ My own experience and observation have satisfied me that a width of twelve feet at the grade line, upon embankments, of moderate height, and composed of good material, is quite ample for the foundation required to support the ties, eight feet in length, which sustain all the weight of the engine and train as it passes; and that any greater width is not only surplusage, but actually injurious to the proper drainage and stability of the track. And I know that many first-class roads, in the United States, have been, and are now being built upon this plan; and that in some cases the width has been reduced to eleven feet.

“ There was another important consideration, however, which had very great weight in my own mind, not only in the location of the line, and in the establishment of the gradients; but also, in regulating the widths, at formation level, of excavations and embankments, which was, the *liability of serious obstruction from snow*. And in my opinion this should be a paramount consideration



upon a Railway located in this portion of Canada, which must be operated from four to five months in each year, with a large body of snow upon the ground.

“There can be no doubt that the track and roadway can be cleared of this snow with much greater facility, upon a narrow, than it could upon a wider road-bed.”

It may not be improper also to quote the opinion of the eminent Engineering House in London, England, “Sir Charles Fox & Sons,” which is also referred to in the same letter, respecting the *snow difficulty* :

“The location of the Main Line appears to have been carefully studied, and the gradients are so arranged as to avoid cuttings as far as possible, a matter of the greatest importance in Canada, to prevent heavy drifting of snow in the winter,”

“*Second.*—The culverts or water-ways are built upon imperfect plans,” &c.

*Reply.*—I claim that the Government Engineer could not have examined the manner in which any one culvert or water-way has been constructed upon this road, with sufficient care to enable him to form an intelligent opinion as to its strength or permanency.

The following letter from Mr. Lindsay, Resident Engineer, will, I think, fully bear me out in this statement :

ENGINEER DEPARTMENT OF THE NORTH SHORE RAILWAY.

Quebec, January 23rd, 1875.

GENL. S. SEYMOUR,

Chief Engineer.

DEAR SIR,

As requested, I now give details of the manner in which the culverts constructed on the 1st Residency so

far have been built. The foundation pits were dug three feet below bed of stream, under the main body of culverts, and four feet under the end walls; then a flagging course of large flat stones, from a foot to eighteen inches thick, well bedded, laid in the bottom. The walls then built on this flagging course, the end walls being started a foot lower, sometimes at both ends, and sometimes only the lower end, a foot of good sound paving stones is put in between the walls and extends some distance beyond the ends of the culverts.

The walls are built 2f. 6in. thick in all culverts not exceeding 3f. vertical opening; when higher, they are proportionably increased in thickness. The covering is of good sound stones, over-lapping the walls at least half their thickness.

The coping has been put on only one or two as yet. The above relates to culverts built dry, of which there are seven nearly completed, and one about one-third finished.

Of culverts in cement there is but one built, all but coping, a very substantial structure, a 7f. by 5ft. box, walls 3f. 6 inches thick on a solid stone foundation, this is laid throughout in cement, is in a deep ravine, on a skew.

The streams where the above mentioned dry box culverts are built, are quite small and almost dry in summer, an apron wall can always be put down at the outlet of any of these structures, if found necessary to prevent scouring after the next spring freshet.

I consider 3 feet to be quite ample depth to put foundations down for small culverts in this part of the country, where the early falls, prevent the frost from penetrating to that depth.

Herewith I send plans of each kind of culvert as designed similar to those on the Intercolonial Railway.

Yours truly,

(Signed) JOHN LINDSAY,

Resid't Engineer.

I have constructed innumerable works of this kind upon the same plans during the last thirty years, in every variety of climate; and I challenge any one to point out a single structure that has ever failed in any particular.

*Third.*—The masonry in the Bridging, although apparently good of its kind, is generally too small, the piers especially. Those intended to carry a span of 160 feet, are but 5 feet thick, or fifty per cent too thin to bear the great vibration caused by the trains running at high velocities, over the large spans. The only pier as yet completed, viz, that on the west side of the Jacques Cartier River, designed for two spans, or 300 feet of superstructure, is but 4 feet 6 inches thick at under side of coping. This pier is founded on rock, which from its want of elasticity, like the stone sleepers on the old railways, will augment the shattering effects of passing trains, that will surely wreck it sooner or later; especially as there are no through stone (with the exception of the coping), passing from side to side in the body of the work; and the cementing matter used in its construction is very weak. The usual thickness of piers, in similar situations, on well constructed works, is not less than seven feet thick?"

*Reply.*—I have taken the pains to copy this objection entire, for the purpose of noticing the inaccuracy of many of the statements which it contains; as well as the fallacy of the conclusions at which it arrives.

1st As to *inaccuracies*.—The piers which are “intended to carry 160 feet spans of bridge substructure.” are *not* “but 5 feet thick.” I admit that they were originally drawn to 5 feet upon the plans : but, contrary to my own judgment, I changed the plans at the Portneuf and St, Maurice Rivers, from 5 to 6 feet in thickness, some weeks prior to the date of the Government Engineer’s last report, upon the representation of a member of the Government, that the Engineer had advised it ; and also, from an intimation from the Contractor, through his Engineer, that he preferred it.

I would have been most happy to have informed the Government Engineer of the change, if he had given me an opportunity of doing so.

The length of bridge superstructure resting on the pier at the Jacques-Cartier River, is *not* “300 feet,” as implied by the Government Engineer, unless he can demonstrate that a connecting pier between two spans, sustains the weight of both trusses throughout their entire length.

The cementing matter is *not* “very weak” as stated by the Government Engineer. On the contrary, I know from frequent tests applied to it personally, during its construction, that it is exceedingly strong and adhesive.

The following letters from the Resident and Assistant Engineers, are also offered in evidence.

Quebec, January 2nd, 1875.

GENL. S. SEYMOUR,  
Chief Engineer,

DEAR SIR,

In reply to your communication, requesting information relative to the Hydraulic Cement used in the

structures upon my Residency, I beg leave to say, that the cements used are those known as "Gauvreau's Cement," and the "Island of Orleans Company's Cement." The former was extensively used on the Intercolonial Railway on the first 100 miles, the latter was also used to some extent, and wherever used, were subjected to severe tests. All cement used on the 1st Residency of the North Shore Railway was tested frequently by myself, my Assistants and Inspectors, and the conclusion come to, was that it was perfectly reliable at 1½ sand to 1 cement, which proportions were consequently adopted, altho' much of it would have stood 2 sand to 1 cement.

Its subsequent appearance shows good adhesive qualities, as very little wash has taken place, and it has set perfectly solid and strong.

I enclose a certificate from Mr. Temple, Assistant Engineer on 2nd Sub-division, and will endeavor to procure others from the late Inspectors of masonry, as soon as I can find their addresses.

Yours truly,

(Signed,) JOHN LINDSAY,  
Resident Engineer.

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Quebec, 2nd January, 1875.

JOHN LINDSAY, Esq.,  
Resident Engineer,  
N. S. Railway,  
Quebec.

DEAR SIR,

The cement mortar used in the Pier and abutment for the Jacques Cartier Bridge was from the Island of

Orleans Company, and was mixed in the proportions of 1- $\frac{1}{2}$  sand to 1 cement.

It was tested by yourself at the commencement of operations, and I had the specimen at my boarding-house, for some time. It set perfectly hard.

The masonry set firm, and the joints of the Pier look solid with no appearance of wash.

I remain,

Yours truly,

(Signed,) E. B. TEMPLE,

Assistant Engineer.

If the Government Engineer desires to contest this point farther, and in a practical way, I will agree to have the pier taken down to any extent he chooses, if he will agree to pay the expense of rebuilding it, in case his statement is not confirmed.

“The usual thickness of piers in similar situations on well constructed Roads,” *is less than 7 feet*, instead of “not less than 7 feet” as stated by the Government Engineer.

There are several bridges now standing in perfect condition, upon the Erie Railway, which I constructed more than twenty years ago, in much more exposed situations, and of much longer spans, than the Jacques Cartier bridge, where the piers are *less than seven feet thick* under the coping. If the Government Engineer desires to contest this point, in a practical way, I will agree to send any reliable man that he may name, to measure the thickness of the piers (in similar situations) under the bridges of as many of the first-class Railways

in the United States as we may agree upon; provided he will pay the expenses, in case his statement is not confirmed.

2nd. As to *fallacies*.—The Jacques Cartier pier, of which the Government Engineer makes an example, is the thinnest one upon the road, and contains  $103\frac{1}{2}$  superficial feet of bearing surface under the coping. According to the usual methods of computation, and allowances for safety, it will sustain 5,692 tons of useful load. The greatest weight that can ever come upon it, including the weight of the bridge superstructure, and assuming the bridge to be loaded with locomotive engines throughout its entire length, is 238 tons; which shows that the pier is capable of sustaining *with perfect safety*, 24 times any weight that can ever come upon it.

With reference to the “*great vibration* caused by trains running at high velocities over these large spans,” upon which the Government Engineer seems to base his entire argument, I will remark, that trains are never allowed to run at “high velocities” over structures of this kind; not however as a means of avoiding the *great danger* of which he speaks; but as a means of safety from accidents, either to the train, or to the superstructure of the bridge while the train is passing.

The Jacques Cartier Bridge is composed of two trusses extending from massive abutments upon either bank, and resting in the center, or nearly so, upon the pier in question. I would therefore be pleased to see the questions demonstrated, either *practically* or *scientifically*, by the Government Engineer: 1st, As to how much *vibratory motion* this pier will endure with safety; and 2nd, as to how much it can ever be made to vibrate from its normal position, by the passage of trains over it at the “highest velocities” that he would authorize, if he were operating the road.



I maintain that masonry, if well constructed, of good materials, can never be affected injuriously, from this cause, under a wooden bridge superstructure. There is a liability, however, to a lateral strain upon the masonry which supports an iron superstructure, caused by the contraction and expansion of the metal ; which is effectually guarded against by placing rollers under the ends of the trusses.

I would therefore suggest to the Government Engineer, that his objection may be obviated, either in this manner, or perhaps by placing a thick bed of India Rubber or Gutta Percha upon the present bearing surface of the masonry, at very much less expense to the Contractor, than by increasing the thickness of the pier to seven feet.

I maintain also, that *thin* masonry is quite sure to be of much greater relative strength than *thick* masonry, for the reason that it can always be much more firmly bound together ; I also maintain, that it is the duty of the Engineer to keep his plans within the lowest limits of entire safety ; as well on account of economy in construction, as the permanency and stability of the work.

The masonry in question, although not composed entirely of "through stone," is so thoroughly bound together by the *inter-locking* or *over-lapping* of the different courses, that I consider it to be quite equal, both in horizontal and vertical strength, to what it would be if constructed of "through stone."

The objection raised by the Government Engineer to the *rock foundation* which underlies this pier, is so novel in its character ; and is sprung upon me so unexpectedly, at this late day, that I shall not even attempt to answer it.

It would of course be superfluous for me to offer the



Government Engineer any assistance in the *scientific* solution of the problems heretofore referred to, with reference to vibratory motion, and its effects either upon the particular pier under consideration, or upon masonry of this kind generally; but I will venture to refer him to a case which affords a very satisfactory *practical* solution of the problem.

It will probably be admitted that the Railway Suspension Bridge at Niagara Falls, affords as good an example of extreme exposure to the influences of *vibratory motion*, as any other that can be named.

This Bridge is composed of a single span of  $821\frac{1}{2}$  feet in length, measured from center to center of piers. There are two square stone piers at each end of the bridge, each one of which supports one-fourth of the entire superstructure, and also of any load, or tensile strain that can ever come upon it. These piers are each founded upon *solid rock*; and are each  $78\frac{1}{2}$  feet high, above the bottom of the Bridge; and they are each *eight feet square at the top*.

This Bridge has been in constant use since 1853, or during the past twenty years, and, so far as I am informed, it is now as perfect in all its parts, as it was when the first locomotive engine, and train of cars passed over it.

From the above data we are enabled to deduce the following mathematical expressions:  $8 \times 8 \times 4 = 256$ ; therefore, if 256 feet of bearing surface will successfully sustain the weight of the Niagara Railway Suspension Bridge of  $821\frac{1}{2}$  feet span, and all the weight that comes upon it, together with the "*augmented shattering effect of passing trains*," due to the fact of its being a *flexible suspension*, instead of a *rigid truss bridge*, how long will the Jacques-Cartier pier, with  $103\frac{1}{2}$  feet of bearing surface, and having  $158\frac{1}{2}$  feet in length of *truss bridge* to sustain, successfully fill the same requirements.

I will leave the Government Engineer to solve the problem, and to profit by the result, as I have neither time nor inclination to follow this branch of the subject further.

“*Fourth.*—The proposed plan of founding piers on soft bottoms in the deep waters of the large rivers, which in some instances are 25 feet deep at low water, although economical, I consider hazardous, &c.”

*Reply.*—The Government Engineer has, in the objection above stated, for the first time raised a question which I consider at all reasonable or debatable; and I shall therefore endeavor to answer it as fully as possible.

The Specifications provide that :

“Whenever solid rock is not found, the foundations will consist, either of paving, concrete, piling, or platforms of timber and plank, as the Engineer may direct.—The whole to be protected by sheet piling, rip-rap, crib-work, or cofferdams when necessary; and executed in the most thorough and substantial manner.”

When the Chicago Contracting Company made the first proposition, and negotiated the present contract for constructing the road, the parties, all of whom were practical railway men, were particular to inquire respecting the kind of sub-structure that would be required for the masonry of the bridges over the many large streams, which the profiles then exhibited to them, showed were to be crossed by the Railway; and I informed them that, so far as I could then judge, from a somewhat superficial examination of these streams, the foundations would be of the same character as those which I had previously adopted for a Railway bridge of a mile in length, across the Potomac River, at Washington, U. S.; which, as they very well knew, were composed of piles, driven in 30 feet water, and protected by cribs filled with stone; and had then stood the severe

tests of high floods and ice-jams of the Potomac River, during a period of ten years.

If the above assurance had not been made by me, I do not think that the contract would have been closed upon its present terms ; although the specifications, as quoted above, which I afterwards prepared, were fully approved by the Chicago Contracting Company, and were allowed to form part of the contract.

I am not aware that the present Contractor, when he assumed the contract about one year ago, had any knowledge of the above facts. And I do not even know whether they will be regarded, by any one but myself, as having a material bearing upon the present question.

I will freely admit that the plans objected to by the Government Engineer, are to a certain extent an innovation upon the old stereotyped plans in use for such purposes ; and therefore, that they are liable to the severest criticisms from a peculiar class of the Engineering profession, who never like to depart from old customs. I have therefore taken great pains to satisfy myself fully as to their safety, as well as their adaptability to the purposes for which they are intended, upon this road. And I have also taken suggestions from several practical Contractors, as well as from many sound practical Engineers, with reference to such changes in my original plans, as would tend to increase their safety, and facilitate their construction.

I have therefore come to regard the perfected plans as being entirely unobjectionable, provided the specifications and directions of the Engineer and Inspector are adhered to in every particular by the Contractor, during their construction.

I had the honor of addressing a communication to the President and Directors, on the 16th July, 1874, in which the following paragraph occurs :

“ To illustrate this principle, I will refer briefly to but a single instance of the many which must necessarily occur during the progress of the work.

“ The plans which I have designed for the sub-structure, or foundations in deep water, required for the masonry in the bridges which are to span several of the large Rivers, which the line of Railway crosses, are peculiarly my own; and are much cheaper than the ordinary stereotyped plans in use for such purposes. But in order to render them perfectly safe and permanent, the greatest care and attention must be exercised in carrying out every detail of the plan, in the execution of the work. If the power to see that this is done, through the agency of Engineers and Inspectors of my own selection, and in whom I have the most entire confidence, is taken from me, I hold that I cannot justly be held responsible for the success of the plan. The failure to drive one single pile to the required depth, or to place one single bolt in the right position, might endanger the safety of the entire structure, which, although it might stand until after the Railway Company had accepted the road from the Contractor, would be liable to be undermined, and destroyed during the very next freshet that might occur.”

It is quite evident to my mind, however, that the Government Engineer, judging from his remark that “ should the surrounding crib settle, the pier would be destroyed,” does not understand either the theory of the plan, or its practical adaptation.

I take the liberty of quoting the following extract from a Report recently made to the City Council of Quebec, by Mr. Charles Baillargé, City Engineer, as showing his opinion of these foundations :

“ Persons unacquainted with Bridge building on a mud bottom, may not have confidence in this system of

founding piers of stone masonry on what they may consider such a perishable material as wood ; but it is well known that wood, which is altogether and at all times completely under water, is imperishable, logs having been recovered from under water in Europe, which were known to be more than 800 years old, in a perfect state of preservation. Again, as to solidity and stability, I may say that hundreds of the most important and heaviest works in Europe and the United States of America are founded, in some cases, on wooden piles, driven into the bed of Rivers, Estuaries, &c., &c., as is now being done at Batiscan and Ste. Annes."

The following extract, from my letter to the President of June 5th, 1873, before referred to, will show the opinion of " Sir Charles Fox and Sons " upon the same subject :

" We have examined the details of the River Bridges, and having been informed by General Seymour, as to the nature of the foundations, and the extent and power of the ice-drifts in the several Rivers, we are satisfied with the designs, and consider them well adapted to their purpose."

I am not at all sensitive upon the question of these foundations ; and if the Board shall conclude, upon a full investigation of the subject, that any other plan, which shall come within the requirements of the general specifications attached to the contract, is preferable, I see no reason why such plan should not now be adopted for all the rivers, except the St. Anne's, where the work upon the present plan has advanced to such an extent that it could probably not be changed, without incurring a claim for damages, on the part of the contractor.

" *Fifth.*—The superstructure of many of these bridges, especially from Quebec to Portneuf, is much longer than the water way of the streams require," &c. Also, " the

same objection applies to trestle work, on which a portion of the railway is to be laid."

*Reply.*—The spans of the bridges above referred to, except the Aux Pommés, Lachevrotière and Champlain, which are still under advisement, have been decided upon, after a careful study, and personal observation of the streams and their sources, during a period of four consecutive years. Whereas, the Government Engineer has never to my knowledge, passed through the country *but once*; and then over a considerable portion of the distance, between Quebec and Pont Rouge, in a *driving snow storm*; and on the following day, the remainder of the distance to Portneuf, when the ground was *covered with snow*.

In some cases, it has been found necessary to bridge the slopes of the adjoining banks, as well as the streams, in order to obtain secure foundations; but in no case would I consider it safe, to reduce the clear opening required for the passage of the water.

In cases of this kind, I have always acted upon the two principles:

1st. That we have never yet experienced the highest floods; and,

2nd. "That, when in doubt, the decision should always be upon the side of safety."

The entire question of Trestle work is still in abeyance.

*Sixth.*—The cement and sand being used at Portneuf Bridge—were very indifferent—the latter indeed, quite unfit for the work, as I pointed out to the Resident Engineer."

*Reply.*—The above objection being the last in the series; and also, as appears from his report, the only one which the Government Engineer "pointed out to the Resident Engineer" who accompanied him over the line on his tour of inspection, I will only state in reply,

that the Inspector of the work, Mr. A. Trepanier, whose especial duty it was to pay the closest attention to all important matters of this kind; and whose later experience in such matters has been upon the Intercolonial Railway, shall, if within call, be invited at once to furnish a full and satisfactory reply to the objection raised by the Government Engineer.

Having thus noticed and answered all of the objections made by the Government Engineer, I will conclude what I have now to say, with the following remarks :

1st. In considering this whole subject, so far as any decision is to be influenced by the rough and unfinished condition of the work, at the time of its inspection by the Government Engineer, it should be borne in mind, that the contract, being for a " lump sum," as it is called, the Contractor cannot consistently be required to perform any particular portion of his work, at any specified time; provided the *entire work* is completed in the manner and within the time specified in the contract; and, therefore, the Engineer can only endeavor to see, that when the work is done, it is properly done.

2nd. If the requirements of the Government, through their present Engineer, respecting the changes that *must* be made in the present specifications, grades, earth-works, masonry, foundations, &c., including the location of the line within and near the City of Quebec, which he has still more recently recommended, are insisted upon, I do not hesitate to say, that either the Railway Company, or the Contractor, or both, as may be decided hereafter, may as well provide immediately for, from a half million, to a million dollars, over and above what has been heretofore anticipated, in order to meet these requirements.

3rd. Having now been connected with this Road during the past four years; and having, during that period, devoted my entire time, and the best energies of my body and mind : 1st, In an effort to induce respon-



sible parties to undertake its construction, upon such terms and conditions as the Company were prepared to offer: 2d. In an effort to place these parties, by the negotiation of their securities, in a condition to commence and carry on the work; and, 3d. In an effort to have the work properly constructed when it commenced, it may very well be imagined with what feelings I regard the present condition of things, as affecting the final success of the enterprise.

4th. Having devoted a somewhat long and varied professional life, to the construction and management of some of the most difficult and important public works upon the American Continent; among which may be named the Erie, and the Union Pacific Railways; and having constructed upon the former, the Portage Bridge, of 234 feet in height; and upon the latter, the Dale Creek Bridge of 134 feet; all of which are now standing evidences, either of my possessing or not possessing the amount of professional skill required to construct the North Shore Railway upon proper principles; I think it should be regarded as quite improbable, that I would willingly consent to risk my professional reputation, which is my only dependence in life, either by the construction of this important work upon defective plans; or by failing to do my whole duty to the Railway Company, which has honored me with its confidence.

It would also seem to be equally improbable that, after having filled the most important Engineering positions in the General and State Governments of the United States, I should, at this late day in my professional life, require to be taught the first principles of my profession.

Respectfully submitted,

S. SEYMOUR,

Chief Engineer.

TO THE PRESIDENT AND DIRECTORS.



*Government Standard No. 3.*

Sometime subsequent to the date of Mr. Light's second report, he was requested, in conjunction with Mr. Baillaigé, the Engineer appointed to inspect the works by the Corporation of Quebec, by a special Committee of the Board of Directors having the matter in charge, to indicate in precise terms the standard to which the road must be made to conform; "to render it acceptable to the Government and the Corporation as a *first class Railway.*"

The following is a copy of their joint report upon the subject :

Quebec, 9th March, 1875.

A. H. VERRET, ESQ.,

Sec'y. of the North Shore Railway Co.

SIR,

In accordance with a resolution passed on the 3rd inst., at a meeting of the special Committee of the North Shore Railway, wherein Messrs. Baillaigé and Light were requested to come to a mutual understanding and make known, with the least possible delay, what modifications are necessary to be made in the specifications and in the plans of the Road, to render it acceptable to the Government and the Corporation, as a first class Railway, taking into consideration, however, the resources at the disposal of the Company, for the construction of their Road.

Messrs. Baillaigé and Light beg to report on the above as follows :

*First.*—That the road-bed (or base of ballast) be

raised more or less, equivalent to an average of at least one foot throughout its entire length.

*Second.*—That the cuttings be increased from 18 to 24 feet in width, to admit of thorough drainage.

*Third.*—That although Messrs. Fleming and Light are decidedly of opinion that a width of 17 feet at “formation” or base of ballast level, would ensure more permanency, safety, and ultimate economy. Yet taking the present resources of the Company into consideration, we are prepared to recommend, that a width of 15 feet, as now arranged for the Montreal Northern Colonization Railway, be adopted as the width at “formation level” on the North Shore Railway. It being understood that the road-bed shall be so made that it will retain the full width of 15 feet, after it has thoroughly shrunk and consolidated.

The undersigned are induced to recommend this reduction in width of road-bed, because these embankments can be *widened* hereafter if desired, without interfering materially, with the general plan of the Railway, whenever the resources of the Company will admit of the increase being made.

*Fourth.*—That a foot of ballast be placed under the sleepers, as well as carried up to the level of their upper surface, as shown in the diagram attached. The width of the ballast being 10 feet at the level of top of sleeper, and 14 feet 6 inches at the base, or at formation level.

*Fifth.*—That the top width of piers, shall in no case be less than from 5 to 7 feet, for spans of from 80 to 160 feet, and that these piers be constructed of first class masonry. Mr. Light being of opinion that the specifications for masonry, in use on the Montreal Northern Colonization Railway, from their freedom from ambiguity, be adopted on the North Shore Railway.

*Sixth.*—That the foundation for piers in deep water, shall be so altered and strengthened, to the approval of the undersigned as to ensure that safety and stability which they do not now possess. This modification we believe being within the scope of the contract.

As regards the second resolution : “ That Messrs. Baillaigé and Light be also requested to please make known to this committee, the modifications which might be considered as *extras*, if however there are any, or are not provided for in the contract ; what the probable cost would be, and what items of the contract they would recommend to be retrenched to meet all such modifications.”

That in the event of the Committee being unable to arrive at a satisfactory solution of these questions, we would respectfully suggest that they be referred to Mr. Fleming, who has already gone into this matter, and made certain recommendations. Should the Committee so desire, we shall have no objection to join in such reference.

With regard to what items of the contract may be retrenched to meet *extras* that may be determined on, if any. The Committee will doubtless take into consideration, as already suggested in our previous reports, to what extent the stations, machine shops, and rolling stock may be reduced, including perhaps, with the concurrence of the Government and Corporation, the extension to deep water.

We have the honor to be,

Sir,

Your obedient servants,

(Signed) CHAS. BAILLAIRGÉ,  
A. L. LIGHT.

Upon perusing the foregoing Report, the Engineer in Chief prepared and submitted to the Secretary of the Company, the following letter and remarks upon the subject.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, March 11th, 1875.

MR. SECRETARY,

Having been favored with a hasty perusal of a Report dated March 9th 1875, made by Messrs. Charles Baillaigé and A. L. Light, respecting a required standard for this road, I beg leave to submit the following remarks in relation thereto, for the consideration of the special Committee and the Board of Directors.

I have found this standard to be so much more vague and indefinite than the contract and specifications, that I have thought it important to suggest several questions with reference to each specification, in order that they may be reasonably well understood.

Yours very truly,

S. SEYMOUR,

Chief Engineer.

A. H. VERRET, Esq.,

Secretary.



Remarks of the Chief Engineer upon the Standard submitted  
by Messrs. Baillaigé and Light, on 9th March 1875.

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1st. ELEVATION OF ROAD-BED OR TRACK.

They say : " that the road-bed or base of ballast must be raised more or less, equivalent to an average of at least one foot throughout its entire length."

This specification is so very vague and indefinite, that it will be found impossible to comply with it understandingly, without first obtaining answers to the following questions :

Where, or at what points must the road-bed be raised *more*, and at what points *less* than is indicated upon the present profiles ?

Upon what bases must the *average* be computed, which will hereafter be considered by the Government and City Inspector as " equivalent to an average of at least one foot."

Does the term " throughout its entire length " refer to the *entire length* of the main line and piles branch—or to the *entire length* of the main line—or to the *entire length* of any particular portion of the main line.

2. WIDTH OF CUTTINGS.

They say : " that the cuttings must be increased from 18 to 24 feet in width to admit of thorough drainage."

To comply with this specification understandingly, will require answers to the following questions :

What are the widths of the cuttings as now designed ?

At what points are these cuttings to be increased ?

To what extent between the extreme limits of 18 and 24 feet, must each particular cutting be increased beyond the width now designed, in order "to admit of thorough drainage."

### 3. WIDTH OF ROAD-BED.

They say : "that a width of 15 feet, as now arranged for the Montreal Northern Colonization Railway, must be adopted as the width at formation level," after becoming "thoroughly shrunk and consolidated."

The following questions arise with reference to this specification :

What is the "arrangement for the Northern Colonization Railway" ?

Will the Engineer be precluded from increasing the width beyond the limit of 15 feet, in cases where, in his opinion, the nature of material, or height of bank may require it ?

Will the Engineer be precluded from raising the "formation level" to the base of the cross-tie ; and reducing its width to 12 feet, in cases where the native material is such as to require no ballast ?

### 4. BALLAST.

They say : "A foot of ballast to be placed under the sleepers, as well as carried up to the level of their upper surfaces, as shown on the diagram attached. The width of the ballast being 10 feet at the level of top of sleeper ; and 14 feet 6 inches at the base, or formation level."

The following questions arise with reference to this specification.

Does it not *reduce* the top-width of the completed road-bed, at the *full grade line* to a *less width than 12 feet*, as required by the existing contract and specifications ?

Is this ballast to be added to the top of the original road-bed, when the native material is as good as any ballast that can be procured within a reasonable distance ?

Is not the quantity of ballast required per mile, more than is required upon the Montreal Northern Colonization Railway ?

Must the out-line of the road-bed and ballast, when fully completed, be made to conform in all respects and in all cases, to " the diagram attached " ?

##### 5. DIMENSIONS AND CHARACTER OF BRIDGE MASONRY.

They say that : " The top width of piers shall in no case be less than from 5 to 7 feet, for spans of from 80 to 160 feet, and constructed of first class masonry." The masonry specifications of the Montreal Northern Colonization Railway, are also referred to, as furnishing a proper standard for the masonry.

The following questions are very important as connected with this specification :

The Jacques-Cartier pier having already been completed with a less width, under the coping, than the above *minimum*, " What is to be done about it ? "

The piers for the Port-Neuf bridge having already been commenced upon a basis which admits of a top width of 6 feet, under coping, what is to be done about them ? Will the present plans for these piers fill the requirements of the specifications ? And if not, what changes are to be made ?

Referring to the plans already designed for the different bridges upon the entire main line, where the pier masonry has not yet been commenced : " What *specific width* between the limits above named, will be required for each particular pier ?

Does the bridge-pier masonry, already constructed, come up to the required standard, for *first class masonry* ? And if not, must it be taken down and rebuilt, and all future work constructed in strict accordance with the letter of the standard referred to, including the provision for using *lime mortar* instead of *hydraulic cement* ?

#### 6. FOUNDATIONS IN DEEP WATER.

They say : " Foundations for piers in deep water shall be so altered and strengthened to the approval of the undersigned, as to insure that safety and stability which they do not now possess. This modification, we believe, being within the scope of the contract."

The following very important questions suggest themselves with reference to this specification.

In what respect are the present plans and specifications so far defective, as to endanger the " safety and stability " of the work ?

What " alterations and strengthenings " *shall* be made in the present plans at each particular locality, that they will meet " the approval of the undersigned ?"

*Must* the work already executed under the existing plans and specifications be thrown away, and new work and materials be substituted therefor ?

Will the materials already procured and delivered, be available for the " approved " plans ; or must other material be substituted therefor ?



Does the expression: "*this modification we believe being within the scope of the contract,*" either decide or imply that "the undersigned" believe that none of the previously named modifications are "*within the scope of the contract?*"

Believing that the foregoing suggestions are of vital importance to the interests of the Railway Company, at the present time, with reference to saving a very large and *useless* expenditure, on the part of the Contractor, or the Company, as the case may be, they are,

Respectfully submitted, by

S. SEYMOUR,

Chief Engineer.

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Upon receiving the foregoing communication, the Committee at once passed a Resolution inviting the Government and City Engineers, together with the Contractor and the Engineer in Chief, to hold a conference with the Special Committee on the morning of March 12th 1875, the result of which, as recited in the following "memorandum" may be regarded as:

*Government Standard No. 4.*

MEMORANDUM.

On Friday morning, March 12, 1875, the special committee held a meeting at which Messrs. McGreevy, Light, Baillargé and Seymour were present by invitation, under a Resolution moved the previous day by His Worship the Mayor of Quebec, and adopted by the Committee.

The Mayor, by consent of the Chairman Hon. J. J. Ross, took the initiative in the proceedings, and stated, that inasmuch as the Chief Engineer had, on the previous day, submitted some "Remarks" upon the "Standard" established for the road by the Government and City Engineers, in a joint communication dated 9th March 1875, in which remarks it was shown that a good deal of vagueness existed in many of the details connected with said standard, he, the Mayor, had conceived the idea, that by bringing all the parties together before the committee, it would be quite possible, as he knew all parties considered it very desirable, that these details should be fully harmonized, so that there could be no possible misunderstanding hereafter.

After these general remarks, the Mayor called the attention of Mr. Light to the vagueness of his standard respecting the height of the grade line, noting several points to which attention had been called by the Chief Engineer.

Mr. Light replied that he intended to have the increased height of one foot apply to the entire Main Line between Quebec and Montreal; that he had calculated the additional quantity of material in earthworks that this increased height would involve, and that he proposed to distribute this increased quantity where it should be most needed, in some places considerably more, and in other places perhaps less than one foot, but one foot should be the average. Upon being asked whether he had seen the profiles of the present located line west of Three Rivers, he answered, No! that he had applied for them in Montreal, but that the Resident Engineer informed him that the Chief Engineer had given special orders that no one should see them.

The Mayor then requested the Chief Engineer to produce the profiles of the entire Main Line as now

located, which upon being done, the Government and City Engineers were requested to indicate upon them such an arrangement of grades as they should insist upon to meet the requirements of their standard. These gentlemen however declined to examine the profiles, but said that "the road must be gone over *profils in hand*, to determine height of road." Upon being asked by the Chief Engineer whether they would be good enough, at the same time to indicate the proper width of the different cuttings, they said they would.

With reference to the width of embankments, upon being further questioned by the Mayor and Chief Engineer, they said that the width at sub-grade, or formation level, might exceed 15 feet in some cases where the material was bad, &c. And that it might be reduced to 12 feet, where the material was so good as to require no ballast.

With reference to ballast, upon being shown a diagram prepared by the Chief Engineer, which contemplated 2000 c. yds. per mile, they condemned it emphatically, and insisted that the diagram which accompanied their report of the 9th, which they said contemplates 2,500 c. yds. per mile, should be adhered to in every particular.

With reference to the Jacques-Cartier pier, already built, Mr. Light said that it must come down, that it was much too small, that the cement was worthless, that there could not be more than 150 or 200 c. yds. in the pier; and that it could be taken down and properly rebuilt for \$3.00 per c. yd. Also that in rebuilding, it must be made "7 feet thick at top under coping, coping to be taken off or not allowed to project; batter 1 in 24, to be laid in Portland hydraulic cement, 2 of sharp clean sand, and 1 in cement, in face of work; 3 of sand and 1 of cement, in the backing."

With reference to the Portneuf Piers, now partly constructed (to a height of 8 feet, and 10 ft. 5 in. in thickness at top), upon being asked by the Chief Engineer, if these must also come down, Mr. Light said that they could remain and be carried up from their present height with a batter that would "bring them out 7 feet at top." Upon being informed by the Chief Engineer that the masonry already constructed at Portneuf was of the same character, and laid in the same cement as the Jacques Cartier Pier, and also laid with sand which he had already reported as being "quite unfit for the work," Mr. Light replied that this particular work being at the bottom of the pier, and subject to constant inundations and moisture from the stream and surrounding earth, the character of the work, cement, sand, &c., was not so important; but if, on examination in the spring, any material defects were discovered, he would allow the piers to be taken down and rebuilt.

With reference to a general standard that should govern the thickness of piers in all cases, after consultation between the Government and City Engineer, the following was determined upon: "5 feet for spans of 80 feet; 6 feet for spans of 120 feet; 7 feet for spans of 160 feet; and proportionately for intermediate spans." Upon being asked by the Chief Engineer, whether the height or number of the piers should be considered in connection with their thickness, Mr. Light replied that no difference would be made or allowed on that account.

With reference to the character of bridge masonry, Mr. Light insisted that the specifications for the "Montreal Northern Colonization Railway" should be adhered to in every particular. Upon his attention being called by the Chief Engineer to the clauses in these specifications which permitted lime mortar to be used, instead of hydraulic cement, Mr. Light replied that he would not permit lime mortar to be used in work of

this nature, under any circumstances whatever. And also, that no lime mortar had been used thus far, on the Northern Colonization Railway.

Upon being asked by the Chief Engineer whether the requirements respecting the Jacques Cartier pier, "that there should be no coping, or that it should not be allowed to project," would apply to all the piers upon the road, Mr. Light replied that it would most certainly apply to all piers, for the reason that the weight of the bridge coming upon the front edge of a projecting coping, would have a tendency either to detach the coping, or pull over the pier. And he gave the Committee a beautiful illustration of his idea, by placing a book in a projecting position over the side of the table at which we were sitting, and showing how easily it could be tipped over by the least pressure upon its outer or projecting edge.

Upon being asked by Col. Wm. Rhodes, the President of the Company, whether in reconstructing the Jacques-Cartier pier, Mr. Light would kindly suggest some means of obviating the objections which he had previously raised to its being founded on solid rock, Mr. Light, without suggesting any present means that had occurred to him for obviating that difficulty, referred the President to Railway experiences in England, where it had been found necessary to substitute wood for stone foundations under the rails, in order to avoid "the shattering effects of passing trains."

The Chief Engineer, at the request of the Mayor, then produced the plans for foundations in deep water, and requested the Government and City Engineer to indicate upon them such changes or modifications as they would insist upon, in order "to ensure that safety and stability which they do not now possess."

After consulting together, Mr. Light informed the

Committee that he had already expressed the opinion, in his report to the Government of January 12th 1875, that these foundations were "*hazardous*," and that he had not since changed his opinion. He also referred the Committee to a bridge near Montreal, the foundations of which were constructed upon the same plan ; and which, without any stone piers resting upon them, would now he found very much distorted and out of shape ; and be therefore doubted whether any modification of the plan which he could suggest, would render it entirely safe.

He also stated that the Chief Engineer had taken four years to study the subject, during which time he had made at least three modifications in his plans ; therefore he thought it but just and reasonable that he should be allowed a little time in which to decide upon the subject.

The above proposition appeared to be so very reasonable that the Committee at once decided to grant all the time necessary, and the Mayor of Quebec made the following minute upon the subject :

#### DEEP WATER FOUNDATIONS.

" The Engineers Baillairgé and Light are not prepared to pronounce upon the changes in plans. Will consider the question in connection with General Seymour, and the Company will adopt their conclusion."

Everything connected with the " standard ", except the height of the grade, the width of the different cuttings, and the character of the foundations in deep water, having thus been clearly defined by the Government and City Engineers, the Chairman of the Committee politely informed those who were not members, that they could withdraw.

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*Government Standard No. 5.*

On the day following the above mentioned conference, the Committee received another joint report from Messrs. Light and Baillairgé, of which the following is a copy :

Quebec, 13th March, 1875.

A. H. VERRET, ESQ.,

Secretary North Shore Railway,

SIR,

In accordance with resolutions passed on the 3rd and 12th instant respectively, at a meeting of the Special Committee of the North Shore Railway, wherein Messrs. Baillairgé and Light were requested to come to a mutual understanding, and make known with the least possible delay, what modifications are necessary to be made in the plans of the road, to render it acceptable to the Government and the Corporation as a first class Railway, taking into consideration, however, the resources at the disposal of the Company, for the construction of their road, Messrs. Baillairgé and Light beg to report on the above as follows :

*First.*—That the road-bed (or base of ballast) be raised more or less, equivalent to an average of at least one foot throughout its entire length. With regard to this raising of road-bed, we suggest that the whole line be passed over, profile in hand, and the points where the raising should be made be indicated on that profile.

*Second.*—That the cuttings be increased from 18 to 24 ft. in width to admit of thorough drainage.

*Third.*—That although Messrs. Fleming and Light are decidedly of opinion that a width of 17 feet at

“Formation,” or base of ballast level, would insure more permanency, safety, and ultimate economy, yet, taking the present resources of the Company into consideration, we are prepared to recommend, that a width of not less than 15 feet, as now arranged for the Montreal Northern Colonization Railway, be adopted as the width at “Formation Level” on the North Shore Railway, it being understood that the road-bed shall be so made that it will retain the full width of 15 feet after it has thoroughly shrunk and consolidated. Where the native material is sufficiently good to be used as ballast, the road-bed may be raised or left one foot higher, and reduced to 12 feet at under side of sleeper. The undersigned are induced to recommend this reduction in width of road-bed, because these embankments can be *widened* hereafter if desired, without interfering materially with the general plan of the Railway, whenever the resources of the Company will admit of this increase being made.

*Fourth.*—That a foot of ballast be placed under the sleepers, as well as carried up to the level of their upper surfaces, as shown in the diagram attached. The width of the ballast being 10 feet at the level of top of sleeper, and 14 feet 6 inches at the base, or at Formation level.

*Fifth.*—That the top width of piers shall in no case be less than from 5 to 7 feet for spans from 80 to 160 feet; 5 feet for spans of 80; 6 feet for spans of 120; 7 feet for spans of 160; and proportionately for intermediate spans, which of course will necessitate the rebuilding of the pier at the Jacques Cartier Bridge, in conformity with this suggestion, or the erection of an additional pier. The additional thickness required at the piers of the Bridge at Portneuf, of which foundations are already in place, can be obtained by altering the batter thereof. That these piers be constructed of 1st class masonry. Mr. Light being of opinion that the specifications for masonry in use on the Montreal North-



ern Colonization Railway, from their freedom from ambiguity, be adopted on the North Shore Railway ; and that Portland Hydraulic cement be used in all first class masonry, in the proportion of 2 of sand to 1 of cement in face work, and 3 of sand to 1 of cement in the lacking and hearting.

*Sixth.*—That the foundations for piers in deep water shall be so altered and strengthened, to the approval of the undersigned, as to ensure that safety and stability which, in their opinion, they do not now possess, this modification (clause No. 6) we are of opinion is clearly within the scope of the contract.

We have the honor to be,

Sir,

Your obedient servants,

(Signed,) CHS. BAILLAIRGÉ,

A. L. LIGHT.



### III.

#### WHAT ALL PARTIES HAVE AGREED TO DO, AND HAVE DONE ABOUT IT.

The Special Committee, after having received the above final report from the Government and City Engineers, submitted to the Board of Directors on the 13th March, a report in relation thereto from which the following is an extract :

“ These gentlemen, after having taken cognizance of the above mentioned resolutions, submitted the annexed report as embodying all modifications of specification required by the Government and Corporation, to ensure a first class road, according to the views entertained by these Engineers.

Your Committee therefore recommend your Board to adopt these modifications, or alterations in the specifications, as forming part of the contract.

As to the question whether these modifications are provided for by the contract, in the sense that the Contractor is bound to execute them without exacting an indemnity, your Committee do not deem it advisable to give their opinion, but recommend that should the Contractor claim that these modifications are extras, this question be submitted to arbitration, with the understanding that the decision of the arbitrator or arbitrators, will bind the Contractor and Company.”

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On the 15th March 1875, the Engineer in Chief submitted to the President of the Company, the following communication upon the subject referred to in the foregoing extract from the report of the Special Committee :

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, March 15th, 1875.

MR. PRESIDENT :

The Provincial Government and the City of Quebec having, through their respective Engineers, decided upon some changes in the present grades, plans, and mode of construction adopted and in part executed upon the Road, all of which, if insisted upon, must necessarily involve a considerable increase in the cost of construction ; and the question having arisen as to whether the whole or any portion of this increased expenditure is covered and provided for under the existing contract, I would respectfully submit that, from the nature of the case, it will necessarily be quite impossible to arrive at any just and equitable conclusions upon this subject, for some time to come. The following are the reasons :

1st. The changes that are to be made, are as yet only determined in a very vague and indefinite manner ; those in relation to the height of grade and width of cuttings having been left to be determined by " passing over the whole line profile in hand " &c., which must necessarily occupy considerable time, even in case it can be done at all, understandingly, while the snow is upon the ground.

2nd. After these changes shall have been fully determined upon, and well understood, it will necessarily be the work of considerable time to ascertain, with any degree of precision, their effect upon the final cost

of the work as compared with any data, information, or understanding that may hereafter either be agreed upon by the Railway Company and the Contractor, or decided upon by arbitration, or in the Courts, as the case may be, as having formed the legitimate basis of the existing original and supplemental contracts.

3rd. In determining upon this basis for the contract, a good deal of time will necessarily be occupied in an investigation of all the facts, correspondence, and other evidences relating thereto, from the time of the commencement of the negotiations which eventually led to the final consummation of the contract, until the present time.

4th. After a full and satisfactory determination of the basis of the existing contract, and the consequent decision as to whether it covers the whole or any portion of the increased expenses involved in the recent elevation of the Government Standard, it will necessarily be the work of considerable time to compute the precise proportion of these increased expenditures, if any such should be determined upon, which should be borne by the Railway Company and the contractor respectively.

5th. If, in deciding upon the basis of the existing contract, it shall be determined that the location of the line, the arrangement of the grades, the requirements as to the width of earth works, the plans and detailed specifications for foundations, masonry, &c., or the schedule of quantities, as they existed at any particular date or period of time, must be regarded as representing the outside limit of the work to be executed, and expenditures to be made by the Contractor, in order to fully complete and equip a first class railway in accordance with the terms of the contract, then it becomes quite evident that no just comparison can be instituted between these different elements, as they existed at that particular date or period of time, and the same elements

as they must necessarily exist at the final completion of the contract, until the entire work upon the main line has been completed as a first class railway, "and shall have been accepted as such by the Lieutenant-Governor in Council, on the report of the Provincial Railway Board."

6th. Even should the Schedules of quantities and relative contract values, which have been prepared by the Chief Engineer from time to time, as a basis for progress estimates, be taken as a guide in the determination of the basis for the existing contract, I do not consider it at all certain, that, when the main line of the road shall have been fully completed to the acceptance of the Government and the City, the aggregate values of the final quantities and amounts of the different items or classes of expenditure, will be found to exceed those which were based upon the line as located, grades as arranged, and plans as anticipated in 1872 and 1873, as they were then fully understood and approved of, both by the Railway Company and the Contractors; and which forms substantially the basis of the present revised Schedule; which Schedule, as Mr. Fleming very justly remarks "was prepared under the contract for the purpose of enabling the engineer to arrive at a just and equitable basis for monthly estimates and payments; and so far as I can judge, *for that purpose only.*"

Should the character of the foundations in deep water be radically changed, however, as now contemplated by the Government Engineer, that particular item will of course be materially increased above the value named in any former schedule, although it has already been determined by the Government and City Engineers that this increase or modification "*is clearly within the scope of the contract.*"

7th. I have already expressed an opinion, which has been fully concurred in by Messrs. Fleming and Shan-

ly, to the effect that the Contractor should be indemnified for any loss, either in work, materials, or expenditure which he has already, or may hereafter sustain, by reason of changes made, either in the location of the line, the arrangement of the grades, or in the plans of structures, in cases where he may have entered upon the work in good faith, and it is afterwards found that the whole or any portion of his expenditure is lost or thrown away.

It would appear, at the first glance, that this item at least, could be determined upon and settled at once; and I have no doubt whatever that it can be determined much sooner than the more important questions, previously alluded to; and consequently that some plan for its adjustment may with propriety be agreed upon at the present time. But when it is considered that the Government and City Engineers have not yet determined upon the height to which the grade shall be raised at different points upon the line, nor the width to which the different cuttings shall be excavated; nor the nature of their proposed modifications in the plans for foundations in deep water; nor the precise *treatment* which shall be administered to the *sick Jacques Cartier Pier*. And when it is further considered, that the Contractor may, and if he consults his own interests undoubtedly will, postpone the bringing of the earthworks which he has already constructed, either *up or out* to the required standard, as the case may be, until after the track shall have been *laid* upon the present graded surface, when it can be done with much greater facility and economy than at present, it becomes quite evident that a final settlement of even this small item of difference, cannot be arrived at understandingly, for at least some months to come.

In view of the foregoing facts and considerations, it would seem that the only course which the Railway Company can consistently pursue at the present mo-

ment, is to give to the Government and the City, some satisfactory assurance that the work will be made to conform in all respects, to the required standard; and also to give to the Contractor some satisfactory assurance or guarantee, that any extra expenditure which may be required of him, over and above such as is clearly provided for in the existing contract, in order to make the work conform to the required standard, will be properly adjusted as soon as the same can be intelligently ascertained and acted upon.

Respectfully submitted,

S. SEYMOUR,  
Chief Engineer.

COL. WM. RHODES,  
Prest. N. S. R. Co.

The foregoing communication was read before the Board of Directors, at a special meeting held March 15th 1875, after which the Board adopted the report of the special Committee, and transmitted a copy thereof to the contractor for his approval.

On the 17th March 1875, the contractor addressed a letter to the President of the Railway Company, from which the following is an extract :

" I agree to the Resolution passed by the Directors of said Company on the 15th instant, and shall conform thereto; and shall carry out and perform the works referred to in the report of Messrs. Light and Baillaigé, which I have examined, according to the tenor thereof; and to leave to the decision of three arbitrators named in the usual manner, the question as to whether said works referred to in said report are extra, and not

included in former contract ; and what amount shall be paid me, if any, for such extra work when performed by me."

Upon transmitting the above action of the Railway Company and the Contractor, to the Government, it proceeded to pay over to the Company, the remainder (\$30,000) of the \$110,000 which was assumed to be due on account of " Estimate No. 4 ", up to Nov. 1, 1874, amounting in cash values to \$426,254.96.

" Estimate No. 8 ", up to April 1, 1875, amounts in cash values to \$546,220.69.





## IV

### A CAREFUL SYNOPSIS OF THE GOVERNMENT STANDARD.

Inasmuch as all parties have agreed to adopt and adhere to the standard of construction which the Government Engineer has insisted upon as being requisite to secure a *first class railway*, it seems quite important that this standard should be fully understood at the outset.

The following synopsis of the respective standards has therefore been carefully prepared, in order that no further difficulty or misunderstanding may occur with reference to the proper execution of the work.

#### *Standard No. 1.*

This Standard provides that "the embankment at formation level should not be less than 17 feet wide; and that the cuttings should not be less than 24 feet." Also that "The formation level between here (Quebec) and Three Rivers, should generally be raised up bodily from one to three feet throughout its entire length, with the exception of the river crossings, and at the five or six points where cuttings of medium depth occur." Also: "The value of this (the present cost of) grading I would propose to double, certainly 50 per cent at least should be added to the quantities of earthwork."

Also: "The Contractor of course cannot be expected to make radical changes without compensation."

*Standard No. 2.*

This Standard, after re-iterating the requirements of "Standard No. 1," as to height and dimensions of earth-works, provides :

2nd. "The culverts or water passages, through the embankments, are built upon imperfect plans."

3rd. "The masonry in the bridging, although apparently good of its kind, is generally too small, the piers especially."

4th. "The proposed plan of founding piers on soft bottoms, in the deep waters of the large rivers, which in some instances are 25 ft. deep at low water, although economical, I consider hazardous."

5th. "The superstructure of many of these bridges, especially from Quebec to Portneuf, is much longer than the water-way of these streams require."

6th. "The cement and sand being used at Portneuf Bridge, the only place I found masonry in progress, were very indifferent. The latter indeed quite unfit for the work, as I pointed out to the Resident Engineer."

*Standard No. 3.*

This Standard provides :

1st. "That the road-bed (or base of ballast) be raised more or less, equivalent to an average of at least one foot throughout its entire length."

2nd. "That the cuttings be increased from 18 to 24 feet in width."

3rd. "That a width of 15 feet, as now arranged for the Montreal Northern Colonization Railway, be adopted as the width at formation level, on the North Shore Railway; it being understood that the road-bed shall be so made, that it will retain the full width of 15 feet, after it has thoroughly shrunk and consolidated."

4th. "That a foot of ballast be placed under the sleepers, as well as carried up to the level of their upper surface, as shown in the diagram attached. The width of the ballast being 10 feet at the level of top of sleepers; and 14 feet 6 inches at the base, or formation level."

5th. "That the top width of piers shall in no case be less than from 5 to 7 feet for spans of from 80 to 160 feet; and that these piers be constructed of 1st class masonry. Mr. Light being of opinion that the specifications for masonry in use on the Montreal Northern Colonization Railway, from their freedom from ambiguity, be adopted on the North Shore Railway."

6th. "That the foundations for piers in deep water shall be so altered and strengthened, to the approval of the undersigned, as to insure that safety and stability which they do not now possess. This modification we believe being within the scope of the contract."

#### *Standard No. 4.*

This Standard provides for the same additional height of road-bed as Standard No. 3. It admits that the Government Engineer had not seen the present profiles west of Three Rivers, (one half of the road.) It declines to indicate the proper grade height upon the profiles submitted by the Chief Engineer, but decides that "the road must be gone over, profiles in hand, to determine height of road, &c."

It decides that the width of embankments at sub-grade, or formation level, may exceed 15 feet in some cases, and that it may be reduced to 12 feet in other cases.

It insists that the ballast diagram shall be adhered to in every particular, and that 2,500 cubic yards shall be the quantity of ballast per mile.

It insists that "*the Jacques Cartier Pier must come down,*" and be re-built "7 feet thick at the top under coping." It suggests no method of obviating the difficulty of this pier being founded on solid rock.

It permits the foundation masonry in the Port-neuf piers, to remain undisturbed, but the batter must be changed so as to bring the piers to a width of 7 feet at top.

It provides for the thickness of all bridge piers, without regard to their height, or the total length of the bridge, as follows: "5 feet for spans of 80 feet; 6 feet for spans of 120 feet; 7 feet for spans of 160 feet; and proportionately for intermediate spans."

It insists that the coping upon bridge masonry shall not be allowed to project; that the batter of the face walls shall be 1 in 24; that the masonry shall all be laid in Portland hydraulic cement, 2 of sharp clean sand to 1 in cement, in face of work; and 3 of sand to 1 of cement in the backing; that the masonry specifications in use upon the "Montreal Northern Colonization Railway" shall be adhered to in every particular, and that *lime mortar* must not be used under any circumstances whatever.

It insists that the plans and specifications for foundations in deep water are "*hazardous,*" and cites to a bridge near Montreal as an evidence of this fact; but it requires time to determine upon, and submit a proper Standard for this class of work.

*Standard No. 5.*

This Standard provides for the same additional height of road-bed as Standards No. 3 and 4; but "suggests, that the whole line be passed over, profile in hand, and the points where the raising should be made, be indicated on that profile."

It re-iterates "that the cuttings be increased from 18 to 24 feet in width, to admit of thorough drainage."

It limits the width of road-way at formation level, to 15 feet, but allows it "to be raised or left one foot higher, and reduced to 12 feet at under side of sleeper, where the native material is sufficiently good to be used as ballast."

It adheres to the diagram for ballasting referred to in "Standards No. 3 and 4." It re-iterates the width of masonry in Bridge piers as specified in "Standard No. 4," with the following additional remark; "which of course will necessitate the rebuilding of the pier at Jacques Cartier Bridge in conformity with this suggestion; or the erection of an additional pier." It also re-iterates the conditions embodied in "Standard No. 4," respecting the Port-neuf bridge. Also as to the use of the "Montreal Northern Colonization Railway Specifications for masonry, Portland Cement, proportions of sand, &c.; but no allusion is made, either to the batter of the face walls, or the objections to projecting copings.

The condition respecting the foundations in deep water is as follows:

"Sixth. That the foundations for piers in deep water shall be so altered and strengthened, to the approval of the undersigned, as to ensure that safety and stability which *in their opinion*, they do not now possess, this

modification (*clause No. 6*) *we are of opinion is clearly within the scope of the contract.*"

The above sentences in *italics* will be found to differ somewhat from the language used in "Standard No. 3." It will be also observed that no allusion is made to the future preparation and submission of plans for this class of work "by the undersigned," as contemplated in "standard No. 4."

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Before leaving this branch of the subject, it may be expected, particularly by *Railway experts*, that attention will be called to the remarkable degree of clearness, consistency, and freedom from that "*ambiguity*" which is so proverbially fatal to all *first class railway enterprises*, which has thus far been displayed in the erection of the "Government Standard."

It is believed however, that these most important characteristics will have fully impressed themselves upon the mind of the reader, as he has followed, step by step, the different stages of progress towards that state of perfection, which the standard will have reached, after the Government Engineer shall have passed over the line, "profile in hand" and established the proper heights of the grade line; and also indicated such changes in the plans for foundations in deep water: "as will ensure that safety and stability which they do not now possess."

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## V

### REMARKS EXPLANATORY AND INTERROGATORY.

In order that no misapprehension need be entertained respecting either the principal characteristics of the Government Standard ; its entire freedom from *ambiguity* ; or its effect upon the plans and mode of construction provided for, and being in good faith carried out, under the existing contract and specifications, it is proposed to submit the following explanatory remarks and interrogations upon that subject :

1st. The *width of earth-works*, at sub-grade or formation-level, as contemplated by the specifications, and already in part constructed, is *substantially the same* as that provided for in "Government Standards No. 3, 4 and 5."

2nd. The *top-rail-grade-line*, as arranged by the Chief Engineer upon the profiles of the entire main line, as revised in 1874, is *two feet and over*, above the natural surface of the ground, for 75 per cent of the distance, (one half of the road) between Quebec and Three-Rivers, and it is *three feet and over*, above the natural surface of the ground, for 90 per cent of the distance, (one half of the road) between Quebec and Montreal.

3rd. In a report to the Railway Company, dated March 4th, 1875, the Chief Engineer recommends : "that the top-rail grade line be so arranged as to secure an elevation of *at least three feet* above the natural sur-

face of the ground, in all cases where this elevation is not *necessarily* controlled by *maximum* grades, *minimum* curves, *unavoidable* cuttings, bridge elevations, and bridge approaches. Also by a due regard to dangerous or objectionable undulations in the grade."

An inspection of the present profiles will show, that the above condition may be complied with, by elevating the present grade line, not more than an average of one foot, over a less distance than 20 per cent of the entire length of the Main Line.

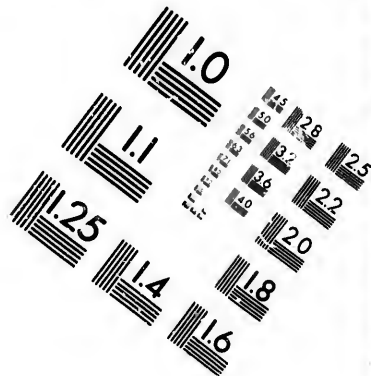
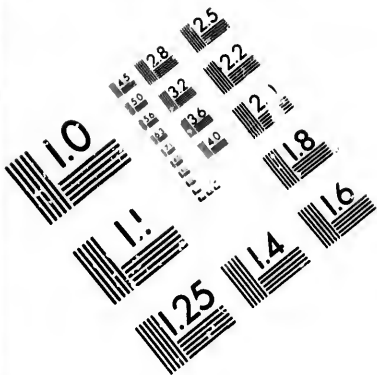
4th. A recent critical inspection of the line between Quebec and Three Rivers, made with particular reference to an estimate of the probable future *snow obstructions*, as based upon an observation of the almost unprecedented depth of snow during the past winter, shows conclusively that the present arrangement of the grades, is almost entirely unobjectionable, and that the increased height as recommended by the Chief Engineer, will *beyond a question*, effectually meet and overcome all difficulties and delays from that source.

5th. The diagram for *ballasting*, referred to in "Standards No. 3, 4 and 5," shows the ballast to be 18 inches thick ; 10 feet wide at top, *on a plane*, level with the top of the cross-tie ; and 14½ feet wide at the base, or plane of "formation level."

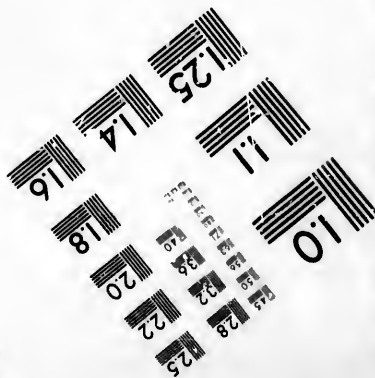
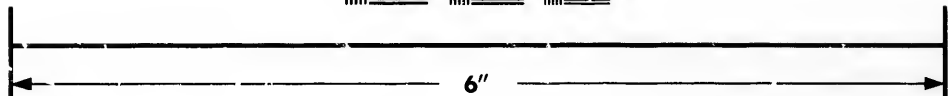
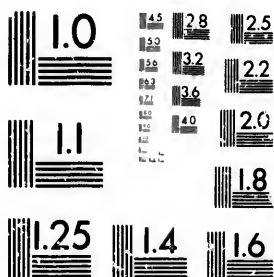
Any good practical supervisor of track will occupy the first month or two of the time of his men, in removing the *superfluous* material from the end of the ties, and *throwing it over the bank*. After which he will give the ballast a slope from the top center of the tie, to the end of its base ; and thence to its outer angle or finish, in order to facilitate drainage, and clearing the track of snow. All this surplus material is therefore only so much *waste*, or *unnecessary expense*. The contract says : "*nothing superfluous* will be required."







**IMAGE EVALUATION  
TEST TARGET (MT-3)**



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The schedule estimates of the Chief Engineer, provide for 2,000 cubic yards per mile of ballasting, over a distance of 125 miles, of the main line, the entire length of which is 157 $\frac{1}{2}$  miles.

6th. With reference to *bridge piers*, Mr. Walter Shanly says : " I should say that *six feet will be ample width for the top of the piers* ; and with such stone as I have seen come from Deschambault, for instance, I would not fear to build and guarantee them on a width of *five feet across the coping.*" The "*Jacques-Cartier pier,*" about which so much has been written and said, is *five feet and one inch* across the coping ; and is composed of stone *quite equal if not superior to the Deschambault* ; and it has been demonstrated that it will sustain *twenty-four times* the weight that can ever come upon it ; and that, relatively speaking, it is more than *twice as strong* as the piers of the *Niagara Suspension Bridge* ; yet " Government Standard No. 4 " says : "*it must come down* and be rebuilt with a thickness of 7 feet under coping." And Government " Standard No. 5 " says : "*it must come down, or an additional pier must be erected* ;" whereas, the contract says : "*nothing superfluous will be required.*"

7th. Government Standards No. 4 and 5 say, that the thickness of bridge piers must be " 5 feet for 80 feet spans ; 6 feet for 120 feet spans ; 7 feet for 160 feet spans, and proportionately for intermediate spans " ; by which rule of proportion the Jacques-Cartier pier would be only 6 feet, 10 inches thick ; and the Port-neuf River piers would be only 5 feet, 10 $\frac{1}{2}$  inches, thick. Whereas the plans for the Port-neuf piers are now 6 feet thick at top, and in part constructed, yet Government Standard No. 4, says : that, both these, and the Jacques Cartier piers, "*must be 7 feet thick at top under coping.*" *Which of these directions must be complied with ?*

8th. "Government Standard No. 4" says, that the coping upon bridge piers must not project over the face of the work, lest the weight of the bridge truss, as it rests upon the edge of the coping, will *tip it up*, and *shatter* the masonry underneath. Whereas, the weight of a truss-bridge is never allowed to bear upon the edge of the coping; but it always rests upon a *wall-plate of timber*, setting back at least as far as the front line of the face of the pier. *Where then is the danger?*

9th. "Government Standards No. 4 and 5," say, that "the specifications for masonry in use upon the Montreal Northern Colonization Railway, must be adopted for the North Shore Railway." Whereas the present detailed specifications for masonry upon the North Shore Railway, refer to the specifications for the "Intercolonial Railway," as a guide with reference to the general character of this class of work in the more important structures upon this road. These specifications are *almost identical* with those in use upon the "Northern Colonization," except that they do not allow for the use of *lime mortar*, which "Government Standard No. 4" entirely condemns, while it directs unqualifiedly that the work be done under the specifications in which its use is allowed. *Which of these directions must be complied with?*

10th. "Government Standard No. 1," says: "The Contractor of course cannot be expected to make radical changes, *without compensation*." Whereas, Government Standard No. 5, referring to a modification in the plans for *deep water foundations*, says: "this modification (clause No. 6), we are of opinion, is *clearly within the scope of the contract*." Is it to be inferred from this, that the proposed modifications, or changes in these plans, will be only *nominal*, and not *radical*?

11th. It is quite true, as stated by the Government Engineer, in "Standard No. 4," that the Chief Engineer

had given *special orders* to the Resident Engineer, that no one should be allowed to examine the profiles of the line between Three Rivers and Montreal, which were then in the Montreal Office.

The profiles referred to, were in an unfinished state, having only a pencil grade line upon them, as arranged by the Resident Engineer, for the purpose of copying upon the land maps, which were then in preparation in the Montreal Office.

Besides, the Chief Engineer was of the opinion, that it would be quite as well to settle the questions that the Government Engineer had raised, respecting the line between Quebec and Three Rivers, before opening up a new field for his criticisms, upon the line west of Three Rivers; particularly as his instructions from the Government confined his investigations to "*the quantity and character of work done, and materials furnished*;" and he had already reported to the Government that he had "*made a careful inspection of that part of the North Shore Railway between Quebec and Three Rivers, this being as far as any works are in progress, &c.*"

The profiles of the entire main line, as revised in 1874, with the grade line as established by the Chief Engineer, subject to the approval of the Board of Directors, have been in the Chief Engineer's Office in Quebec, during the entire period of the Government Engineer's connection with the road; and the Chief Engineer would have been most happy to have looked them over with the Government Engineer, at any time that suited his convenience, with a view of comparing notes, making explanations, &c., &c.; but, unfortunately, it has never yet happened to suit his convenience.

12th. If an opportunity of this kind had been afforded, the Government Engineer would have learned,

among other things, that over a large portion of the distance " between the 30th and 40th miles from Quebec, where the line is cutting for a considerable portion of the distance, " (as stated in Standard No. 1, also in Commissioner's letter) the grade line was drawn from one to two feet lower, upon the profiles, than the work had been actually laid out and in part constructed upon the ground, owing to the failure on the part of the Resident and Assistant Engineers, to rectify an error in the levels, upon the profiles, which had been rectified upon the ground.

13th. It is quite noticeable that the very serious objections which were raised in Standard No. 2, to "*the culverts or water ways*", also to the unnecessary length of *bridge superstructures and trestle-work*, are not noticed or provided for in subsequent standards.

Is it therefore to be inferred that these objections are withdrawn ?

14th. Neither is there anything said in any of the Standards about *Wooden Cattle guards* ; or the quality of timber admissible for cross-ties and fencing.

Did all these escape the vigilant eye of the Government Engineer ; or has he still another "Standard" in reserve to cover these important matters ?

15th. The following extract from the Chief Engineer's "*Report on the situation*", dated March 4th, 1875, will show that the Government Engineer cannot refrain from calling the attention of the Government, in a derogatory manner, to the affairs of this road, upon every occasion that presents itself.

" In another report (of which I have not the date, but probably written about the same time) upon the "*Montreal Northern Colonization Railway*," the same

Government Engineer, in speaking of the Engineering Expenses upon that road says :

“ This compares favorably with similiar expenses on the North Shore Railway, where these three items to date amount to about \$180,000, while the value of the work done is but \$220,000, *the Engineering being about 80 per cent on the actual outlay for work done.*”

“ As I have had the honor of laying before the Board full replies to the multiplied objections raised by the Government Engineer to the class of work upon this road, under date of January 9th, and January 26th 1875, it will be supererogatory to repeat them here ; but as I have had no previous opportunity of noticing the extraordinary statement respecting this road, which he has volunteered to make in a report upon an entirely different road, I will merely remark, that a reference to the “ Statement of Engineering expenses upon the Main Line up to December 1st 1874,” hereto annexed, and marked “ Appendix No. 4,” will show that *his statement has no foundation in fact.*”

The “ *Statement* ” above referred to, shows that the Engineering Expenses up to Dec. 1th 1874, were 28½ *per cent* of the total expenditure ; and that the Engineering expenses, chargeable to construction proper, up to the same date, were 9 *per cent* of the total expenditure on account of construction ; and that upon the completion of the road, they will not exceed 6½ *per cent* of the entire expenditure.

It also shows that the Engineering Expenses incurred in 1871, and 1873, amounting to \$43,705.28, were *practically* thrown away, on account of the failure of the County subscriptions ; and the delay of the Contractors in going forward with the work.

Is it altogether just, that the success of this great work should be jeopardized by gross mis-statements of



this nature, made and promulgated under the sanction, and by the authority of the Provincial Government? And is not the fact that such mis-representations have been made, by the present Government Engineer, quite sufficient to destroy all confidence in his statements respecting any other matter connected with this road?

16th. Referring to the *give and take* policy, suggested by the Government Engineer, in "Standard No. 1," for adjusting differences, or settling *general averages* with the Contractor, in compensation for *radical changes, &c.*, if a precedent were wanting for such a course, it will be found in a similar policy which was pursued for a time, upon the "Intercolonial Railway" as shown by the following extracts from the published "*Report of the select standing Committee on public accounts*, in reference to section 16, Intercolonial Railway," printed by order of the Dominion Parliament in 1874.

(See pages 22 and 23.)

*Mr. A. L. Light being under examination.*

"139. You are engaged on the Intercolonial Railway?—*I am.*"

"140. In what capacity?—*I am District Engineer.*"

"141. What distance is embraced in your District?—*Six sections. It is what is called the Miramichi District, including the Miramichi bridges.*

"142. What are your duties Mr. Light, as District Engineer?—*To take a general supervision of, and be responsible for the works, under the Chief Engineer. I have to see that the orders of the Chief Engineer and the specifications generally, are carried out; to see that the works are performed in the proper manner, and in accordance with the specifications.*"

" 143. What number of miles have you in this district? *A little over 120 miles.*

" 144. How many miles are there in section 16? *About 18½ I think.*"

" 151. Who determined the plans of the construction of this section? *Well, I am responsible for all the plans of this district, of course really responsible to Mr. Fleming. I generally first arranged it myself, and then submitted it to Mr. Fleming for his approval, and he made such alterations as he pleased.*"

" 155. Have you heard Mr. Fitzgerald's statement in reference to the striking out of structures and bridges? *I have.*"

" 156. Do you know how far that statement is correct? *I should think in the main it was correct. Culverts have been struck out of that work, and although I am not prepared to say that his statement was exactly correct; yet I think in the main it was so.*"

" 157. Were any of these culverts returned as completed? *There were a few that were so returned. I am not prepared to say how many; but they were the smallest kind of structures, not exceeding two feet.*"

" 158. Then the whole 34 were not so returned? *No; I think the number was five or six.*"

" 159. Do you know whether payments were made to some of the contractors in the same manner as if these works had been done? *I cannot tell you that. Payments are made through the office of the Commissioners. I pay nothing.*"

" 160. Does not the Schedule of prices, as applied to quantities, pass through your hands? *Yes, I believe there was some such return in the early stage of the work.*"

161. Has there been any equivalent work done of any other kind in lieu of these culverts struck out? *I think there was; there was a very considerable amount of ditching done, much more than would be necessary, had all the culverts been constructed according to the original contract.*"

(See page 33 of same Report.)

*Mr. Light cross-examined by Mr. Mills.*

" 285. Were you aware that Mr. Buck reported the striking out of these 34 culverts? *Not officially.*"

" 286. Do you know whether the striking out of the 36 culverts was reported to the Chief Engineer? *I do not, Sir.*"

" 287. When you say there were 28 struck out, by whom were they struck out? *By myself. I mean by direction of the Chief Engineer. I mean we consulted together.*"

" 288. Did you act on Mr. Buck's report? *No, I never looked upon them as fixed, until I got the Chief Engineer's approval.*"

" 289. Upon what information did you proceed? *I examined the work and acted on my own personal information, and such information as I was able to procure from others.*"

" 290. Have you gone over this line often? *Yes, I went over the line two or three times a year perhaps. I am not sure that I went over the work every year during the progress of the work. It is possible that I did not.*"

(See page 34 of same report.)

" 322. Was there any time for two years together

you were not over this road? *I cannot tell you. I should think not, &c.*"

(See page 37 of same report.)

*Mr. Sandford Fleming, Chief Engineer, being examined.*

" 359. What was the class of Engineers appointed, who were entrusted with the supervision of the work? *First: The District Engineers who were all appointed with my approval. Second: Division Engineers. Third: Assistant Division Engineers.*"

" 360. What was the principal duties of District Engineers? *They were to have the supervision of every thing done in each District, and receive instructions from me with regard to Engineering matters, and see that they were carried out.*"

(See pages 38 and 39 of same report.)

*Mr. Fleming still under examination.*

" 398. Mr. Buck was on this road for a number of months? *He was there part of the time.*"

" 399. By whose authority? *By authority of the Commissioners.*"

" 400. Did he report to you the progress of the estimates? *Yes, through Mr. Light.*"

" 401. Did you act upon his report? *Certainly.*"

" 402. Were payments made upon Mr. Buck's report? *Yes, on the quantities returned by Mr. Buck as executed.*"

" 403. Are you aware Mr. Buck returned a number of culverts as executed that were not done? *I learned*

*to my surprise he had done so. The whole masonry returned which was not executed was 200 or 300 yards."*

"404. Of the 54 culverts marked on the profile, how many were dispensed with in constructing this section? *I cannot at present say, but will look it up."*

"405. Was the error committed by Mr. Buck, corrected as soon as discovered? *Yes. It is due to Mr. Buck that I should explain the reason why it was done. Mr. Buck rightly or wrongly dispensed with one or more culverts, by substituting ditching or other work. He thought when the ditching was substituted, that he ought to return the culverts as executed; and did so."*

"406. Did he make any return of the number of yards of ditching done in lieu of the construction of culverts? *No.*

"407. Do you think the ditching cost anything like the sum the Contractors saved by it? *I think not."*

(See page 79 of same report.)

*Extract from Statement of J. W. Fitzgerald, Esq., Engineer in charge of Section 16.*

"The ditching which Mr. Light magnifies as having been done, in lieu of the masonry thrown out, is very trifling; and a portion of it has been done with a view of effecting a still further reduction in the remaining culverts. Every yard of this work, and all other work, however, is included in the monthly estimates, and is paid for like other earth-work. The masonry struck off is paid for beside."

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The above quotations are given here, not for the purpose of doing injustice to, or of casting reflections upon any of the parties to the controversy, which was

the cause of the investigation ; but merely as showing the precedents established by the *Dominion Standard for first class Railways*, not only with reference to the proper treatment of contractors ; but also with reference to the remarkable degree of industry, perspicuity, and knowledge of the work entrusted to them, which were exhibited on the part of some of the Engineers, who were revelling in *Government Pastures*, while occupying high positions upon that important national work.

Reference is respectfully made to the entire report, in order to show the reliance to be placed upon the statements of the different parties connected with the transaction ; and also the remarkable degree of *discipline, system and economy*, which are practised upon the *Government works* of the Country.



## VI.

### FURTHER VIEWS OF MR. WALTER SHANLY, UPON RAILWAY STANDARDS.

I desire in this place to call attention to the following extract from a letter just received from Mr. Walter Shanly, under date of "Boston, March 24, 1875," which, although its place, had it been received earlier, would more properly have been in my recent "*Report upon the situation*," to which it refers; yet I consider the views therein advanced to be so appropriate to the discussion of "Standards for first class railways" generally; and also, that Mr. Shanly is so fully entitled to the confidence of both the Railway Company and the Government, that anything he may say upon the subject will, I trust, not be considered as entirely out of place here.

*Mr. Walter Shanly to General Seymour:*

(Extract.)

"I very much regret that I had not more time to give to the questions you referred to me. I was so situated at the moment that I had to answer you immediately, or postpone doing so indefinitely. I should have liked to enlarge somewhat, on what I will call the absurdity of Engineers, whose financial experiences have been wholly in Government pastures, deciding that henceforward all our railways must be turned out from the shop finished to a nicety; complete and "first class"



in every particular. If that is to be the "law," the day of railway building in Canada, save and except of "Government lines" is pretty well over. Engineers who propound that doctrine, do not understand the needs of a young country (and the North Shore country is yet young in its ability to construct railways), and do not know what admirable useful pioneers, the kind of roads they are so glib to condemn, have been on this Continent. The great "first class" lines of to-day, the B. and O., the N. Y. C., the Pennsylvania, the Boston and Albany, and others in the same category, have all "risen from the ranks" so to speak, and have come to be what they now are, through the vast growth and progress of the country, which they themselves, in their earlier and humbler existence as second, third or fourth class roads, or what you will in the way of classification, have been mainly instrumental in bringing about.

I do sincerely hope you have, by this time, got matters so arranged that you will be able speedily to show us along the North Shore, just such a railway as your contract and specifications contemplate. Its construction will supply a great need in the Province of Quebec; and that you are able, as I trust it will be proved you are able, to give the country a road as good in the very first stages of its existence, as it is designed to be, is, or will be, a marked evidence of the growing prosperity of Canada; for when the line was first talked about, 20 years ago or more, we would have been only too well content to have obtained one of very far inferior characteristics to those which you purpose giving it now.

The Engineers who speak contemptuously of narrow embankments, wooden bridges, and iron rails, would doubtless condemn as utterly unfit for use, were they to see them now, some of the roads that you and I have helped to build in the olden time; and which, for all their "shaky character" did quite as important service



in their day and way, as their aristocratic descendants are doing now.

I have built as good railway work as any man in America, and as bad; and I am not sure that I do not look back on the latter with quite as much satisfaction as on the former; because in getting the rails down *anyhow*, through a new and poor country, I felt that I was laying the way for such broad changes and improvements as, in the contrast with what had been before, one might well be proud of aiding to bring about.

It was a hard, but not a bad school for Engineers, tending greatly to brighten their financial wits, where they let their contracts first, and then had to consider how to make one dollar do the work of two, or of three just as likely, as "estimate time" came around from month to month.

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Mr. Walter Shanly is too well known throughout the whole of Canada, and the United States, to require any endorsement at my hands; and therefore, I do not envy the position of any *narrow minded* and *impracticable* Engineer, whose history and practise, as connected with this or any other *great public enterprise*, brings him within the circle to which Mr. Shanly alludes, in his well timed and scathing remarks.

It will be sufficient for me to say in this place, that it will be a most auspicious day for this Road, when it shall have fully recovered from the blow, which has so recently been dealt to it, by Engineers of this class; who, although they may plead in excuse, that they have been instigated and encouraged by persons high in authority, both in the Government, and in the Railway Company, should nevertheless not complain if they are held to a personal responsibility for the results of their professional acts and opinions.

## VII.

### REMARKS IN CONCLUSION.

Entertaining, as I do, a very high regard for the Provincial Government, and every one of its members ; and admitting, as I do, its *power* to exercise full control over the subsidy, or aid, which it has so liberally granted to this Company, without which the construction of the railway would never have been undertaken ; and appreciating, as I do, the power which it can exercise, and the responsibility which it assumes, not only *directly*, as it is now doing, but also through the agency of the Board of Directors, (in which, in conjunction with the City, it has a majority of members) over the *Standard*, or class of railway to be constructed, as well as over the payments that are to be made therefor from time to time, as the work progresses ; and believing, as I do, that all the objections that have been raised by the Government, through its Engineer, to the manner in which the work has been, is being, and is to be constructed, have been fully answered by this and previous Reports from this office ; and feeling, as I do, a strong and earnest desire to co-operate to the fullest extent, in any measures, or line of policy that shall secure the early completion of the railway, upon the basis which was fully understood and agreed upon by all parties, when the work of construction was commenced ; I trust that I may be pardoned for submitting the following remarks in conclusion :

1st. That, so far as it is possible to form an intelli-

gent opinion respecting the various requirements of the Government Standard, it is not apparent that they will have a tendency to materially improve the *real character* and *intrinsic value* of the work, over and above the Standard which was being carried out in good faith by all parties, before the advent of the present Government Engineer; while it is very apparent that, if all the Government conditions are insisted upon, they will entail upon the Railway Company, and the Contractor, a very large and *superfluous* expenditure, which they are not at present prepared to meet.

2nd. That, as stated, in the Chief Engineer's "*Report upon the situation*," dated March 4th, 1875 :

"When it is considered, that by the terms of the act of 1870, granting lands in aid of the Company, the Government has power to withhold these valuable timber lands, now amounting to 1,140,875 acres, until : "The said Railway shall have been completed and put in operation *to the entire satisfaction of the Lieutenant-Governor in Council*," it is difficult to see what better security the Government could hold, for the faithful performance of all obligations imposed upon and assumed by the Railway Company."

"*And even had Government no such security, it is manifest from the reports, correspondence, &c., referred to herein and appended hereto, that the work being done, and for which the contract and specifications provide, are such as will meet the requirement that the road shall be first class.*"

"The height of grades, a difficulty of easy solution, being perhaps the only one objected to by the Government Engineer, which is not fully and satisfactorily answered thereby."

3rd. That unless the Government, and the Railway Company, adopt to some extent, the line of policy so

clearly indicated, and forcibly endorsed in the above letter from Mr. Walter Shanly ; and also in his previous letter, which was appended to the report above referred to ; instead of being guided by a policy which dates back to where Mr. Shanly says he stood "*a quarter of a century ago*" ; and the inspirations for which have come entirely from "*Engineers whose financial experiences have been wholly in Government pastures,*" it is very much to be feared, that a great and important public improvement will still be allowed, (as it has been during the past twenty years), to languish out a feeble existence, and finally to die under its treatment, beyond the hope of any future resurrection.

4th. That unless the Government, the City of Quebec, and the Board of Directors, require the Contractor to proceed promptly with his work, in such a manner as to comply fully with the terms of his contract ; and at the same time secure to him the prompt payment of his progress estimates as he earns them, and as they are clearly provided for in the contract, it is very much to be feared that, even if Mr. Shanly's policy were to be adopted, the present generation will be allowed to pass away, without witnessing the full realization of their long cherished hopes, respecting the final completion of the *North Shore Railway*.

All of which is most respectfully submitted, for the consideration of the Provincial Government, the City Council of Québec, and the Railway Company.

SILAS SEYMOUR,

Engineer in Chief of the  
North Shore Railway.

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