

Q. Who is they?—A. Mr. Lumsden; I am not sure who it was, whether it was he or the inspecting engineer. I just mentioned it one day, but they would not hear of it.

Q. But if left to yourself you would have introduced some sags as momentum grades?—A. Yes; in the roads down south I did that in every case.

Q. There was a rumor passed that indicated to the commission that you were not on that work often enough to keep in close touch with the grading; what do you say to that?—A. I think I was on the work more than any district engineer: that is on the road from one end to the other, and knew every foot of it better. At one time the commissioner told me I was going out on the road too much, to send my assistant, that I ought to stay home and look after things, and not be going out on the road so much. That was Mr. McIsaac spoke to me.

Q. I wanted you to say that to contradict some information we had to the contrary?—A. That is a mistake altogether.

Q. I do not want to leave this with a wrong impression in connection with the action of Mr. Tomlinson on that trip when you increased the classification. You indicated to us that Tomlinson was clearly anxious—and an advocate—to raise the classification over what you had made it originally?—A. Yes.

Q. And wanted to make it still higher than you finally made it?—A. Yes.

Q. You are giving me that without any mental reservation at all?—A. Yes, he was very indignant because I did not raise it higher.

NATIONAL TRANSCONTINENTAL RAILWAY INVESTIGATING COMMISSION.

Before: MR. GEORGE LYNCH-STAUNTON, K.C., *Chairman*, and MR. F. P. GUTELIUS, C.E., *Commissioner*.

(Evidence taken on the train, at the boundary between Ontario and Quebec, June 20th, 1912.)

C. O. Foss, sworn:

By Mr. Gutelius:

Q. How old are you?—A. Sixty.

Q. How many years have you been in charge of responsible railway construction?—A. Most of the time for 25 to 30 years.

Q. What were the largest railway jobs that you had during that time?—Give four or five?—A. About the first construction work I did was the road from Dallas to Cleburn, Texas, in 1880.

Q. For what company?—A. The Texas Trunk.

Q. What next?—A. I built a piece of road in Iowa, known as the Des Moines Osceolla and Southern, from Des Moines, Iowa, down to pretty near the Missouri boundary, to a place called Kingsmere, and I was on the location of the Wisconsin, Iowa and Nebraska, from McGregor southwest to Kansas City. I had malaria fever shortly after that, and had to leave the west, and went to Nova Scotia in 1883.

Q. What next?—A. I was on the construction of what is known as the Nova Scotia Central.

Q. On the Nova Scotia Central you were in responsible charge of a portion of the work, or all of it?—A. All of it.

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Q. As chief engineer?—A. Yes. After it was built I operated it as Superintendent of Maintenance of Way for a while.

Q. The same road?—A. Yes, and then Mackenzie and Mann bought this road, and I worked for them, and had more or less to do with the ballasting, ties and timber. They built from Halifax round the south shore.

Q. That is for Mackenzie and Mann?—A. Yes. I left there in 1904, and came to the Transcontinenttal as chief of a party on preliminary surveys, in the fall of 1904.

Q. What portions of the line?—A. I made a preliminary survey of what is known as the river route from Fredericton, about 40 miles towards Woodstock, meeting Gard and party 23 miles below Woodstock; and then I came to Edmundston in the preliminary, from Edmundston to Grand Falls, and I went out near Boiestown, south of Boiestown, and ran practically over the ground that we located and built on to Napadogan, and so on, to the southeast of the Miramichi, where we crossed it now, and traversed up the ice, and made two or three trials to get over that summit. First I tagged it, and then Mr. Westbrook came upon the line. About that time I was appointed assistant district engineer, and took charge of the survey generally under Mr. Dunn.

Q. As assistant district engineer you had charge of the location under Mr. Dunn?—A. Yes.

Q. And assisted him in starting out the construction parties, and finally succeeded him as district engineer?—A. In 1908, yes.

Q. The specifications for this railway in the matter of classification differed from other specifications that you worked under?—A. Yes, in some particulars.

Q. What is the principal difference?—A. Well, we had generally only made two classifications, sometimes three; but solid rock and everything else was used on the Halifax and Southwestern.

Q. How many classifications did they use on those American roads?—A. We usually had prairie excavation and sometimes gumbo, a hard material called gumbo; very little rock on any of those western roads I was on; in fact, there was none.

Q. So that the first specification that you worked on that had these three classifications was the N.T.R. specifications?—A. Yes.

Q. Do you remember the prices paid on the Halifax and Southwestern for rock and for other excavation?—A. My recollection is that rock was \$1.30 and everything else 40 or 45.

Q. On this work did your resident engineers keep a force account?—A. Yes.

Q. Which was reported through to you?—A. Yes, and through to Ottawa.

Q. So that you could figure fairly closely the cost of various cuts?—A. Yes.

Q. You also received report covering the amount of powder used in each cut?—A. Yes.

Q. The matter of classification of your district, I understand, was one of controversy from time to time?—A. Yes.

Q. Were your original ideas of classification the same as you are now classifying?—A. Practically.

Q. If you had taken the specifications as they were given to you and classified the work, without any instructions from superior officers, would your classifications have been the same as they now stand?—A. I think so.

Q. What I am trying to reach is whether your personal ideas coincide exactly with what you are doing now?—A. Well, take this last contract, for instance; in 1907 a considerable amount of this work was done.

Q. Prior to your taking charge as district engineer?—A. Yes. Mr. Dunn went over the work in the autumn of 1907, while I was temporarily in district E, and graded up the classification, I think, and it remained on about the same basis for a while. I may say that in 1908 he had left, and he came back again as inspecting engineer for the Grand Trunk Pacific, in the summer of 1908; he

stayed until the spring of 1909, and they transferred him to the west, and shortly after sent Mr. Boullion, and he then took exceptions to some places, some fill on contract 4; quite a good many on contract 5—all this assembled rock question, and that, and some of the loose rock classification on contract 6.

Q. Who is the contractor for six?—A. Lyons and White. Then it was that I said I thought it would be better to refer the whole thing to the Board of Arbitrators that had been appointed for that purpose, and it was done.

Q. This Board is composed of whom?—A. The chief engineers of the G.T.P. and the N.T.R., with Mr. Schreiber as umpire.

Q. What did they do?—A. Before the arbitrators came at all, Mr. Grant and Mr. Woods came down and settled some, perhaps a dozen places, straight give and take agreement, and they got into a dispute, they had a misunderstanding in some way over it. Mr. Grant said Mr. Woods had agreed to a certain thing, and Mr. Woods said he had not; anyway they got into a dispute, and they quit, and Mr. Grant went back to Ottawa. That was last September, I should think.

Q. That was to settle the objection raised by the G.T.P.'s inspecting engineer, Mr. Boullion?—A. Yes, and then in November the Board of Arbitrators came down and went over the balance of these objections.

By the Chairman:

Q. We want to know whether the G.T.P.'s objection was that the classification was too low or too high?—A. Too high.

By Mr. Gutelius:

Q. The objections raised by Mr. Boullion that the classification was too high did not apply to the G.T.P.'s contract?—A. Well, he made no objection on contract one, which was theirs, the first fifty miles; nor on contract two which was McMannus's, nor on contract three, which was also theirs, from Chipman to McGibbon; he did not raise any objection on that forty miles, and then on contract 4 he raised objections in ten or a dozen places, I suppose, here and there. Then on contract five he objected to all those places where any assembled rock had been allowed, and a few places where he thought too much loose rock had been allowed, and then on contract six, all the places where assembled rock had been returned, and a good many places where he claimed too much loose rock has been returned.

Q. Did the arbitrators cover all of those points?—A. All of the objections that were standing. I may say between him and Woods, they withdrew their objections in several places on contract 6.

Q. That was a G.T.P. contract?—A. No, that is Lyons and White; that is the last contract; it comes right here to the boundary. After Grant and Woods had this misunderstanding I suggested to Woods that he and I go along down the line, and see if we could not settle some of these places, and I said "Now, if there is any of these places that you, on looking this thing over, think are all right, say so, and we will check them off". He did. In quite a few places he thought the objection was not serious, better withdraw it; so they did, and then the residue of this was summed up in what the arbitrators came and went over.

Q. Did the contractors themselves know anything about this arbitration?—A. Oh, yes.

Q. Were they satisfied with the findings, or have they accepted them?—A. Well, they were not satisfied. They have not made any move to test it, that I know of.

By the Chairman:

Q. You might state first, whose were the different contracts on your section; start at number 1?—A. Number 1 was G.T.P.

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By Mr. Gutelius:

Q. Extending from where?—A. Moncton to Mile 50; two was J. W. McMannus & Company, from 50 to 58. Three was G.T.P., from 58 to 98—four miles; and four, from 98 to 164 was G.T.P.; five, from 164 to 195 1-2 was Kitchen & Company; and six, from 195 to 256 and a fraction was Lyons and White.

Q. In our examination of Moncton yard excavation, we noticed that the hard material on the south side did not extend closer to the surface than 18 to 30 inches, and on the north side, where a steam shovel was working, the soft material seemed to go down from three to five feet; does that seem about right to you?—A. Yes, as it showed there.

Q. What do you say about the depth of the soft material over that whole yard?—A. I should think it would average perhaps 2 1-2 feet.

Q. Do you think the material as classified in the estimate will bear that out, and, if it does not, should it?—A. Yes, about 25 to 30 per cent, I think. The cutting is an average of something like nine feet.

Q. If the plough test were applied to the surface material, you would expect it to show about 30 inches to three feet?—A. Somewhere about there: two or three feet.

Q. And that proportion would be common excavation?—A. Yes.

By the Chairman:

Q. Is there a borrow pit?—A. Not in the yard. There is a borrow pit up above about a mile.

Q. Was there not an amendment to the common excavation paragraph, 36 and 36a, "No classification other than that of common excavation will be allowed on material from borrow pits, except by order in writing of the engineer"?—A. Yes.

Q. Was there an order in writing given for common excavation out of that borrow pit near Moncton?—A. I could not say, I am sure, whether the engineer in charge gave an order—you mean notice to the contractor?

Q. Yes; I understand there is a borrow pit about mile 2?—A. Yes.

Q. Was there any payment made above ordinary train haul for material taken out of that borrow pit?—A. No, that was not train haul at all; that was straight into that big fill, and it was classified probably about the same as the yard there.

Q. Was there an order in writing to classify it?—A. I could not say about that. It would mean, technically, that, while he required an order in writing, if he verbally told him he could borrow there, it is usually done.

Q. If he verbally told him, he would get nothing but common for it; do you see that? Have you considered that?—(No answer).

By Mr. Gutelius:

Q. If a written order was given to the contractor for borrowing material from the pit at mileage 2, where about 66,000 yards of material was removed, you will send us a copy of that order?—A. If it was given, it would probably be given by the resident engineer or Mr. Balkam, the divisional engineer.

Q. You will undertake to procure that and send it to us?—A. Yes.

Q. In this connection, I would like you also to advise us of all classified borrow that was not ordered in writing by the engineer?—A. All right.

Q. At mileage 16 there is a cutting 4,000 feet in length. (Profile shown witness). The classification shows loose rock 5186, common excavation 8642. The material has the appearance of common excavation from the plough test idea, from two to three feet thick over that cut. Do you remember the material?—A. Not specially, no.

Q. If you find in a test that there is three feet of loose material on that cut, would not this classification appear to be too high?—A. Yes, if there was three feet all the way on that cut it would make a greater difference than what is shown there.

Q. Referring to the profile, mileage 26 to 28, would it have been possible to have lowered the grade, without interfering with the maximum gradients and saved some money?—A. Yes; this grade could be lowered for a mile and a half and some saving could be made.

Q. Can the engineers at Ottawa figure this approximately correctly?—A. Approximately, yes.

Q. The cross-section is fairly level?—A. Yes.

Q. There is a similar profile between mileage 30 and 31?—A. Yes, I see it.

Q. Say 30.3 to 31; could that receive the same treatment?—A. That maximum grade would have to be got through the shallow cutting all the way. Whatever you dropped the grade between mileage 30.3 and mileage 31.3 would have necessitated additional cutting at the top of the grade at 31.3.

Q. Could not the material taken from this cutting west of mileage 31 have been used to the east in that cutting?—A. Yes.

Q. So that a net saving might have been secured without increasing the gradient?—A. Without increasing the gradient, yes.

Q. With your experience as an engineer, and knowing that there are a number of such places on your district, why did you not lower these grades?—A. Well, in some cases, I do not know whether that particular case or not, the grades were put on at Ottawa; sometimes they were changed there, anyway, and the idea held out was to keep the line up clear of snow and water.

Q. Can you give us a definite reference to any instructions from the Ottawa office to keep these grades up?—A. Well, I won't answer that; I won't undertake to say that I can, but when I go into the office and look over the correspondence, if I can find anything I will produce it.

Q. You are quite sure in your own mind you did have such instructions?—

A. I know the grades were changed in Ottawa in some cases, but I cannot say just which they applied to, whether they applied to that particular case or not.

Q. Were profiles generally approved in Ottawa before you started the work?—

A. Always.

Q. To what height do you consider it is necessary to keep the top of the tie above the surrounding country, when there is no other influence for protection against snow?—A. Oh, say two or two and a half feet. Of course more would be better in heavy snows, but in ordinary snows that would enable you to clear the line easily.

Q. That would mean that the grade line shown on your profile should be, at least, a foot above the surrounding country?—A. Yes.

By the Chairman:

Q. Is that for snow or water?—A. That is for snow alone.

By Mr. Gutelius:

Q. What do you say about water?—A. Well, if it was a wet place, where it was likely to be flooded under very heavy rain conditions, I would like to have it up two or three feet above the probabilities of water.

By the Chairman:

Q. That last answer applies only to districts that are liable to be flooded?—A. Sure.

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By Mr. Gutelius:

Q. Referring to the muskeg cut at mileage 36, the information I have shows that some of this muskeg was classified as loose rock?—A. Yes.

Q. And I understand you are making some change in that?—A. Yes.

Q. Is this change in harmony with your personal ideas as to classification?—

A. Well, I think that material was really more expensive and difficult for a contractor to handle than many other places that would easily be classified as loose rock.

Q. Do you feel that you are justified in allowing the cost of moving to influence you in a classification?—A. I think every engineer in the world is influenced somewhat by that.

Q. But by adherence to the specification literally—A. If a contractor was obliged to move that with scrapers or carts or ordinary teams that were used when that specification was made 30 or 40 years ago, it would be a very difficult matter, because that was a mush of water and mud—black mud. The only way he was able to get that out was by working under it with a steam shovel. If he had to go on top of it with teams it would have been practically out of the question. He could not handle teams on it at all.

By the Chairman:

Q. The specification provides that only such material as cannot be ploughed—that means that it is too hard to plough—indurated clay and other materials—shall be classified as loose rock?—A. The inference, of course, is that that means that the material is too hard to plough; but if you could not plough it at all, if you could not get horses on to it to plough it, would it not still be material that could not be ploughed.

Q. Do you consider if it is too hard to be ploughed or too soft to be ploughed, that it is loose rock?—A. If you take the broad view—

Q. Which view do you take?—A. Let me make an explanation. If you take the broad view that this specification is to cover material, not necessarily because it is too hard, but because it is difficult to move, then I think it would apply to muskeg mud—It might apply. If you say strictly that this must be so hard that you cannot plough it, and that is the meaning of the specification, then muskeg, mud and quicksand, and all this sort of material that is more expensive to handle than ordinary loose rock material, would have to be classified as common excavation.

By Mr. Gutelius:

Q. To whom do you look for correct information as to how broad or how narrow the specification should be construed?—A. Well, if it is a matter of doubt and opinion, you have got to refer to the chief, of course. You have to be governed by his direction, no matter what your opinion may be. The chief ordered me to cut that out—to cut out all the muskeg material in the district.

Q. Some of the muskeg which has been excavated was wasted?—A. For the simple reason that you could not put it in a bank of any size and hold it there.

Q. Why did you take it from beneath the grade line and waste it?—A. From beneath the grade line?

Q. Yes, in that dug out place?—A. You mean over where it was taken out and refilled?

Q. Yes?—A. Well, the grade had to be kept down low, in order to keep a length of siding there, and if we had put ballast on top of that muskeg, it would simply have mushed right down, the ties would have gone right down into it.

Q. Explain why you dug out muskeg below the grade line and filled in again at the several points which we noticed along the line?—A. Because I believed that that was good construction.

Q. Did you ever do it on any other railway?—A. Oh, yes, where there was only a small amount of muskeg like there was in those cases, two feet or so.

Q. Did you ever do so much as that?—A. Where there was any considerable depth of muskeg with a very light fill, I would cross-way it, but that would cost a great deal more money in a case like this than to remove the little depth of muskeg.

Q. You wasted this muskeg, and you knew what expense you were undertaking to make this solid roadbed, and considered that it was good construction?—

A. Yes.

Q. Was it necessary?—A. I think it was.

Q. Would it have been necessary under Mackenzie and Mann's construction?—A. I have in some cases put a light roadbed on a thin layer of muskeg, and I always found it coming up through the ties and through the ballast, sooner or later.

Q. Supposing I told you that I have seen 30 and 40 miles of muskeg embankment made, and track laid on it, and operated over nine months?—A. You would get that up where it would be dry.

Q. On this railway?—A. You would get that where it would dry out. That is different from putting it down on the flat where it lays.

Q. Then you do not think this would have dried out?—A. I do not think so.

Q. Where you see it on the bank there now you can walk over it?—A. Yes, because it is piled up and exposed to the drying effect of the weather.

Q. Would not the weather have had the same effect on it in banks?—A. This is not in a bank; it is putting the ballast on it down inside.

Q. It makes a very expensive railroad, does it?—A. If you have any amount of it to remove. In places we removed it in those roadbeds there was only about a foot and a half or two feet.

Q. Have you any idea how much muskeg you wasted?—A. On the roadbed.

Q. All waste muskeg not used in fill?—A. Exclusive of mileage 36 cut that we had to take it out, there was very little wasted.

By the Chairman:

Q. Did you not put in some of this muskeg in some fill somewhere?—A. If we did, it ran out.

Q. Did you not put in some?—A. The only place we used any muskeg in a fill and kept it there, was in a small place along mile 26, 27 or 28. We cut some ditches on the side and made a small embankment, such as you speak of in the west, and we covered it with ballast, top and sides, a couple of feet thick.

By Mr. Gutelius:

Q. Referring to the same cut at mileage 36, I notice there is 60,000 yards of loose rock returned?—A. Yes.

Q. The muskeg is included in that figure?—A. Yes.

Q. The remainder of the cut struck me as though it contained a larger percentage of common excavation than the 88,000 yards shown. You remember the material?—A. Yes.

Q. Don't you think there was a greater quantity of that clay which was ploughable?—A. Very little, outside of the muskeg.

By the Chairman:

Q. Is there any rock there at all?—A. Yes.

Q. Whereabouts is it?—A. There was considerable rock in the bottom of the cut and those big masses you saw in the bank all through it.

Q. There is 4,000 yards of solid rock?—A. Yes.

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Q. Did that consist of boulders?—A. Some solid rock in the very bottom, and those big boulders, those big masses you saw on the side going up all through the cut.

Q. What became of them?—A. They went into the fill.

Q. Do you think that is a fair amount of solid rock?—A. Yes, I should think so.

Q. Half as much as the common?—A. I should think so.

Q. Refer to mile 59. In the cutting just west of this mile post we find a reddish clay which had the appearance of being the same material in the matter of consistency or hardness that we moved by picking in the Moncton yard. The classification of this cut shows 600 yards solid rock, 6,800 loose rock, and 811 yards common excavation. The length of the cut indicates that if a two or three foot blanket of common excavation were allowed that the quantities would be very much increased; do you remember the case?—A. Yes, I remember it.

By the Chairman:

Q. If you find the material in this is similar to that in Moncton yard, do you not think that the common should be increased and the loose decreased?—A. That is, if there was 2½ feet taken off, do you mean?

Q. Yes?—A. I do not know just how that would work out.

Q. Don't you think that the material is the same?—A. It would be in the proportion, I think, of about 70 to 30.

Q. What does that mean?—A. 70 per cent loose to 30 per cent common.

Q. Do you speak from recollection that that would be proper?—A. I am not saying whether it would be proper. I am saying if they found there was three feet of that that would be it.

Q. Take the fill at 60.6; do you know if that fill was made full width originally from neighbouring cuts?—A. I think it was, yes.

Q. A large amount of train fill, however, was necessary to put it in its present condition?—A. Well, it sloughed down at the sides there and settled the top.

Q. Did this sloughing amount to very much on your whole district?—A. Quite a good deal.

Q. And every yard that sloughed required train fill?—A. For the most part, yes.

Q. Did that item amount to very much in the total cost of the work?—A. I could not undertake to say how much offhand.

Q. Was it a serious item in the amount of train fill yardage?—A. I should think it would represent altogether probably 50,000 or 60,000 yards.

Q. At mileage 62 there were borrows on the north and south sides?—A. Yes.

By the Chairman:

Q. Why was there so much loose rock in that, do you remember?—A. It was scraping right on the solid rock.

Q. But you did not take any of the solid rock out?—A. There was a little taken out, which I told the officer the other day. I pointed out to him that here it would have to be cut out.

Q. You have ordered him to take out the solid rock item?—A. Yes, I have ordered him to.

Q. How much is it?—A. 647 one place and 8 yards in another place. I will tell you what they did really. They came on to a thin layer of sand stone, and they took it out, and then went on and took out some more material that was not solid rock under that. The whole thing was only about two to three feet and a half in depth, but they took this all out and classified 647 yards of the thin layer as solid rock. I called attention to it the other day and said, "We cannot allow that to go in; we cannot allow that in the borrow".

Q. What do you think of that loose rock there? Is that not overdone?—A. I would not undertake to say that. They took some on top of this thing and took some underneath. I did not see it done; what the nature of it was I do not know.

Q. Is there any appearance there of loose rock to be seen now?—A. I think they induced the contractor to take this material instead of train-hauling it, which would have cost as much as the loose rock, plus over-haul.

Q. Does it not look more like common excavation than it does like loose rock?—A. Well, in case one did not see it taken out at all, and talking about it here, and not having examined it any more than having seen it going by, it would be hardly fair to say it was not loose rock and was common excavation.

Q. Has it not the appearance of common excavation to one looking at it?—A. He would say that was ploughed, probably.

By Mr. Gutelius:

Q. If you refer to mileage 64, you will note in a cut of some 14,000 yards, 231 yards only was classified as common excavation. I pointed this out to you, suggesting that there was 18 inches of loam and loose material. Is 231 yards sufficient for a cut of that size, when the 18 inches is apparent?—A. Eighteen inches would make more than 231 yards. I will put it that way.

Q. My memorandum says that you thought the same when we were looking at it?—A. Yes.

Q. Will you take that up and rectify it?—A. Yes.

Q. You remember that cut at 65.5?—A. Yes.

Q. Describe that cut and give the classification shown before you?—A. That was a cut of shale, with some earth on top; solid rock 2,145, loose rock 10,085, and common excavation 1,575.

By the Chairman:

Q. The cut consists, does it not, of common earth and shale, more or less; I am not giving the proportions?—A. Yes.

Q. It consists of common excavation and shale?—A. It consists of earth material and shale.

Q. As I recollect it, there is from two to three feet of common excavation over that shale that can be easily handled with a pick and shovel. Am I right in that?—A. There may be. I did not particularly examine that place.

Q. Now, we come to the shale. To me the shale appeared to be from two to three feet that you could shovel out in the ordinary way with a shovel?—A. Well, that was working into the side of it, where the weather had disintegrated it.

Q. No, from the top, when we cut in?—A. I did not see that.

Q. Do you not think that is right?—A. I would not undertake to say.

Q. If I am right in that, should it be classed as common, in your opinion?—A. If it is material that can be taken out with a shovel, yes.

Q. And then the remainder of the material, right to the bottom of the gradient, is shale, is it not?—A. Yes.

Q. And how was that removed?—A. I think the whole shale part of it was blasted, but I think that the upper part of it, that was considerably softer, was returned as loose rock, judging from the quantities, and here I think there was more of that material we call shale than is shown in the 3,000 returned as solid rock. There was only 3,000 solid and 10,000 loose.

Q. Which part is solid rock?—A. Probably the lower part of it is harder than that on top that you shovelled into.

Q. Do you put no part of the top as common?—A. I do not know about that.

Q. If we can take it out with an ordinary shovel it should be common?—A. Yes.

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Q. If it is taken out by blasting what should it be?—A. Solid rock.

Q. Why did you not put it all in as solid rock?—A. I cannot say. I did not see the work taken out. I do not know what influenced the man's mind.

Q. You took the return made by the resident engineer on that?—A. Yes.

Q. If he found it as I say it impressed me that it was, then the percentage of common is greatly too small, is it not?—A. If it can be shovelled.

Q. The next cut 66.6, solid rock 8,677, loose rock 8,445, and common excavation 3,980, is that not in the same position as the other?—A. No, no shale in that.

Q. Do you not think that is shale in there?—A. No.

Q. We thought it was shale; what is it?—A. It is more sandstone.

Q. Where do you find solid rock in that? Is it not all either common or loose?—A. Well, the solid has probably been returned as assembled rock. I would have to look that up in the record at home. It comes in under the category of assembled rock.

Q. It would not come in under the category of ledge?—A. No.

Q. It is either loose or assembled rock?—A. Yes.

Q. What do you classify as assembled rock?—A. All the things I have personally seen—

Q. You got some special instructions from the late chief engineer about assembled rock?—A. Yes.

Q. And it is what he describes in that memorandum, as you understand it, that you have put in as assembled rock?—A. Yes.

Q. So that you were not left to your own discretion as to whether or not you would classify that as assembled rock? You simply followed the instructions of your superior officer?—A. So far as I understood them.

Q. And in that cut all the solid rock comes under that head?—A. There was some assembled rock in that cut and the balance was assembled rock.

Q. Have you had experience with assembled rock classification before this?—A. Never; never heard of such a thing.

Q. As construction engineer, do you consider the assembled rock classification under Lumsden's circular as being a practical instruction?—A. No.

Q. If his instruction in connection with assembled rock had never been made, would any considerable amount of money have been saved on the work?—A. Yes. I could not give an estimate offhand.

Q. I would like to have an expression from you as to classification of steam shovel material that does not require blasting, as to whether it could consistently be called loose rock?—A. Well, if it is material that would be classified as loose rock under any other conditions of removal, I consider it should be classified as loose rock if removed by steam shovel.

Q. In that connection, is it not a fact that you are influenced in classifying certain materials that are moved by hand on account of their cost of removal?—A. Undoubtedly.

Q. Is it not possible to carry that same argument into steam shovel work where it is easily removed; the classification then should be right?—A. I do not think so. I think the contractor has the same rules applied to material as if he was moving it by pick and shovel, because he has paid a lot of money for the steam shovel, and gone to a lot of expense to get the men there and operate, and keep them up; otherwise he would be penalized for putting on plant, if you gave him any other treatment.

By the Chairman:

Q. In other words you say that if it is loose rock, as a matter of fact under the specification, the fact that by a modern appliance he removes it more cheaply should not penalize him?—A. Exactly.

By Mr. Gutelius:

Q. Then, conversely, if he uses an antiquated appliance, and it costs him a large amount of money, should you not still adhere to the specification, regardless of cost?—A. Oh, well, strictly speaking, yes but the question arises whether a man's mind is not, perhaps, influenced somewhat by what he sees it is costing a man to get the material out.

Q. Then is it not natural for him, unconsciously, to equalize that high classification by a lower classification when it is moved by steam shovel?—A. And he always does. You can go over the work to-day, and you will find the classification of the fifty miles that is all done by steam shovel is lower than that same class of material that you strike on the next contract beyond; and why? Because it was removed by steam shovel.

By the Chairman:

Q. From what you have said, it is not, then, in the interest of the owner of the railway to encourage or allow work to be done by stationmen?—A. No, sir, never. He had better pay at least ten per cent more to the man with the plant and know that he is going to get it done twenty per cent cheaper.

By Mr. Gutelius:

Q. We will take up the question of the possibility of a momentum grade between mileage 134 and 135. Mileage 134 is located at the foot of a long six-tenths maximum westbound grade, which extends for eight or ten miles?—A. Yes, sir.

Q. My suggestion is that this grade should have been extended level from mile 134 to 134.8 on a point thirty-five grade, and proceed on a one per cent. grade to the cutting at 135.3, a distance of about one half mile. What do you say as to whether that would be practicable?—A. Yes, it would be practicable. It would probably reduce the fill from 128,000 to about 50,000 yards.

Q. Why did you not use momentum grades of this character on your district?—A. Because I had no information and authority to do so.

Q. Did you endeavour to secure authority for the use of momentum grades?—A. So far as I remember, the whole thing was settled before I was district engineer.

Q. And your understanding—A. Is that no momentum grades were allowed.

Q. Could any considerable amount of money have been saved on your district if momentum grades had been allowed in places of this character?—A. Doubtless it could. That is probably the most glaring instance in the whole district.

By the Chairman:

Q. From the construction or operation point of view, do you see any serious objection to momentum grades having been adopted on this railroad under all the conditions that existed here?—A. Of course the first question is easily answered. There is no difficulty in the construction. Then it becomes a question of operating; on which I do not consider myself an expert.

Q. Is it a usual practice, in good railroad construction to use momentum grades?—A. I know it is used on roads of high character in many places, and, of course, on cheap roads where I have been on construction, we had to use momentum grades.

By Mr. Gutelius:

Q. What grades did you follow between mileage 178 and 185?—A. Point four.

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Q. These seven miles of railway, including Salmon River Viaduct?—A. Yes.

Q. Can you give me a rough estimate of the cost of this seven miles of railway, including the Viaduct at Salmon River, Caton Brook and Graham Brook?—A. Something over two million, I think. It is more than two million, but, without the figures before me, I do not want to pin myself to anything. I may say that this is very easily determined by reference to the estimates.

Q. The exact figures are easily determined by reference to the estimates? A. Yes.

Q. This is clearly the most expensive seven miles on your district?—A. Oh, yes.

Q. Did you have to do with the location of this line?—A. I did.

Q. What preliminary surveys did you make?—A. We made preliminary surveys all over that part of the country, and later on I had a preliminary survey made, with a view of getting down with a pusher of 1.10 from each way, a jack-knife pusher, down as near the level of Salmon River as possible.

Q. How near to the Salmon River did that survey bring you?—A. About 55 feet.

By the Chairman:

Q. What is the height of the viaduct over Salmon River now?—A. Practically 200 feet.

By Mr. Gutelius:

Q. Did you find practically a one point one route?—A. Oh, yes, you can get round there.

Q. Was there much additional distance?—A. I do not think so. I do not remember the exact amount.

Q. How much money, roughly speaking, would have been saved had that jack-knife one-point ten-grade been adopted?—A. Oh, something like a million and a half, I should say.

Q. What did you do toward getting this one-point one grade accepted?—A. Well, I discussed it with the then district engineer, who I think, discussed it with the authorities at Ottawa; I do not know whether there is any correspondence in the office to show; at any rate, I was told at the time that it would not be considered.

Q. Is this not a country where you would expect a one per cent grade to be used in railway construction?—A. As a pusher.

Q. Has not the adoption of the four-tenths eastbound and six-tenths westbound enormously increased the cost of the railway, not only between the tunnel and Salmon River viaduct, but over the entire district?—A. Well, I do not think I would want to say that, because there are sections of it where the point-four and point-six fit as nicely as anything could, but a great many places the adoption of these grades, of course, has very largely increased the cost.

Q. If a six-tenths grade had been used between Chipman and the top of the hill east, you could have lowered the crossing at Chipman and escaped that 9,000-foot cut at the top of the hill, could you not?—A. To a considerable extent, yes, certainly. It would have enabled us to have gone over the summit of this cut—not exactly over it, because we would have had to take something off this way, but it would have reduced that 75 per cent, say, just speaking roughly.

Q. The excavation was solid 35,000, loose 96,000 and common 24,000?—A. We could have cut the rock all out. They could have gone over the top of the rock and cut the other 60,000 yards down to probably 30 or 40 feet. On the other hand, going west on the point-six, it would have required some development or lengthening of the work, which could have been secured.

Q. What additional expense would there have been there?—A. Not very much; perhaps an extra \$50,000 on that ten miles.

Q. And you would have saved approximately how much on the line between Chipman and mile 50?—A. I should say that the whole transaction would have netted a saving of \$150,000, taking into account the development you would have to make here, charged against part of what you would have saved here.

Q. The net result would be that the Government would have been \$150,000 to the good?—A. I think at least that.

Q. In the matter of the use of wooden trestles on a new railway of this character, what have you to say as an engineer, for or against?—A. Well, I consider it highly practicable to use substantial, say Southern pine trestles, with a life of ten to twelve years.

Q. Instead of what?—A. Instead of permanent construction at the outset.

Q. What objections do you see, as an engineer, to the construction of permanent heavy fills in a new country such as your district traverses?—A. You are then confined to the use of such material as lies at your hand much of the way, which has to be taken for whatever price there may be in the contractor's schedule, without the opportunity to do this filling subsequently, when the ordinary plant of the road when being operated, power, and that sort of thing, may be at liberty, and the work can be done to the best advantage and at the cheapest cost.

Q. Is there any advantage in filling in the future on account of the effect of clearing of the right of way and drying out of the material?—A. Yes.

Q. What are the advantages?—A. If you wait until the material has dried out, it is more likely to stay in place, and, more than that, you are not obliged to make that fill all in one year, but you will make a portion of it, such as will stand, and when you find it is reaching the point where it is likely to slough and slip, let it be till it hardens and dries out, and then in another year take the balance and complete it, but if you are obliged to construct it at the time, and you find your material slipping on you, then you have to adopt some other alternative, which is going to be a great deal more expensive, like the borrowing of rock, or something of that sort.

Q. It is a fact that you borrowed rock to hold mud fills, at large expense, which might have been saved, if the same material had been subject to drainage for a number of years?—A. Yes.

Q. I asked you to-day why the Salmon River Viaduct was not extended, rather than have the heavy fill at the east made of borrowed rock, and what reply did you make?—A. That the authorities at Ottawa would not permit of steel viaducts on curves.

Q. As an engineer do you think that is a sound objection?—A. No. We crossed the High River at Bridgewater on a twelve degree curve on a steel bridge, but of course I do not think that is good construction, if it can be avoided—so sharp a curve as that.

Q. But for a three-degree curve?—A. Anything up to a five or six; five anyway.

Q. Up to a five-degree curve you see no objection to it?—A. No.

Q. In reference to Coal Creek fill, mileage 45, by reference to your letter, May 31st, to Chief Engineer Grant, I note that the cost of this fill at present is \$423,000?—A. That is the total.

Q. Did you expect this to cost that much money?—A. No.

Q. Why?—A. Because we expected to fill it with much cheaper material.

Q. What did you fill it with?—A. We put in a certain amount of earth, and found it sloughing and slipping, and all going to pieces, and we had to borrow rock to make it permanent.

Q. How high was the fill of soft material when you discovered it was liable to slide and slip?—A. Well, when we got in the approach to an elevation of 35 feet, I think—something like that.

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Q. You decided that that material was unfit to raise to the total height?—
A. Yes.

Q. What did you do when you came to that conclusion?—A. I took the matter up with Ottawa, and of course one of two things had to be done: either to borrow rock at the side at the price that had been fixed for rock borrow, \$1.10, or train haul material 45 miles, which would have taken a considerable amount of yardage in addition; it would have cost about 90 cents a yard, with an over-haul, as against \$1.10 for rock, and I recommended the rock.

Q. Did it occur to you at that time to recommend wooden trestles?—A. No, because the question of wooden trestles had been settled; there were no wooden trestles to be built.

Q. If that question has not been settled, do you think you would have recommended it, knowing the character of the material?—A. Very likely I would, yes.

Q. In actual construction where you make these fills, does not the contractor first construct a temporary wooden trestle over the whole distance, to carry the trains and dump the material?—A. The contractor has to do that.

Q. And the construction of those temporary trestles is a matter of large expense, is it not?—A. It depends upon whether the contractor is using the standard or narrow gauge outfit.

Q. Was it not a large expense to them?—A. They used a narrow gauge outfit, with dinkey engines, and they figure that the cost of wooden temporary trestles is about five cents a yard—

By Mr. Gutelius:

Q. For small trestles?—A. Yes.

Q. What do you estimate the cost of large trestles for standard equipment, per yard?—A. I do not know, for a structure like that.

Q. I want it generally, if you feel you can give a figure?—A. I think you would have to double that; ten cents a yard. They say here we are getting 50 cents a yard; ten cents of that goes into the temporary trestle, so they actually get forty cents a yard for train fill.

Q. That is lost, is it not, where the fill is made?—A. Yes, that is the end of it; it is buried up, so far as having any value, after it is buried up.

Q. You are familiar with this printed book of general instructions to civil engineers concerning surveys and construction?—A. Yes.

Q. Paragraph 26, curvature, says that curves less than 300 feet long are objectionable and should not be used. What do you say of that instruction?—A. I say I would use a curve fifty feet long, if it was all that was required.

Q. Then you do not agree with that instruction?—A. I never could see where it had any practical force whatever. Why should a man limit himself to 300 feet?

Q. What do you say to 600 feet of tangent between transition curves?—A. I cannot see the slightest advantage to be gained by it.

Q. Do you see any disadvantages?—A. There might be serious disadvantages. It might increase the cost of your work very materially.

Q. Did it affect you on this?—A. We never adhered to that. It was afterwards reduced to three, and we have in cases reduced it to two.

Q. That instruction was not followed in all cases in the construction of this line?—A. No.

Q. Broken back curves must not be used. On a railway where curves terminate in transitions, such as this, is there any objection to broken back curves?—
(No answer).

By the Chairman:

Q. What do you understand by a broken back curve?—A. I balk right there. I would say I do not know what was in the mind of the man who made the book as to what should be considered a broken back curve, and I think it is this; if you have had a short tangent in there without the spiral, it would be a broken back. If there is objection to the broken back, it must be on the ground that it must make bad riding track or dangerous track. No other ground would be of any value.

Q. The minimum length of tangent between curves in the same direction, which is limited in this book to 600 feet, has the same objection in your point of view as the minimum length of tangent between curves in opposite directions?—A. Yes.

Q. You afterwards received instructions not to make curves of any greater length than 1,000 feet?—A. I did, but I found it impossible to follow those instructions in a great many cases.

Q. You were limited in curvature to six degree?—A. Yes.

Q. And these only in special cases?—A. Yes.

Q. By the original instructions?—A. Yes.

Q. Could you have saved any considerable amount of money on the heavy work of your district, if you had been given greater latitude in the matter of curvature?—A. Well, there are not very many places. We pointed out one or two places yesterday.

Q. Two or three places on the heavy work?—A. Yes. We did use them freely on that heavy work from the tunnel down—five and six degree curves.

Q. Eight degree curves in the two or three places would have saved a large amount of money?—A. Yes.

Q. 106.7, do you remember that place?—A. Yes.

Q. What do you say as to that?—A. Considerable excavation might have been saved at this point.

Q. I notice a concrete wall at mileage 147.2, deflecting the stream to an abutment in the bridge at this point. How did you happen to use this character of construction?—A. Well, that was a thin concrete wall. I do not think it cost any more than a substantial cedar crib would have cost us.

Q. You consider then that that construction is all right?—A. Yes.

Q. In passing over a number of fills, which were from 20 to 24 feet in width at the top, you told me that this excess was made generally to please the G.T.P.'s Inspecting Engineer?—A. Yes; and at present I have that in my office asking what I am going to do about narrow fills. I have the letter in answer in my office.

Q. Have you many narrow fills?—A. No.

By the Chairman:

Q. What do they refer to as narrow fills?—A. I do not know.

Q. Fills that are 18 feet across the top?—A. The specification specifies that embankments up to 16 feet in height should be 16 feet wide on top, and above 16 feet in height to 18 feet on top.

Q. And you think you have complied with the specification?—A. Yes, I think I have substantially complied with the specification. A man might go out and find a low bank somewhere that was not quite that width for a few feet.

By Mr. Gutelius:

Q. Who prepares your yard and building plans and specifications?—A. I should have to answer that those come to me from Ottawa.

Q. In the matter of gravity water supplies, you told me that you were given instructions to install gravity water supplies, if their cost did not exceed \$25,000?

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—A. Yes, and the dumping plant in addition. As I remember it, I wrote to Mr. MacPherson, the assistant chief engineer, asking him how much capital expenditure, in his judgment, would be allowed on gravity water supplies, and he replied, “\$25,000, plus the pumping plant”. I do not know if that is just as it is worded, but that is the gist of it.

By the Chairman:

Q. Did you install gravity supply where it did not exceed the amount specified by Mr. MacPherson?—A. Yes.

Q. Can you give us what the average cost of your water tanks and gravity supply amounted to?—A. I could not give you that, but you have it all here.

Q. What capacity of water supply in gallons did you install?—A. Well, of course, in a gravity supply we generally planned that we had water enough for any number of trains, but, as I said a moment ago, if you are going to undertake to figure whether a gravity supply is cheaper than a pumping plant, you must have the number of trains and the amount of water that is going to be required. If you are going to fit up a road for two or three trains each day, that is one proposition; if you are going to fit it up for ten trains each way, or twenty trains daily, that is quite another proposition.

By Mr. Gutelius:

Q. You think your water supply along the division as installed is equal now to ten or more trains per day each way?—A. Yes.

By the Chairman:

Q. From what I have seen and heard, it appears to me that there was a general policy to construct at once, quite irrespective of the cost, a railway of the very highest permanent construction, without taking at all into consideration the cost?—A. That was practically my understanding.

Q. So that there was not given to the engineers any discretion wherein they might use their knowledge, experience or ingenuity in saving money by adopting other principles?—A. I never was given that discretion.

Q. That discretion is surely given in the construction of high class railroads by people who have to take into consideration the cost of constructing, even the very highest class of railroads, is it not?—A. I so understand it.

Q. Prudent constructors of high class railroads usually postpone any avoidable expenditure until after the road is in operation, until after the road is constructed for some years, when, from time to time, they make additional expenditures, for the purpose of bringing their road up to the highest state of efficiency?—A. I do not know whether I should answer it this way, but this is how it is in my mind; that if that was not so, we would not have had any railways in this country.

Q. A railroad as a matter of fact is never finished?—A. That is a trite saying.

Q. It is true that all the very finest roads in the world are being constantly improved by straightening curves and raising gradients?—A. That is going on all over this continent to a great extent and has been for a good many years.

Q. Did you ever hear of a policy such as appears to have been adopted in the case of the building of the Transcontinental having been adopted in the construction of any other road in America?—A. That is a pretty sweeping question. I would answer that I never heard of one to any such extent.

Q. Can you tell me one where any such policy was ever adopted, even of a shorter extent?—A. Well, Mr. Gutelius will correct me if I am wrong, but I think one of those coal roads going to Pittsburg was built regardless of expense. It was built to the highest possible standard.

Q. How long was that road?—A. I would not like to say; I do not remember the mileage.

Q. About 200 miles?—A. Yes.

Q. Do you know why that policy was adopted in that case?—A. I assume it was adopted because they knew at the outset that they had enormous freight tonnage to haul over it.

By Mr. Gutelius:

Q. That railroad was owned by the United States Steel Corporation?—A. Yes.

By the Chairman:

Q. Built how long ago?—A. Ten or twelve years ago.

Q. They contemplated immediate use of it to its utmost capacity?—A. I think they figured to a certainty before they built it that they had to handle enormous freight.

(NATIONAL TRANSCONTINENTAL RAILWAY ENQUIRY COMMISSION
MEETING AT OTTAWA, OCTOBER 16th, 1912.)

Present: G. LYNCH-STAUNTON, K.C., *Chairman;* F. P. GUTELIUS, C.E.

CHARLES C. FOSS, District Engineer on District A, National Transcontinental Railway, sworn:

Examined by Mr. Gutelius:

Q. With reference to the concrete used in the foundation for Little Salmon river viaduct, in Victoria County, New Brunswick, about mile 183, what mixture of concrete was used at that time?—A. For the foundation, that is the base course, 1 by 3 by 5; for the shaft of the pedestal, 1 by 2 by 4.

Q. Generally speaking, what mixture of concrete were pedestals of that character made of?—A. Most of the shafts of pedestals were 1 by 2 by 4.

Q. The original instructions, in connection with mass concrete of that character required you to use a mixture of 1 by 3 by 5 and 1 by 3 by 6?—A. I understand so.

Q. What was the contract price for 1 (cement), 2 (sand), 4 (broken stone) on Willard & Kitchen's contract, who were the contractors building this bridge?—A. \$15.00 per cubic yard.

Q. What was the price for 1 (cement), 3 (sand), 6 (broken stone)?—A. \$10.50.

Q. What was the contract price for 1 by 3 by 5?—\$11.50.

Q. What was the contract price for 1 by 2 by 5?—A. \$12.00 per cubic yard.

Q. From your statement, I see that 1,661 yards of 1 by 2 by 4 concrete was used in the shafts of these pedestals?—A. Whatever estimate is given there is right. On referring to my statement I find that that is correct.

Q. So that the class of concrete used when these various items are considered, is a very important matter?—A. Yes.

Q. Amounting roughly to how many dollars?—A. You mean the difference between that and 1 by 3 by 6?

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- Q. Yes?—A. There would be \$4.50 a yard between that and 1 by 3 by 6.
 Q. There would be a difference of between \$7,000 and \$8,000 between the use of 1 by 2 by 4 and 1 by 3 by 6?—A. Yes.
 Q. In your letter of explanation, dated September 3, 1912, you say:—

“I beg to say that the authorization given Mr. Balkam, in the matter of concrete mixture at the Little Salmon River viaduct, was, in the course of personal discussion of the matter and not in writing.”

- Q. Is that the fact?—A. Yes.
 Q. On September 4, the next day, you wrote him another letter:—

“I beg to say that as the chief engineer had authorized the use of 1 by 2 by 4 mixture in this class of pedestals in viaducts in other parts of the work, I saw no reason why, if it were necessary or advisable at other points, it should not be used here, the material being no better than that found at other points where this mixture had been used.”

- Q. What other point did you have in mind?—A. Particularly Four Mile Brook.

- Q. In a letter from Mr. Lumsden you received authority to use 1 by 2 by 4 mixture in the pedestals at Four Mile Brook. That letter to which you refer is dated August 6, 1908. I now show you the letter in which Mr. Lumsden says:—

“Owing to the poor sand which you seem to be able to obtain in this section of New Brunswick for the making of concrete, it may be advisable to use 1 by 2 by 4 in places, but before doing so the price for such should be arranged with Messrs. Lyons and White, and I would consider \$11.50 per cubic yard a fair one.”

- A. That is right.

- Q. You replied to Mr. Lumsden on the 10th of August, advising him that there were only 60 or 70 yards of concrete involved and that their price for 1 by 2 by 4 mixture is \$12.00 and that you hardly think it was worth while to ask them to change the contract price for a difference of fifty cents?—A. Yes.

- Q. Why was it necessary to rebuild these pedestals at Four Mile Brook?—A. They were injured by the frost.

- Q. What was the character of the material used in the original concrete?—

- A. Well, slate gravel, slate sand. In the second one they had to bring sand from away down at MacAdam.

- Q. That sand was brought in on cars from near MacAdam Junction on the C.P.R.?—A. Yes.

- Q. From your letters I learned that you were afraid of the sand and gravel because of its poor quality?—A. Yes, it was not as good as quartzite sand and gravel.

- Q. It occurred to me, Mr. Foss, that in going to MacAdam Junction for sand, you remedied the difficulty of poor concrete by securing good sand?—A. Yes, so far as Four Mile Brook is concerned.

- Q. Why then, did you increase the quantity of cement in the mixture as well as change the kind of sand?—A. To make assurance doubly sure.

- Q. Does it not look as though, in the interests of economy, you should have taken advantage of the fact that as you were getting a first class sand you could have used a cheaper mixture?—A. Perhaps that would have been good enough.

- Q. Now, it appears from your letter, that the authority given in Mr. Lumsden's letter of August 6, was used by you to enrich the mixture in the

pedestals of the Salmon River viaduct?—A. I do not know whether it would be allowable or fair for me to say that I did discuss personally that matter with Mr. Lumsden here in Ottawa, generally as to pedestals everywhere.

Q. It is perfectly fair for you to tell us what transpired?—A. Yes, and he readily agreed to the use of 1 by 2 by 4 mixture in the class of pedestals in any viaduct. That was subsequent to this correspondence.

Q. Then you say you had verbally authority from the chief engineer?—A. I consider I had.

Q. When did this conversation occur?—A. I should think some time in the same summer that this correspondence took place, but I cannot specify the date. It was at a later period when I was here.

Q. And the authority that you had received from Mr. Lumsden verbally, had back of it the character of the material in that locality?—A. Yes, that was discussed.

Q. And was not that the real reason?—A. Oh, yes.

Q. You did not consider the 1 by 2 by 4 mixture, necessary on masonry work in district F, when you were there?—A. I was only there for a month, and I really never got in touch with that work.

Q. The character of sand and gravel there was first class?—A. Yes.

Q. So that 1 by 3 by 6 would do?—A. 1 by 3 by 6 for base courses, and 1 by 3 by 5 for pedestals, I should think would be ample.

Q. Do you remember that in Mr. Lumsden's letter of August 27, 1908, to you, he says:—

"In regard to yours of the 11th instant, asking for extra work order, it is the contractors' business to furnish good, clean, sharp sand, no matter where he has to get it from, and you should not allow any other to be used in the work. Such being the case I do not feel prepared to give an order for the removal of unsatisfactory work, etc."

A. That was with reference to Four Mile Brook.

Q. Does not that indicate to you that the character of the material that is economically available ought not to influence the mixture. That is, if the contractor had to send to MacAdam for sand, and to MacAdam for gravel, even, that was his own affair?—A. Yes.

Q. Now, tell us about your troubles at Four Mile Brook?—A. If you required the contractor to haul that material on wagons, eight or nine miles from the cars, that would be rather unreasonable.

Q. Do you feel that the unreasonableness of it would justify you in paying him a higher price when you had an ironclad contract with him?—A. Well, I must say I think it would.

Q. It was a question of transportation?—A. Yes, that would be a question of transportation.

Q. Suppose he had constructed a temporary wooden bridge to have got the track over, or waited until the track-laying reached the bridge, you would have insisted on sand and gravel like that you got from MacAdam, and you would also have insisted on 1 by 3 by 6 and paid him at 1 by 3 by 6 price, would you not?—A. If he had a track to deliver it, oh yes.

Q. Am I right in assuming that one of the principal reasons for using the rich 1 by 2 by 4 mixture at Little Salmon, was, that the local sand and gravel was not good enough to be used in the 1 by 3 by 6 mixture?—A. That is the reason.

Q. Although it was clear to your mind from the contract and from Mr. Lumsden's letter to you, of August 27, 1908, that it was the contractors' affair as to where they would get good sand and good gravel?—A. Yes, you could put that construction on it.

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Q. What other reason is there besides that?—A. Besides the necessity of making what we thought a safe mixture?

Q. What other reason do you see for authorizing the 1 by 2 by 4 mixture?—

A. None.

Q. You speak of Mr. Balkam; did he concur in this arrangement?—A. Mr. Balkam was insisting on it.

Q. He was afraid of 1 by 3 by 6 mixture made of local sand and gravel?—

A. Yes.

Q. In your discussion with the chief engineer, in connection with the adoption of a richer mixture, was that the only reason you think of that was used for its adoption?—A. Yes.

Q. Did not Mr. Lumsden, in his talk with you, refer to its being the contractors' business as to where he should get the material?—A. I do not think he did in that conversation.

Q. Did you forget about it?—A. He had reached the conclusion that it would be in the interest of safety to build the shaft of pedestals, as he expressed it, above ground, of 1 by 2 by 4 mixture, especially where there was any doubt about any of the material that could be easily obtained.

Q. Now, Mr. Foss, you are an engineer of large experience, and you have worked on a great many contracts where you have had to make your own decisions; if you had been constructing a railroad on the most economical lines, and it was left to your own discretion to deal with that contract, would you have paid \$4.50 more for concrete than you were required to pay under that contract?—A. If I was working in the interests of economy, I should probably try to save in other places than in a structure of that height, weight and importance; I should consider that a few thousand dollars spent there might be in the interests of economy.

Q. Between \$7,000 and \$8,000 is the amount involved at that place, in connection with the contracts. Now remember, that the size of these pedestals was calculated by the Bridge Department, so that ordinarily 1 by 3 by 6 concrete, which was originally prescribed for that point, would be considered enough; the width of the shoes at the foot of the trestles was made large enough so that the strain could be properly carried down to it; the concrete would have to be built under your instructions so that it would come up to the specifications; would you not have been justified in insisting on the contractor getting such materials as would give such results?—A. Under the strict letter of the contract probably yes.

Q. So that it was in the nature of a help out to use the poor sand and lots of cement?—A. Yes.

Q. Having Mr. Lumsden's letter about the Four Mile Brook pedestals, did it occur to you that you should have made a special deal with Willard & Kitchen for any enrichment of concrete that you required?—A. Well, at any rate I did not.

Q. But, looking at it from that point, it might have been a proper thing to do?—A. Yes.

Q. Do you believe that you got a straight 1 by 2 by 4 mixture in these shafts?—A. If I can believe the evidence of the resident bridge engineer and the inspector, I certainly did.

Q. Are they men that you would reasonably believe?—A. Yes.

Q. Did you make any figures as to what difference in cost to the contractors, there is between 1 by 2 by 4 and 1 by 3 by 6 concrete, on this particular work?—

A. We have, from time to time.

Q. What is your idea of the difference in cost between the two?—A. It depends on how much the contractor is paid for cement and how far he has to transport it.

Q. What is your idea of the cost per barrel of cement at Salmon River?—A. The cost per barrel of cement at Salmon River was at least \$3.00 or \$3.25.

Q. That was a high price?—A. They had to haul it.

Q. How many miles did they have to team it on wagons?—A. About ten miles.

Q. I made a calculation this morning, the result of which was that six-tenths of a barrel more of cement was used in 1 by 2 by 4 than in 1 by 3 by 6, does that sound about right to you?—A. I expect so.

Q. So that the extra cement, taking it at three dollars a barrel, would, at Salmon River, amount to \$1.80 a yard?—A. Yes.

Q. With that in mind it would appear that you could at that time have made a deal with the Willard & Kitchen Company, to construct these pedestals of 1 by 2 by 4 concrete for \$1.80 a yard more than their contract price for 1 by 3 by 6, does that seem about right?—A. Possibly, though I do not think they were very much open to deals.

Q. Did you ever make any contract prices for extras with these people?—A. No.

Q. Did you ever make any contract prices for extras for work under your jurisdiction?—A. No.

Q. You did not consider that it was the duty of the district engineer to look after these special prices as you were going over the work?—A. Well, I

Q. Were any of the Grand Trunk Pacific officers there to look it over?—A. never had any instructions in regard to determining any changes in price except possibly that one suggested.

Q. That was the one at Four Mile Brook?—A. Yes.

By the Chairman:

Q. The contract provides, does it not, that changes in extra work must have been first directed in writing by the engineer and notified to the contractor in writing, as well as the price to be paid for such extra work?—A. That is extra work that is not covered by any item in the schedule.

Q. Yes, but the contract also provides that no additions or changes shall be made by anybody?—A. I have always understood that no change could be made without an Order-in-Council.

Q. That is not the point I am speaking of here—you have got a situation before you in which you think that a change should be made in the mixture of cement. Now, that change will necessarily materially increase the cost of construction to the Government. And that is one of the changes provided for under section 11 of the contract?—A. Well, 1 by 2 by 4 mixture is specified, and the price is named for it.

Q. It is in the contract that any mass concrete in piers, abutments and bank foundations and turntables, shall be 1 by 3 by 6?—A. It is changing the concrete for a particular structure, but it is not changing the contract.

Q. You are changing the mixture of the concrete in the piers?—A. In the pedestals.

Q. You are changing it from 1 by 3 by 6 to 1 by 2 by 4? And it is distinctly stated in the contract, section 68 of the general specifications, that that material is only used in copings and in bridge seats, and so you were making a change there which is not authorized by the contract and specifications, but which may be done under section 11 of the contract; and, section 11 of the contract gives the engineer the power to make such changes, but it provides that such changes must be authorized in writing by the engineer, and that the contractors shall not be entitled to any increased price for such changes, unless it shall have first been directed in writing, by the engineer and notified to the contractor in writing. This is a very serious change and one which should have been authorized by the chief engineer in writing. You said that the necessity for making that change arose only from the fact that the contractor could not obtain the material

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he agreed to put in the piers, except at an increased price to him—could it possibly be argued that the contractor should be paid anything more than the extra expense to which he had been put. I am speaking now of the fairness of the proposition alone?—A. It may have been error or a mistake, but it was done.

Q. When you make the returns for these changes, do you indicate them in your estimates?—A. Yes, we indicate that a certain amount of 1 by 2 by 4 mixture was used.

Q. And that would have been apparent in your first estimates sent to the Ottawa office.—A. Yes.

Q. When was your attention first called to the use of this concrete being irregular?—A. I think after the pedestals were all completed, that is my recollection.

Q. To what railway station was the cement used at the Little Salmon viaduct, hauled by the contractor?—A. Grand Falls.

Q. On the C.P.R.?—A. Yes.

Q. For what structures and extending over what part of the railway, did the contractor have his cement delivered at Grand Falls?—A. From recollection I should say, from mile 178 to the Grand Falls connection, about mile 194.

By Mr. Gutelius:

Q. By whom was your attention first called to the fact that the use of 1 by 2 by 4 mixture was questioned?—A. I think in a letter from Mr. Uniacke.

Q. What is the status of the estimates at present in connection with the payment for that concrete?—A. You mean, are the estimates made based on the classification returned in that list?

Q. Yes?—A. They are.

Q. The shafts of these pedestals are returned on these present estimates as 1 by 2 by 4 concrete at \$15.00 per yard?—A. Yes.

Q. In view of all the circumstances in this case, would it be a hardship on the contractor if the commission were now to recommend that he be paid only for the cost of the extra cement, which he put into the mixture?—A. I do not believe it would; I should not think it was a hardship on the contractor.

Q. Now, what you have said concerning the pedestals on the Salmon river viaduct will apply also to all 1 by 2 by 4 concrete used on contract No. 5 in mass work?—A. I think so.

Q. The conditions in the Salmon River viaduct case are similar to these in other cases, with respect to 1 by 2 by 4 mixture?—A. Yes.

Q. From the statement which I have shown you, the total yardage of 1 by 2 by 4 concrete, amounts to 5,136 yards on contract No. 5?—A. Yes.

Q. So that the sum of money involved on that contract, in respect to concrete will amount to about \$22,000?—A. I do not think you could make a comparison on this specification between 1 by 2 by 4 and 1 by 3 by 6, I think you must compare it with 1 by 3 by 5.

Q. And the price of 1 by 3 by 5 was \$11.50 per yard?—A. Yes.

Q. So that it would be a saving of from \$3.50 to \$4.50 a yard and would amount to between \$15,000 and \$20,000 on that work?—A. Yes.

Q. In your evidence in June last, you stated that if a jackknife pusher grade had been constructed across the Little Salmon River Valley, that something like one and a half million dollars could have been saved—since that time you have made a further estimate, what are the figures of that estimate?—A. Had a jackknife pusher grade been adopted at the Little Salmon River, there would have been saved \$1,644,882, and I think—I do not know whether you want me to put that in the evidence or not—I think that would have been somewhat increased if a careful pusher had been worked out and located.

- Q. You think a still larger saving than that would have been effected?—A. Yes, probably a saving of one and three-quarter million dollars.
- Q. Having in mind the character of the railway, its cost, and the business that could reasonably be expected on it, would you, if left to your own discretion, have constructed this jackknife pusher grade instead of the big trestle?—A. I would have constructed it anyway, left to my discretion.
- Q. You would have built a pusher grade there if you were left to your own discretion?—A. Yes.
- Q. Why?—A. Because, calculating the money at four per cent interest, the interest on the money that would have been saved would probably amount to \$75,000 a year and that would certainly have paid for pushing the heaviest traffic that is likely ever to go over that road.
- Q. I have before me a memorandum in connection with the location of the divisional yard at Edmundston, New Brunswick, where was the yard finally built?—A. At Edmundston.
- Q. What location was originally suggested by you?—A. At mile 256.
- Q. What saving do you consider would have been effected if the yard had been built at mile 256?—A. About \$100,000.
- Q. Would that location of the yard at mile 256 have been as efficient in the matter of operating the railway as the present location?—A. Geographically, I think the yard is better situated at Edmundston, but if you are asking the question merely as to the local operation of the yard, it would have been as efficient there as at Edmundston.
- Q. What advantage would the location of the yard at Mile 256 have had over the location of the yard at Edmundston?—A. In addition to the advantage of the lesser cost, there would have been room for expansion.
- Q. Is there any room for expansion at Edmundston?—A. None.
- Q. Referring to the geographical location of the yard, what is the length of engine district on either side of the Edmundston yard?—A. I understand it is 113 miles east and 125 miles west.
- Q. By placing the yard at mile 256, what would have been the length of engine district?—A. About 139 miles east and 99 miles west.
- Q. In the light of your present knowledge of this matter, where would you have constructed the yard, as an engineer?—A. I would have constructed it at mile 256.
- Q. And saved \$100,000?—A. Yes.
- Q. Who actually passed upon the location of the yard at Edmundston?—A. I understand it was done between the commissioners and the Grand Trunk Pacific.
- Q. Do you think the Grand Trunk Pacific was interested?—A. I believe it was a matter of negotiation between the Commissioners and Mr. Woods, chief engineer of the Grand Trunk Pacific.
- Q. Were any of the Grand Trunk Pacific officers there to look it over?—A. I do not know whether Mr. Woods came there especially for that.
- Q. He was there and looked it over?—A. Yes.
- Q. In the early negotiations did not the city of Edmundston offer free water if the yard had been moved to Edmundston?—A. My recollection is, that they offered free right of way; I am not so sure about the water, although I think so.
- Q. What was the final result? Did you get either the right of way or the water free?—A. They made a written agreement that the right of way was not to cost more than a certain amount, and anything beyond that Edmundston was to pay, but I do not remember the figures now.
- Q. Do you remember whether you kept within that figure?—A. I think we did.
- Q. So that you got nothing from the town of Edmundston?—A. No.
- Q. Although they offered free right of way and talked about free water?—A. Yes.

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Q. I have information that you are paying \$2,000 a year for water for terminal purposes at this yard? Is that correct?—A. We are not paying it yet, but I understand we are to pay it.

Q. In your previous testimony, Mr. Foss, in the matter of gravity water supply, you said that the supplies provided on your district were ample for any traffic that might be handled on that railway. I would ask you now if you concur in the recommendation that \$25,000 be expended for gravity water supply at a station?—A. No, outside of divisional points, no.

Q. What is the outside figure that you think should be expended on a gravity supply where water can be pumped with a gasoline pump?—A. The question of permissible expenditure to obtain a gravity supply, can only be decided by a study of conditions at each particular location, but for wayside stations where a pumping supply can be obtained in proximity to the tank, without an extensive lift, I consider \$12,500 the greatest expenditure justifiable to obtain a gravity supply.

Q. You made returns under the heading "solid rock" of what has been called "assembled rock"?—A. Yes.

Q. Can you tell us what percentage, if any, of boulders, of a cubic yard and over in size, was included in assembled rock?—A. No boulder measurement was kept and as regards boulders contained in assembled rock, I am satisfied on contract No. 1, from my knowledge of the cuttings from which these returns were made, fifty per cent of this rock would have filled the specifications for boulders, namely, one cubic yard. The same, I am satisfied, would hold true of the small amount of assembled rock returned on contract No. 2. On all the other contracts, I think an average of five per cent would cover all the boulders that would be measured by the yard and returned in the assembled rock statement. This would amount to, on contract No. 1, 3,534; on contract No. 2, 305 yards; on contract No. 3, 1,509 yards; on contract No. 4, 5,175 yards; on contract No. 5, 5,780 yards; on contract No. 6, 3,110 yards; showing a total of 19,413 yards of boulders measuring a cubic yard and upwards in the assembled rock returned in my district.

Q. The remainder of the assembled rock returns are made up of smaller stones and interstitial material?—A. Yes.

By the Chairman:

Q. Do you know how much assembled rock has been returned in your own whole district?—A. You have a statement of it there; it is 305,009 yards up to the first of September, 1911.

Q. Did you adopt any rule in classifying material as assembled rock, as to the percentage of rocks there must necessarily be in the mass?—A. No. There is no hard and fast rule that could be applied to that.

Q. You could not tell then what average percentage of rock was in the material classified as rock in your district?—A. I cannot say.

Q. Assuming you had charge of the building of this railway for a company, which had ample funds to build a first-class railway, with a four-tenths grade eastbound and a six-tenths grade westbound, and assuming that your instructions had been to build a first-class road as cheaply as possible without scamping the road or impairing its efficiency, could you have saved any of the money expended by the commission in your district?—A. To work out the greatest possible economy, without detracting from the final efficient character of the road, if it were left to my discretion I could have saved money.

Q. Could you have saved a large amount or a small amount of money?—A. I could have saved a large amount of money.

Q. Indicate in what particular you could have made this large saving?—A. The two great items would be the jack-knife pusher grade which I think should have been constructed at Salmon River, and the general use of timber trestles.

Q. Would increasing the curvature to eight degrees have been out of the question on such a road as you would build?—A. For the most part it would not be necessary, only on occasions. There are a few places where that might have been done. By the adoption of moderate momentum grades in certain cases, money could have been saved. At Coal Creek a timber trestle would have saved a large amount of money. I would have used lighter rails in sidings and yards. I would have used a 65-pound rail in the sidings and yards which is just as good as an eighty-pound rail for that purpose. I would have used wooden culverts in the moderate banks in a country where you could get cedar.

Q. Could you turn all that into dollars?—A. Oh, bless your heart, no.

Q. Do you think you could figure it out?—A. Oh yes.

Q. Will you make up a statement showing the saving in dollars which you could have effected in this way?—A. To prepare a statement of that kind would require a great deal of work. The data is already in this office, and if you will furnish it to me in convenient form, I shall make such a statement as you ask for.

Q. If these economies were practised in the construction of this road, would it, for all commercial purposes, be as efficient a road as it is now?—A. Yes.

Q. And could as large loads be hauled over it at the same cost?—A. You build a line at 0.6 and 0.4 grade, or its equivalent pushing capacity, and with reasonable curvature and compensation on it, then you can haul just as big a train over a timber trestle as you can over a solid fill. Then the only question that comes up is as to whether you have arrived at the broadest basis of economy in the maintenance and operation, and that feature is determined by the traffic.

By Mr. Gutelius:

Q. Then, the advantage in deferring the filling of timber trestles lies in the fact that in eight or ten or more years you will actually know what the governing feature is, whereas at present you must guess it; by the governing feature I mean the traffic?—A. Just so.

The witness was not further examined for the present.

(NATIONAL TRANSCONTINENTAL RAILWAY ENQUIRY COMMISSION. MEETING AT OTTAWA, TUESDAY, OCTOBER 15th, 1912).

Present: G. LYNCH-STAUNTON, K.C., *Chairman*; F. P. GUTELIUS, C.E.

ARTHUR E. DOUCET, District Engineer, National Transcontinental Railway,
sworn:

Examined by Mr. Gutelius:

Q. Mr. Doucet, give us a short description of your experience in responsible railway engineering work?—A. I started with the Canadian Pacific Railway in 1880. I was engineer on the Algoma Branch of the C.P.R. from 1881 to 1883. I was then resident Engineer on Lake Superior for the C.P.R. from 1883 to 1885

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at Jackfish Bay. During 1886 I was assistant engineer on the Lachine Bridge for the C.P.R. From 1887 to 1898 I was contractors' chief engineer for R. G. Reid & Co. From 1898 to 1900 I was chief engineer of the Arrowhead and Kootenay Railway for the C.P.R., and engineer in charge of reducing grades on the prairie, and I was also, during that time, in charge of reducing grades between Farnham and Newport. From 1900 to 1904 I was chief engineer on the Quebec & Lake St. John Railway and the Great Northern Railway of Canada. Then from 1904 to the present time I was district engineer of the Transcontinental Railway. I gave up the chief engineership of the Quebec & Lake St. John Railway in 1908.

Q. So that you have had about thirty-two years of experience in railway construction in Canada?—A. Yes.

Q. With reference to the specifications under which the National Transcontinental Railway is being constructed—I direct your attention to the clauses covering the classification—have these classification clauses been changed from the original in any contract under your charge?—A. So far as the classification is concerned, no.

Q. So that it is fair to assume that any interpretation that may be placed on any one of the contracts would apply to the others?—A. Yes.

Q. You are familiar with the classification used on the Canadian Pacific Railway?—A. Yes.

Q. In a general way, does the three item classification of the C.P.R. and the one under which you are now working on the Transcontinental, agree, and if not what are the special points of difference—I refer particularly to the practical understanding of them, rather than to the phraseology?—A. Yes, practically they agree.

Q. Would it be fair for an observer to assume that the three classifications, solid rock, loose rock and hardpan, and common excavation, would be interpreted the same as in the case of the C.P.R. classification?—A. Yes, generally speaking.

Q. Then, Mr. Doucet, a contractor who was in the habit of working under C.P.R. specifications, would naturally bid with the expectation that he would receive the same classification as he had been accustomed to receive under C.P.R. engineers?—A. Yes, with this exception, that perhaps the material might be different on the portion he was tendering on, to the work he had been doing previously on the C.P.R.

Q. But, based on the specification itself, the price ought to be practically the same?—A. Yes.

Q. How did prices on the contracts on your district compare, generally speaking, with prices that were given contractors on the last C.P.R. or Great Northern work that you were on?—A. They were low on the Transcontinental, in comparison.

Q. How did your classification under this contract compare with the classification you had experienced with the C.P.R. and Quebec & Lake St. John Railway in the matter of solid rock?—A. So far as any work I did for the C.P.R. is concerned, we did not meet the same material; with the Quebec & Lake St. John Railway it was the same classification.

Q. Did you have an item on the Quebec & Lake St. John Railway that compares with what we know in the specification as "assembled rock"?—A. No.

Q. Will you describe "assembled rock" as you understand it, and as it has been returned?—A. A mass of boulders held together by some cementing material, clay, hard compact sand; the boulders forming at least fifty per cent of the mass, and the whole mass requiring constant blasting practically, to be taken out.

Q. Did the size of the boulders or rock fragments have any influence on the classification?—A. Yes.

Q. What, under that interpretation, could be considered the average size that would be called "assembled rock"?—A. Anything over eight or nine inches.

Q. If the mass contained rock fragments and boulders over eight inches, in the major diameter, and was held together, as you say, with fifty per cent of the mass composed of stones of that character and larger, did you call it "solid rock"?—A. Yes.

Q. When this was called "solid rock," what was the nature of the interstitial material?—A. It was very hard clay or very hard sand which must have been acted upon by the water at some period to make it practically hard like cement.

Q. Now, if you had that material without any stones in it, what would you classify it as?—A. Without any stones, I would classify it as "loose rock."

Q. And if you had the stones separately, what would you classify it as?—A. It would depend on measurement.

Q. If you had these stones separately, with very loose sand intervening, what would you classify it?—A. The stone would be measured as loose rock up to a certain size.

Q. So that when these two materials are found together, they were considered, under the interpretation which the chief engineer placed on the specification, as "solid rock"?—A. Yes, when the two are met together in the proportions above stated of fifty per cent or more of rock.

Q. In the matter of the third classification, namely "common excavation," it is stated in paragraph 35 of the specification that all cemented gravel, indurated clay, and other materials, that cannot in the judgment of the engineer be ploughed with a ten-inch grading plough, behind a team of six good horses properly handled, shall be classified as loose rock?—A. Yes.

Q. If such material could be broken up by such a plough and such a team, what would it be called?—A. Common excavation.

Q. Was that interpretation followed strictly on your district?—A. Well, it was meant to, that was my intention.

Q. Did you classify any material as loose rock, which was too soft to plough?—A. No.

Q. So that this ploughing clause is really a test for hardness?—A. Exactly, it must be a test for hardness, because if you take a very steep side you cannot possibly put horses there to plough it; it must be intended as a test of hardness and nothing else.

Q. And the fact that a team of six horses is specified, rather than four horses, as is usually specified in grading work, would indicate that it was a plough test rather than a practical method of removing material?—A. Yes.

Q. Referring again to the solid rock specification, of which assembled rock forms a part, could you, as district engineer, have classified the material which you described a moment ago as being composed of fragments of loose rock, and cemented gravel, could you have classified it as solid rock based solely on your interpretation of the specification? That is, could you have consistently classified this material as solid rock without instructions or the interpretation from your superiors?—A. Yes, I did do so.

Q. In doing so, you are cognizant of the fact that the material was composed of loose rock and cemented gravel which separately would have taken loose rock classification?—A. Yes, if you look to the encyclopædia for the interpretation of rock, you will find that they give "rock" as a glacial deposit composed of boulders and clay. They say it is sand, or hard sand and clay, which has been deposited there by glacial action.

Q. Did you ever work under any other specification, in which the material that you classified there as solid rock, under assembled rock, was placed in that classification?—A. Your idea is to ask me if I met with the same thing on the C.P.R., would I have done the same thing. I would have given a certain proportion of it as solid rock, and I think most engineers would have done so.

Q. Would the proportion be anything near like the proportion you gave in this case?—A. Yes, practically.

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Q. Did you ever really do that?—A. I did it on the Quebec & Lake St. John Railway.

Q. You gave solid rock for that mixed material?—A. A proportion, yes.

Q. And your specification on the Quebec & Lake St. John Railway was practically the same as the Canadian Pacific Railway?—A. Yes.

Q. And the same as this specification?—A. No, this was different.

Q. How could you harmonize that with the condition that solid rock must contain solid rock excavation which includes all rock found in ledges or masses of more than one cubic yard, when you tell me that these pieces of stone are as small as eight inches?—A. The cementing material comes in there. The cementing material holds the boulders and makes up a mass which really renders it necessary to use constant blasting to get it out.

Q. Is it not possible that all of these rock fragments or boulders could be removed by picks and bars, working in the face, without the use of powder?—A. Not practically.

Q. My question is, was it not possible to do so?—A. It was possible, in the sense that you could take out a cut of limestone for instance, without the use of powder, if you take time enough. To my mind, it was impossible to take these masses of boulders and cemented stuff, out by pick and shovel; we never could have got through at all if we did that.

Q. Is it not a fact that in all the exploration digging done on your division, it was possible to dig around every one of these boulders with a pick, so that it would fall out of the face of the cutting?—A. That was possible.

Q. Then, your reason for calling this material solid rock is, that it was more practical to remove it by blasting?—A. Yes.

By the Chairman:

Q. When these specifications were given to you as district engineer, were you given any interpretation of them by the commission, or were you left to interpret them yourself?—A. Left to interpret them ourselves.

Q. I speak of yourself, that means you and your assistants?—A. Yes.

Q. In taking section 34 of the specification, did you interpret the word "mass" to include anything more than rock?—A. When it was brought to my attention, yes. When I first saw the specification, I took it for granted that the classification would be the same as on all other railways. It did not catch my attention until the matter was specially brought to my notice by the engineers on the ground.

Q. Did I understand you to say that at first blush you took solid rock excavation to include only rock?—A. Yes.

Q. You did not think when you first read section 34, that you should include any other material than rock in solid rock excavation?—A. Yes, ledge rock and boulders over a yard.

Q. You afterwards changed your opinion on that?—A. When it was brought to my attention, yes.

Q. Who brought it to your attention?—A. It was brought to my attention by my assistant engineer, Mr. Gordon Grant, a very short time after construction started.

Q. Tell us about that?—A. They were working at La Tuque where most of this assembled rock was being met with. Mr. Grant came back to my office and reported that large masses of boulders and cemented material between were being met with and that the percentage of solid rock was being given for that material. Mr. Woods, assistant chief engineer of the Grand Trunk Pacific, and Mr. Armstrong, district engineer of the Grand Trunk Pacific, went up to La Tuque, and on the way back they came into my office and said that though the classification might be a little high still they had nothing to complain of. Mr. Woods instructed Mr. Armstrong, the district engineer of the Grand Trunk Pacific, to give me a letter approving of the classification to date. This

was in June, 1907. I went personally over the work at the time, inspecting with my assistants and division engineers, and found no reason to change the classification that was being returned.

Q. This was the occasion on which it was brought to your attention that more than mere rock was being classified under the head of solid rock excavation?

—A. Yes.

Q. Do I understand you that you then re-considered clause 34 and came to the conclusion that it included these masses?—A. Yes.

Q. That made a serious difference, did it not, in the classification?—A. Yes.

Q. Did you bring that to the attention of the chief engineer?—A. Yes.

Q. Do you know whether it was brought to the attention of the commission at that time?—A. In August of 1907, Mr. Woods made another visit to the work with Mr. Armstrong, and on his return I believe he discussed the matter with our own chief engineer, Mr. Lumsden, complaining that the classification was too high. Mr. Lumsden had been up there himself in June, 1907, and made no complaint as to the way in which the classification was being returned, but on Mr. Woods bringing the matter to his notice, he wrote me in October, 1907, to say that he intended to go up to La Tuque to inspect the work, that he would be accompanied by the commissioners, by Mr. Woods and by Mr. Armstrong, and that he required me to have my assistant, division, and resident engineers on the ground, so that we could go over the work and discuss the classification between ourselves. We all got there. Mr. Lumsden and the other engineers walked over the ground.

Q. Did the commissioners walk over the ground?—A. The commissioners were there and they did not go over the ground. Mr. Lumsden did not express any opinion on the ground, but on our return to Quebec he told me in my office that he could not approve of the classification. Mr. Lumsden did not, however, say, what the classification ought to be, and did not give me any orders to reduce the returns as made. Matters went on in this way, until in December, 1907, and January, 1908, we received from Mr. Lumsden a blue print and interpretation of the item "solid rock." This interpretation, it appeared to me, coincided with the classification we had been returning. The only debatable point being the amount of rock contained in the mass and its measurement of boulders. The district engineers met Mr. Lumsden in Ottawa in January, 1908, to discuss the blue print and then explained to him that it was impossible to measure all the rocks, instancing the cut at La Tuque where separate measurements were impracticable. He then consented to change the measurement clauses to meet our objections. He wrote me at the end of January, 1908, and also in February, asking me if the classification returned by us agreed with his interpretation, and I answered: yes. Mr. Lumsden knew that no deduction had been made and knew by personal observation the material moved, so that if he still thought the excavation, as returned by us was too high, he could have ordered us to reduce it. Estimates were returned monthly and were approved by him until June, 1909. In the meantime, estimates were given to the contractors and the men were paid off. When the arbitrators, Messrs. Schreiber, Kelliher, and Grant, came over the work in June, 1910, they gave us a practical application of their interpretation of the item "assembled rock." When they reached mile 23 on contract 8, the furthest point east at which the Grand Trunk Pacific Railway engineers had made objections to the classification, they stopped, and Mr. Kelliher, on behalf of the Grand Trunk Pacific, and Mr. Grant, on behalf of the Transcontinental Railway, with Mr. Schreiber's consent, appointed the district engineer of the Grand Trunk Pacific, Mr. Fotheringham, and myself, to go over the whole of the remainder of the work, and they instructed us to classify according to the method we had seen them pursuing during their arbitration. If we agreed, our decision was to be final; if not, an appeal was to be made to our respective chief engineers. A stipulation was made that in case of agreement, we were to sign the notes

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conjointly, and send one copy to Mr. Kelliher, and the other to Mr. Grant. These instructions were faithfully and conscientiously carried out and final estimates were returned which were approved in Ottawa, and the contractors were paid off.

Q. Were the estimates changed to suit the quantities found by the arbitrators, Messrs. Kelliher, Grant and Schreiber?—A. Yes.

Q. What mileages were covered by them?—A. From mile 132 to mile 115, and from mile 85 to mile 66 on contract 10, and from mile 1 to mile 23 on contract No. 8.

Q. Did the arbitrators make many changes in the classification from that which your engineers made originally?—A. Yes, they made a good many changes.

By the Chairman:

Q. Did they put it up or put it down?—A. They put in up in one case.

By Mr. Gutelius:

Q. Do you remember what case that was?—A. It was in the case of borrow, where they raised it to fifty per cent solid and fifty per cent loose.

Q. And prior to that what was it?—A. All loose rock.

Q. Did you and Mr. Fotheringham cover the remaining cuts that were omitted by the arbitrators?—A. We covered the whole work that was not gone over by the arbitrators.

Q. So that between the arbitrators and you as their deputies, the whole of your district was passed upon by the arbitrators?—A. Yes.

By the Chairman:

Q. All interpreting the specification as you did?—A. Yes, of course there may be some of the work not finished, and in connection with that there may be something to do yet.

By Mr. Gutelius:

Q. Now Mr. Doucet, suppose the chief engineer, Mr. Lumsden, should have insisted with reference to your district on the interpretation that solid rock could only mean solid rock in masses of a cubic yard or larger, what would have been the effect?—A. The effect would have been to change about one million yards of solid rock into loose rock.

Q. And if you had received such positive instructions from the chief engineer, Mr. Lumsden, you would have been guided by them.—A. Had I received such positive instructions, there would have been nothing left for me to do as district engineer but to follow out the instructions of the chief engineer.

By the Chairman:

Q. You accompanied the present commission, Mr. Gutelius and myself, on the inspection over part of your district, did you not?—A. Yes.

Q. What part did you go over with this commission?—A. We went over part of contract No. 8 east of the Quebec bridge, and contracts Nos. 9, 10, 11, and 12 north of the Quebec bridge.

Q. Did this commission examine everything you wished them to inspect in order to arrive at a proper conclusion, so far as it was possible for them to do so?—A. Yes.

Q. There was nothing, was there, that you wished them to look at that was not examined by them?—A. No.

Q. Do you think that so far as the inspection could be made at this date, that the inspection made by this commission was sufficiently exhaustive?—A. For a general inspection, yes.

Q. This commission had excavations made at certain points along the line, had they not?—A. Yes.

Q. Were those made under your supervision?—A. No.

Q. Under whose supervision were they made?—A. We appointed the division engineers or resident engineers as the case might be, or the contractors' superintendents, to put in the excavations.

Q. They were made under your direction?—A. Yes.

Q. Assuming that you had had charge of the building of this railway for a company which had ample funds to construct a first-class railway with a four-tenths eastbound grade and a six-tenths westbound grade, and assuming that your instructions had been to build a first-class road as cheaply as possible without scamping the road or impairing its efficiency, could you have saved any money that was expended in the construction of the present Transcontinental road?—A. Yes.

Q. Will you give instances where, had you such control, and these instructions, you could have saved money?—A. Well, by the introduction of momentum grades.

Q. What do you mean by momentum grades?—A. A down grade which allows you sufficient momentum to climb up on a heavier grade than the standard grade.

Q. That is to say, if you assume a distance of a mile of four-tenths grade from one end to the other, instead of filling to a four-tenths grade the whole distance, you could have allowed the track to dip in certain places and thereby saved filling?—A. Yes, and saved cutting as well.

Q. So that an engine hauling a train loaded to the limit, to be hauled along a four-tenths grade, would pass over those dips without any additional assistance?—A. Yes.

Q. That is commonly called a velocity grade?—A. A velocity or momentum grade.

Q. It differs from a pusher grade in that, in the case of a pusher grade you must use another engine to help the train over the grade?—A. Yes, the same fully loaded train.

Q. And that is, as you have said, a saving which the commission could calculate from the material in this office, without your assistance?—A. Yes.

Q. Will you tell me anything else in which you could have made a saving?—A. I think if we had been allowed to use a little heavier curvature, we would have effected considerable saving without impairing the grades.

Q. And you say a saving could have been made in that?—A. Yes.

Q. What limit would you put upon that increased curvature?—A. I think we could have used eight degree curves occasionally at important points.

Q. By that you mean that the curves would have been greater?—A. The curves would have been sharper and would have enabled us to stick to the contour of the ground better than by using a lighter curve.

Q. And instead of having to cut into the hillsides as you have done?—A. Yes.

Q. Can you give me any other?—A. In places, we might have used some wooden trestles. Of course, the rule was laid down that these were not to be used.

Q. Is it not the practice of railway companies in construction, to first put in wooden trestles?—A. On all the roads I have been on, yes.

Q. Have you heard that wooden trestles have been put in on the Grand Trunk Pacific, west of Winnipeg?—A. I have heard so.

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Q. Do you know that wooden trestles were put in by the Grand Trunk Pacific on their line from Fort William to Graham?—A. No.

By Mr. Gutelius:

Q. In all your experience as an engineer, in other railway constructions, you have built wooden trestles?—A. Yes.

Q. And where the ordinary excavated material did not fill openings except in cases where waterways required them?—A. Yes.

Q. And if wooden trestles had been used on your district, you would have been saved the construction of all the concrete arches?—A. Not all of them, but the important ones yes.

Q. Most of them?—A. Yes.

Q. You would have saved rock borrow in such hills?—A. Yes.

Q. You are now preparing a statement showing the saving that could have been effected if the policy of wooden trestles had been adopted?—A. That statement has been prepared already.

Q. That statement will represent the saving that might have been effected?—A. Closely, yes.

Q. Now, with regard to using cast iron pipes in farm crossings, if you had been building this railway economically would you have used these?—A. No.

Q. What would you have used there?—A. I think possibly we would have used these open culverts, stringers, and planking.

Q. And a very considerable saving might have been effected there?—A. Yes.

Q. Are you familiar with the term over-break in rock-cutting?—A. Yes.

Q. Did the over-break which was returned compare favorably with over-break on works which you have had charge of heretofore?—A. Yes.

Q. It was not a larger?—A. No, not after the changes that were made.

Q. Not after you arbitrated?—A. Not after the changes that were made during the classification.

Q. At La Tuque, if the matter were left to your own discretion and judgment in the matter of grade and alignment, what money saving would have resulted?—A. I certainly would have used a .65 grade instead of a direct four-tenths grade.

Q. What saving in distance would have been effected by a .65 grade?—A. About three miles.

Q. And how much money would have been saved?—A. About one million dollars.

Q. Knowing that a saving of one million dollars, as you have stated, could have been made at La Tuque by adopting a .65 grade, what action did you take?

—A. The chief engineer being away from Ottawa at the time, I immediately wrote to the Commissioners.

Q. You wrote to the Commissioners direct?—A. Yes.

Q. Is the letter to which you refer a letter dated June 21st, 1906, and addressed to the Hon. S. N. Parent, Chairman of the Transcontinental Railway Commission, Ottawa?—A. Yes.

Q. Tell us the history of that in your own words?—A. On making the final surveys of the line at La Tuque, we found that by the actual levels we could not possibly get down to the level of the La Tuque flats, using a four-tenths grade, unless we took a very roundabout way, increasing the length of the line some three miles, and at a very excessive cost. The use of a direct four-tenths grade, also prevented us from using the Flats at La Tuque for a divisional point. We found that a direct line could be had by starting from Creek a Beauce to the La Tuque Flats using a .65 grade. I had the engineers look very carefully over the ground, and run a number of lines to prove that it would be in the interests of

the Commissioners to use this direct line. This .65 grade could not be considered altogether as a pusher grade. It was much shorter, had less curvature, and would cost much less to build than the four-tenths grade. It would also have enabled us to use the Flats at La Tuque for a divisional yard, whereas, by the adoption of the direct four-tenths grade, we were forced to move our yards two miles further to the west at what I might call an excessive cost. By adopting the .65 grade, we would have saved \$300,000 on the construction of the yard alone.

By Mr. Gutelius:

Q. Do you figure that you gave the chief engineer and the Commissioners sufficient information to have enabled them to have made a proper decision?—A. Yes, and I know that they were in favor of adopting my suggestion, but for some reason unknown to me, we were informed that the line on a 0.65 grade could not be entertained.

Q. You produce as an exhibit, your letter of remonstrance to the Chairman of the Commission?—A. Yes.

Q. Do you remember the bridge over the Boucenne River?—A. Yes.

Q. It is a high trestle bridge on a tangent?—A. Yes.

Q. The contour of the ground at that crossing did not appear to lend itself to a straight bridge across?—A. No.

Q. Will you explain what would have been the economical way of crossing that river, and why the economical method was not followed?—A. We were not allowed to use curve bridges.

Q. And those heavy rock cuttings you see at each end of that bridge were occasioned by the instructions to build the bridge on a tangent?—A. Yes.

Q. With reference to the bridge at Boucenne River, do you see any objection to building a bridge of that character on a curve?—A. No.

Q. Is the Boucenne Bridge the only bridge where money was expended to escape constructing bridges on curves?—A. No, the Milieu River Bridge is another.

Q. Have you any gravity water supplies on your district?—A. Yes, we have three.

Q. Where is the most expensive of these gravity water supplies situated?—A. At Roberge.

Q. What did that cost?—A. \$11,375.00.

Q. Do you not think that \$11,375.00 is too much capital expenditure for a gravity supply at a wayside station?—A. Yes.

Q. What figure would you suggest as being about right for a supply at such station?—A. The maximum would be from about \$7,000 to \$8,000.

Q. Had you any instructions as to the limit you should go for obtaining water supplies?—A. We were instructed to expend as high as \$15,000 to secure gravity supplies.

Q. You are familiar with the pusher grade from the St. Francis River west?—A. Yes.

Q. What is the grade on that river?—A. 1.1 westbound.

Q. What is the rate of grade that could be used if the pusher engines were of the same size as the leading engine handling a six-tenths train?—A. 1.47.

Q. If a 1.47 had been used instead of a 1.1 grade, what saving might have been effected?—A. Between \$43,000 and \$44,000.

Q. Would it have been as good a railroad?—A. Yes.

Q. And if you had been building a railroad, using your own judgment and authority, would you have used a steeper grade?—A. Yes.

Q. What is the weight of rails you used in your sidings and yards?—A. Eighty pounds, the same as on the main line.

Q. If you were constructing this railroad economically, would you have used

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eighty pound rails in sidings and yards?—A. No, we recommended that fifty-six pound rails should be used on the sidings.

Q. Do you believe that the efficiency of the railroad would have been quite as good if fifty-six or sixty pound rails had been used in the sidings and yards?—A. Yes.

Q. You know the Batiscan River Bridge?—A. Yes.

Q. Suppose you had been permitted to use a momentum grade at that point, have you any idea of what saving might have been effected?—A. Between \$20,000 and \$30,000.

Q. Would you have had as good a railway?—A. Yes.

By the Chairman:

Q. If these changes that you speak of, had been made in the construction of this road, would you have had as good a railway for practical commercial purposes as you have now?—A. Yes, as far as the present efficiency of the road is concerned.

Q. And you could haul the grain of the west just as well over it as you could over the present road?—A. You could haul the same loads.

By Mr. Gutelius:

Q. You are familiar with the book of instructions issued by the Commission to the engineers?—A. Yes.

Q. In these instructions you are limited by article 26 to six degree curves?—A. Yes.

Q. And no matter what expensive construction would be involved by the use of six degree curves?—A. Yes.

Q. As an engineer did you consider it safe to issue instructions of that character before the country had been exploited?—A. No.

Q. You consider it was dangerous to issue such instructions?—A. Yes.

Q. In what locations in your district could you have saved large sums of money if you had been permitted to use sharper curvatures?—A. Principally along the Milieu River Valley and along the St. Maurice Valley.

Q. Without going into definite estimates, could you have saved tens or hundreds of thousands of dollars if the curvature along these two rivers had been increased to between eight degrees and ten degrees?—A. I should say between \$125,000 and \$150,000 might have been saved in these two locations.

Q. Would the efficiency of the railway have been lessened by increasing the curvature to eight degrees?—A. No.

Q. Do you know of curves of that character being used on main lines of railway where the railway does not suffer thereby?—A. On the work I was on for the C.P.R. at Jackfish Bay, on the main line we had an eight degree curve outside a tunnel which certainly did not impair the efficiency of the line in any way.

Q. So that the saving which might have been effected along Milieu River and the St. Maurice River would have been another item in the economical construction of this line, if you had had your own way?—A. Yes.

By Mr. Gutelius:

Q. Referring again to momentum grades, describe why the introduction of momentum grades would have been economical?—A. In a letter which I wrote to the chief engineer's office, I pointed out that very considerable sums of money could be saved by using momentum or velocity grades, as we would have been enabled, in many cases, to reduce both hills and cuttings by introducing virtual grades, rather than uniform actual grades.

Q. What is a momentum or equivalent grade?—A. A momentum grade means that advantage is taken of the fact that a train, descending a grade accumulates energy which increases the hauling capacity of the locomotive by an amount dependent on the length of falling grade and the velocity of the train, and this extra hauling capacity will protect the introduction of steeper grades than the engine is theoretically loaded for.

Q. That is, if your ruling grade is four-tenths, and you approach the foot of a one per cent. hill, at a speed of thirty miles an hour, you would be able to pull over that 1 per cent. grade your four-tenths load, provided the grade is no longer than 1,000 or 1,500 feet?—A. About 1,500 feet.

Q. So that you could have reduced many heavy cuttings by raising the grade in these cuttings from ten feet to fifteen feet?—A. Most of our summit cuttings could have been reduced by one-half.

Q. And in the matter of fills, a momentum grade policy would have enabled you to introduce many long sags?—A. Yes.

Q. And save as much as ten feet or fifteen feet of filling?—A. Yes.

Q. Have you any idea, Mr. Doucet, of the percentage of the cost of filling that might have been saved in your district if a momentum grade policy had been adopted?—A. I have looked to that and I think that between seven per cent. and ten per cent. of the cost of grading could have been saved.

Q. Without impairing the efficiency of the road for all practical purposes?—A. Yes.

Q. It has been said that the reason for not using wooden trestles was on account of their excessive cost, as figured by the cost of timber in these tenders?—A. That is not my understanding. The policy of the Commission that wooden trestles would not be used, was well known before the tenders were called for, and it was expected that only a very small amount of timber would be used in this construction.

Q. What was the price per thousand cubic feet, board measure, asked in some of the tenders?—A. I think \$80.00. When contractors see that quantities are small they generally put a high price opposite, as it does not affect the grand total.

Q. May we conclude from what you have said, that if the policy had been to build wooden trestles, a tender very much lower than \$80.00 per thousand feet, board measure, would have been put in?—A. Yes, because any contractor would know that if he put in a big price for timber on a large quantity, his total might be affected to such an extent that his tender might be run up high.

Q. And no engineer, would under such circumstances, accept a tender for \$80.00 per thousand, board measure, for timber?—A. No.

Q. What would be a fair price for the timber on contract No. 8?—A. Between \$40.00 and \$45.00 per thousand.

Q. So that in our comparisons, it would be fair for us to use the price of \$45.00 per thousand for frame trestles?—A. Yes, \$45.00 or \$50.00.

Q. Why did you put in a double track yard between Cap Rouge yard and Cap Rouge viaduct?—A. At the time I took charge of that portion of the work, the construction of the double track was already under way, and I understood from Mr. Hoare, my predecessor on that work, that the line was to be a double-tracked line between the yard and the Cap Rouge viaduct. I may say that about thirty per cent. of the work had been done at different points when I took the work over from Mr. Hoare.

By the Chairman:

Q. This cut is on the north side of the river and about one mile from the Quebec Bridge?—A. Yes.

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By Mr. Gutelius:

Q. You are familiar with the Ludger Noel yard?—A. Yes.

Q. I notice that this yard was constructed with side walls eleven feet higher than the standard plan, why was that done and who is responsible for it?—A. My then assistant, Mr. C. L. Hervey, was responsible for the extra height of the walls; it was done without my sanction or knowledge.

Q. About how much additional money was expended at this point, more than would have been expended had you been consulted?—A. \$14,000.

By the Chairman:

Q. Was the question of economy made a cardinal feature in the construction of this railroad?—A. No; I do not think it was.

Q. Did the Commission, so far as you know, ever intimate in any way that it was desirable that the engineers should carefully consider every step in the construction of the road, with a view to spending only the amount of money that was reasonably necessary?—A. No; we had no communication from the Commissioners to that effect.

Q. Are you familiar with the Feher nutlocks that were supplied to your division?—A. Yes.

Q. Describe that nutlock?—A. It is a piece of tin fitting over the nut with the ends turned up, which rots away in a year or eighteen months after it has been put in place.

Q. So that you consider that any money expended on these nutlocks might have as well been thrown away?—A. I may say that half of them are out of the tracks now.

By Mr. Gutelius:

Q. What would you say as to the advisability of using 1 x 2 x 4 concrete for the Riviere du Sud arch. Do you think concrete of that strength was necessary?—A. Yes, because that is one of the worst river crossings we had in the district. There are about 300,000 logs driven annually down that river, and the fall from one end of the culvert to the other is about ten feet. The water rises up to the spring of the arch at flood water. I consulted all my engineers at the time of the construction, and we all came to the same conclusion, namely, that a stronger mixture than 1 x 3 x 6 should be put in at this place.

Q. The extra strength was on account of possible erosion by logs and ice?—A. Yes.

Q. Don't you think that one foot or eighteen inches of 1 x 2 x 4 concrete would have answered the purpose quite as well as to use that mixture throughout?—A. Well, we have there the example of the logs striking the solid rock at the outlet of the culvert and gouging pieces of rock out of the face of the bluff. It seems to me that these logs would have had the same effect on the side of the culvert as they had on the solid rock.

Q. What is the difference in price between 1 x 3 x 6 and 1 x 2 x 4 on that contract?—A. The difference in price was \$5.00 per yard.

Q. There was considerable discussion over the concrete used in this arch?—A. Yes.

Q. What was the ultimate outcome of that discussion?—A. The difficulty was that the contractors met the chief engineer in Ottawa, and an agreement was arrived at that this concrete should be returned as 1 x 3 x 5 mixture at a price of \$12.00 per yard. I may say that this agreement has since been rescinded and the concrete is returned as 1 x 3 x 6 at \$10.00 per yard.

Q. The matter is still in controversy?—A. Yes.

Q. Referring again to overbreak, in classifying overbreak, did you allow a percentage of loose rock as provided for in the specification where it says that the material shall be classified as it falls in the cut after the shot is fired?—A. Yes.

Q. You arrived at that as closely as it could be estimated?—A. Yes. In some cases I may say that where loose rock does not show in the returns, it was due to the fact that the overbreak was really a rock borrow and used as rip-rap or protection of embankments in adjacent fills in lakes or rivers.

Q. Suppose that in a solid rock cut, twenty-five per cent. of the total quantities were returned as solid rock overbreak, would that classification be in accordance with these specifications?—A. No; under ordinary circumstances a proportion of the overbreak should have been returned as loose rock.

The witness was not further examined for the present.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION,
OTTAWA, OCT 11th, 1912.)

(EVIDENCE TAKEN IN THE OFFICES OF THE NATIONAL
TRANSCONTINENTAL.)

A. G. MACFARLANE, sworn.

By Mr. Gutelius:

Q. Give us, in short form, your experience prior to your going with the Transcontinental Railway?—A. I began in the year 1882 on the Kingston and Pembroke Railway, and I worked there as rodman, and was there for four years—worked as rod man and instrument man latterly.

Q. And where else?—A. From there I was on the Baie des Chaleurs for two years, and I was on the survey of the Rapid Transit road, Cleveland, Boston and New York—six months there—and I was on a branch line of the Canada Atlantic, was there about a year, and then I was up on the main line of the Ottawa, Arnprior and Parry Sound, eight years, and then I was down on the Mainland, Nova Scotia, for two years, and then on the Algoma Central for nearly a year, and then I went on the Canadian Northern and was there four years, and then I came on to this road.

Q. So that you have had a very general experience in surveys and construction of railroads in Canada?—A. Yes.

Q. During the past 30 years?—A. Yes.

Q. What positions did you fill on the N.T.R.?—A. The first position I was locating engineer: when construction started I was division engineer for division 7, on District F, and was there for two years, call it as divisional engineer, and I was about three months assistant district engineer on District F. and then I was district engineer on B. for one year, and then I was inspecting engineer for about two years, and then I was on F., and was on F. for about a year.

Q. Put on F. as district engineer?—A. Yes.

Q. Which position you still hold?—A. Yes.

Q. You were actively engaged as divisional engineer while the contractors were excavating Division 7?—A. Yes, or a good portion of it.

Q. Which was the time that the first discussion on classification was in progress?—A. Yes.

Q. You were at the meeting at Kenora?—A. Yes

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Q. Who were present at that meeting of the leading engineers and commissioners?—A. The chief engineer of the work, Mr. Hodgins, Commissioner Young, John Heaman, and I think B. J. McIntosh; I think that was all.

Q. Was there any Grand Trunk representative?—A. No.

Q. When you left that meeting, what was your understanding in connection with the handling of material excavated outside of the sections?—A. My understanding was that there was a portion of that would be allowed as solid rock, other than what you could attach to the specification, but as to what it was going to be, there was nothing definite.

Q. You understood that a more liberal classification was going to be given to overbreak than provided in the specification?—A. Yes.

Q. Did you ever receive any definite written instructions after that meeting?—A. No, nothing definite.

Q. Up to the time the work was finished, no instructions came from Ottawa or elsewhere, so far as you know?—A. I think Mr. Lumsden, after I left there, sent instructions—I know he did, because I have seen them—which appeared to be founded on the specification alone.

Q. This meeting was February 8th, 1908?—A. Yes. There were no instructions came out until after I left, as regards the general interpretation of the specification by Mr. Lumsden.

Q. In the matter of overbreak?—A. No.

Q. There was nothing in Mr. Lumsden's blue print, or the instructions, in connection with overbreak, was there?—A. No, I do not think so; that is my remembrance of it: the documents would show.

Q. With reference to the specifications governing classification, do you understand that these specifications would enable an engineer to classify soft mud as loose rock?—A. No.

Q. The plough test, then, is a question of hardness, or difficulty in removing on account of hardness, or the stones it contains?—A. Yes, according to the specification.

Q. Do you understand that has been generally lived up to on District F?—A. I do not think it has been lived up to, right to the dead—I mean the test.

Q. Have you corrected anything that you have discovered in that classification, so that it is reasonably within this specification?—A. Yes, I have lately, since the Commission was there, but I did not measure the portion on the McArthur contract.

Q. With reference to the McArthur contract, you have made no corrections there, for what reason?—A. This matter has been handled by the arbitration, and I did not even examine it with the idea of making corrections, because it has been handled by the arbitration and settled.

Q. With reference to the arbitration, and your general knowledge of District F, do you consider that the arbitration results are within reasonable limits?—A. Yes. I must qualify that, probably, as to the question of assembled rock, which I never understood, and do not understand yet.

Q. You refer to diagram 5 in Mr. Lumsden's interpretation, in connection with solid rock?—A. Yes, a diagram without any scale, or without any clue from which to judge what was meant.

Q. Assuming that the stones shown on diagram 5 are all less than a cubic yard, and that the interstitial spaces are filled with clay and sand, what would you be compelled to classify that material as, under the specifications and contract, without reference to Mr. Lumsden's interpretation?—A. And the stones touching, then I would call it loose rock: that is all I would do.

Q. Under classification of solid rock, which reads, "Will include all rock found in ledges or masses of more than one cubic yard", what is your understand-

ing of the kind of rock covered by the word "masses"?—A. My opinion would be lumps of rock.

Q. Lumps of rock over a yard, whether they be in the form of boulders or large rock fragments?—A. Yes. That is my opinion, as an engineer, based upon the specifications, without reference to any instructions.

Q. The overbreak on District F. on the McArthur contract, we noticed in our recent trip, is a very serious matter. What proportion of the total solid rock do you think is overbreak?—A. Thirty to forty per cent.

Q. Have you ever, in your experience as an engineer, encountered any rock excavation that had anything like such a quantity of overbreak?—A. No, I never did.

Q. How, in a general way, do you account for this large amount of overbreak on this contract?—A. In the first place, the cuts are very much larger than anything I have ever seen before, and the rock is of a very seamy nature, more so than any other rock I have ever seen before. Their method of taking it out was something new to me, the putting down of holes, say anywhere from three-quarters depth of a hole to the full depth of a hole, back from the face and springing them, sometimes three and four times, heavily springing them.

Q. Just explain what springing a hole consists of?—A. In the first place, you have a limited space: you have just got the hole to work on, and you put down all the dynamite you can into that: sometimes you only put two or three sticks at first, and have a drop fuse, a small fuse lit and dropped into the hole: they let that off, and it tears it up in the bottom, and after that cools off they put some more in; they can probably put five or six times as much the second time, and that tears out quite a hole below, and they will squib this the third time before they get it large enough so as to get enough explosive there to take that out. In the course of this springing, where you have seamy rock, very often it opens up the seams, and when you go to load this hole afterwards, a great deal of the power escapes through the seams. You do not get the result you probably would expect. Possibly the next hole you squib the rock will be of a more solid formation, not so many seams, and you put down your explosive into that, and it tears it all to pieces. That is what makes it so difficult for an engineer to say to a contractor—in fact, you cannot say to a contractor—what is necessary to load in a hole, because you do not know the conditions below.

Q. When you are in that condition of mind, however, you are assuming that it is impermissible to blast with deep drilling?—A. Yes.

Q. What depth of hole is a reasonably good sized shot?—A. Well, 25 feet should be the extreme, I should think.

Q. With a hole 25 feet deep, say 25 feet back from the face—A. I do not think they very often did it that far: say 18 or 20.

Q. Well, say 18 or 20 feet back from the face, what quantity of dynamite would be used in the final blast, roughly?—A. I think we used to figure on about three-quarters of a pound to a pound—about three-quarters of a pound of dynamite to a yard of rock, so as to displace it. It would be about 500 or 600 pounds of dynamite.

Q. Did you ever see rock blasting done before where shots of that size were used?—A. No.

Q. How was the blasting of rock excavation handled on work with which you were previously connected?—A. We used to put down about three holes, probably back eight feet from the face. The cuttings were lighter, and we would strip it very lightly.

Q. About how many pounds of dynamite would be used in this operation?—A. Pretty near the same amount per yard, but it shatters much smaller, and it was distributed better, you see: it would be in three holes.

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Q. And about how many pounds?—A. As near as I can remember, about three-quarters of a pound to the yard is what we always used to figure on on roads I have been working on.

Q. So that a blast six feet in depth, set back four feet would take 15 to 20 pounds of powder.—A. Yes.

Q. If that character of rock drilling and blasting had been used in this work, would it have been possible for them to make so much overbreak?—A. No, it would not.

Q. Which of these methods do you think the original specifications contemplated.—A. The method of careful blasting.

Q. By careful blasting, you mean numerous small shots—A. Numerous small holes and shots, or the old-fashioned method.

Q. What is a reasonable percentage of overbreak —A. From my knowledge, as an engineer on other works, I should say that 25 to 30 per cent, with the modern method of blasting, is about right for overbreak.

Q. What percentage of overbreak would you expect if they used the old-fashioned method of blasting —A. I do not think it would go over twenty per cent.

Q. Suppose that you could have limited the depths of the shots on those big cuttings on District E. to twelve feet, what effect would that have had on the overbreak?—A. It would have decreased the overbreak.

Q. Down somewhere to near what the old-fashioned method would have given you?—A. Yes.

Q. Do you remember the big cutting at mile 139?—A. Yes.

Q. What was the greatest depth of that cutting at rail level?—A. I do not know that: about 40 feet at the widest portion: 35 to 40 feet.

Q. The amount of overbreak in this cut, I see from the records, is over 28,000 yards, which is practically the same as the amount of rock inside of the section.—A. Yes.

Q. How do you explain this?—A. Mr. Poulin, the district engineer, said he wanted to get the track out to the Winnipeg river, in order to put the bridge in, and it was necessary to have all these cuts out as rapidly as we could tear them out. In talking the situation over we discussed the matter as to what they should be allowed for that.

Q. You discussed the matter with him?—A. Yes; and on account that we required all this material for fill and the long distance, there was a scarcity of filling material, and the long haul would bring the train haul material very nearly up to the price of solid rock, as far as we could see, and, taking these things into consideration, he thought the contractor should get solid rock prices.

Q. And the contractors were so advised?—A. Yes.

Q. And you finally paid them for all the rock excavated, which included this 28,000 yards of overbreak?—A. Yes.

Q. What rate did the subcontractors receive for removing this solid rock?—A. About \$1.25 a yard.

Q. And the main contractor, McArthur, received how much?—A. \$1.70. He had a sub between him and the other man at \$1.50.

Q. But there was a profit between McArthur and the first subcontractor of 45 cents a yard?—A. The man that did the work, yes.

Q. And, as there is practically 60,000 yards in the cut, the profits accruing to the original contractor and the first sub amounted to about \$27,000; is that right?—A. Yes; that is between him and the first sub.

Q. So that the profits are equal to about one dollar a yard for all the overbreak in that?—A. That is the profit on the whole amount.

Q. Did the crowding of the rock cuttings and the heavy shooting actually help in the completion of the work?—A. No.

Q. If it were to be done over again, you would not have concurred in rushing the work in that manner?—A. No; I never did, and do not approve of it.

Q. You felt at that time that you were opening a door to the contractor that was really dangerous?—A. Yes.

Q. And you are not surprised now, when you are faced with this 28,000 yards?—A. No. I do not think he really wanted to do it, but they were hounding him to get it done.

Q. Who was hounding him?—A. It came through the chief engineer. As far as I know, I think the Commissioners were at it, too. The chief engineer sent out a regular list of cuttings, which you would be surprised at, telling us to tell the contractor that he must move so many thousand yards per month out of each cutting, and that was done some time in 1907, in order to get that work done there, and the man that was behind the whole thing was Mr. Morse, of the Grand Trunk Pacific.

Q. Why was Morse rushing it, do you think?—A. We all thought he was going to blame the tie-up, so to speak, on the National Transcontinental instead of the Grand Trunk Pacific, that they would be ready with their piece between Fort William and Graham, and we would not be done with ours, and the grain would be held up on account of the road not being finished.

Q. So that it was a race between the Lake Superior branch of the Grand Trunk Pacific and the N.T.R. between Graham and Winnipeg?—A. Yes, to get the wheat from the west to Fort William.

Q. What was the actual result?—A. The actual result was that in 1909, when the rock was all out—it was a year and a half after that before they got it open—something like that. I think the rock was all out in the spring of 1909.

Q. When did the first wheat go over?—A. Some time in 1910; I think it was something like a few hundred bushels was put over.

Q. Just enough to say that they hauled some in the fall of 1910, whereas this extra expenditure was made about two years before?—A. Yes.

Q. Referring to overbreak in general, and the partial understanding that you had at Kenora, how did you return overbreak after that meeting?—A. We returned it as overbreak.

Q. As solid rock overbreak?—A. Yes.

Q. That is, you measured every yard that was taken out of the cut, and returned it at solid rock prices?—A. Yes. This was done with the full knowledge of the district engineer, and I understand the same knowledge of his superiors.

Q. As a divisional engineer on whom the responsibility of classification rested, did you feel that the placing of this overbreak in the solid rock column settled it and ended it?—A. No, I never felt that.

Q. What else could happen?—A. All estimates must be finally referred to the chief engineer for his signature; we never knew what he was going to do.

Q. And by his signature, you mean his approval?—A. Yes, his final approval.

Q. Was it given to him in such shape that he knew what part of the solid rock was overbreak?—A. Yes, I think so.

Q. In any event, you rested your case on the action of higher officers, and were satisfied in your own mind that they were familiar with your intentions?—A. Yes.

Q. You were ready at all times to accept a criticism or instructions in connection with overbreak?—A. Yes.

Q. And you were particularly ready in that, when you refer to the clause that says that overbreak shall be paid for as it falls in the cut, were you not?—A. Yes.

Q. And you rather expected that the chief engineer's office would ask for, or demand, a portion of loose rock in the overbreak?—A. That is at the first, before

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they let it drag on so long, I expected that, but when these estimates were coming in, and the contractors were being paid for them, it looked as though they were not going to do anything with it.

Q. Then you assumed that the chief engineer proposed to let it go through, fully aware of what he was doing, as solid rock?—A. Yes.

Q. Now, by reference to the specification, Article 38, where it says, "The classification of material from slides shall be made by the engineer, and will be in accordance with its condition at the time of the slide, regardless of prior conditions," if you were simply given this Article 38 as a guide for slides in rock cuttings, would you not be compelled, under it, to classify that portion of the overbreak where the pieces were less than a cubic yard as loose rock?—A. Yes.

Q. How would you arrive at that in a practical way?—A. We could arrive at it by giving a percentage.

Q. Suppose we had a cut that contained 1,000 yards of overbreak, and you, in your judgment, concluded that 500 yards of that overbreak was loose rock, and suppose the entire cutting including overbreak amounted to 4,000 yards, based upon cross-section measurement, how would you return that 500 yards of loose rock, and would your returns increase the total calculated quantity in the cut?—A. I think that 500 yards of solid rock measurement is to be estimated as loose rock; give them the explanation of it, or otherwise give them 750 yards.

Q. Then you would increase the quantities in the cut 250 yards?—A. Yes, with an explanatory note.

Q. And you would make an explanatory note on your return?—A. Yes.

Q. The reason for this explanatory note is that that method is not provided for in the specification?—A. That is right.

Q. Then, if you hewed to the specification closely and measured in excavation only, you would not be justified in giving a yard and a half for a yard?—A. No.

Q. Without special authority, or this explanatory note?—A. No.

Q. Referring again to overbreak while this work was in progress, what was your habit, and that of your engineers, when you discovered contractors shooting these tremendous blasts?—A. The engineer notified the contractor that there would be reductions if he did not change his method and did not use more caution, and they promised to, and they claimed they used all the caution they could, and the results were not any better. We did deduct quantities from some of the cuttings on account of heavy blasting.

Q. Ought you not to have reduced the yardage of overbreak for all material that was wasted?—A. Yes.

Q. As divisional engineer, in looking over your quantities, I find that you did not grant any loose rock in many cases of overbreak?—A. No.

Q. What protection have you for not doing so?—A. At the Kenora meeting I got the idea that we would receive some further instructions in connection with overbreak, and, pending the receipt of such instructions, I returned the whole amount of overbreak as solid rock, expecting that it would be corrected to conform with whatever instructions the chief engineer might make.

Q. You are familiar with this little book of instructions to civil engineers on the N.T.R.?—A. Yes.

Q. In the matter of curvature, on page 38, it is laid down "That the maximum curve on a level shall not exceed six degrees." Do you think that this bald statement or instruction was a wise one?—A. No.

Q. Why?—A. Well, it might run you up into some fearfully heavy work, where a very slight deviation in the curvature might avoid it.

Q. Then the instruction re curvature should have had some moneterial limitation?—A. Yes; something of that description.

Q. This positive rule gave the locating engineer no discretion when he was three weeks away from the chief engineer's office, even though he would find a place where a large saving might have been effected?—A. Yes; that would happen when locating on a ruling grade.

Q. What approval did location plans receive from higher officers?—A. Well, they were referred from the locating engineer to the district engineer, and he is supposed to have recommended it to the chief engineer, and he referred it to his assistant, I think.

Q. In the line that you located, did you receive any criticism in the matter of reducing the cost of the line from your higher officers?—A. No, not that I know of. I am pretty sure I did not receive any.

Q. What would you say about the 600 feet of tangent between curves?—

A. That is something that I would insist upon, with monetary limitations.

Q. It is unfortunate that they did not give monetary limitation to those tangents?—A. Yes. I think that where you have a particularly rough country, you can afford to figure on less speed of your trains; therefore you could increase your curvature, shorten your tangents and introduce compound curves.

Q. Don't you think that broken-back curve provision is a mistake?—A. I do. Having proper adjustment between curves, I do not see that it makes any difference.

Q. Article 29 says, "Every effort will be required to secure level track at stations"; is that a practical instruction for a locating engineer?—A. No.

Q. Why?—A. I think on the grades we had there we could put a station almost on our maximum four-tenths, without any very great inconvenience.

Q. And if you followed this instruction you would have had to locate your stations before you located your line?—A. Yes; you would always have to have that in your mind when locating.

Q. Which is an impracticable situation?—A. Yes.

Q. If you were designing this railway, and were given the limiting grades, in the interest of economy would you not have used wooden trestles, for the first eight or ten years at least, at certain points?—A. Yes.

Q. If that method had been adopted, where would the greatest saving have been effected?—A. We would have saved building the arches, and in some cases would have saved a large amount of money, where the filling was made of rock borrow.

Q. Can this commission arrive at a reasonable estimate, through your offices, as to what saving might have been effected, if the policy of building wooden trestles had been adopted?—A. I think so.

Q. If you had been given these limitations in the matter of grade and haulage capacity, would you, in the interest of economy, have introduced momentum grades?—A. Yes.

Q. It is possible to save a considerable amount of money in cuttings and fills, and still get the same haulage capacity?—A. Yes.

Q. And still have what are known as short sags or humps?—A. Yes, particularly going over short summits.

Q. Would that change amount to very much on the portion of the line which you located?—A. I guess half of my location was on maximum grades that you could not have touched very well.

Q. But through level and undulating country, it is a saving proposition?—A. Yes.

Q. And is not detrimental to the railway generally?—A. No.

Q. Did you make an examination of the C.P.R. engine house and engine terminals in Ottawa today?—A. Yes.

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Q. How does that class of house compare with the houses which you built?—
A. For efficiency and for the purpose for which it was built, I think it compares very favorably.

Q. In any event, it is quite as good?—A. It is quite as good; that is, in my opinion.

Q. Did you notice the coaling plant?—A. Yes.

Q. When I tell you that that coaling plant cost less than \$10,000, do you not consider that it might have been better to have followed that design than to have built the very expensive storage bunks that you have at Graham and Transcona?—
A. Yes, I think something similar to that would have been better.

Q. How much money would you have saved at each point?—A. About \$18,000.

Q. Suppose you had been given District F to locate and build, with a limitation of a virtual four-tenths grade against eastbound traffic, and a further limitation of \$60,000 per mile cost, could you have built such a railroad?—A. I think I could have given it a pretty close shave.

Q. What are the things that stand out most prominently in your mind as the difference between such a railroad and the one that has been built?—A. Well, having such closely defined instructions about curvature and grade: sometimes by an additional few hundredths on a momentum grade, I think it would be almost as serviceable a road, and you could save thousands of yards: by putting in a little sharper curvature you could save thousands of yards, and by putting in virtual grades you could save thousands of yards, and have it as efficient as it is today.

Q. You would not have graded second sidings?—A. No.

Q. You would have used wooden trestles liberally?—A. Yes; every place where we thought there was no danger of being shot out. If we had been allowed to put in lighter steel in sidings we could have saved a lot of money.

Q. How about the entrance to Winnipeg?—A. If we could have made a feasible arrangement with the Canadian Northern, for the present, at least, that would have been the proper way to enter Winnipeg; nor would I have built the Transcona shops, nor would I have built the double track over the Sturgeon river between Lake Superior Junction and Graham, nor would I have built the double track from Transcona shops in to Winnipeg.

Q. And you would have fixed the overbreak feature, too, if you had to stay within \$60,000 a mile?—A. Yes, if they had left it to me there would never have been more than 25 or 30 per cent at the outside.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION;
EVIDENCE TAKEN IN TRANSCONTINENTAL OFFICES,
OTTAWA, JANUARY 16th, 1913.)

HARVEST P. GOODWIN, sworn.

By the Chairman:

Q. You are one of the inspecting engineers of the Transcontinental Railway are you not and have been inspecting engineer since when?—A. From the beginning of January, 1912.

Q. You were formerly in the employment of this Commission were you not?
—A. Yes.

Q. In what capacity?—A. As locating engineer and division engineer.
 Q. Where were you division engineer?—A. On contract No. 14.
 Q. Where is that?—A. District "E" Abitibi Lake.
 Q. How long were you division engineer?—A. For about a year.
 Q. And during that time did you acquire any experience in classification on the division?—A. Yes, during that year they were grading and I was classifying the work.

Q. In October of the year 1912 you were instructed to go to what contracts?—A. Nos. 13, 14 and 15.

Q. To contracts Nos. 13, 14 and 15 to inspect the work and to make plough test for the purpose of checking the classification which had been made of the grading on those contracts, were you not?—A. Yes.

Q. Did you follow your instructions?—A. I did.

Q. When did you go to that country?—A. I do not know the exact date. Some time in the month of October.

Q. How long were you up there?—A. Just a month. Between September 18th and October 20th.

Q. Did you make any plough test on the work?—A. I made two plough tests, one on contract 14 and one on contract 15.

Q. Did you make a sufficiently extensive plough test to satisfy yourself as to how the excavation should be classified on those contracts, 13, 14, 15 and 16?—A. I consider I did.

Q. And did you make a reclassification of the grading on contracts 13, 14, 15, and 16?—A. No; I made a report on what I considered,—

Q. Did you make a report on the character of the country and classification?—A. Yes.

Q. Have you a copy of your report?—A. I have and I produce it. It is as follows:—

"From my plough tests and what ploughing had been done during the progress of the work, I am convinced that there is very little, if any, clay on this district too hard to plough.

"The following are the estimates as they stand at present:

Contract No. 13 (District "CD"). Macdonell & O'Brien, Contractors.

Solid rock	9,565 cubic yard—	1 per cent
Loose rock	65,363 " "	— 9 " "
Common excavation	671,108 " "	— 90 " "

Contract No. 14, Grand Trunk Pacific Railway, Contractors.

Solid rock	98,131 cubic yard—	2 per cent
Loose rock	2,078,769 " "	— 48 " "
Common excavation	2,197,714 " "	— 50 " "

Contract No. 15, E. F. & G. E. Fauquier, Contractors.

Solid rock	25,363 cubic yard—	1 per cent
Loose rock	1,253,395 " "	— 49 " "
Common excavation	1,262,204 " "	— 50 " "

Contract No. 16, O'Brien, Macdougall & O'Gorman, Contractors.

Solid rock	11,324 cubic yard—	.5 per cent
Loose rock	894,955 " "	— 34 " "
Common excavation	1,723,147 " "	— 65.5 " "

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" Contract No. 13

"The work on that portion of Contract 13 which is in District "CD" was done during the present season, and the classification was done in strict accordance with the specifications, i.e., all material that was not too hard to plough was classified as common excavation, while mixed material was classified a certain percentage of loose rock according to the amount of stone it contained and the nature of the material.

"Ledge and boulders over one cubic yard only were returned as solid rock. No assembled rock was allowed as solid rock. The result of this classification is that only 9 per cent of the whole was returned as loose rock.

" Contract No. 14:

"The character of the country is very much the same on all of these contracts and had the same systems of classification been carried out on contract 14, as on contract 13, the difference would have been that 1,641,308 cubic yards would have been returned as common excavation instead of loose rock.

"Making an allowance for any slight difference in the character of the country and for a liberal classification 20 per cent of loose rock would be sufficient.

"Instead of 2,078,769 cubic yards of loose rock only 874,822 cubic yards would have been returned, making a difference of 1,203,847 cubic yards. The difference in price between loose rock and common excavation is .31c per cubic yard, making a total of \$373,192.57 on the whole contract. The amount of over-classification in solid rock is only small,—some assembled rock was allowed but in no great quantities.

" Contract No. 15:

"Applying the same rule to contract 15, i.e., allowing 20 per cent for loose rock, the difference would be 745,003 cubic yards would have been returned as common excavation instead of loose rock, making a difference of \$223,500.90. The same remark in regard to solid rock applies to this contract as well as contract 14.

" Contract No. 16:

"Applying the same rule to this contract, the difference would be 369,090 cubic yards, which would have been returned as common excavation instead of loose rock, making a difference of \$155,017.80. Solid rock on this contract same as the others.

"This would make a difference of \$751,711.27 on the three contracts."

(NATIONAL TRANSCONTINENTAL RAILWAY INVESTIGATION COMMISSION. OTTAWA, SEPTEMBER 5th, 1912.)

Present: G. LYNCH-STAUNTON, K.C., *Chairman*; F. P. GUTELIUS, C.E., *Commissioner*.

GORDON GRANT, chief engineer National Transcontinental Railway, sworn:

By Mr. Gutelius:

Q. You are chief engineer of the National Transcontinental Railway and have been engaged in engineering work on this railway since when?—A. Since May, 1905.

Q. You were appointed chief engineer of the National Transcontinental Railway when?—A. In July, 1909.

Q. Refer to the specifications attached to the contract, and under the heading of "Classification," paragraph 34, you will see the expression "Solid rock excavation"—the classification of solid rock has been one of the most important items in railway construction in which you have been engaged during your experience as an engineer?—A. It has.

Q. Has the term "solid rock" in the various specifications under which you have worked been interpreted practically in the same way?—A. It has.

Q. What other specifications are you familiar with?—A. I am familiar with these specifications—I worked on railways in South America, the Intercolonial Railway specifications, the specifications of railways in the United States, and the C.P.R. specifications, and the Transcontinental specifications.

Q. And in your experience in these different specifications you have found that solid rock generally has been considered the same in all of them?—A. In all of them, yes.

Q. Generally?—A. Yes.

Q. A new item, Mr. Grant, under "solid rock" appears in the interpretation of "solid rock" in the Transcontinental specifications, which is generally known as "assembled rock"?—A. Yes.

Q. Did you ever come across the term "assembled rock" before?—A. I did not.

Q. In the other specifications with which you are familiar did you have any trouble to classify all sorts of material without using such a classification as "assembled rock"?—A. I never classified anything else as solid rock on any other road except ledge rock and boulders over a yard.

Q. And you never found it necessary to find any kind of solid rock such as assembled rock?—A. No, because the specifications of the other roads as a rule would define anything or would include an item for anything out of the ordinary such as on the Cape Breton Railway we had a classification for gypsum. On other roads we would have a special item for shale rock, rock debris, and such material as that.

Q. Where it occurred in sufficient quantities to justify a special price?—A. Yes.

Q. Can you, Mr. Grant, give us the history of this new item of assembled rock, and how it became a portion of the Transcontinental specifications, if it ever did?

Mr. Staunton: It is not a portion of the specification, it is an interpretation.

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By Mr. Gutelius:

Q. Can you tell us how it became an official interpretation?—A. It came about in this way. On October 7, 1907, the assistant chief engineer of the Grand Trunk Pacific Railway, Mr. H. A. Woods, wrote a letter to Mr. Lumsden, the commissioners' chief engineer, complaining of over classification in district B, particularly with reference to the work in the neighborhood of La Tuque. A special investigation was held with reference to this complaint on October 25, 1907, by the commissioners' chief engineer, his staff, and the contractor, and Mr. Woods was also present with his inspecting engineer, Mr. John Armstrong. This investigation was held with the view of ascertaining whether or not the Trans-continental engineers were classifying too high, and whether or not Mr. Woods' complaint was well founded. The chief engineer and the others walked over some six miles of the line that was complained of by Mr. Woods. Nothing definite was agreed on on the ground so far as I know. Mr. Lumsden returned to Ottawa, and after considering the matter issued his interpretation of the specifications together with an explanatory letter and an explanatory diagram in which was included among many others items "assembled rock."

By the Chairman:

Q. Items covering assembled rock?—A. Yes.

Q. And declaring it to be solid rock excavation?—A. And instructing the engineers to classify assembled rock as solid rock. That is the history of how assembled rock came to be included in the official classification.

By Mr. Gutelius:

Q. When you became chief engineer, Mr. Grant, did you perpetuate the interpretation of assembled rock as being solid rock, and if so why?—A. When I became chief engineer in July, 1909, the work had been proceeding for some years under Mr. Lumsden's interpretation of these specifications which had been duly approved by the commission, and in discussing this with the commission it was decided that the same interpretation would be adhered to as had been officially approved of in the past.

By the Chairman:

Q. You produce a letter dated January 4, 1908, written by P. E. Ryan, secretary of the commission, to Mr. Lumsden, in which he says:—"I beg to advise you that your letter of the 9th instant giving your interpretation of clauses 33, 34, 35 and 36 of the specifications for construction, modified so as to conform with the opinion expressed by the Deputy Minister of Justice, was considered by the board on the 10th instant and approved."—A. Yes.

Q. Has that approval ever been recalled?—A. It has not. That interpretation is still acted upon.

Q. A moment or two ago you said that at a conference between you and the commissioners it was decided to adhere to the Lumsden interpretation?—A. Yes.

Q. When was that conference?—A. It was in this way: Immediately on being appointed chief engineer I discovered that Mr. Lumsden had refused to sign the May and June estimates that were then due for payment. I also refused to sign those estimates until I had gone out on the line to see what I was signing for, and as I understood Mr. Lumsden had refused to recognize assembled rock when he went over the line with the chief engineer of the Grand Trunk Pacific Railway Company. I asked the commissioners whether or not I would have to recognize it and I was then told I would have to adhere to Mr. Lumsden's interpretation of the specifications which had been approved by the board.

Q. Mr. Lumsden contended, did he not, that the engineers were not classifying under the head of "assembled rock" material which he intended to be covered by his definition of assembled rock?—A. That is as I understand it.

Q. Do I understand from you that the commission instructed you that you were to follow the interpretation that had been given of assembled rock by the engineers on the work?—A. They instructed me that Mr. Lumsden's interpretation of the specifications and his blue print diagram were in other words the official interpretation of the classification.

Q. But why did Mr. Lumsden want to go back on his own interpretation?—A. Because he contended that there had been a great deal of material classified as assembled rock which in his opinion was not solid rock.

Q. Then, were you to put the same interpretation upon Mr. Lumsden's blue print as he contended should be put upon it; was that your instructions?—A. No, I got no definite instruction as to what was "assembled rock."

By Mr. Gutelius:

Q. Your instructions were to strictly adhere to the blue print and the printed instructions that went with it?—A. Yes.

By the Chairman:

Q. Was the Board aware at the time you had this conference with them then, just after your appointment as chief engineer, that the engineers on the work had given a different interpretation to Mr. Lumsden's blue print than that which he contended should have been given to it?—A. The Board were well aware that Mr. Lumsden did not agree with the interpretation put on his blue print by the engineers.

Q. Then the engineers in the field and the chief engineer in the office differed as to the interpretation to be put on the blue print?—A. They did.

Q. To the knowledge of the Commission?—A. Yes.

Q. Did the Commission know that a classification was being made by the engineers which did not meet with the approval of the chief engineer.—A. They did.

Q. Did the Board agree with Mr. Lumsden or with the engineers in the field?—A. That I cannot say.

Q. Did the Board know that Mr. Lumsden refused to sign estimates which were made up on the interpretation of the engineers in the field.—A. They did.

Q. Did the Board know what the difference between them was?—A. They must have known, because Mr. Lumsden had been home for some time in Ottawa before he resigned.

Q. Was he not at La Tuque with the Commission when they went down to examine that in October?—A. I believe he was.

Q. Lumsden was at La Tuque?—A. He was.

Q. And the Board was there?—A. They were.

Q. Did he point out at that time where the engineers were going wrong?—A. He wrote them on his return from La Tuque.

Q. Pointing out where in his opinion they were going wrong?—A. Not definitely.

Q. Did he write them at any time pointing out where he differed from the engineers?—A. No, he did not.

Q. Did he bring it to their knowledge?—A. He brought it to their knowledge in a vague way in a letter written shortly after his visit to La Tuque in October, 1907; that letter can be found on Mr. Ryan's file.

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Q. In his letter of October 30, 1907, to the Commissioners, Mr. Lumsden says that he does not agree with the interpretation put upon the specifications by Mr. Doucet and the other engineers in the field—that is before he made up the blue print, is it not?—A. Yes.

Q. After he made his interpretation which was accompanied by the blue print on the 9th of January, 1908, of the classification clauses in the contract, he claimed that the engineers did not follow his instructions correctly, did he not?—A. He did.

Q. He claimed that the engineers were classifying as assembled rock, material which was not rock?—A. Yes.

Q. And he said that he intended by the assembled rock clause to only include—A. Not to my knowledge.

Q. He claimed that in his evidence before the House of Commons did he not?—A. So far as I know Mr. Lumsden on his tour of arbitration classified nothing as assembled rock except ledge rock and boulders over a yard.

Q. But he contended, did he not, that nothing should be classified as assembled rock, excepting rock, did he not?—A. He did.

Q. Now then, when you were before the Commission to receive your instructions you knew that he had made that contention, that that was the proper interpretation of assembled rock, did you not?—A. I did not. I never knew what Mr. Lumsden's contention was until I heard his evidence a year afterwards at the investigation.

Q. Then that explains why it is that when you received the instructions from the Commission to follow the Lumsden interpretation you allowed material to be classified under the head of assembled rock just as it had been done before you were appointed?—A. That is why.

By Mr. Gutelius:

Q. And you were further left to your own resources in the matter of interpreting the Lumsden interpretation?—A. Quite so.

By the Chairman:

Q. There was a great controversy for years, was there not, over what was solid rock in the specifications?—A. Yes.

Q. The engineers before they visited La Tuque had been classifying as solid rock, under the head of "rock in masses," what they stated was a mixture of cemented material and boulders of nearly every size?—A. Yes.

Q. And, as you have said, this was objected to by Mr. Woods?—A. Yes.

Q. Then it appears that the contractors fortified themselves with the opinion of several leading counsel in Ontario and Quebec?—A. Yes.

Q. And these gentlemen gave opinions to their clients in which they stated that in their opinion the contractors were entitled to have the solid rock classification for this material?—A. They did.

Q. Now, that was a very important item, was it not?—A. The most important on the road.

Q. And it was one which it was desirable that the Commission should obtain the best advice possible upon?—A. It certainly was.

Q. And the Commission was furnished, I believe, with copies of the opinions got by the contractors from their own lawyers?—A. Yes.

Q. Did the Commission on their part then obtain an opinion from their own counsel as to the proper interpretation of these specifications?—A. They did not; at least not that I ever heard of.

Q. Did they accept the opinions of the contractors' counsel?—A. I do not know whether they did or not.

Q. Mr. Lumsden drew up this interpretation, and in his first draft he stated that the boulders, in order to come under the head of assembled rock, should measure a cubic foot and upwards, did he not?—A. He did.

Q. I have read the letter of the Deputy Minister of Justice and it does not appear to me that he has given it as his opinion that it was proper to classify assembled rock under the solid rock heading; did you understand that he had given an opinion to that effect; he uses the word "if"?—A. I do not know that I ever studied his letter.

Q. Here is his letter. The letter here dated Ottawa, 6th January, 1908, from Mr. Newcombe, Deputy Minister of Justice, to the secretary of the Transcontinental Railway Commission. I find it says:

"Referring to your letter of 20th ultimo with which you submit the correspondence with regard to the classification of excavated material and the interpretation of clauses 33, 34, 35 and 36 of the general specifications for construction of the Eastern Division of the National Transcontinental Railway, I have the honor to state that upon consideration of the papers submitted I see no reason to differ from the classification stated by the chief engineer in his letter to the commissioners of 16th ultimo except as to the statement that 'rock assembled (the individual pieces of such assembled rock exceeding one cubic foot in size), such as in the judgment of the engineer may be best removed by blasting,' is to be classified as solid rock excavation under clause 34. I do not understand upon what principle the chief engineer limits the size to pieces exceeding one cubic foot. The specifications speak of rock found in ledge or masses of more than one cubic yard which in the judgment of the engineer may be best removed by blasting. If 'rock assembled' may be regarded as a mass of rock, and if it may be best removed by blasting, I do not see why under the specification it is material whether the individual pieces exceed or are less than one cubic foot in size, and if 'rock assembled' is not regarded as a mass, the minimum limit of size which can be classified as solid rock exceeds one cubic yard.

"It seems to me however, that these questions are largely engineering questions, the solution of which depends principally upon the judgment of the engineer and having regard to the terms used in the specifications, I must call your attention also to clause 15 of the Contract which provides that the engineer (that this term to be construed as defined in clause 2 of the contract) shall be the sole judge of work and material, and that his decision on all questions in dispute with regard to work and material shall be final, thus expressly stipulating that such questions as these shall be submitted to the decision of the chief engineer.

"I wish to say that it is very difficult for me to advise generally upon the interpretation of these specifications, and a general ruling may not infrequently overlook the peculiar facts or circumstances of an individual case which if stated might lead to an exception or modification. I would prefer to advise upon any special case as it may arise, having all the particulars and circumstances stated.

"Papers returned herewith.

"I have the honour to be,

"Sir,

"Your obedient servant,

E. L. NEWCOMBE,

"Deputy Minister of Justice."

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You will notice that he does not say in that letter that under any conditions boulders or stones of less than a yard should be classified as solid rock excavation?

—A. I notice that he uses the word "if".

Q. So that, so far as you know, although the Commission adopted this assembled rock interpretation, and although the Commission knew that the contractors had been fortifying themselves by the opinion of counsel, the Commission never got a legal interpretation of these specifications for themselves?—A. Not to my knowledge.

Q. Don't you think they ought to have done so?—A. I think it would have been a wise precaution.

Q. Did you ever suggest it to them?—A. No, I was not in a position in these days to do so.

Q. When you became chief engineer did you ever ask them for a legal interpretation of that specification?—A. I did not.

Q. You acted on the instructions the Commission gave you?—A. Yes.

By Mr. Gutelius:

Q. In your letter of December 23rd, 1909, to the district engineers, with reference to the method of keeping records of the various classes of excavation you were particularly careful to have the solid rock returned under Mr. Lumsden's diagram known as assembled rock, kept separate, apparently with the object of keeping the quantity as low as possible, am I right in that?—A. Yes, you will see also that my instructions are that the division and district engineers are to be held responsible for any returns made under assembled rock, so that in case of a dispute later on they would not be in a position to blame the resident engineer.

Q. You expected disputes in the matter of assembled rock?—A. I expected that as in the past returns under this heading would be disputed by the Grand Trunk inspecting engineers or by myself.

Q. If you had been chief engineer at the time Lumsden wrote this interpretation would you have made the "assembled rock" item?—A. I never would have written any official interpretation of the specifications as I considered that was absolutely unnecessary.

Q. That is, in general?—A. I do not think that the specifications require any written interpretation. They are perfectly plain and to me they are all right.

Q. Then, the result of Mr. Lumsden's interpretation would not make the specifications any plainer than they were originally printed?—A. Mr. Lumsden's interpretation had a contrary effect. It mixed up the whole business and resulted in a great deal of material being returned as assembled rock which is not solid rock.

Q. And should not be paid for as solid rock?—A. And should not be paid for as solid rock.

Q. In our recent inspection, Mr. Grant, I think I noticed material classified as assembled rock, and shown on the estimate as solid rock, which was composed of loose rock material, with a few large boulders, was I right in that?—A. You were right.

Q. Now, describe the material which we found on District "B" which has been classified by the engineers as assembled rock, using as far as you can the terms of the original specification?—A. On my recent trip over the line I find cuttings classified as assembled rock in which the material consisted of sandy loam mixed into which there were boulders of various sizes, rock fragments, and portions of shale rock, which, if "assembled rock" had not been allowed these cuttings would have been returned as follows: All boulders over a cubic yard would have been classified as solid rock; boulders over a cubic foot and up to a cubic yard would have been classified as loose rock, and the balance of the material would either have been classified as loose rock or common excavation according to its hardness.

Q. Do you know whether your records would enable you to determine the quantity of boulders in excess of a cubic yard or more?—A. I do not know. For a long time boulder measurements were not got, that is previous to my being chief engineer, since which time boulder measurements were kept. But, on questioning the engineers with reference to these boulder measurements they told me that they were not satisfactory in many cases or they had not confidence in the men who were measuring the boulders.

Q. Did you not select these boulder measurers?—A. No.

Q. Who selected the men who measured the boulders in these cuts?—A. All below the rank of resident engineers were nominated by the different commissioners, each man for his own district.

Q. Can you give the names of the commissioners and the districts over which they had jurisdiction in this respect?—A. Commissioner McIsaac had jurisdiction over District "A" which is the Province of New Brunswick; The Hon. Mr. Parent, Chairman, had jurisdiction over the Province of Quebec, or District "B"; Mr. Calvert had jurisdiction over Districts "E" and "D" in the Province of Ontario, and Mr. C. A. Young had jurisdiction over District "F" in Manitoba and Ontario.

By the Chairman:

Q. Each one of them controlled the patronage in his own district?—A. Yes.

By Mr. Gutelius:

Q. Do I understand that the employees known as boulder measurers were appointed without the approval of the chief engineer?—A. Yes.

Q. Were these men usually experienced in classification of railway excavation?—A. Not that I know of.

Q. You understand that they were ordinary?—A. Fellows looking for a job.

Q. And probably would have been unable to figure the contents of a boulder if it were a sphere?—A. Yes.

Q. Are they the kind of men who would know anything about geometry?—A. No, they would not.

Q. Is a knowledge of geometry necessary for measuring rock masses of this kind?—A. No, I do not think so, but if a fellow was willing and reasonably clever he could be made a good boulder measurer in a short time by the resident engineer.

Q. By the resident engineer teaching him?—A. Teaching him, provided that he was willing to do the work as directed.

Q. What was the deficiency of these men generally that caused the engineers to state to you that they had not confidence in them?—A. The trouble in some cases was that the men so appointed did not look upon the engineers as their bosses, and were not very particular whether they obeyed instructions or not.

By the Chairman:

Q. Who had power to dismiss them?—A. Claiming that as they were appointed by the Commissioners they could not be dismissed except by direction of the Commissioners.

Q. The measurement of boulders is a very important item in the classification?—A. Yes, sir.

Q. There are boulders to be found in nearly every part of the country traversed by the railway excepting Districts "C" and "D"?—A. Yes.

Q. Do you agree with us that it is very important that not only reliable but competent men should have been chosen to make these measurements?—A. Certainly.

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Q. Instead of picking up all over the country men who were, as you say, just looking for a job?—A. Yes.

Q. Had these boulder measurers it in their power to affect the classification very much?—A. They had.

Q. Tell me how they could do it?—A. They could do it by being careless and not visiting the cuts at frequent intervals to see what boulders were being moved and measuring each boulder to see that it was a yard or over, and also seeing that they did not measure the same boulder more than once, by seeing that the boulders they had measured were removed and put in the dump and not left to be remeasured when the fellow came back on another trip.

By Mr. Gutelius:

Q. What check do the resident or higher engineers have of the accuracy of the reports of boulder measurers?—A. None, except what notes they may take when going through the cutting themselves and investigating at frequent intervals the boulder measurers' records to see that they correspond with their own notes.

By the Chairman:

Q. Have you known of cases where there have been any improper measurements—did the division engineers instance to you when they were complaining, any case where the measurements had been unreliael?—A. Yes.

Q. Can you give us some of them?—A. Some of the division engineers on District "B" when questioned by me as to why they did not have boulder measurers in certain cuttings, explained that the boulder measurers had not proved satisfactory to them, that they got more reliable returns by frequently visiting the cuts themselves and doing any boulder measuring themselves than trusting to Tom, Dick or Harry, that was sent to them as a boulder measurer.

Q. Then it must necessarily follow, if the resident engineers had to do this work themselves, that their returns might be more or less inaccurate?—A. Yes.

Q. Because they could not be on the ground all the time to measure the boulders and they had to estimate the boulders in the various cuttings in their residencies?—A. Yes.

Q. Now, if the commission had appointed efficient and reliable men to do this work it might have affected the classification very materially, might it not?

A. It would have affected it. I do not know to what extent but at all events we would have had reliable classification.

Q. You would have had reliable classification?—A. We would have had reliable classification instead of percentages.

Q. In the absence of reliable boulder measurers how do the resident engineers make their classification?—A. The engineers would take notes of the amount of boulders on each time they visited the cut and estimate for the material excavated that they did not see.

By Mr. Gutelius:

Q. Based on the information gathered in their notes?—A. Yes.

By the Chairman:

Q. How long were the boulder measurers on these various districts?—A. Boulder measurers have been on more or less for the last three years; some division engineers would have them and others would not.

By Mr. Gutelius:

Q. Were the boulder measurers supplied whenever the division engineer asked for them?—A. Willingly.

Q. Were they ever supplied to your knowledge where the division engineer did not want them?—A. That I cannot say, because I never knew anything about these appointments. They were all arranged through the district engineer and the commissioners.

Q. Considerable difficulty was experienced in securing uniform classification for clay in Districts "C" and "D"?—A. Yes.

Q. By reference to paragraph 35 in the classification the description of loose rock provides for material that in the judgment of the engineers cannot be ploughed with a 10-inch grading plough behind a team of six good horses properly handled—on your inspection did you find the field engineers classifying material as loose rock which could be ploughed and if so will you give us a description?—A. Yes, I found clay classified as loose rock that was ploughed with a 2 and 4 horse and put into the bank with wheel and slush scraper.

Q. And that was classified as what?—A. Classified from 40 to 80 per cent loose rock.

Q. What did you do as chief engineer?—A. When I was on my arbitration trip with the chief engineer of the Grand Trunk Pacific Railway and Mr. Schreiber this classification was all reduced to what the arbitrators considered would be fair under the specifications. I may say that the reason the engineers gave for so classifying this material was that it was hard and in their opinion could not be ploughed, in the sense that it was to the advantage of the contractor to plough it. There was no doubt that a considerable amount of this material classified as loose rock by the engineers could have been ploughed with six horses properly handled as specified, in which case it was common excavation.

Q. You also reduced from loose rock to common excavation a quantity of soft clay which the engineers had called loose rock?—A. Yes, a considerable amount of soft clay in District "D" was reduced from loose rock to common excavation. This soft clay had been classified by the engineers as loose rock because in their opinion it could not be ploughed from the fact that horses could not walk in it without becoming mired.

Q. Did you find any frost classification?—A. Yes.

Q. Tell about that?—A. On both Districts "F" and "D" a considerable amount of frozen clay was classified as loose rock. On having been appointed as chief engineer I called the commissioners' attention to this and told them that in my opinion this could not be allowed and that I intended to have all frozen clay which had been classified as loose rock or solid rock, removed from the estimates.

Q. And that was done?—A. And that was done; and I would like to explain that when the engineers classified clay as loose rock or solid rock in the specifications they did so openly.

Q. Openly?—A. Yes. In the case of the frozen material classified on District "F" it was done under the direction of the chief engineer Mr. Lumsden, and this had been agreed on at a meeting held in the district engineer's office in Kenora where the chief engineer, the divisional engineers and Commissioner Young were present. With reference to the classification for frozen material on District "D" this was done by the district engineer owing to the pressure on him from Ottawa to have the work rushed during the winter season.

By the Chairman:

Q. What do you mean by the pressure from Ottawa; do you mean the pressure of the commissioners?—A. Owing to the pressure from headquarters, that is by the commission and chief engineer to have the work rushed during the winter season.

By Mr. Gutelius:

Q. Did you reduce the classification in these items which you have just described?—A. I did, and I notified the commission that unless I had written instructions from them no classification would be allowed for frost.

Q. Why did you not concur with the engineers who classified soft clay as loose rock?—A. Because in my opinion the specifications for loose rock are controlled by the hardness of the material and not the softness of it. These specifications are referring to the hard materials, that is, material must be hard and not soft to be called loose rock.

Q. What do you say to the reason given for classifying loose material on a steep hill side because it could not be ploughed in the practical sense of the term?—A. I look upon that as sheer nonsense.

Q. Then, in your opinion, the plough feature of the specification is a test for hardness?—A. Yes.

Q. And the fact that a six horse team is named in the specification goes towards showing that it was prescribed as a test rather than as a practical method of ploughing?—A. I am of opinion that when six horses were specified it was done with a view of proving that the material must be very hard before it could be called loose rock and that this was meant as a test more than a practical method of removing material.

The witness was not further examined.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION:
EVIDENCE TAKEN IN TRANSCONTINENTAL OFFICES,
OTTAWA, NOVEMBER 21st, 1912.)

HUGH D. LUMSDEN, sworn:

Examined by Mr. Gutelius:

Q. You were chief engineer of the Transcontinental Railway between what dates?—A. From 1904 to July, 1909.

Q. Who prepared the original specifications for the construction of this railway?—A. Well, there were several connected with it: Mr. Butler, Mr. Woods and myself.

Q. They made the original drafts, and you made some corrections?—A. Yes, Mr. Woods and Mr. Butler, I think, made the original draft.

Q. Do you remember of having changed the clauses with respect to classification in the original specifications?—A. I have no recollection, at the present moment, of making any changes.

Q. You did, however, make an interpretation, after a certain number of contracts had been let on the original specifications?—A. Yes.

Q. As shown in the blue print and explained in your letter of January 30th, 1908?—A. Yes.

Q. Before making that interpretation and sending out the blue print, with whom did you confer?—A. With the Commissioners.

Q. How did you happen to take the matter up after that with Mr. Schreiber? Did the Commissioners suggest Mr. Schreiber?—A. Yes, my recollection is they did; they suggested Mr. Schreiber.

Q. And the interpretation which you made was the result of your conference with Mr. Schreiber?—A. Yes.

Q. Who drew the original picture for that item number 5 on the blue print?
--A. Mr. Schreiber drew that.

Q. The position you took prior to the issuing of that blue print, and in your subsequent evidence before the House of Commons Investigating Committee, indicates to me that your personal idea of solid rock was and is that to be solid rock it must be a piece of stone about a cubic yard or larger, is it not?—A. A cubic yard or larger, yes.

Q. The issuing, then, of the blue print which showed assembled rock, was intended to be a compromise between your personal ideas and the conditions that you were confronting at that time?—A. Yes, it was.

Q. Am I right in assuming that item number 5, as shown in this interpretation, means that the stones can be smaller than a cubic yard?—A. It did mean that.

Q. Will you tell us how you happened to be persuaded to make this compromise classification?—A. While at La Tuque with the Commissioners on their car, they brought up the subject of solid rock, the interpretation of the solid rock, and I then stated that my interpretation of it was that it meant rock in ledges, or boulders over a cubic yard, or masses of detached rock over a cubic yard. They all disagreed with me; that is, the Commissioners and the contractors; and the only person who sided with me on that occasion was Mr. Woods, assistant chief engineer of the Grand Trunk Pacific. Then, after returning here, opinions were handed me by, I think, the Chairman—I cannot be positive who handed me these opinions, of different K.C.'s on the interpretation of the specification.

Q. Those were the letters from Messrs. Shepley, Lafleur—A. Yes, there were a number of them.

Q. Ritchie, Lacoste and others?—A. I do not remember the names of all of them; I should think there were four or five.

By the Chairman:

Q. What did the Commissioners contend at La Tuque was the proper interpretation in that conversation?—A. That it meant masses of other material than rock.

By Mr. Gutelius:

Q. The Commissioners argued with you at La Tuque that solid rock meant material composed of rock fragments, earth and clay in the interstices?—A. That it meant masses of other material than rock, other than what I knew as rock.

By the Chairman:

Q. What description of material?—A. Clay or the hardpan, or anything that was in a mass that was hard, I presume. I do not think they ever went into any detail of what the description would be.

By Mr. Gutelius:

Q. They really wanted you to call the material in that cutting at La Tuque solid rock?—A. When you say at La Tuque, it was not at La Tuque; it was in the neighbourhood of La Tuque; it was not really at La Tuque, because the cutting at La Tuque was sand, but it was south of La Tuque a little bit where this discussion took place. It was on the track of the Quebec & Lake St. John road before it comes into La Tuque, and we had been over some of the work in that neighbourhood.

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Q. Let us try to describe the material in the cutting where this discussion actually occurred; it contained some occasional boulders over a cubic yard?—A. Probably ten per cent or less; I cannot begin to go into percentages.

Q. Would you say between ten and fifteen per cent of boulders over a cubic yard?—A. There was a lot of boulders, but I could not say the percentage.

Q. There was a lot of small stone between these boulders?—A. Yes. My recollection of it is that there were masses, a great many cubic yards in some and then down to small stones.

Q. And some clay?—A. Yes.

Q. And sand?—A. Not much sand, principally clay and boulders and masses of rock; they were not really boulders; they were more like detached pieces of rock than boulders; square ends.

Q. They had corners on them?—A. Yes.

Q. These individual pieces could have been removed from a vertical face with a pick and shovel, provided they were smaller than half a yard?—A. I believe they could.

Q. That was your opinion?—A. I do not remember all those particulars, but I believe they could.

Q. Returning to Ottawa, you were handed by one of the Commissioners, presumably the Chairman—A. I think so; they handed me, or sent them in to me.

Q. The opinions of many eminent lawyers which were addressed to the contractors?—A. They were. My recollection is they were all addressed to the contractors.

Q. Did they give you any opinions that were addressed to the Commissioners, or yourself, from other lawyers?—A. After a time I had some communication with Mr. Newcombe in connection with it.

Q. But not from any outside legal talent?—A. No.

By the Chairman:

Q. You submitted this interpretation to Mr. Newcombe?—A. Yes.

Q. You got no opinions from anybody, but you did, after the interpretation was made, submit it to Mr. Newcombe, the deputy minister?—A. Yes.

By Mr. Gutelius:

Q. Can you tell us in detail how you were advised to check this matter up with Mr. Schreiber by the Commissioners?—A. I cannot give you any detail about it. My recollection is that Mr. Parent suggested I should go up and see Mr. Schreiber and talk it over with him. That is my recollection of it; I do not remember particulars at all.

By the Chairman:

Q. Did you see Mr. Schreiber before you drafted your interpretation?—A. Yes.

Q. And then the blue print and the attached letter are the result of your joint efforts?—A. Mr. Schreiber actually drew the original—I won't say the original of this, because I think we made a new tracing of it.

Q. At any rate, the whole diagram, if I may so describe it, was the work of Mr. Schreiber?—A. The actual diagram was the work of Mr. Schreiber; I rather think the shale rock might not have been, but I am not positive: I think it is number 6; I am not sure that that was on Mr. Schreiber's original.

Q. Did you tell Mr. Schreiber that the Commissioners contended for the inclusion of assembled rock in the solid rock classification?—A. I cannot say that I did. I explained to Mr. Schreiber the whole situation. I told him about the meeting at La Tuque—at least, I am under the impression that I did. I would not like to swear I did, for the simple reason that I do not recollect the conversation, but I am pretty well satisfied I did.

By Mr. Gutelius:

Q. You made him familiar with the situation as it was at that time?—A. That is my recollection of it.

Q. Then did Mr. Schreiber have any personal view as to how that clause should be interpreted, or did he only endeavour to put the views of the Commission?—A. I won't say he put the views of the Commission; I did not see him with the Commissioners.

Q. But I mean the views of the Commission as explained to you?—A. I cannot say that.

Q. Was that his own?—A. This was his own sketching. I know that.

Q. You do not recollect what his own opinion was as to how that was to be interpreted?—A. No, I cannot say that I do, but that is what he drew up.

Q. Was this—as was stated in what was called the Lumsden investigation—was this assembled rock classification being actually carried out on the Transcontinental before the blue print came on?—A. Oh, I do not think so; I do not know. I think there had been a lot of it classified on some sections, but not on this, certainly not.

Q. But in the same way?—A. I think there had been a lot of stuff classified as rock which I did not consider rock.

Q. What brought up the controversy, or conversation, or argument at La Tuque?—A. My going over the cuttings, and seeing material that I did not consider rock being classified as rock.

Q. Then you actually pointed out to the Commission material being classified as solid rock that, in your judgment, should not have been so classified?—A. Yes.

Q. And you wished that to be reclassified, did you not?—A. Well, I thought it should have been.

Q. That was what brought up the controversy between you and the Commission?—A. To the best of my recollection.

Q. And the Commission, as I understand you, agreed that the classification should stand as it was or at least argued that it should stand as it was, and you disagreed with them?—A. Yes.

Q. Did you make your personal views clear to Mr. Schreiber when he and you were discussing this interpretation?—A. I believe I did, but I do not recollect the conversations that took place at all. I saw Mr. Schreiber half a dozen times backwards and forwards.

By the Chairman:

Q. You returned from La Tuque, and Mr. Parent either sent to you, or handed to you, the opinions of several counsel given to the contractors?—A. Yes.

Q. You read those opinions?—A. Yes.

Q. Did they convince you that you were wrong?—A. I cannot say they did convince me I was wrong.

Q. Or did they weaken your conviction?—A. I thought that, all coinciding, there must be something in it, though I could not see it.

Q. Did you so express yourself to Mr. Parent?—A. I cannot recollect distinctly.

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Q. You must have, because he then told you to go and see Mr. Schreiber?
—A. Yes. I felt doubtful whether there might not be something in their contention.

Q. Then you naturally would have told the whole case to Schreiber?—A. I presume I did; I believe I did.

Q. But at this length of time you cannot positively recall it?—A. I am satisfied I did, but I do not remember the occasion of doing it; I would not like to be positive.

By Mr. Gutelius:

Q. Your relations with Mr. Schreiber have always been most kindly?—A. Yes.

Q. And in a discussion of that character you would give him the benefit of all your personal ideas?—A. Oh, I think so.

By the Chairman:

Q. I suppose you appreciated, did you not, that if this assembled rock interpretation was given these specifications, it would largely increase the cost of grading this road?—A. I believe it would.

Q. From your knowledge of the road and what you saw, it would cover a great mass of material that would otherwise go in as loose or common, would it not?—A. Yes.

By Mr. Gutelius:

Q. We find that in distinguishing between the common excavation and loose rock that the plough-test clause was interpreted to mean a method of removing the material, rather than a test of hardness. Did you understand that the six-horse team clause was a test of hardness?—A. I did—a test of hardness.

Q. Referring to your interpretation in that blue print, did you show this to the Commissioners before sending it out?—A. Oh, yes, sir.

Q. Was it what they wanted?—A. I do not remember the details of the conversation when I showed it to them, but I am satisfied I showed it to them and they approved of it.

Q. So that the result of the meeting at La Tuque, from the Commissioners' standpoint, was that they had their way?—A. Well, I cannot say what their standpoint was, except that they would not agree with me in the interpretation I made at La Tuque. They never themselves, that I remember, made any attempt at a classification of their own, but they simply would not agree with me that that solid rock meant only rock a yard or over.

Q. You are familiar with the little book of instructions, a reprint of which was issued over your signature, dated January, 1907?—A. I cannot say that I am very familiar with it now.

Q. You know that there was such a book?—A. Yes.

Q. When you came on the work you found a book of this character had already been written by Mr. Butler?—A. I think Mr. Butler wrote it, to the best of my recollection. I am not positive about that.

Q. You will notice by paragraph 26 of the instructions, the curvature is limited to six degrees?—A. Yes.

Q. If a large amount of money could have been saved by the introduction of an eight-degree curve, and that matter had been brought to your attention, would you have allowed the use of an eight-degree curve?—A. If the Commissioners approved of it.

Q. You would have taken it up with the Commissioners?—A. Yes.

Q. But personally there is a point in economy in grading that you would have recommended using an eight-degree curve?—A. I think very possibly I would. There were no cases came up where any recommendation was made. There is no doubt these instructions were issued with the idea that the engineers in the field should not use more than six-degree curves.

Q. And the other instructions contained in the same paragraph apply with equal force?—A. I believe that is the same.

Q. In the matter of the pusher grade ascending westward from the St. Francis River, the ruling westbound grade is six-tenths?—A. It was to be, yes.

Q. The pusher grade to the west of the St. Francis River was built on a one-point-one grade?—A. I believe so.

Q. If it had been built on a steeper grade, it would have reduced the filling across the valley next adjoining the bridge, would it not?—A. Yes, by increasing the grade you would have reduced the amount of the work.

Q. Did you pass upon the rate of grade on that hill?—A. I remember having a profile from Mr. Doucet of that grade.

Q. Did Mr. Doucet give you any comparisons between the one-point-one, as finally approved, and a steeper grade?—A. I cannot recollect that he did. I cannot remember that he did.

Q. You would probably remember if he did?—A. I am not sure. I do not recollect. He might have and might not.

By the Chairman:

Q. You know that there is a large amount of overbreak allowed to the contractors on this line?—A. Yes.

Q. Overbreak is not usually allowable at all?—A. We used not to allow it.

Q. But can you conceive of any conditions which could arise on this line which would justify the allowance of overbreak or where would you allow it, if you allowed it at all?—A. If I could get out of it, I would not allow it at all.

Q. In what case would you be justified in allowing it?—A. When the material was required to make up embankments where cheaper material could not be got.

Q. Then if you had to allow overbreak in such cases as you indicate, according to this specification that overbreak is to be classified after it is shot, and as it lies in the cut: that is right, is it not?—A. Yes.

Q. So that in shooting this rock would you expect that the pieces would be all a yard or larger?—A. No.

Q. That is an impossible condition to arise?—A. Yes.

Q. Did you ever know of overbreak being in a cut all of a greater size than a cubic yard?—A. I cannot answer that. I can say that I have seen overbreak where it was all over a cubic yard, where it was the whole hill side of a cut.

Q. It slipped off?—A. Yes.

Q. A special case, but generally speaking, the rock, when it is exploded by the shots, comes down in large and small pieces, some over and some under a cubic yard?—A. Yes. As a rule the small pieces are near where the charges are, and the big pieces come where the overbreak is, as a rule.

Q. So that you would expect part of that overbreak would be classed as solid and part as loose rock, following the rule laid down in this specification?—A. Yes.

Q. Do you think there was a lot more overbreak allowed on this railway than should have been allowed?—A. I think so, I think specially in the case where it was deliberately wasted, blown over the sides and wasted at the top, and borrowed material at the ends of the cut to make it up.

Q. You saw that yourself?—A. Yes, I cannot give the place now.

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- Q. What district was that?—A. That was on the west.
Q. District F, McArthur's contract?—A. Yes.

By Mr. Gutelius:

Q. Would you care to give us an idea as to what would be a reasonable percentage to allow in the matter of overbreak?—A. Oh, I could not give you a percentage. My own idea is that I should want to have nothing to do with overbreak. I had nothing to do with overbreak except in the last ten years. The Commission declined to pay for anything, unless it was a straight case of a slide.

By the Chairman:

Q. That is what the specifications provide for?—A. That was my intention originally.

Q. Clause 38: "Materials in slips, slides and subsidences, extending beyond slopes in cuttings will not be paid for, unless, in the opinion of the engineer, such occurrences were beyond the control of the contractor and not preventible by the use of care and diligence"?—A. Yes.

Q. Do you take that to be overbreak?—A. That refers to what would be really unavoidable overbreak, which, in case of taking off a toe of stratified rock, you take out the toe and the whole thing comes out. That is called legitimate overbreak.

Q. Is it not material that slides into a cut and not material that is thrown out? It is material that falls in, and not material that goes out?—A. Yes, that is what it meant—the material that falls in and not what is thrown out.
(Adjourned for 1½ hours).

(After adjournment).

By Mr. Gutelius:

Q. On September 13th, 1905, you wrote to Mr. Hoar, then engineer in charge of Quebec Bridge connections, as follows:—"In reply to yours of the 11th instant, re providing for double track from Quebec Bridge westerly to near Cap Rouge Viaduct, you had better provide for such, using 29 feet for width of top of embankment" and so forth?—A. Yes.

Q. How did you happen to authorize the construction of double track between these two points?—A. My recollection of it is that the Canadian Northern were to join that track a little east of Cap Rouge Viaduct, and it was done with the idea of accommodating them as well as the Transcontinental; that is my recollection of it.

Q. Do you remember of any contract or agreement made with the Canadian Northern?—A. I do not know of any; I do not remember any agreement.

Q. You know that the Act provides for a single track railway —A. Yes.

Q. And that it would require some special arrangement to build double track?—A. Well, if it was for any distance, I should think it would; that is three miles, is it not? With a yard as they proposed to have it at St. Foye, by the time you come to the end of the yard tracks, there is not very much of a double track.

Q. Do you think you authorized that on account of a prospective deal with the Canadian Northern? —A. Whatever I did, I did it after consulting the Commission, I did not do it off my own bat.

Q. So that you are satisfied you did it under the authority of the Board?—
A. I am satisfied the Board was aware of it, and I cannot remember now whether it was not done through their instructions. I cannot recollect the instructions, but it was done, at any rate, with their knowledge.

Q. Reading the correspondence might give you some idea?—A. That is my recollection of it, just as I say; that I understood that the Canadian Northern were to utilize that line to get across the Quebec Bridge.

Q. And you would not have authorized the construction of double track off your own bat?—A. I do not think so. I am satisfied I would not do it, except so far as the siding was concerned, and have it run up to the limits of the St. Foye yard.

Q. But this being only three miles, you are quite satisfied this order had the concurrence of the Commissioners?—A. No.

Q. What was your idea of the proper method to enter Winnipeg?—A. I always advocated that we should go in along with the Canadian Northern, crossing the C.P.R. alongside of that, practically making one signalman cover the three lines south of the C.P.R., St. Boniface yards.

Q. How did the location for the shops, which occurred under your jurisdiction, come about? Who suggested that location for shops?—A. I do not know who suggested it.

By the Chairman:

Q. They were located in your time, were they?—A. Yes.

Q. Did you personally have anything to do with the location of them?—A. Not as far as getting the land is concerned. They had an offer of a large block of land there and they took it.

Q. Did you know they had to bring water all the way from Winnipeg, and the sewage all the way back?—A. At that time we did not expect to have to bring the water from Winnipeg. They had a flowing well right on that property, but the water turned out so hard it was no good for engine purposes, and they had to take it from Winnipeg.

Q. Try and give us something as definite as you can about the suggestion for that location?—A. I cannot. I simply do not remember who suggested it, or whether they had options; there was a lot of land they had in view.

Q. Did you suggest it?—A. I never suggested it.

Q. The correspondence shows that the first letter written about that location of the shops was written by you?—A. Yes.

Q. That is the reason I want you to try and recollect?—A. I did not want to locate it on those long narrow locks—what they call the river locks; they were about 600 feet wide.

Q. At any rate, someone else found that location and submitted it to you?—

A. Yes. The yard was the thing that was contemplated in the first instance and not the shops. I do not remember whether the shops were talked of at the first start. It was after the thing had been going a while that the question of the shops came up.

Q. Had you known that the shops were going to be located on that property, would it have affected your judgment in the location?—A. I do not think it would at that time. I think it might, if I had known we were going to have so much trouble getting water, but at that time I imagined we were going to get any quantity of water, because there was one splendid flowing well on that property, and I thought when they got one there would be no trouble in getting more, but the water turned out to be very bad.

Q. Were there other locations suggested by the parties buying land besides this one?—A. Yes, there was one I remember; it was somewhere on those long, narrow locks, nearer St. Boniface, but I think they were owned by Mackenzie, not William, but Rod Mackenzie, and I remember something being talked of the shops going there. They were trying to sell that land for shops to the Commission.

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Q. And this Transcona location was the only other one in addition that came up?—A. That is the one I recollect now. This other is close to an old road that ran out there, I cannot remember the name. It was the road that ran out about a short distance east of where their first track ran on to the Canadian Northern. I think that branch ran out to a gravel pit. It is the Dundee branch. My recollection is that this land they talked of for a station was in here somewhere.

Q. That is about half way between Winnipeg and the terminal yards?—A. Yes; I do not know the exact position.

Q. Who had the purchase of this land in hand?—A. I do not know the man's name. Do you mean actually doing the negotiating up there?

Q. Yes, which of the Commissioners?—A. Mr. Young.

Q. Is it the modern railway practice, in the construction of new lines, and reducing the gradients in existing lines, to take advantage of the momentum of moving trains to climb short grades or inclines whose rate of grade is in excess of the rate of grade on the long ruling grade?—A. I believe that is the practice now.

Q. Is the object of introducing these short grades or inclines to reduce the cost of grading the railway?—A. Yes.

Q. And is it a fact that where they are introduced the efficiency of the road is maintained?—A. That I am not prepared to say. I am not an operating man; practically, I am not an operating man.

Q. Is it believed among engineers generally that their efficiency is maintained, without pledging your own opinion on it?—A. I have not had anything to do with operation, and I am not prepared to state.

Q. Is the location of the railway influenced by the introduction of momentum grades?—A. As I personally have not laid out any roads with momentum grades, I am not prepared to answer that question. I quite fancy it would be, but I have not been in the habit of using them. I think, as far as I can recollect, momentum grades have all come in within the last eight or ten years.

Q. Momentum grades have come in, as a matter of fact, have they not, since they have been adopting the lower grades?—A. They have come in, within my knowledge, in the last eight or ten years.

Q. But before eight or ten years ago, it was the practice to have one per cent grades?—A. Yes.

Q. And so, as a result of reducing the grade, they have introduced the momentum grade?—A. I think that is correct.

Q. Would you not say, speaking generally, that if you were instructed, as the engineer of a Transcontinental railway, to use momentum grades, that it would be necessary for you to so advise your staff when they were locating the line?—A. I should think so. If I was going to use momentum grades, I certainly would have to instruct them to that effect.

Q. Because the location of the road would be influenced by that fact, would it not?—A. Yes.

Q. Would you agree with the statement that in the building of this railway, if the policy of introducing momentum grades had been adopted, it would, in all probability, have made a considerable saving in the cost of the grading of the road?—A. I imagine it would make a saving in the cost, but I am not prepared to say that it would add to the efficiency of the road.

Q. Because you say you are not in a position to give an opinion on that?—A. No.

Q. You mentioned a few moments ago that you were not an operating man?—A. No.

Q. There are two classes of engineers, are there not; those whose experience is entirely confined to the constructing of railways?—A. Yes.

Q. And another who have the experience of constructing and operating railways?—A. Yes.

Q. Can you tell me whether or not the Commission consulted, or employed, to advise you and them, any engineer of standing, who had that double experience?—

A. I cannot say that they did. I do not know what they call Mr. Butler.

Q. So far as you know, they did not?—A. No.

Q. Do you not think it would have been a very prudent step for them to take to have given you the assistance of a man who had a large experience in operating railways?—A. I do not know; I cannot say that.

Q. On this very question of momentum grades, he might have given you some very valuable information, might he not?—A. He might.

Q. During your time, at all events, there was no operating man?—A. MacPherson was an operating man.

Q. No operating man other than Mr. MacPherson employed on the staff by reason of his having been an operating man?—A. Not that I recollect of.

Q. Did you consult Mr. MacPherson on this question of momentum grades?—A. I am not sure that I did; I believe I talked to Mr. MacPherson about it.

Q. Did the Commission consider the question officially at all?—A. Not that I remember.

By Mr. Gutelius:

Q. In the matter of height of embankment in level prairie country, how high above the surrounding country would you say the base of rails should be, to give reasonable protection against snow?—A. Two and a half to three feet.

Q. So that if a profile staying within four-tenths and six-tenths grades had been laid down, so as to give 2½ to 3 feet above the surrounding country, that would be as efficient a railway as if those embankments were raised higher?—A. I think so, assuming that you are within the gradient limits.

Q. Now, as to wooden bridges; in the early days of construction, we know, from the correspondence, that you advocated the construction of wooden bridges?—A. Yes.

Q. You would have built, if that policy had been adopted, wooden trestles over depressions in the roadbed that could not have been filled with material removed from adjoining cuttings, or be filled with common excavation that could have been borrowed within the short haul, would you not?—A. Yes, with the understanding that there would be no price for extra haul.

Q. Would the construction of such trestles have interfered with the efficiency of the railway in the matter of transporting trains—the size of trains?—A. No, I do not think so.

Q. Is the custom of constructing wooden bridges, as we have just described, the usual practice on new railroads in Canada?—A. Yes, in unsettled countries.

Q. It would be reasonable to suppose that these trestles could be filled later on, if it were so desired, for less money than it would cost during original construction?—A. Yes. We had a bid of 25 cents from the G.T.P., whereas our contract prices for train fills were from 45 to 58. Of course that included the temporary trestles.

Q. In deferring the filling of these trestles, is there any advantage to be gained in the matter of the size of the openings?—A. Yes.

Q. Just explain that, will you?—A. Well, in an unsettled country there are very few know the sizes the streams may get to in the spring, and if they have a good big open trestle across it, they have a number of years for the section men and others passing to get an idea of the volume of that stream, and to avoid putting in a structure that is too big or too small.

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Q. The probability is that if this policy had been adopted on the Transcontinental that the size of the structures built in eight or ten years would be more economical than those built now?—A. That would be the natural result.

Q. Would the cost of the railway have been influenced, if that policy had been adopted, on account of the further knowledge that the engineers would have had concerning soft muskegs and foundations for structures?—A. Oh, yes. If the country was cleared for a number of years it would certainly give the soil a chance to dry out and give them a chance to know something about it.

Q. So that many of the slips and slides we have had might have been avoided?—A. Some of them might have been avoided.

Q. Who do you consider is responsible for the policy of not building wooden trestles on this railway?—A. I should say the Commissioners.

Q. The fire risk in connection with trestles on this railway would not have influenced you in abandoning their use?—A. Not in abandoning their use.

Q. How would you meet that danger?—A. By clearing away all inflammable material round the base of the trestles, and clearing the land out a little further for that purpose.

Q. You would have cleared it so that it would be impossible for them to start a fire?—A. I would not say impossible; I would say improbable.

Q. In your discussion with the commissioners, did you make it clear to them as to the large amount of money that might be saved in original construction, if wooden trestles had been used?—A. No, I do not remember any discussions with them on the actual saving that was going to be effected.

Q. Don't you feel that you put up a proper case?—A. I did; I felt so at the time, but, talking now, I do not remember the particulars. Mr. Woods and I were quite in accord in the matter, and wanted to put in timber trestles.

By the Chairman:

Q. Do you think this Commission ever took the question of economy seriously into consideration at all in the construction of this road?—A. There were lots of things I thought could be more economically done.

Q. Did they ever, to your knowledge, seriously consider the question of economy?—A. I do not recollect any glaring cases of it.

By Mr. Gutelius:

Q. The Commission employed the engineers to do this work?—A. Yes.

Q. And not you?—A. No.

By the Chairman:

Q. You had not a free hand to choose your staff?—A. No.

Q. You simply approved the men they suggested?—A. Yes. In the first start, when Mr. Wade was Chairman, I dare say I suggested a number of names; in the first start, of men I happened to know, and latterly I had to suggest men I wanted to get, to the Board. If they had any names they would always send them in to me for approval.

By Mr. Gutelius:

Q. And they did not always get your approval for appointments in really important cases?—A. Yes.

Q. With regard to the wooden bridge proposition, if the wooden bridge policy had been adopted, how much time do you think might have been saved in the construction of this railway?—A. I think considerable time could have been saved.

Q. Two seasons?—A. They could have gained at least one; they might have gained two, but I would not like to say.

Q. In connection with the letting of the contract for District F. to J. D. McArthur, the tenders for this work were advertised for in the regular way; bids were taken by the commissioners and opened. Were you present when the bids were opened?—A. I think not. The reason I say that is that when the first few contracts were let I certainly was not, because I did not know who the contractors were.

Q. You only had the information by numbers of the tenderers?—A. Yes.

Q. Which would indicate that you were not present when those numbers were allotted?—A. No, I was not present. I did not see the original tenders at that time.

Q. You were given a form on which the unit prices were shown opposite the items, and each of those forms was given a number?—A. Yes.

Q. Now, in the contract for District F., the form that was given to you had a number of blank places?—A. Yes.

Q. Which were filled in with red ink?—A. Yes.

Q. Do you know how these prices happened to be filled in that way?—A. They were filled in by me; to the best of my recollection, I filled them in personally, myself.

Q. This character of work was unusual, in moneying out tenders, was it not, to fill in blank items?—A. Yes, it was unusual; I was not in the habit of doing it.

Q. Did you do this off your own bat?—A. No, I was instructed to do it. I called attention to the fact that one of these tenders had not any prices in for a number of articles they were bound to use a lot of.

Q. Do you remember how that instruction was given to you and by whom?—A. I cannot remember who gave the instructions directly, whether it was the Chairman or Mr. Young, or whether it was before the whole Board; I do not remember the particulars of it.

Q. When you filled the tenders in, did you have any knowledge that it was McArthur's tender you were filling?—A. Not that I am aware of; I may have suspected whose tenders they were, but I had no direct knowledge. I have no recollection of knowing; I did not try to know, in fact.

Q. Did you notice after the bids were moneyed out and comparisons made, that the tender in which you put the red figures was the winning tender, the lowest tender?—A. Oh, I knew afterwards, of course.

Q. Did you not feel a little nervous over fixing up a tender that developed into the winning tender?—A. I cannot say that I remember feeling nervous about it. I was doing it under instructions from the men who were letting the contract, and I did not think very much about it at the time; at least, that is my recollection.

Q. You felt that you were moneying this out under instructions?—A. I was.

Q. And that you were relieved of the responsibility in connection with the work?—A. Yes. My recollection is I put in figures that I was using and had used for making an estimate of what it should cost. My recollection is I put in those same figures moneying that out.

Q. Did you have anything to do with discussing with McArthur whether he would accept these or new figures that you put in?—A. I do not recollect discussing it with McArthur.

Q. You understand it would be necessary for his attention to be called to the fact?—A. Oh, yes, he had to sign the schedule, I presume, when he signed the contract.

Q. And someone should have called his attention to the fact that this schedule was not the one contained in his tender?—A. I presume so; he must have done.

Q. But you do not know about his being advised of it at all?—A. I do not personally know. I do not recollect having had anything to do with it.

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Q. Referring to the detail of the tender, we find that in the returns made in your office that under item 10, "Pile delivered, as per engineer's bill" and item 11, "piling driven" that each of the figures quoted were moneyed out without reference to the words shown on McArthur's tender "Driving only"? Did you know McArthur's tender showed "Driving only" on it?—A. I do not see that that "Driving only" would affect it.

Q. Did it not strike you, in looking over these various tenders, that when tender number one showed 35 cents for "Piling delivered" and 65 cents for "Piles driven", and tender number 2 showed 20 cents for "Piles delivered, and 35 cents for "Piling driven", tender number 3, 22 cents for "Piling delivered" and 24 cents for "Piling driven", that when tender number 4, which is McArthur's, showed 25 cents for "Piling delivered" and 15 cents for "Piling driven", with the words "Driving only" attached, that there must have been some misunderstanding between the people who made the tenders?—A. I do not remember noticing anything of the kind.

By the Chairman:

Q. When they moneyed out McArthur's bid on the piles, they moneyed out the 15 cents in a column, and beside that, they moneyed out the 40 cents for the other amount. They did not split other amounts; McArthur split his?—A. They are all split all the way through.

By Mr. Gutelius:

Q. Will you answer my former question; did it not strike you, in looking over these various tenders, that when tender number 1 showed 35 cents for piling delivered and 65 cents for piles driven, and tender number 2 showed 20 cents for piles delivered and 35 cents for piling driven, tender number 3, 22 cents for piling delivered and 24 cents for piling driven, that when tender 4, which is McArthur's showed 25 cents for piling delivered and 15 cents for piling driven, with the words "driving only" attached, that there must have been some misunderstanding between the people who made the tenders?—A. "Driving only" was considered all the way through; that is under item 11 "Piling driven"; that is my recollection of it.

By the Chairman:

Q. That fellow was charging 65 cents for driving those piles?—A. It may be a great deal more than it is worth.

Q. It is not what he intended?—A. It may not be.

By Mr. Gutelius:

Q. In order to show that the question we are discussing was not unknown at that time, I would refer you to your letter January 2nd, 1907, to the commissioners, in which you say, "I also allowed the 20 cents per lineal foot for piles delivered, as well as the 40 cents per foot for piles driven, having found, in making a comparison of the tenders, that they had been so computed, except where specially mentioned otherwise"?—A. I do not remember that.

Q. Don't you mean in that, that this piling driven was this special case referred to in that letter? You are not sure about that?—A. No. This letter evidently refers to a new deal made with the contractors in connection with hauling stuff by train. This letter was written in connection with that deal down in Quebec, in regard to train haul material and temporary trestle.

Q. In connection with the letting of the contract for District F. to J. D. McArthur, the tenders for this work were advertised for in the regular way; bids were taken by the commissioners and opened. Were you present when the bids were opened?—A. I think not. The reason I say that is that when the first few contracts were let I certainly was not, because I did not know who the contractors were.

Q. You only had the information by numbers of the tenderers?—A. Yes.

Q. Which would indicate that you were not present when those numbers were allotted?—A. No, I was not present. I did not see the original tenders at that time.

Q. You were given a form on which the unit prices were shown opposite the items, and each of those forms was given a number?—A. Yes.

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Q. Which were filled in with red ink?—A. Yes.

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Q. This character of work was unusual, in moneying out tenders, was it not, to fill in blank items?—A. Yes, it was unusual; I was not in the habit of doing it.

Q. Did you do this off your own bat?—A. No, I was instructed to do it. I called attention to the fact that one of these tenders had not any prices in for a number of articles they were bound to use a lot of.

Q. Do you remember how that instruction was given to you and by whom?—

A. I cannot remember who gave the instructions directly, whether it was the Chairman or Mr. Young, or whether it was before the whole Board; I do not remember the particulars of it.

Q. When you filled the tenders in, did you have any knowledge that it was McArthur's tender you were filling?—A. Not that I am aware of; I may have suspected whose tenders they were, but I had no direct knowledge. I have no recollection of knowing; I did not try to know, in fact.

Q. Did you notice after the bids were moneyed out and comparisons made, that the tender in which you put the red figures was the winning tender, the lowest tender?—A. Oh, I knew afterwards, of course.

Q. Did you not feel a little nervous over fixing up a tender that developed into the winning tender?—A. I cannot say that I remember feeling nervous about it. I was doing it under instructions from the men who were letting the contract, and I did not think very much about it at the time; at least, that is my recollection.

Q. You felt that you were moneying this out under instructions?—A. I was.

Q. And that you were relieved of the responsibility in connection with the work?—A. Yes. My recollection is I put in figures that I was using and had used for making an estimate of what it should cost. My recollection is I put in those same figures moneying that out.

Q. Did you have anything to do with discussing with McArthur whether he would accept these or new figures that you put in?—A. I do not recollect discussing it with McArthur.

Q. You understand it would be necessary for his attention to be called to the fact?—A. Oh, yes, he had to sign the schedule, I presume, when he signed the contract.

Q. And someone should have called his attention to the fact that this schedule was not the one contained in his tender?—A. I presume so; he must have done.

Q. But you do not know about his being advised of it at all?—A. I do not personally know. I do not recollect having had anything to do with it.

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Q. Referring to the detail of the tender, we find that in the returns made in your office that under item 10, "Pile delivered, as per engineer's bill" and item 11, "piling driven" that each of the figures quoted were moneyed out without reference to the words shown on McArthur's tender "Driving only"? Did you know McArthur's tender showed "Driving only" on it?—A. I do not see that that "Driving only" would affect it.

Q. Did it not strike you, in looking over these various tenders, that when tender number one showed 35 cents for "Piling delivered" and 65 cents for "Piles driven", and tender number 2 showed 20 cents for "Piles delivered, and 35 cents for "Piling driven", tender number 3, 22 cents for "Piling delivered" and 24 cents for "Piling driven", that when tender number 4, which is McArthur's, showed 25 cents for "Piling delivered" and 15 cents for "Piling driven", with the words "Driving only" attached, that there must have been some misunderstanding between the people who made the tenders?—A. I do not remember noticing anything of the kind.

By the Chairman:

Q. When they moneyed out McArthur's bid on the piles, they moneyed out the 15 cents in a column, and beside that, they moneyed out the 40 cents for the other amount. They did not split other amounts; McArthur split his?—A. They are all split all the way through.

By Mr. Gutelius:

Q. Will you answer my former question; did it not strike you, in looking over these various tenders, that when tender number 1 showed 35 cents for piling delivered and 65 cents for piles driven, and tender number 2 showed 20 cents for piles delivered and 35 cents for piling driven, tender number 3, 22 cents for piling delivered and 24 cents for piling driven, that when tender 4, which is McArthur's showed 25 cents for piling delivered and 15 cents for piling driven, with the words "driving only" attached, that there must have been some misunderstanding between the people who made the tenders?—A. "Driving only" was considered all the way through; that is under item 11 "Piling driven"; that is my recollection of it.

By the Chairman:

Q. That fellow was charging 65 cents for driving those piles?—A. It may be a great deal more than it is worth.

Q. It is not what he intended?—A. It may not be.

By Mr. Gutelius:

Q. In order to show that the question we are discussing was not unknown at that time, I would refer you to your letter January 2nd, 1907, to the commissioners, in which you say, "I also allowed the 20 cents per lineal foot for piles delivered, as well as the 40 cents per foot for piles driven, having found, in making a comparison of the tenders, that they had been so computed, except where specially mentioned otherwise"?—A. I do not remember that.

Q. Don't you mean in that, that this piling driven was this special case referred to in that letter? You are not sure about that?—A. No. This letter evidently refers to a new deal made with the contractors in connection with hauling stuff by train. This letter was written in connection with that deal down in Quebec, in regard to train haul material and temporary trestle.

Q. Were there any other tenders in which the words "Driving only" were used?—A. I do not know; I do not remember it even in that.

Q. To refresh your memory further that the items 10 and 11 were not clearly understood, I would ask you, why did you change the reading of the specifications in the 1909 reprint, to make the items read "Piles delivered" and "Piling driven"?—A. I do not remember why.

Q. This arrangement is clear, is it not?—A. I do not remember. What is the old one?

Q. "Piling delivered will include piling furnished by the contractor at the bridge site, as ordered by the engineer, and will be paid for by the lineal foot, but any lengths in excess of those ordered will not be paid for". "Piling driven will be paid for at the specified rate per lineal foot in the finished structure, which will include all work of any kind in connection therewith"?—A. "But will not include the piles themselves"; that is added.

Q. It has been put in to make it perfectly plain as to what was actually meant, although your interpretation of the old specification and the new one is the same?—A. Yes.

Q. In the matter of letting the contract number 18, from mileage 162.5 to mileage 237.5, District F, the contract was finally awarded to Fauquier Brothers; that is north of Lake Nipigon?—A. Yes.

Q. In making a comparison of the tenders, I notice that tender number 2 shows solid rock \$1.75, loose rock 65, common excavation 31?—A. Yes.

Q. Whereas tender number 3, on which the contract was finally given shows solid rock \$1.80, loose rock 60, common excavation 38?—A. Yes.

Q. The fact that the contract was given to tender number 3 at \$1.80 for solid rock, which is five cents more than tender number 2, and common excavation 38 cents, whereas the other tender showed 31, suggested that probably some other item in these tenders influenced the totals; that was natural, was it not?—A. Yes.

Q. By referring to item 74 (e), removal of moss, I notice there was estimated by the engineers 665,400 cubic yards of moss?—A. Yes.

Q. For which tender number 2 bid 35 cents, tender number 4 bid 32 cents, but tender number 3, which received the contract, bid 12 cents?—A. Yes.

Q. Did you notice those items?—A. I have no recollection of noticing them.

Q. Now that your attention is called to 665,000 yards of moss on 75 miles of railway, does it not occur to you that that is an inflated figure?—A. It looks very big.

Q. If your attention had been called to the information which we have just shown you, would you have done anything about it?—A. I could not say whether I would or would not, because I cannot remember how that was going out, except it came in from the engineers on the work.

Q. Assuming that it did come in from the engineers on the work, and your attention had been called to it, and recognizing, as you must have done, that it would influence these bids something like \$200,000, you would have paid attention to it and looked into the matter?—A. Yes. This is the first I recollect seeing that.

By the Chairman:

Q. Could you conceive that there would be that much moss in that country?—A. We were led to believe in the first start that there was a great deal more moss in that country than there turned out to be—more soft bottom, I mean. There was generally moss on top of clay, and only two or three feet of it, and no muskeg at all.

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Q. I wish you could answer me fairly directly in regard to that, that if you had known that that large amount was there, that you would have given this matter attention?—A. I presume the information I had at the time that we made up the quantities was that that was the amount. I cannot recollect anything about it at all.

Q. Here is a letter dated October 14th, 1912, from T. S. Armstrong, which reads as follows:—"With regard to moss, this is the one item in the schedule that was never seriously considered. It was never mentioned in the return of quantities by the locating engineers, and personally I knew nothing of what quantity there might be, but in my travels to the locating parties, I knew that in some places in the woods it was a couple of feet deep, and as this item was in schedule form 89, we took the profile, and on level swamp country I simply add enough moss to cover, in case it might have to be moved. The moss was only moved and wasted when found necessary in shallow embankments; also on original estimates the yardage was not deducted from earth quantities". It would appear from this letter that Mr. Armstrong would have taken that 665,000 yards item into account?—A. I forget whether it was on that section or not.

Q. I understand he had charge of the locating parties and made the original estimates?—A. I cannot say where the quantities came from: I do not remember.

Q. In the tenders and in the contract is included several items for which prices were not given. I have in mind engine houses?—A. Yes.

Q. Was it your understanding that the engine houses really would go with the grading contracts when these specifications were drawn?—A. I do not recollect that the engine houses were mentioned at all. I do not think at the time those contracts were let there were any plans that they could bid on. That is my recollection. I do not think they were included, because I do not think there was a plan of an engine house at that time, and they could not tender. I do not suppose it was intended to cover it.

Q. But the contractors subsequently held to it that they must be contractors for the engine houses on force account, or on some basis that might be agreed upon?—A. If we were including those things we should have had a price in the schedule for them.

Q. Your opinion is that it was not fair to hold those under the contract?—A. No, but if the contractor saw fit to do the work, we might let him have it afterwards, but I do not think that the engine houses or section houses were covered in this contract, because no prices were given.

Q. With reference to a proposed point 65 grade west of La Tuque, you remember making a recommendation to the commissioners that you be allowed to construct this La Tuque pusher grade?—A. Yes. That was an eastbound grade.

Q. You felt when you made that recommendation that it was a proper, economical thing to do?—A. Yes.

Q. Why did you not do it?—A. Because we were not allowed to do it.

(EVIDENCE TAKEN IN N.T.R. OFFICES).

Ottawa, March 28th, 1911.

HUGH D. LUMSDEN, recalled:—

By Mr. Gutelius:

Q. Were you ever given to understand by the Commissioners that you were limited to expenditure in connection with the construction of the railway, so far as your department was concerned?—A. Not that I recollect of.

Q. When you accepted and approved the specifications, was it not with the understanding that the interpretation so far as solid rock was concerned, should be the same as that to which you had previously been accustomed?—A. I understood it so.

Q. The instructions to engineers contained in the little book, in the matter of curvature, limited the curvature to six degrees for main tracks?—A. Yes.

Q. In approving these instructions, was it that six degree curves should be adopted, no matter what the cost of the railway should be, at these points of curvature?—A. The six-degree limit of curvature was given in order to limit the engineers on the ground from making any alignment, using anything more than six-degree curves, but had special cases been brought to my notice, I would have considered whether the use of somewhat sharper curvature might, owing to the great saving in expense, have been adopted.

Q. You understood that to increase any single curve on the main line over six degree would have required the approval of the Commissioners?—A. Yes.

Q. And the Grand Trunk Pacific?—A. Yes.

Q. The reason for that being that the Commissioners and the Grand Trunk Pacific had approved of these instructions?—A. Yes; well, I don't know about the instructions; I do not know definitely whether they approved of them or not, but it was an understood thing we were not to exceed six degrees.

Q. Was it not understood by you that they did approve these instructions because they did not object to them?—A. I do not think their signature was ever obtained to them that I remember of.

Q. But you understood they approved those instructions?—A. Generally, I believe they did. I have no recollection now whether any objection had been raised or not.

Q. In the matter of your interpretation of the solid rock specification, in which you introduced what has been known as assembled rock, item number 5 of your blue print, in view of the position which you had taken in connection with solid rock classification in the correspondence and discussion, and in the Lumsden enquiry, will you tell us why you made this interpretation?—A. To conciliate the Commissioners and the contractors, I consented to this interpretation, although I never personally agreed with it.

Q. In connection with the purchase of the surveys, plans, profiles and notebooks from the Grand Trunk Pacific, what proportion of those surveys were of any use to you in locating the National Transcontinental Railway?—A. From Winnipeg to a point, say sixty to a hundred miles, or thereabouts, east of the north end of Lake Nipigon.

Q. You did not make any use of the surveys from that point to North Bay?—A. No.

Q. Considerable money might have been saved in this railway if virtual or momentum grades had been used?—A. I say there might have been.

Q. Why did you not take advantage of this economy?—A. Because, in my idea, we would not have had then actual four and six-tenths grades.

Q. And you felt that actual four and six-tenths grades were the character of a railway that you were expected to build?—A. Yes.

Q. In the matter of train fills on contracts 9 and 10, from the correspondence we note that you figured that 36 cents was the proper price to pay for trail haul filling on these contracts. At a meeting at Quebec between the chairman and the contractors, you consented to a price of 55 cents per cubic yard being paid. In your letter of January 22nd, 1907, you state that you eventually consented to a price of 55 cents per cubic yard, "which, in my opinion, is a very good one"?—A. Yes.

Q. Did you mean that 55 cents was a very big price to pay?—A. That was my opinion.

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Q. How did you happen to consent to this high price?—A. From the expressions made by the chairman.

Q. What do you mean by that?—A. I remember distinctly the chairman coming in at the tail end and saying we should settle it.

Q. And that was the price at which it was settled?—A. Yes.

Q. At the same meeting in Quebec it was also decided that two prices should be paid for piles, whereby piles delivered would cost 20 cents, and piles in the work 60 cents, instead of 40, as called for in the contract?—A. I think that 40 cents must be piles driven; I assume that; I am not sure; I do not remember that settlement, but I have no doubt it must be so.

Q. In your letter you state "I also allowed the 20 cents per lineal foot for piles delivered, as well as 40 cents per foot for piles driven, having found in making a comparison of the tenders that it had been so computed". That is a very flimsy reason for giving the double price, is it not?—A. As I told you, I do not remember anything about that settlement, but I know there was some trouble about the difference between what the contractors understood and what I understood. I know there was a dispute between the contractors and myself as to the interpretation of that, and, for that reason, the subsequent schedule was changed, making it clear that there was a separate price for the driven piles and the other, and it was settled that those contractors should receive the two prices, at that meeting.

Q. In connection with the pusher grade from St. Francis River east, did you make an endeavour to secure an economical rate for a pusher grade, or did you simply take the lowest grade that seemed consistent with this character of railway?

—A. I took the lowest grade.

Q. An unwritten understanding among the engineers indicated that, if it were at all possible, steel bridges and trestles should be on tangents? Was that intended to be a hard and fast rule?—A. It was generally, but exceptions might have been taken which would have been submitted, and I have no recollection of any being done.

Q. If a considerable amount of money could have been saved, you would not have hesitated to put light curvature on some of those structures?—A. I think not.

Q. What was your intention when you decided to use 80 pound rails on sidings and in yard tracks?—A. It made a uniform rail on the system, and my idea was that the rails of the sidings should have been used for repairs on the main line, as long as it was under government operation.

By the Chairman:

Q. What would you put in the place of those rails when you took them out?

—A. We would then have got in relaying rails.

By Mr. Gutelius:

Q. You would then have got in second hand rails to take the places of those which you would transfer to the main line?—A. Yes.

By the Chairman:

Q. A sixty pound rail is sufficient for a yard, is it not?—A. Well, they do not care about them to-day.

Q. Sixty-five?—A. Yes.

By Mr. Gutelius:

Q. If you had known that the Grand Trunk Pacific Railway were going to take over the railway as the rails were laid, in the interest of economy, would you not then have used lighter rails in the sidings—if the Grand Trunk Pacific were agreeable?—A. I think I would have.

(CONTINUATION OF EXAMINATION OF HUGH D. LUMSDEN,
FRIDAY, MARCH 29th.)

Examined by Mr. Staunton:

Q. The contractors tendering for the general work and grading of building the railway, included in the tenders, an offer to build the engine houses and section houses. In the contracts for the general work subsequently let these houses were included?—A. That is so.

Q. In the schedule of price there is no price given at which these section houses and engine houses are to be built?—A. There was no price given.

Q. So that unless the price is to be governed by Clause 35 of the contract, the price was a matter of negotiation between the commissioners and the contractors after the contract was signed?—A. Yes.

Q. As a matter of fact, do you know that these structures were built under force accounts?—A. I cannot answer that question, I do not recollect.

Q. Why was it that prices were not arranged for the building of these engine houses and section houses?—A. Because at the time the contracts were let no plans and specifications for the engine houses and section houses had been prepared.

Q. Was it not improper to ask for tenders on these works until plans and specifications had been prepared?—A. It would be better if they had not been asked for.

Q. You mean that it would have been better to have struck out the words "engine houses and section houses" from the tender and contract?—A. Yes. If it was in the tender it should have been stricken out in the contract.

Q. With reference to Fauquier, Contract No. 18, we notice an item in your preliminary estimates of some 600,000 yards of moss?—A. I do not recollect it.

Q. Did you make a comparative study of the various tenders in comparison, a comparison with each other, for the commissioners before they let the various contracts?—A. I think not; I simply figured out the tenders from the memorandum given.

Q. So that in the ordinary course it was possible for the 600,000 yard item to pass by you, and if the Commissioners were not accustomed to making comparisons of this character, items like this could pass?—A. I was not in a position to say. I had never been in that country, I would not know about the 600,000 yards of moss. I might think that it was extravagant, but not being on the ground I took the figures of the Engineers who were there. That is my recollection of the thing. In fact I did not remember anything about that moss until it was mentioned later.

Q. You do not feel that you are called upon to make a study of the various tenders to ascertain whether there was any trick bids?—A. I do not recollect making any study of them.

Q. In the matter of the three piers built by the pneumatic caisson process, I note in your letter of December 6th, 1906, to the commissioners, that you concur with Mr. Uniacke and Mr. Butler in the use of the pneumatic process for placing the foundation of these pedestals in the waterway at Cap Rouge River for the carrying on the viaduct?—A. Yes, I wrote that letter.

Q. It is not the fact that you did not know anything personally about that?—A. I knew nothing personally about pneumatic works and I said so.

Q. You simply trusted to what had been done by Mr. Uniacke and Mr. Butler?—A. Yes.

Q. And the chairman?—A. And the chairman.

Q. Do you know that the Commission was familiar with that pneumatic arrangement?—A. I am satisfied they were.

Q. I show you a copy of a letter of Mr. McPherson, dated January 8th, 1908, in which he refers to the construction of the pusher grade at the Little Salmon River Crossing, instead of building a large viaduct, and whereby a large amount of money could have been saved; do you recall why you did not reply to that letter or take up the matter?—A. I remember that surveys were made at that point for the purpose of doing away with the large viaduct, which were not satisfactory, as far as I remember. I have no recollection of ever being on the ground there, and I do not think I was. I remember on two occasions I asked to use .6, one at La Tuque and one east of Quebec Bridge, and I was turned down; in the first instance I was turned down by the government, and in the second instance by the Commission, and subsequently, as far as I remember, I made no application to allow an increase in grade.

Q. Do you remember taking into consideration increasing the grade at Chipman, to lessen the cost of these seven miles?—A. I do not.

Q. On our inspection, we counted many miles of embankments through level country that we thought were excessively high, what is your idea of the height that the base of grade should be above surrounding level country where the question of drainage or grade is not a factor?—A. From two to four feet.

Q. Do you realize on the day that you were persuaded to accept the 55 cents train filled price on contract 9 and 10 that that was sounding the deathknell of your wooden bridge scheme?—A. I did not realize it at that time, as far as I remember; that was in September.

Q. On January 19th, 1909, a month after that, you wrote the commissioners asking for instructions as to whether you should make provision for standard trestles and accept the Grand Trunk Pacific's offer to build at twenty-five cents in the future?—A. Yes.

Q. They never answered this letter of yours?—A. I do not recollect ever receiving an answer.

Q. There was no reason for them answering it, because you had already decided to build all these places with train fill?—A. We were not bound to build them. We could have put in permanent trestles after that if we had elected to do so, but I could not do it without their sanction.

Q. I do not quite understand why you felt that you were compelled to get their authority for the construction of permanent wooden trestles?—A. That evidently was my reason for writing to them, because they had been against my putting in wooden trestles.

Q. They had been speaking against it?—A. I talked over it with regard specially to putting in these trestles in the northern country.

Q. An inspection of the plans of buildings, which the Grand Trunk Pacific gave to you for use on the Transcontinental, indicate that they were more expensive than buildings usually used, did you accept their plans without any question?—A. I cannot recollect what occurred.

Q. You did not put an architect on to modify the Grand Trunk Pacific plans?—A. I do not recollect having done so.

Q. We do not find that you issued any instructions in connection with the crossing of muskegs, soft ground, in which the soundings would indicate the difficulty in filling either by cross-logging or pile bridges?—A. I talked over the thing often enough, but whether I had written much about it or not I do not know.

Q. Were there not some very expensive sink-holes encountered?—A. Yes.

Q. Don't you think that those you have in mind could have been crossed if pile bridges had been used instead of filling?—A. They would be temporary.

Q. By temporary you mean ten or twelve years?—A. During the life of the piles.

Q. How did you happen to allow the contracts to cover fencing of the right-of-way in that wild country; the railway is fenced from one end to the other?—A. I do not think it is; it may be for all I know.

Q. What was your intention in connection with fencing?—A. Anywhere there was a chance of cattle being in the neighborhood; I would not fence it anywhere except where the country was inhabited or in the vicinity of habitation; I never knew the whole line was fenced.

Q. You keep a diary—A. I have kept a diary since 1867. The following is an extract from my diary and shows where I was on the dates mentioned:

"Feb. 6th.—Left Ottawa during night, delayed 4½ hours at North Bay, left there 4.15, wreck near Verner.

"Feb. 7th.—Treaudeau 9.50, on train all day, 6 to 8 hours late.

"Feb. 8th.—Reached Kenora early in morning, there all day, left for Winnipeg about midnight.

"Feb. 9th.—Reached Winnipeg about 7 a.m.

"Feb. 10th.—(Sunday) in Winnipeg.

"Feb. 11th.—Drove out to Panet Road with Hazlewood and back, in Winnipeg until 7, then left by No. 2.

"Feb. 12th.—On time at Fort William and Schreiber, 20' late at White River.

"Feb. 13th.—Reached North Bay 1 hour late and Ottawa at 4.55, went home.

"Feb. 14th.—In office all day, at meeting 12.20, Commissioners opening tenders (not present).

"Feb. 15th.—In office all day, had tenders 1 and 3 handed me before 1 p.m., and 3, 4 and 2 before 5.15, started men on figures.

"Feb. 16th.—Meeting 11.50. The Commissioners decided I was to use the estimates as returned by the district engineers and not my own, for the various sections tendered on.

"Feb. 17th.—Sunday.

"Feb. 18th.—In office all day, meeting 11.50.

"Feb. 19th.—Completed moneying out of tenders and handed to Commissioners—meeting 12.00."

Q. On the 14th of February your entry in your diary is that you were in the office all day; at meeting 12.20—that means the meeting of Commissioners?—A. Yes.

Q. Then you say: "Commissioners opening tenders, not present"?—A. Yes.

Q. Why were you not present when the tenders were opened?—A. I was not wanted, I was not asked to be present, I was asked to leave.

Q. It was intimated to you that your presence was not required?—A. I do not know it was on that occasion, but it was on a previous occasion.

Q. Why didn't you remain when the tenders were being opened?—A. Because I was told by the Commissioners I was not wanted. I do not say I was that day, but on a previous occasion I was told they would open the tenders themselves and give me the figures afterwards.

By Mr. Gutelius:

Q. It was understood you were not to be present when tenders were opened?
A. Yes, that is the long and short of it.

By Mr. Staunton:

Q. What do you mean by your entry on February 16th: "Meeting 11.50. The Commissioners decided I was to use the estimate as returned by the district engineers and not my own for the various sections tendered on."?—A. Some days

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before the tenders were expected in, I don't remember the time, I had given Mr. Parent a copy of the quantities in the different sections. Between that time and the time of the tenders coming in, I did not give this out, the Contractors had no knowledge of this; I thought we would use a lot of timber and trestles in that eastern country, and I put in a lot of timber and deducted a certain amount of earthwork to correspond. It was found out, either on the day of the meeting or the day following, that I had changed the quantities from the time I had given them to the Chairman, and I was instructed not to use the quantities that I put in, but to use the same as I had previously given them to the Chairman.

Q. Then, I understand that you first prepared an estimate founded on the information sent to you by the various district engineers?—A. Yes.

Q. And that, you prepared a new statement on these estimates showing that in detail?—A. Yes.

Q. And afterwards you changed the estimates?—A. Certain items in the estimates.

Q. And subsequently you were directed not to use these changed estimates, but to use the original ones?—A. Yes.

Q. I suppose that when you figured out the tenders you used these original and not the amended estimates?—A. I used what they told me to use, that was the estimates as returned by the district engineers.

Q. From whom did you get your instructions as to that?—A. At the board meeting, from the Chairman, I presume.

Q. Why did you put in your diary the entry that you were not present when the tenders were opened?—A. I do not know why I put it in.

Q. Do you think as chief engineer you ought to be present when they were opened?—A. I cannot tell you what was in my mind; I was perfectly willing not to be present.

Q. You did make a note of it for future reference that you were not present at the opening of the tenders?—A. I was not present at the opening of any of the tenders, that I remember, for general construction.

The witness was not further examined.

(NATIONAL TRANSCONTINENTAL RAILWAY INVESTIGATING COMMISSION: AT OTTAWA, OCTOBER 3rd, 1912.)

Present:—G. LYNCH-STANTON, K.C., *Chairman*; F. P. GUTELIUS, C.E., *Commissioner*.

D. MACPHERSON, assistant to the Chairman, sworn:

By Mr. Gutelius:

Q. You were assistant chief engineer of the National Transcontinental Railway, between what dates?—A. 15th July, 1905, and I am not exactly sure of the date, some time in November last, 1911, I think that is approximately.

Q. And prior to that time?—A. Division engineer on the C.P.R. eastern division.

Q. Your total engineering experience, then, covers how many years?—A. Approximately, twenty-five years with the C.P.R., and seven with this, thirty-two years.

Q. Were the original specifications for the construction of this railway prepared prior to your assuming the position of assistant chief engineer?—A. Yes.

Q. Who did you understand prepared these specifications?—A. Well, I understand that Mr. Butler had the most to do with them for the Transcontinental; I have also understood that Mr. Woods for the Grand Trunk Pacific Railway; I do not know whether Stephens had previous to that or not. I am only speaking from hearsay about that anyway.

Q. Did you in your official position have to do with the preparation of the general instructions to civil engineers on the Transcontinental Railway?—A. No.

Q. These (showing book) are not the original instructions, Mr. MacPherson?—A. No.

Q. (Showing book) Kindly refer to clause 26 in which it is stated that the maximum curve on the railway shall not exceed six degrees—if you had prepared these instructions, Mr. MacPherson, would you have adopted a positive limitation of six degrees for a railway of this character and through a country of this character?—A. I think I would, on the hypothesis that we were building a high-class road, I would have limited it to six miles unless there was something very very special. As a general rule, I would have stopped at six as a maximum.

Q. I notice further that this paragraph requires at least six hundred feet between transition curves. Would you have required any such distance between curves if you had prepared these instructions?—A. I would not have made that hard and fast, no. If it would have saved a lot of money by tracking that out, I would have allowed the transition curves to run together.

Q. Would you have allowed them to run together where the curvature was compounding or reverse, if you had full lengths of transition curves?—A. I think I would have preferred a short bit of a tangent on reverse, I think.

Q. In passing over the railway, we noticed a number of high-trestled bridges built on tangents with approaches that were very expensive, whereas cheap approaches could have been provided if these steel trestles had been constructed on curves. Do you see any objection to building steel trestles on curves?—A. Well, I would certainly prefer them on the straight, but I would think that every particular case would have to be gone into on its merits, whether the additional cost of putting them on the straight was justifiable or not.

Q. In your engineering experience, have you ever formulated any monetary value to be placed on the difference between straight or curved bridges?—A. I do not think I ever went into it in any great detail.

Q. It was simply the general element of safety that a straight track has over curves?—A. Yes, that and the element of cost.

Q. By reference to the original general specifications, I note that under instructions to persons proposing to tender, paragraph 4, wherein it is stated: "Any tendering in which the prices stated for the several items are unbalanced may be rejected." Do you know why that was eliminated from the revised specifications?—A. I do not know, I am sure.

Q. Who could tell this Commission?—A. I do not know unless the chief engineer or the commissioners for the Transcontinental.

Q. Don't you think, Mr. MacPherson, that that clause, or one similar to it, should have been retained in the subsequent issues of the specifications?—A. A clause giving power to the chief engineer to deal with unbalanced tenders should be a portion of every specification.

Q. We have before us, the comparative estimate of tenders for district F, which bears your signature (showing print)?—A. Yes.

Q. Kindly refer to the items, "Piling delivered as per engineer's bill and piling driven". In tender No. 4, "Piling delivered" is quoted at twenty-five cents and "piling driven" at fifteen cents?—A. Yes.

Q. Alongside of the fifteen cents, I see the words, "driving only"?—A. Yes.

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Q. Whereas these words are not used in either of the other three tenders, how did they happened to be used in the case of tender No. 4?—A. These words were used on the extracts from the numbered tenders which were supplied to the engineering commissioners to money out. These words were used on that one tender only.

Q. Just explain to the Commission what information was given to you when you prepared this comparative sheet?—A. The items on a blank schedule, the different numbers, and the prices opposite each item.

Q. And how did you prepare this statement?—A. By multiplying the quantities by the prices of each tender, the prices opposite each tender.

Q. In tender No. 2, "piling delivered" is quoted at twenty cents, and "piling driven" at thirty-five cents?—A. Yes.

Q. I notice that you multiplied out the twenty and thirty-five against the quantities given in tender No. 2, the same as you did in tender No. 4, where the prices were twenty-five cents for "piling delivered" and fifteen cents for "piling driven"?—A. Yes.

Q. How do you explain that?—A. Simply that our instructions were to multiply the quantities by the prices given.

Q. Then, so far as this statement is concerned, it was simply a case of multiplication and addition?—A. Yes.

Q. Now, Mr. MacPherson, as an engineer, ought there not to have been some re-arrangement to get a fair comparison of these tenders, of the prices shown in tender No. 2 and tender No. 4?—A. If I had been dealing with it, as chief engineer, I would have asked the tenderer for an explanation of why there was such a large price for the piles driven as against for the piles themselves.

Q. Surmising, before asking them, that tender No. 2 included the price of piles and driving in the second tender?—A. I would suppose that by the figures, yes.

Q. This is what you would call an unbalanced bid?—A. Not necessarily, no.

Q. But the character of the bid did not probably convey the intent of the contract?—A. I would have asked him what it meant.

Q. Because the prices given were unusual?—A. Unusual.

Q. In your experience, in Transcontinental tenders, were the contractors ever questioned on account of unusual prices to your knowledge?—A. I could not answer that offhand.

Q. As far as you know?—So far as my recollection goes, no.

Q. If the clause concerning unbalanced tenders, to which we referred a moment ago, had been continued, it would then have been a natural thing to take unusual bids up with the contractors, would it not?—A. Either that, or use the chief engineer's discretion and throw them out, but take them up in some way.

Q. But without the clause concerning unbalanced tenders, it was understood that tenders should remain exactly as they were given to you?—A. That was my understanding, that we had to take them just as they were given to us.

Q. To get a fair comparison of tender No. 2 and tender No. 4, what transmissions would you have felt at liberty to have made, if left to your own discretion, to secure a fair comparison?—A. I would have asked the man who tendered No. 2 for an explanation of his figures, what he really thought they meant. That is the first thing I would have done.

Q. There was no doubt as to what tender No. 4 meant?—A. No.

Q. Because you made a notation of driving only?—A. Yes.

Q. Is there any doubt as to what tender No. 2 meant when you made such notation, having the title and description "piling driven" in mind?—A. I think there might be some doubt. I think it would have settled that at once just to have asked him and got that clear, so that there would be no qualifications. That would have been my reason for asking for an explanation.

Q. If there was any doubt as to the meaning of those tenders, there must have been doubt as to the total amounts?—A. Oh, yes.

Q. So that, these statements, so far as those two items are concerned, although carried out mathematically correct, conveyed in the grand totals, a doubtful meaning?—A. The meaning was not certain, that follows from the doubt in connection with the two items.

Q. (Showing sheets.) What are these sheets which we are looking at?—A. To the best of my knowledge they are the original sheets handed to us by the commissioners to money out the tenders for District F.

Q. This sheet is the one referred to in your statement as tender No. 4, is it not?—A. Yes.

Q. I see 40 red ink prices shown on this sheet, what are they?—A. They are engineers' prices. These are opposite items for which the contractor had not filled in any prices.

Q. And they were taken from?—A. They were taken from a schedule of estimated prices made up by the engineers.

By the Chairman:

Q. By whom?—A. Originally by the district engineers, revised and checked.

Q. Who filled in the red ink figures?—A. Well, I cannot say exactly who filled them in, but they were filled in, and a note was put on the sheet here that they were engineers' prices for which no prices had been given by the contractors. I could not say who filled them in.

Q. Somebody in the engineers' department, was it not?—A. I think so; they might have been filled in by the secretary, he sent these to us originally. I am not quite sure, but I think they were filled in by the engineers. The matter was discussed with Mr. Lumsden. That is my recollection, but I cannot say positively.

By Mr. Gutelius:

Q. And they are the same prices that were used for the same items in your comparative estimates?—A. They should be.

Q. By reference to Item 61, "concrete 1-3-6, price \$15.00"; immediately under it, Item 62 "concrete 1-3-5, \$13.00"; is there anything peculiar about these two prices, Mr. MacPherson?—A. The better concrete should be the higher price, and it is the reverse in this.

Q. That is what is known as an unbalanced tender, is it not?—A. Yes.

Q. Item 64, "concrete 1-3-6, \$11.00" that is \$4.00 cheaper than the ordinary 1-3-6, is it not, and the same class concrete?—A. Yes, \$4.00.

By the Chairman:

Q. And the same concrete?—A. The same mixture.

By Mr. Gutelius:

Q. The largest item of concrete in the engineers' estimate is this \$11.00 mixture, is it not?—A. Yes.

Q. So that the unbalanced bid in that one item would amount to something like \$28,000?—A. Yes.

Q. What are the totals of tender No. 2, and tender No. 4?—A. No. 2 is \$30,028,753.35.

Q. And tender No. 4?—A. \$30,010,398.93.

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Q. So that the total of tender No. 4 was so much lower than the total of No. 2?—A. \$18,354.43.

Q. If the piling prices had been changed, as had been suggested, tender No. 2 would have been reduced how much?—A. I do not understand you when you say changed, as suggested.

By the Chairman:

Q. If it had been assumed that the tenderer meant by "piles driven" to supply and drive the piles for that price, the tender would have been so much less.

By Mr. Gutelius:

Q. It would have reduced tender No. 2 \$51,742.00?—A. Yes.

Q. And if the \$11.00 concrete had been returned at \$15.00 in tender No. 4, it would have increased tender No. 4 how much?—A. \$28,196.00.

Q. So that it required the doubtful moneying out in connection with the piling and the unbalanced price interpolated on the authority of the chief engineer, to make tender No. 4 lower than tender No. 2?—A. Yes.

Q. Did you know at the time that you made up this statement that these doubtful conditions existed?—A. Yes, I knew that.

Q. And the chief engineer knew it, because you had discussed the matter with him?—A. Yes.

Q. Now, with reference to your letter of August 9th, 1907, to J. C. Dunn, concerning water supply (witness shown copy of letter) in which you say that if you got a certain gravity supply of water at any point you would be justified in expending \$25,000 more than it would cost to install a pumping plant, "as understood on first cost, allowance for depreciation of plant and cost of running the most economical gasoline pump, would amount to at least \$1,000 per year, when the pump is installed under the tank."—How did you arrive at the \$25,000?—A. I cannot answer that offhand. I had prices for pumps and things, and assumed a value for a man to handle the pump and found out it cost about \$1,000 a year to run it.

Q. So that you based your capitalization at an operating cost of \$1,000 a year?—A. Yes.

Q. You know that on other railways, one pump man operates two and sometimes three pumps?—A. I know that on the C.P.R. one man sometimes runs two and three pumps.

Q. If that were the case, \$1,000 would be high?—A. Yes.

Q. What number of engines did you expect would take water at each of these tanks?—A. We figured on twenty daily trains between Moncton and Quebec, and between Winnipeg and North Bay, that is ten trains each way.

Q. And with ten trains each way, you must have figured that one man's time would be required continually at each pump?—A. Well, I figured that that would be the maximum that would be required.

Q. And you provided for the maximum?—A. Yes.

Q. Don't you think now, Mr. MacPherson, that it would have been better to have made a lower figure for a gravity supply, having in mind that the traffic will not, for some years, be equal to twenty trains per day?—A. Well, yes. I doubt if we did expend \$2,500 for a gravity plant on District A. Certainly that would be an extravagant estimate.

Q. So that, if you had had the construction of the plant at Harburg, which cost \$21,722.00, you would not have expended so large an amount of money?—

A. Not for a less number of trains, certainly not. It was based on the twenty trains daily.

Q. Don't you think that for a new railway, for the first ten years' operation, it would have been fair to estimate \$40,000 per day for twenty tanks?—A. That is quite possible and probable, I might say.

Q. Would you like to modify this statement?—A. I am willing to admit that I overestimated.

Q. I notice that the grade for the westbound pusher grade, District B, west of the St. Francis River, was made on a 1.1 grade, and also that the pusher grade near Tobique, which is against east bound traffic, four-tenths maximum, is also a 1.1 grade. How do you harmonize the use of the same degree of pusher grade in both directions?—A. Well, I do not think they do harmonize. My views of that were, that for a long time to come the traffic in either direction would not necessitate trains too large to haul up either of those grades without pushing.

Q. It will be a long time before they would haul heavier trains with the same class of engines over the Transcontinental than they would haul on the Intercolonial, assuming that the maximum on the Intercolonial grade is 1.1?—A. On that particular section, yes.

By the Chairman:

Q. That is between Quebec and Moncton, you mean?—A. There would be more than one divisional plant. Yes, so far as the engine divisions in which these particular grades are located.

By Mr. Gutelius:

Q. You are familiar with the character of the structure known as the Ludger Noel arch, 141, District B, west of Quebec?—A. I saw it last autumn for the first time.

Q. What criticism have you to offer against that arch?—A. My particular objection is that the bench walls were made, abnormally high, higher than shown on our standard plans.

Q. How much money would have been saved, if the standard plan had been followed?—A. It was estimated about \$14,000.

Q. And you consider, Mr. MacPherson, that that extra concrete was practically wasted?—A. Absolutely so.

Q. In the matter of concrete mixture, we have ten different prices for concrete in our contracts, do you think such a large number of mixtures was necessary or advisable?—A. No.

Q. What are some of the objections?—A. The fewer number of items you have to deal with, the fewer sources of trouble there are, certainly.

Q. The mixture 1-2-4 concrete was used in the pedestals for the Little Salmon River viaduct, and the Rivière du Sud arch. Do you think that these structures required a mixture as strong as this?—A. No, I do not.

Q. What mixture do you think should have been adopted?—A. I think a 1-3-5 was good enough.

Q. And ordinarily 1-3-6, as provided in the specifications, would have been ample, would it not?—A. 1-3-6 in the body of the walls, and 1-3-5 in the arch work.

Q. In our inspection, we noticed many embankments in prairie country where the base of rail was six feet above the level of the surrounding prairie. Assuming that there were no gradient conditions, and that the banks were raised simply for snow through timbered country, what limitation would you have placed on the height of those embankments in the interest of economy?—A. Through timbered country, where the snow was not liable to drift, a two feet embankment would be ample.

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Q. If you were on open prairie, would you raise it two feet more?—A. Yes.

Q. Why were trestle bridges not adopted in crossing gulleys and streams that would not have been made from the excavations in the vicinity of this railway?—A. Do you mean in preference to steel bridges?

Q. In preference to steel bridges, or filled in?—A. Our instructions were that everything was to be made permanent, I think in accordance with the Act.

Q. Do you know of any instructions?—A. The impression that was conveyed to us all was that the railway should be of a permanent construction.

Q. As an engineer, did you join Mr. Lumsden in his suggestion to use wooden trestles?—A. In some specific cases that came up, yes. I know I discussed it with the chief engineer, and was in sympathy with it, but whether I took personal action on it or not I do not remember.

Q. Is it possible to estimate absolutely now, what saving in the construction of this railway might have been effected if wooden trestles had been used?—A. I think it can be estimated very closely.

Q. Who prepared the plans for the buildings?—A. The Grand Trunk Pacific engineer.

Q. What buildings did their plans cover?—A. Station buildings, engine houses, coaling plants, turn tables, freight sheds, ice-houses, store houses, trainmen's houses, some section houses, and tool houses.

Q. How were those plans transmitted from the Grand Trunk Pacific to the National Transcontinental?—A. Sometimes to the chief engineer from Mr. Woods, the assistant chief; sometimes from Mr. Kelliher, and sometimes they came to me. They were not always addressed to the same person or from the same person.

Q. And you accepted those designs and put them into effect?—A. Yes.

Q. In the matter of yard plans, did you confer with the Grand Trunk Pacific in the preparation of the plans for the Graham yard?—A. Yes.

Q. And they concurred with you in that design?—A. I think there was some suggestion made by both sides, but Mr. Woods and I agreed on the plan.

Q. I have before me a letter dated November 20th, 1905, addressed to Mr. Lumsden, chief engineer, which appears to be written by yourself. Did you write that letter (witness shown letter)?—A. I did.

Q. It reads as follows:

November 20th, 1905.

"H. D. Lumsden, Esq.,
"Chief Engineer,
"Ottawa.

"Dear Sir,—

"Attached is correspondence I have had with our district engineers and with the assistant chief engineer of the Grand Trunk Pacific Railway, on the subject of virtual grades.

"You will see that some of our engineers are in favor of using same in certain places, and some are not. Mr. Woods is not in favor of using them. They are degrees only suitable for undulating country and not for long stretches of country on maximum grades.

"Engineering has been described as the art of making a dollar earn the most money, and a judicious use of virtual grades at points where the locomotive engineer has a chance to 'take a run at the grade,' would undoubtedly save money in construction and admit of the line being operated with maximum virtual grades of 0.4 and 0.6, though the actual grades would appear on the profile as steeper. Of course, if we have actual

"grades of 0.4 in locations where the engine can get a run at them, they can be operated as virtual grades of less slope, and the haulage capacity of the engine will be greater than on a virtual grade of 0.4. Will you kindly let me have your ruling early as to whether or not we shall use virtual grades where possible. Please return the file.

"Yours very truly,

"(Signed) D. MACPHERSON,
"Assistant Chief Engineer."

This letter expresses your present opinion of momentum grades?—A. Yes.

Q. Is it possible for the Commission, now that the railway is practically built, to secure from the Engineers' Department, any reliable information as to what might have been saved had momentum grades been used?—A. I think they could collect sufficient information to estimate the saving.

Q. The locating engineers should really have had instructions in connection with momentum grades, should they not?—A. I think they should.

Q. So that any momentum grades which we might project on the profiles of the line as built, would be comparatively insignificant as compared with what might have been accomplished by adopting this economy when the line was located?—A. Yes.

Q. Why were these suggestions contained in your letter of November 20th, 1905, not followed by instructions to build the railway in this manner?—A. Because the chief engineer instructed me that momentum grades were not to be used.

The Commission adjourned.

A. T. TOMLINSON, sworn:

Examined by Mr. Staunton:

Q. What is your occupation?—A. Civil engineer.

Q. You have been a civil engineer for how many years?—A. Thirty years.

Q. And where did you gain your experience?—A. Pretty nearly all over the country.

Q. You have been constantly engaged in railway construction of one kind and another for the past thirty years?—A. Yes.

Q. When were you first engaged on the Transcontinental?—A. In my present capacity I was first engaged—

Q. In any capacity?—A. At the first I was engineer on the prairie on the Grand Trunk Pacific.

Q. But on the Transcontinental?—A. February, 1909.

Q. In February, 1909, you were engaged as what?—A. District engineer.

Q. For whom?—A. The Grand Trunk Pacific Railway Company.

Q. On what district?—A. Districts D. and C.

Q. How long did you continue in that capacity?—A. Ever since.

Q. Are you still district engineer now?—A. Yes.

Q. Have you been engaged in any other capacity during that time?—A. For a short period this work was left without a superintendent.

Q. What work?—A. Contract 14 was left without a superintendent for the contractor, and I took his place for a short time last fall and last winter.

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Q. The Grand Trunk Pacific took the contract for the work where?—A. On contract 14.

Q. And they sublet that contract to some person else?—A. To Foley, Welch & Stewart.

Q. Did the Grand Trunk Pacific Company do any work on it themselves?—A. No.

Q. They sublet the whole contract?—A. Yes.

Q. Do you know on what terms it was sublet?—A. Yes.

Q. What were the terms?—A. Foley, Welch & Stewart were to receive five per cent of the estimates.

Q. That is to say, they were to receive five per cent on the gross cost of the work?—A. No, they were to receive five per cent on the estimates returned.

Q. What do you mean by that?—A. Well, the whole work, for example, might cost four millions; the estimates might be five millions; they would get five per cent on the five millions.

Q. These estimates, then, were made before the work was undertaken?—A. No, this contract was originally let to the Reynolds Construction Company.

Q. By the Grand Trunk Pacific?—A. Yes.

Q. They defaulted?—A. They failed.

Q. And did not undertake the work?—A. Oh, yes, they came and worked for a year and failed, and the Grand Trunk Pacific finally arranged with them to have them leave the work. They were unable to go ahead without financial assistance, and we got them to—

Q. You were not satisfied with the way they were doing the work and got them to give up the contract?—A. Yes, and then Foley, Welch & Stewart took it from them.

Q. Did Foley, Welch & Stewart know, when they took the work, upon what they were going to get the five per cent?—A. I presume so.

Q. Had the estimates been made at that time?—A. The estimates were made from month to month.

Q. Before the work was done?—A. No, made by the Transcontinental engineers from month to month, and turned in to Ottawa—

Q. Before the work is done?—A. After the work is performed.

By Mr. Gutelius:

Q. Before the whole of the work is completed, and after the portion of the work which they pay for is completed.

By Mr. Staunton:

Q. I understand an estimate is to be what a man figures a thing will cost?—A. That is the real meaning of an estimate. It is a guess at what it is going to cost, but we use the word "estimate" as a return of the quantities done during a certain period. The monthly estimate covers the engineer's judgment, or his absolute computations, of what was done during that month.

Q. And that is what they are paid?—A. Yes.

Q. Had they a resident engineer?—A. No.

Q. Who had they?—A. They had just their superintendent.

Q. Did you then become superintendent for Foley, Welch & Stewart when their superintendent left?—A. I was asked to take charge of the work during the remainder of last season.

Q. On the leaving of whom?—A. Of Mr. Swenson.

Q. When did he leave?—A. I think some time in July.

Q. Did you become superintendent on that work for Foley, Welch & Stewart in July last?—A. Yes.

Q. Were you regularly in their employment?—A. Well, no, I do not suppose you could say I was regularly in their employment.

Q. What I mean by that, were you paid by them?—A. Yes, I received remuneration from them.

Q. They paid you a salary for acting as superintendent?—A. Yes.

Q. And at the same time did you continue to receive your salary from the Grand Trunk Pacific?—A. Yes.

Q. Was this arrangement as to engagement and salary made with the knowledge of the Grand Trunk Pacific?—A. It was.

Q. And with their approval?—A. I presume so, they never objected to it.

Q. Did you have any conversation with any of their officials?—A. Yes, Mr. Woods, assistant chief engineer of the road, came up to me several times; he came up to see me several times when I was in charge of the work.

Q. Did he know you were in charge?—A. Yes.

Q. Am I right in saying that with the knowledge and approval of the Grand Trunk Pacific you were acting as superintendent from July till the 1st of April under salary from Foley, Welch & Stewart on this contract 14?—A. Yes.

Q. And you were acting in the double capacity?—A. Yes.

Q. Did your salary with the Grand Trunk Pacific continue during that time?—A. Yes.

Q. Have you discontinued that dual employment?—A. I have on the 1st April. When this season's work commenced it was not thought desirable to keep it up, because there was no logical man last season that could take hold of this work as well as I could.

By Mr. Gutelius:

Q. No man who was available?—A. No. The man who should have taken it unfortunately died; Archie Smith. He unfortunately died a month or two before.

By Mr. Staunton:

Q. Is this a correct statement of Foley, Welch & Stewart's position, as you understand it: they are doing the work on an arrangement whereby the Grand Trunk Pacific supply all the equipment and plant and are getting a percentage of the estimates for their remuneration?—A. Yes, all the equipment and plant is charged to the work.

Q. The equipment and plant is supplied by the G.T.P.?—A. Yes, that is the equipment and plant that is here now. Foley, Welch & Stewart supplied the small car equipment and that sort of thing, when they were here, when they were working at the grading, but not the standard equipment.

Q. Then, in effect, is it not that they are simply managing the work for the G.T.P. on a percentage?—A. Practically so.

Q. What were your duties as district engineer for the company?—A. I think the Act pretty nearly covers that, that the Grand Trunk was supposed to supply district engineers, who conferred, or—

Q. What duties did you perform as such?—A. It was to confer with district engineers here on classification, and to adjust any differences of opinion as each understood it.

Q. What do you mean? If there was a dispute between whom?—A. We were supposed to go over this work and watch the classification, and if we thought there was any wrong classification, to take the matter up with the district engineer; if it could not be adjusted in that way, I generally referred it to Montreal, and it was taken up with the chief engineer.

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By Mr. Gutelius:

Q. The object really was to see that the classification was not too high; in other words, that the work was done economically?—A. I think that was the idea.

By Mr. Staunton:

Q. That was the understanding?—A. I looked upon it that we were here to see that the contractors were not overpaid, and in some cases questions have come up as to whether they had not been underpaid.

Q. Did you ever intervene on classification?—A. I have.

Q. Did you ever endeavor to have the classification changed?—A. Yes, I had it lowered in some cases, after consultation. I have been called by the district engineer to go over the work with him to see whether I thought the classification was such as it should be.

Q. Have you kept a record of these instances?—A. I do not know. A great many of them are settled going over the work, and, as a rule, a tabulation has been made, and the results arrived at. I think those are on file as a rule.

Q. Did you always sign the classification?—A. I could not say whether that has been done on this contract; it has been done on other contracts.

Q. When you speak of this contract?—A. I mean contract 14. On the other contracts I think it was done for the simple reason that the contractors were not willing to pay their men, their sub-contractors and station men, until the district engineer came, and the district engineer of the G.T.P. had arrived at a conclusion on the classification, so that it should not be altered after they had paid their men.

Q. Did that occur on 14?—A. On 14 I do not think any agreements as to the classification were signed. I presume our accepting the estimate was considered sufficient.

By Mr. Gutelius:

Q. Did you ever put your name to them?—A. No, not to any monthly estimates.

By Mr. Staunton:

Q. How did you accept the estimates here?—A. The acceptance by the G.T.P. of payment for these estimates was to a certain extent an acceptance of the classification.

Q. Was it an acceptance?—A. The only reason they were signed on the others was because the contractors would not pay the sub-contractors until an adjustment had been made. The question was not raised.

By Mr. Gutelius:

Q. These were the progress estimates that were given to the contractors for the sub-contractors' portion of the work?—A. No, those were final estimates.

Q. The sub-contractors' final estimates?—A. Yes. On this work, as a rule, no estimates were paid to the sub-contractors, except the final estimates, as I understand it.

By Mr. Staunton:

Q. Was it to the interest of the G.T.P., as contractors, to have the classification as high as possible?—A. I would not say so.

Q. As contractors?—A. It would naturally follow that it was the interest of any contractor to have as high estimates as would be legitimate.

Q. As he could get?—A. Yes.

Q. It would be his interest to have his estimates as high as possible, as a contractor?—A. That would follow, assuming that they are in the contracting business for the purpose of making money.

Q. These estimates that were made, upon which the percentage for Foley, Welch & Stewart was fixed, were made by whom?—A. By the engineers of the Commission.

Q. In consultation with you?—A. Not as a rule.

Q. Were they ever made in consultation with you?—A. Yes, we have gone over this work, the same as we have over any of the rest, and agreed as to whether the classification was right or not.

Q. What do you mean by saying "Not as a rule"?—A. Because the estimates were made here by the resident and divisional engineers and turned in.

Q. But they are not turned in till you see them?—A. Oh, yes. I never see them until after they are turned in. Generally they are down at Ottawa for payment before I see them.

Q. Where do you come in?—A. I sometimes wonder myself.

Q. Where do you come in for consultation on classification?—A. Well, for instance, I think it was a year ago this spring, we went over—it might have been longer ago—it does not matter when it was—two years ago, I think it was—we went over one portion of the work.

Q. Who are we?—A. The district engineer and myself.

Q. Who was it?—A. I think Mr. Mattice was at that time the district engineer.

Q. What portion of that work was that?—A. That was from Cochrane to—

MR. MATTICE—Cochrane to Grant.

WITNESS—Yes, we went from Cochrane to Grant; we went over that and signed papers on that. I think the inspecting engineer, Macfarlane, was along too, and we took the division engineers with us, and they gave us the classification they had given on the different portions of the work, and, as we went along, we signified whether we agreed with them on their classification or not, and, if we did not, it was in some cases changed, as it might be, and I remember in one instance I happened to be down in Ottawa a few days afterwards, and it was stated in Parliament—

Q. We want only the evidence now.—A. Well, that is the only way I could get at it, that it was the district engineer or inspecting engineer advised Ottawa—

Q. Never mind that; just what you did?—A. Well, we approved of the classification over that portion.

Q. And you went over the classification with Mattice and Macfarlane?—A. And approved of the classification.

Q. Did you revise it at all?—A. Yes.

Q. Did you raise it?—A. In most cases on that piece of work we lowered it.

Q. What piece of work was that?—A. I think it was from Cochrane down to Okikidosik.

By Mr. Gutelius:

Q. That was the G.T.P. contract?—A. Yes.

By Mr. Staunton:

Q. Where did you lower it?—A. There were a number of shallow clay cuts that were classified

Q. As what?—A. As loose rock, and some portions of them were wasted, and we cut out the loose rock classification on the basis that shallow cut did not as a rule get down into the hard clay.

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Q. What do you mean by wasted?—A. There were shallow cuts it was very difficult to get plant into. It is very difficult to get plant into works in this country. You have to leave it on a work for a whole year sometimes.

Q. What do you mean by wasted?—A. Wheeled out to the sides, instead of being filled.

Q. The cut was not utilized for fill?—A. No. A portion of it might be and a portion might not be, and we cut the classification out on those cuts.

Q. Because it had been wasted?—A. Yes, and because of the shallowness of the cuts.

Q. In other words, because it was not loose rock?—A. Because we did not consider that it was.

Q. Did you raise any classification on that trip?—A. I do not recollect of any. There was one trip that we made—

Q. I am speaking of that trip?—A. I do not recollect that there was any raising of classification done at that time.

Q. Did you make any other trips?—A. Oh, yes, we made dozens.

Q. Very many?—A. Yes.

Q. Over all the work?—A. Yes, we have been over all the work several times.

Q. And am I right in understanding that it was for the purpose of revising the classification?—A. No, I would not say for revising it; it was to go over it, and to see if we agreed that the classification as given was right.

Q. That is revising it; for the purpose of revising it if you found it necessary?—A. Yes.

Q. How did you revise the classification usually on these trips?—A. As a rule there were some adjustments made.

Q. Were they important adjustments?—A. Sometimes they might be called important adjustments, and other times they were not.

Q. Do you recall any that were important?—A. The most important adjustment we made was in going over work west of Cochrane. I had taken exception to the classification there the first year I came here, and at that time—

Q. Leave out the west part, because we will take that up later. Take this side of Cochrane?—A. This work was in two districts: contract 14 covered a portion of two districts, being divided with the Quebec line. We commenced doing work to the east in Quebec under Mr. Molesworth. Our station men were getting estimates which, no matter how hard they worked, did not even give them a living, no matter what we could give them, even at our own prices, and the classification was markedly different from what it was west, and Mr. Swenson, of Foley, Welch & Stewart, brought this to my attention, and said he thought Mr. Molesworth ought to come down and look over the work himself, and he did, with me, and the classification was considerably increased; in fact, before that there was practically no classification.

By Mr. Gutelius:

Q. At your request?—A. I will not say at my request.

Q. As a result of you?—A. As a result of our going, Mr. Swenson went with us, and we took the resident engineers, and it appeared they wanted to give more classification, but the assistant district engineer would not allow them to.

By Mr. Staunton:

Q. Where was that?—A. That was on District 6.

Q. From the Quebec line to where?—A. From the Quebec line east as far as we were working at that time; I do not know how far we were working.

Q. About what distance would that be?—A. Probably down about to here some place.

Q. Where?—A. Beaver Dam, or some place down there.

Q. Who has classified that work before you went on it?—A. I think Mr. Wetherby.

Q. Who was he?—A. Assistant district engineer.

Q. When was that, that you went on the work?—A. That we came down here?

Q. Yes?—A. I suppose in 1910, I should think.

Q. What had he classified low, below what you thought it should be classified?—A. The clay, of course.

Q. What had he classified the clay as?—A. Common excavation, as a rule. He had allowed a small percentage of classification, but very small.

Q. Have you any idea about how much the yardage was in that?—A. No.

Q. It was considerable anyway?—A. The work was in progress at the time; I could not tell you.

By Mr. Gutelius:

Q. Do you know what residency that was on by number?—A. Yes, probably residencies from 13 or 14 up to 18.

By Mr. Staunton:

Q. Have you told me who went with you then?—A. Mr. Molesworth and myself.

Q. And the district engineer?—A. Molesworth was district engineer himself.

By Mr. Gutelius:

Q. And Mr. Swenson took an active part in the discussion, as contractors usually do?—A. Surely.

Q. The same as you would have done if you had been in Swenson's place at that time?—A. Yes.

By Mr. Staunton:

Q. And Molesworth passed on this work before that?—A. No, I do not think so. I could not bear witness to that.

By Mr. Gutelius:

Q. Mr. Molesworth would have passed on it before it would get to the contractor?—A. He had signed the estimates as they came in, but without any knowledge of what it was in the field.

By Mr. Staunton:

Q. You could not swear to that?—A. I think I could pretty nearly swear to it, but it would be almost impossible to do it.

Q. Was he on the ground?—A. He had been on the ground before that.

Q. Where was he spending his time?—A. At Mattawa.

Q. Would he periodically go over this district?—A. He very seldom came up here.

Q. Would he periodically go over it?—A. I do not think he had been over the work at all.

Q. You do not think he had been over it at all?—A. No; he might have been over some small portion, but very little. It was very difficult to get over, and he was a very old man.

Q. How old a man was he?—A. I should think he is in the neighborhood of 69; well, over 60, I should say.

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Q. Had any other of the work, any other of the clay than the clay you have been telling me about been classified as common excavation?—A. Oh, yes.

Q. I mean clay which you had at that time classified as loose rock?—A. No, I do not think there had.

Q. Why did you think that clay should have been classified as loose rock?—A. Because it was not common excavation.

Q. That was not the reason?—A. That was my reason.

Q. It might be solid rock?—A. It was not solid rock and was not common excavation.

Q. Why was it not common excavation?—A. That is my judgment of it.

Q. Why? How did you arrive at that?—A. Because it could not be handled as common excavation.

By Mr. Gutelius:

Q. It cost too much for common excavation?—A. Yes, and all classification is based on the cost, I don't care what anybody says.

By Mr. Staunton:

Q. All the estimates you made were based on the cost?—A. On the difficulty of handling the material.

Q. You ignored the specification?—A. I certainly did.

By Mr. Gutelius:

Q. That was the contractor's point of view?—A. We got a specification which did not cover the country at all, and you know just as well as I do, as an engineer, that it does not. The first year we were up here we had a chief engineer who would not say aye, yes, or no, and if we wanted to get this work done we had to pay for it, it does not make any difference whether it is Grand Trunk contracts or anybody else; we would have the whole work stripped of men, unless we could pay them wages.

Q. It was costing too much for the classification that the Transcontinental engineers were giving?—A. Yes.

Q. And you, as a representative of the G.T.P., assisted Mr. Swenson in getting that classification raised?—A. I do not think you should put it that way.

Q. Perhaps it is a little too strong?—A. Because that is not the fact. The contractors west had progressed further with their work.

Q. Never mind that?—A. I do not want to be pinned down as doing something that was dishonest.

By Mr. Staunton:

Q. Oh, no, no. I would like to get your evidence in a concise way. I am directing your attention to the fact that the classification says that only such indurated clay and other material shall be classified as rock as cannot, in the judgment of the engineer, be ploughed with a ten-inch grading plough, behind a team of six good horses properly handled?—A. And I maintain that the condition of this clay at that time was that you could not put a team of six horses on to plough it.

Q. Why not?—A. You would simply mire your horses.

Q. It was too soft?—A. Yes, a good deal of it. We had rain and rain, and you could not put a team into it.

Q. Would you classify as loose rock material too soft to be ploughed?—A. I say the plough test has nothing to do with it, in my judgment, because you have a condition which does not obtain—

Q. Then in your action in classification, you ignored the plough test?—A. I certainly did. I hold it does not maintain in this country at all.

Q. And you valued it by the cost of getting the material out?—A. No. It was not common excavation, and we could not make it solid rock. There were some cases I would have been quite willing to classify as solid rock, because it was just as hard.

Q. You were guided by the cost of getting it out?—A. I would sooner put it, the difficulty of handling the material.

Q. How would it be more difficult than common excavation?—A. It takes more time.

Q. And costs more money?—A. Yes.

Q. Is that not the result?—A. Surely.

Q. He would not care about the time, if he was making money on it?—A. I say on account of the difficulty. It is the same thing; you can call it bread or cheese.

Q. Does it not all come back to the one place, that you were influenced by the cost to the contractor of getting out the material?—A. I do not think that you are right in putting it that way, because if you give us something that is impossible, your courts will not hold a man who has to do something impossible in law, and we were up against a condition of material here which was not covered by any clause of the specification, and is that any reason why we should say "We won't give him anything more" or put that down as the lowest?

Q. Why did you put it in as loose rock if it was not covered by the specification?—A. Why should we not put it in?

Q. You might put it in a class by itself?—A. We would have to go to Ottawa to get legislation.

Q. Why should you not put it in a classification by itself?—A. If the work had been done by the C.P.R.

Q. Do not argue. Should you not, as an engineer, put it in a class by itself?—A. We were not allowed to.

Q. If you had been allowed to, would you have put it in a class by itself?—A. Yes.

Q. It is not loose rock or common excavation within the meaning of the specification, in your opinion?—A. No, it is not.

Q. And you say that because there was no other way out of it, you put it in as loose rock?—A. Yes; some of it comes under that loose rock specification. There is a great deal of it you could not put a team on, and if you had put a team on, it would not have been in any condition that you could benefit in handling it.

Q. Because it was too soft?—A. Yes; you might plough a furrow of clay out, and lay it out, and then you have to get to work with your picks and shovels to break it, before you could handle it. Mr. Gutelius will probably understand that better than you, because he has been up against the same proportion.

Q. Could you tell me about how much of that material was classified as loose rock which was too soft to plough?—A. Oh, I could not tell you. I could not even arrive at a conclusion. It has covered three years now, and after our decision was reached we went on to something else, and it would be almost impossible to say.

Q. Could you tell me how much of that material could have been turned over by a plough?—A. I think a plough could have made a furrow through possibly fifty per cent of what we classified.

Q. As loose rock?—A. Yes, but it would be no advantage to the contractor or commission or anybody else, to have that furrow made.

By Mr. Gutelius:

Q. What started you on that trip with Mr. Swenson and Mr. Molesworth?—A. We went down there to look into the complaints that were coming in from that work.

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Q. Who made these complaints?—A. Mr. Swenson.

Q. Direct to you?—A. Direct to me, and I fancy to Mr. Molesworth as well.

Q. Did you have any conference with Mr. Woods in connection with that?—A. I do not recollect that I did. It is possible that I did, though; it is possible that I told him that the standard of classification down there was entirely different to what it was on the older work.

Q. That the standard of classification was higher than the classification on which these boys were giving on the G.T.P. contract?—A. It was on part of the G.T.P. contract. There is about half of it on each district.

Q. The portion that you have been district engineer on includes more than the G.T.P. contract?—A. Yes, it includes 45 miles east of our contract and 200 miles west.

Q. Did you have occasion on either of the contracts east or west to increase the classification?—A. I think it was done in several instances further west.

Q. Do you know definitely?—A. I know it was in several instances, and on the same inspection trips that we raised it in some places we lowered it in others.

Q. In both the G.T.P. contract and on the neighboring contract?—A. Yes.

Q. Are the G.T.P. and Foley, Welch & Stewart satisfied with the classification they receive now, as far as you know?—A. As far as I know they are, though our books do not show any material encouragement for going into the contracting business.

By the Chairman:

Q. Is there anything you wish to state?—A. I do not know that there is. In all my consultations with the several district and inspecting engineers who have been here, I have always endeavored to give all contractors in the district the same consideration that was given to the Grand Trunk Pacific contract, and I am not conscious of ever asking for anything on this contract that was not already established, with the approval, I think I can say, of the engineers from top to bottom, including the chief engineer on other contracts.

Q. Has this road been kept at a uniform grade, .04 one way and .06 the other?—A. As far as my knowledge goes. All my information comes from the Transcontinental office. I saw their profiles.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION,
EVIDENCE TAKEN IN TRANSCONTINENTAL OFFICES,
OTTAWA, NOVEMBER 14th, 1912.)

H. A. Woods, sworn:

Examined by Mr. Gutelius:

Q. What is your official position with the Grand Trunk Pacific Railway?—

A. Assistant chief engineer of the Grand Trunk Pacific.

Q. What is your official position in connection with the National Transcontinental Railway between Winnipeg and Moncton?—A. Well, I suppose it might be termed inspecting engineer—no particular title attached to it.

Q. Do you represent the Grand Trunk Pacific?—A. I represent the Grand Trunk Pacific in the work being done by the commission between those points.

Q. As provided in the various agreements and acts?—A. That is right, sir.

Q. When did you first undertake this work?—A. I came to the Grand Trunk Pacific from the Grand Trunk in January, 1905.

Q. That was prior to the undertaking of any work, or letting of contracts, on the National Transcontinental?—A. Yes.

Q. Did you have to do with the rates of grade established on the National Transcontinental by the commission?—A. Not directly.

Q. You are familiar with the book of instructions that was prepared by the commission, and issued over the signature of Mr. J. Butler?—A. I am.

Q. Were these instructions approved by your company?—A. They were not approved formally by the company, although the company made no particular objection, to my knowledge, against the instructions that were issued.

Q. You felt at liberty to criticize the construction of the railway, even though it was in accordance with these instructions?—A. I did, in several instances.

Q. In the matter of curvature, which is treated in Article 26 in these instructions, it says: "The maximum curve on a level shall not exceed six degrees." Do you not think that to issue an iron-clad instruction of this character for a railway that had not yet been surveyed was rather bold?—A. I think it was.

Q. Would you explain the reason why an iron-clad six degree curve is bold?—A. I think it is bold, for the reason that, in going through a country of such an extent as the country which this line traverses, there are many points where a curve with a shorter radius might be used to advantage.

Q. And not interfere with the efficiency of the railway?—A. Not seriously interfere with the efficiency of the railway; I would rather put it in that way.

Q. Would sharper curvature interfere at all with the haulage capacity of locomotives hauling freight trains?—A. If carried to an unreasonable extent, it would, but within reason, while it might detract from the speed of the trains, it would not detract from the haulage capacity.

Q. You are familiar with the term momentum or velocity grades?—A. Yes, sir.

Q. Were they used to any extent on the National Transcontinental Railway?—A. Not to any extent, no, sir. I want to say, in explanation of that, that the maximum grades and curvature were supposed to be fixed, and that engineers were not allowed to vary, or did not vary them.

By the Chairman:

Q. You are speaking of the Eastern division?—A. Yes.

By Mr. Gutelius:

Q. I notice in paragraph 85 of these instructions that "Resident engineers will not be allowed to make changes in grade or in alignment, but will promptly call their division engineer's attention to any possible change they consider beneficial." As representing the Grand Trunk Pacific, were you asked by the engineers of the National Transcontinental to pass upon any curvature sharper than six degrees?—A. I was not.

Q. You are familiar with the railway along the St. Maurice and the Millieu Rivers, are you not?—A. Yes.

By the Chairman:

Q. Referring to the degree of curvature adopted in that territory, it uniformly does not exceed six degrees; is that a fact?—A. Yes.

Q. Do you know whether there were any general instructions given by the commission that a six degree curve should not be exceeded?—A. I have not any positive knowledge. It is covered by the rules in the book of instructions that it shall not exceed a six degree curve.

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Q. But that book of instructions was prepared before the railroad was surveyed?—A. Yes.

Q. Were there any modifications, to your knowledge, adopted in those instructions, after the commission became familiar with the country through which it was going?—A. I think that it is possible that trial surveys had been prepared before this book of instructions; trial surveys had been made, by which it became apparent that a low grade line could be established, before the book of instructions was issued. I think the preliminary surveys were made through this territory prior to this time.

Q. It appears from the first annual report of the Commissioners that the engineers who were sent out to survey this projected line between Moncton and Winnipeg were furnished with printed instructions for their guidance, and for that of the district engineers in charge of parties under them, giving full particulars as to their various duties; they were also instructed to adhere to grades not exceeding 0.4 per hundred adverse to eastbound, or 0.5 adverse to westbound traffic, though in regard to the last mentioned this has been changed to 0.6 per hundred in one or two exceptional cases. The maximum curvature was limited to four degrees. This is a quotation from page 4 of the report. You see from that that these instructions were given before the line was surveyed. In your judgment, was that a wise instruction to give?—A. I think it was a bold assertion that grades and curvature of those maximums could be found through a country which was largely a wilderness, without causing excessive cost.

Q. Without what?—A. Without making excessive cost in construction.

Q. Such instructions as these leave nothing in the discretion of the engineers, do they?—A. They do not.

Q. They must, if they follow their instructions, regardless of cost and regardless of conditions, find a road which will come up to those instructions?—A. They must.

Q. Did you ever know of such instructions being given to engineers, allowing them no latitude whatever?—A. Not positive instructions. Instructions were often given to accomplish certain results, if practicable, but not positive.

Q. So that, if they followed those instructions, they would not bring to the Commission any information upon which they might deem it advisable to change the grade or the curvature?—A. I would not say that, because the running of a line through such a country as that, an engineer has to use his judgment as to the better local conditions, and a line once established would certainly give the chief engineer information on which he could base or change his instructions, if, in his judgment, it was deemed best to do so.

Q. I understand you to mean that the line was so long and so expensive that he would deem it advisable to send out another party to explore another line; is that what you mean?—A. That is not altogether what I mean. What I mean is that the information brought in by his engineers as to the topography of the country might lead him to say "With this information we can reduce the cost by heavier grades and still have a practical road."

Q. Then I understand you, in your opinion, when the Commission obtained information from the engineers sent out to locate such a line as this, that they could realize then the enormous expense that this road would entail to build it, as laid down in the preliminary instructions?—A. Yes; and on the strength of those reports undoubtedly the change from five-tenths to six-tenths was embodied in their instructions.

By Mr. Gutelius:

Q. It is the fact that, as soon as those surveys were made and passed upon by the chief engineer, that an estimate of the cost of this railway could have intelligently been made?—A. I think it could, yes, sir.

Q. Can you give us an idea as to the date, from information placed before you officially, that the Commission might have learned how expensive a railway their original instructions involved?—A. I think that, for a part of the line, that information was known to the chief engineer during 1905, and other parts of the line it was not known for perhaps a year or two later.

Q. Can you recall a time, roughly, when you first got the idea that this was going to be so expensive a railway?—A. Well, I think my attention was called to it more particularly in 1907, and prior to that time, which was before the final location was completed.

Q. Do you care, as an engineer, to defend the instructions that steel bridges and steel viaducts should be constructed on tangents?—A. I do not, in all cases.

Q. Your letter in connection with making the Salmon River viaduct all tangent was not based on your personal judgment?—A. Not altogether, no, sir.

Q. You are familiar with the specifications?—A. I am.

Q. Were you concerned in their preparation and adoption?—A. I had to do with the making of those specifications, as one representative of the company, and they were accepted by our company.

Q. I find that the engineers interpreting these instructions are classifying as solid rock material composed of loose rock and fragments less than a cubic yard; is that in conformance with your understanding of this specification?—A. It is not in conformance with the original specification as made, and as only made through an addition to these specifications, using the term "assembled rock," which was proposed by Chief Engineer Lumsden, and accepted by the Grand Trunk Pacific after an examination of the blue print proposed by Mr. Lumsden, and believing that it worked no injury to the Commission or the company by its adoption, and what we believed to be Mr. Lumsden's and our own interpretation of the same.

Q. Will you answer my question?—(Question read)—A. It certainly is not, unless such material is cemented, so as to require blasting.

Q. So as to require blasting to separate one fragment of rock from another?—A. Yes.

By the Chairman:

Q. You agree, then, that the specification of solid rock excavation, paragraph 34, which reads: "Solid rock excavation will include all rock found in ledges, or masses of more than one cubic yard, which, in the judgment of the engineer, may be best removed by blasting," will not cover anything which is not rock?—A. Yes, that specification has particularly to do with solid rock. It defines what solid rock is. I designed that clause.

Q. If the specification was not modified by the blue print, or by some subsequent amendment, no material which was not rock could be included under that clause?—A. I won't say that.

Q. That specification ought to convey to your mind, as an engineer, my meaning, should it not?—A. It certainly does.

Q. And is it not plain that those words were not intended to cover anything more than rock?—A. All it covered was solid rock.

Q. If you adhered strictly to that instruction, could you classify anything that was not rock under that heading?—A. Possibly not, under the strict acceptance of that specification.

Q. I simply want you to tell me now, if I gave you that into your hands, and told you to live up to it literally, could you classify anything under it that was not rock?—A. No, sir.

Q. You say there was a subsequent modification of that specification in the blue print issued by Mr. Lumsden—is that right?—A. Yes, sir.

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Q. Do you know, as a matter of fact, that for some time before that blue print was issued, particularly in District B, they were commonly classifying as solid rock what is now known as assembled rock?—A. Yes, sir.

Q. And did you, for the Grand Trunk, write a letter of protest against that?—A. I did.

Q. In your letter to Mr. Lumsden, dated October 7, 1907, you say:—

“During the past week we passed over portions of the work from Batican River west for fifteen or twenty miles, and, later, from mile 115 to mile 132”; that is in District B, west of Quebec, is it not?—A. Yes.

Q. The letter continues:—

“With reference to the former portion, the classification was given in distances of from three to five miles, and, as we did not have total quantities of graduation, and could not judge with reference to any particular cutting, although percentages over entire distance seemed excessively heavy in both loose and solid rock. With the latter portion, we had detailed percentages for each cut, and we are greatly surprised at the allowances made for solid and loose rock. In nearly every case where the cuttings were not entirely all ledge, the estimate given for solid rock is double, or more than double, what it should be. In fact, the specifications have been entirely ignored and an excessive allowance made.”

Q. Were those statements, in your opinion, fair criticisms of what you saw?

—A. They were at that time; they were my opinion at that time.

Q. You formed that opinion from a personal inspection of the work?—A.

Yes.

Q. Looking at the specification, paragraph 34, to which I have already referred, you will see they use the word “masses” there. Do you consider that that word “masses” was intended to cover any material which was not rock?—A. It was not, when that specification was written.

Q. Do you know, as a matter of fact, at the time you made your inspection referred to in your letter of October 7th, that great masses of material composed of sand and clay, and similar fragments of rock, were being classified as solid rock, and that it was justified by contending that the word “masses” included more than rock?—A. I do not think it was justified by that.

Q. They justified it by that, did they not?—A. I think that interpretation was what allowed it to be returned in that way, but I think the interpretation was entirely false. That particular work to which I had reference there was a very difficult piece of work, and all kinds of material were found there, and there were some of the cuts that were simply boulders, with a very little sand intermingled with it, you might say almost wholly boulders, and, under a liberal interpretation of the specification, those boulders might have been termed solid rock, although not of a full yard capacity, and I think that is the usual acceptance of engineers, not to confine themselves to an exact measurement per cubic yard.

By Mr. Gutelius:

Q. But they were boulders that would be half a yard or more?—A. Yes.

By the Chairman:

Q. Do you not know that there were great sand hills there which were classified as solid rock?—A. There was one particular cut, and one of the largest cuts there, on which I based this letter, which was at that time very, very largely sand, which afterwards developed, as they went down, into a very much harder material. The top part of it was sand.

Q. I failed to find personally, in all my inspection from the north bank of the St. Lawrence to Parent, any cementing material; did you find any?—A. Oh, yes.

Q. Where?—A. We found it before we reached La Tuque. The first cut east of La Tuque I think was a cemented material. I saw what I would consider cemented material when I was at different places.

Q. Tell me what you mean by cemented material?—A. I mean boulders and clay, or other material, that are lying in a compact mass, and so that you cannot separate them without the use of explosives; that is what I mean by cementing material. I do not care whether they are stones the size of your fist, or half a yard.

Q. Did you ever see anything like that up there?—(Showing specimen).—
A. That is an extreme case.

Q. You call that cemented together?—A. Yes, without a doubt. You do not find that in large quantities. I have handled thousands of yards which I have classified as cemented material.

Q. I am asking you what your cementing material is. Tell me what it is. Is it sand?—A. When you are working with a fall and face in a cut, and here is material which clings together, and it won't be separated you have got to blast it, and probably there will be stones in there half a yard, and others of a very much smaller dimension, and there may be some more than a yard, but you have to use explosives to get that apart.

Q. If I stick a pick in, the fire will fly, but it won't come out?—A. I do not know about the fire, but it won't come out. It was found on that work, because I saw it repeatedly, but it did not cover all the work by any means.

Q. There are not large quantities of it?—A. There is lots of material you cannot separate the earth from the rock.

Q. Could you locate any of it?—A. I cannot locate it by the mileage, but it was in the bottom of the big cut that was taken out by Macdonell, of Macdonell & O'Brien's work and on which the top of it was sand.

By Mr. Gutelius:

Q. Yellow sand?—A. Yes; it was worked with scrapers, without ploughing. and as we went down into that we found ledges of solid rock, and others that cemented material, a mixed material, with stones the size of that cuspidor to half a yard.

By the Chairman:

Q. That is what you mean?—A. Yes.

Q. And whatever of that has been taken out on the line you would have classified as assembled rock?—A. Yes, I would classify it as solid rock.

Q. You would classify it as solid rock under the heading of solid rock?—
A. Yes.

Q. You would not classify the cemented gravel as solid rock under this specification?—A. I certainly would, if it was in large quantities. You would have to classify that material produced as solid rock.

Q. But cemented gravel comes under section 35?—A. Yes, as loose rock. Well, there are different classes of cemented gravel. Cemented gravel very frequently lies in courses, from one to four feet in thickness, and it can be ploughed with one of those grading ploughs sometimes, and other times it cannot, but it cannot be ploughed continuously, as clay can be ploughed.

Q. If it can be ploughed, it is common?—A. No, I want to draw the line, that a plough test means continuous ploughing; it does not mean you can plough the length of the room and stop, and wait, and then go on; it means continuous ploughing.

Q. Why did you not say so in the specification?—A. It was not necessary. I worked under that same specification a great number of years without any question between the contractor and the company. Sometimes the contractor asked for more than he would get.

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Q. You say there was an amendment made to the specification?—A. Yes, which I think had the approval of the Government.

Q. You think that amendment or blue print issued by Mr. Lumsden, dated January 7, 1908, widened the definition of solid rock, so as to include material which had theretofore not been classifiable, if I may use that word, as solid rock?—A. I think so, yes.

Q. To what part of the blue print do you refer as having that effect?—A. I refer to where it shows a stone of smaller dimensions. I refer to number 5; it shows smaller fragments of rock, "Rock in masses of more than one cubic yard, which, in the judgment of the engineer, can be best removed by blasting." I mean that that is not solid rock in the ordinary acceptance of solid rock, but it was decided to term it solid rock, because it is as difficult to move as solid rock.

Q. I do not think you have read that carefully, because it does not say "rock in masses"?—A. It does.

Q. Pardon me, it does not; it says "rock in masses," just exactly as the original specification said. It does not say "rocks in masses" but rock in masses, and the original specification said rock excavation. I have tried to find out how this modified the specification, and I have been unable to do so personally?—A. Well, it probably grew, if you will allow me to say so, out of the interpretation placed upon Article 35 by the engineers, in which masses, although not solid, not ledge, might be termed solid rock.

By Mr. Gutelius:

Q. You only intended, though, to legalize what you would have, in your judgment, called solid rock occurring in these large boulders?—A. Yes, sir, I would have called that solid rock under the original specification, with a liberal interpretation of that specification.

Q. These contracts had already been let prior to the issuance of this blue print?—A. Yes, sir.

Q. As an engineer, does it not strike you that the blue print gave the contractors an advantage that they did not possess in the original contract?—A. Under my interpretation of it, it would not. Under a different interpretation, it might.

Q. Under the interpretation that you found in your official capacity was based upon this clause, did it not give the contractor an advantage that the original contract did not anticipate?—A. I think it might have done so.

Q. Can you not say so positively?—A. Well, I would not be willing to say that, because under my interpretation it made no difference.

Q. But from your experience with the engineers in the field, your knowledge of the cuts, and your knowledge of the estimates and classification, did they not, under this modified instruction, give the contractors more solid rock than you would have given them under your interpretation of the original contract?—A. I think they did.

Q. The greater part of the discussion in connection with assembled rock occurred on District 2, on that portion of the line which might have been eliminated if the sixty-five hundredths line had been constructed?—A. Yes, the greater part.

Q. Are you familiar with the proposal to introduce a point sixty-five pusher grade from La Tuque yard east, instead of four-tenths, which was constructed?—A. Yes I am, fully. My recommendation was that it should be in preference to the four-tenths at this point.

Q. Why?—A. Simply because, with the location, it was particularly adapted for a pusher grade, although a point sixty-five grade could hardly be termed a pusher grade, but it was where a divisional terminal might have been,

or would have been established, and the engine was already there, ready as a helper, to be called upon to push trains out of the yard. Local or passenger trains need no assistance. It was only the eastbound fully loaded trains needed it.

Q. Do you remember how much money might have been saved in construction?—A. I believe it was estimated at \$350,000, but I do not think it was anything like approaching what the difference was actually found to be.

Q. In any event, if the material on the four-tenths line had developed into common excavation and loose rock, as was anticipated, it would have been the economical thing to build that sixty-five hundredths grade?—A. I think it would.

Q. And the introduction now of assembled rock has made a greater reason why it should be built?—A. Yes, although I believe, in the first instance, that two additional tunnels were proposed, which was not afterwards found necessary.

Q. But that is more than equalized by this assembled rock?—A. Yes.

Q. You mentioned a moment ago that a sixty-five hundredths was not in reality a pusher grade; why did you make that remark?—A. A pusher grade is generally considered a one-point one against a four-tenths.

Q. Have you figured what a pusher grade against a six-tenths should be?—

A. I have not. It is about a one point four or five.

Q. We find that a pusher grade was constructed from St. Francis River westbound for ten or twelve miles on a one point one?—A. Yes, sir.

Q. Do you remember the long fill, just after you leave the St. Francis River bridge?—A. Yes.

Q. If a steeper grade than the one point one, say a one point three or four, had been used for those ten miles, would it have affected the cost of that last mile at the foot of the hill?—A. It would have reduced the cost of that heavy embankment approaching the river.

Q. And that is the information which we can get from the local engineers?—

A. Yes.

Q. Would the railway, generally speaking, be as efficient if they had put in a steeper grade, up to say one point three, on that whole side, using the same height crossing the river and the same height crossing the divide?—A. That is a question which I have never considered, but I presume it might have been.

Q. It requires the same amount of power to raise the train up the same height, whether it goes on a one point one or a one point three?—A. Yes.

Q. So that, theoretically, it would have been as efficient?—A. Yes.

Q. Who designed the engine houses, coal shutes, ice houses and freight sheds?—A. They were generally designed in the office of the chief engineer of the Grand Trunk Pacific.

Q. And sent to the National Transcontinental?—A. Sent to the National Transcontinental engineers.

Q. Did the Grand Trunk Pacific insist on eighty pound rails being laid in sidings and yards?—A. I do not think they ever insisted upon its being done. The proposition was made to them that it might be better to use the same weight of rails throughout, thus avoiding the difference in the frogs, switches, and so forth, and it was accepted by the Grand Trunk.

Q. Being a good proposition to the operating company, you accepted it?—

A. Yes.

Q. Did the Grand Trunk Pacific have anything to do, so far as you know, with the elimination of wooden trestles on the Transcontinental Railway?—A. They did not.

Q. Your company would not have objected to the construction of wooden bridges, as is the usual practice on other new railways in Canada and the United States?—A. They would not; they even recommended it in some instances.

Q. There are advantages in the construction of wooden bridges on a new railway through a new country, are there not?—A. There are, in my judgment.

Q. Will you tell us, in your own language, some of the advantages that occur to you?—A. Well, in many instances, the exact amount of water space is not as well known as it is after the road has been constructed for a series of years, and the length of structures can be increased or diminished, when permanent work is placed in, and in that way a considerable saving is often made. There are other places—and I speak now particularly with regard to the clay belt—where we practically had no foundation, and where it has been found that a very considerable saving could have been made by using temporary structures, or what might be termed permanent trestles.

Q. Permanent wooden trestles?—A. Yes. I think this is generally done in the construction of lines of any magnitude, aside, possibly, from Government work here in Canada.

Q. What effect would the construction of wooden bridges have had in the matter of wash-outs, slides and subsidences?—A. I think it would have eliminated many of them.

Q. What do you say to the objection to the construction of wooden trestles in the matter of the fire risk?—A. There is a very considerable risk in using wooden trestles through timbered country, but that can be eliminated to a great extent by proper care in keeping the right of way clear of everything inflammable. There always will be a certain amount of risk in wooden trestles, unless you go to the expense of ballast floors, which have been constructed on pile structure in many places, where permanent work is never considered practicable.

Q. That is, if the vegetable matter had been skinned off the right of way to a distance, varying with the amount of combustible matter there is in the vicinity, and ballast floors used, there would be little danger of fire?—A. Comparatively.

Q. Would the use of wooden bridges influence the locating engineer in locating his line through the adjoining cuttings in the matter of balancing cuts and fills?—A. I think it would probably, in the balancing of his quantities.

Q. If he knew he did not have to balance quantities, he would reduce his cuts very materially?—A. Yes.

Q. Do you think the use of wooden trestles would have reduced the time by one season in the construction of this railway?—A. Well, speaking of the eastern division, I am hardly able to say, from the fact that the material for the structures would have to be brought from long distances. On our western division, where we made use of it, there is no doubt it would have hastened it, but where we have to get our material from British Columbia, it could not be hauled to the location of the bridges erected before the track reached there; in other words, we would have to wait till the track was to a certain point before the material for the structure could be hauled to the point of erection, and, consequently, it is difficult to say. Of course in many instances, where it was near other railways, the work could be advanced very considerably by using those structures.

Q. So that it is fair to say that the completion of the railway would have been expedited to a certain extent?—A. Yes.

Q. You do not feel like making an estimate as to how much?—A. No.

Q. Did you pass officially the various yard plans?—A. Yes. The plans were presented in conformity with the plans of the Grand Trunk Pacific, modified to meet the existing conditions of the different yards. Understand, on the prairie a yard could be laid out without any additional cost, or made very large for future expansions. In certain locations on the eastern division it was impracticable to do it, and even to get a reasonable yard you have to go to a very large expense. I guess they are pretty much all that way.

Q. Was it not unfortunate that the first yards were designed for prairie?—A. Probably it might have been.

Q. The criticism that occurred to me was that a large amount of yard grading might have been saved, if the yard designer had known that these tracks which ramified the outskirts of the yard had come through heavy cuttings or high fills?—A. Yes.

Q. Don't you think there is something in that criticism?—A. Yes, that is probably so. Take the yard at Edmundston; now, we did not intend to make Edmundston a point at all; it was rather forced upon the Commission against our judgment, but it was placed there, and required a very large amount of work, and I do not see very well how you could modify that yard. You might, of course, in some particulars, but you would not eliminate much of the work.

Q. I was thinking particularly of Graham?—A. Yes.

Q. If the same yard tracks at Graham had been placed with thirteen foot centres, without any large area between tracks, a considerable amount of money might have been saved?—A. Yes.

Q. And you explain that, as I understand, because Graham yard was designed after prairie yards, where grading cut no figure?—A. Yes, that is my explanation of that.

Q. What do you say about the double track between Lake Superior Junction and Graham yard, as a matter of economy in railway construction?—A. I never thought it necessary. It may not have been such bad economy to construct that, as that bridge had to be constructed there, and there is a possibility that in the future that will be a pretty busy line, and a second track leading out of a divisional yard, as you know from your operations as superintendent, is a very advantageous thing to have.

Q. But in the interests of economy, you would not have built it?—A. Not at this time.

By the Chairman:

Q. It is a luxury?—A. Yes.

By Mr. Gutelius:

Q. And is that not true of the double track from Cap Rouge to St. Foye?—A. Yes. I think that was made there for a connection with the Canadian Northern. I do not know what else. That was very expensive work from Cap Rouge to St. Foye.

Q. And you would not have passed it, if you had the whole thing?—A. No. That is a very expensive work.

Q. Then across the river, you would have eliminated that St. Chrysostome cut by running?—A. Yes; in other words, I would have occupied 1,500 or 1,600 feet of track already constructed by the Quebec Bridge company, and reduced the cutting, possibly, by the increased grade, probably to one-fourth of what it was.

(TRANSCONTINENTAL RAILWAY ENQUIRY COMMISSION.
MEETING AT OTTAWA, TUESDAY, APRIL 21st, 1913.)

Present: G. LYNCH-STAUNTON, K.C., *Chairman*; F. P. GUTELIUS, C.E.

H. A. WOODS, Assistant Chief Engineer of the Grand Trunk Pacific Railway Company, recalled and sworn:

By Mr. Gutelius:

Q. Mr. Woods, were you present at a meeting in Quebec where the price for train-filled and temporary trestles was agreed upon with the contractors for contracts 9 and 10?—A. I was present when that question was discussed.

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Q. That meeting took place on the 14th December, 1906?—A. So far as I remember, it did.

Q. Who was present at that meeting?—A. The chief engineer, Mr. Lumsden, Chairman Parent, A. R. McDonell, M. J. O'Brien, and M. P. and J. T. Davis and Mr. Armstrong and myself were there.

Q. At that time, a price of 55 cents was agreed upon for train fill and temporary trestles?—A. Yes, sir.

Q. What have you to say about that price?—A. I hardly think that that same price covered all sections.

Q. I said sections 9 and 10?—A. That is right.

Q. What have you to say about 55 cents a yard, as being a proper price?—A. I thought at that time 55 cents was too high. I first thought 45 cents ought to cover it, but after taking into consideration the cost of the trestles and the heavy embankment, I thought 50 cents would be a very liberal price.

Q. That is the price you quoted for the Grand Trunk Pacific later?—A. Yes.

Q. Did it occur to you at that time that when this price was being asked, that it would eliminate the use of standard timber trestles on these contracts?—

A. No, I did not consider that it would. I considered that these temporary trestles and train filling were not adjacent to streams or covering soft yielding foundations, but for ordinary grades where it was expected you would either have permanent works or solid roadbed.

Q. In the light of subsequent events, however, it did sound the death knell for wooden trestles on these contracts did it not?—A. Well, apparently it did, but not necessarily. I considered there were many places where a permanent trestle might have been placed to rather better advantage and more economically than attempting to build embankments or steel structures and particularly on the St. Maurice River, where there are washouts in one or two of the long heavy embankments and where there was soft ground; I thought then it was much better to built trestles because of the fact that this agreement had been made. The question was settled for the district engineers I suppose and the contractors.

Q. And you as inspecting engineer were out of it, because you agreed to the 55 cent price?—A. Because our proposition to build these, where we thought it was necessary, and afterwards to build at the established maximum rate was thrown out, and not considered by the Commission, do you catch me?

Q. Were you familiar with the original surveys that were made by the Grand Trunk Pacific for the line from Winnipeg to North Bay?—A. Which surveys?

Q. Surveys made by the Grand Trunk Pacific?—A. Yes, sir.

Q. Was not a portion of these surveys used by the Transcontinental Railway itself?—A. Yes, sir, I suppose they were used. The line from North Bay, I think, had reached the zone which would be covered by the Transcontinental and it was paid for by the Grand Trunk, and after reaching a point where it might be made use of by the Transcontinental Railway Commission, they took over the surveys and our notes and paid for the same to the Grand Trunk Pacific.

Q. Do you know if any portion of the Transcontinental was built on the line or within a few hundred feet of the line surveyed by the Grand Trunk Pacific?—A. I cannot say it was, I cannot answer that question, although I assume it was. Perhaps not a few hundred feet, but within a few miles. The surveys determined the character of the country.

By Mr. Staunton:

Q. You are not familiar with the location of these surveys?—A. I am not familiar with the actual location of the first survey. I know the Grand Trunk Pacific made surveys in a direction away north of the line; I am speaking now of Lake Superior Junction; they covered considerable territory both north and south, but they had an extreme north line which was not used at all. It was not feasible as not being a direct line.

Q. If I should say to you I had knowledge and there was not a foot of the Grand Trunk Pacific original surveys used in the construction of the Transcontinental, within a mile, you would not contradict me?—A. Oh, no, I would not. At that time it was not certain where the Transcontinental would go. It was uncertain whether it would go north or south of Lake Abitibi, surveys were being made on both sides.

Q. In the matter of the crossing at Coal Creek and River du Sud, where various extensive fills and masonry structures were built, did you or your engineers protest against the extravagant methods used at these two points?—A. I cannot say that any protest was made. In fact, I am positive there was none made. The change from the original plan at Coal Creek was made under the representation by the Transcontinental Commission that under the agreement for filling that and building an arch culvert, works would cost the Commission no more, and it was agreed to by our general manager, naturally preferring a solid road to even a steel structure.

Q. But when it was found that the material in the vicinity was not suitable to make this fill, at the price of 50 cents, and this fill was being made of solid rock, did your representatives protest against this large amount of solid rock being used?—A. They did not, for the reason that representations were made by the district engineer that that clay material adjacent to that was of such a nature that the embankment would not stand, that it did slump out, that several thousand yards went away, that there was no material adjacent to the line or no material other than the old Intercolonial Railway ballast pit, some thirty-five miles away; the cost of overhauling being such, and under the agreement which had been made between the district engineer and the chief engineer for rock borrow, on other sections in which this rock borrow instead of being paid for at \$1.50 was paid for at about \$1.10 1-4, as I remember, and that embankment would be better; that if the material could not be got at less price no objection would be made.

Q. And for these reasons no objection was made?—A. Yes, that occurred to one or two sections on District A. That \$1.10 1-4 figured out by Mr. Foss, in figuring that the cost of the material, the cost of the overhaul of any kind of material, would altogether amount to an equal sum in price, and the rock for that purpose was better than the other material.

By Mr. Gutelius:

Q. What I am criticising you for is, that when you found that the cheaper material was not suitable, that you and your inspecting engineers, on account of your experience, did not suggest the construction of a wooden trestle until such time as it could be filled by the operating company. In the light of the fact that this fill has now cost \$420,000, would it not have been good engineering to have erected a wooden trestle?—A. It is a case of hindsight. We know very much better now what could have been done than we did at that time. The point was this: that the work was commenced, a trestle was put across there, the contractor commenced working, supposing he had material of a nature which would allow him to complete the embankment there. He only found three or four feet at most of clay before he struck rock, and the whole country adjacent is rock underlying three or four feet of clay. He did not make a clean shovel proposition.

By Mr. Staunton:

Q. Do you mean to say they started to make the fill and did not look beforehand if they had material more than three feet deep?—A. Yes.

Q. Did they want to put rock in there?—A. They had no idea there was any rock in that country.

Q. Why did they not think of that beforehand?—A. My dear sir, the surveys did not show any solid rock on that section. There were not any soundings

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taken; there was not any put into the original estimates; these original estimates were not worth a continental. I have always claimed that to Mr. Lumsden from the first, and Mr. Lumsden said it did not make any difference.

Q. Were there no cuts in that vicinity?—A. There was a cut to the westward.

Q. Did they see the rock when they made the cut?—A. They did not make the cut.

Q. Were there any cuts made before?—A. No, we built a temporary line for them, six miles, to get the machinery out; we paid the contractor \$25,000 for that.

Q. You had to get through that other fellow's contract?—A. Yes, that was the trouble with the country to get through originally; the contractors never went through that country.

Q. I cannot conceive of contractors or of railway builders of any experience, or of engineers, going into a country and undertaking to make a fill of clay, and not discovering until after they had put up the wooden trestles that there was only three feet of clay in that country, can you?—A. It looks strange now.

Q. Would it not look strange to you in any shape?—A. Look at the conditions under which all these contracts were taken.

Q. When he got on the ground, if I understand you correctly, the contractor erected a temporary wooden trestle?—A. For a small engine.

Q. And before he erected that trestle he did not discover that there were only three feet of soil on the rock?—A. My dear sir, there were acres cleared on the west end of that bridge, a high bank right west of the structure, and on a part of it there was no growth, it was a sandy loam on top, and, no rock being estimated, the contractor did not look for it.

Q. How far would he have to go down to get foundation for his timber trestle, he would not set it on a sandy soil?—A. Yes, he would; but he probably used sub-sills.

Q. Could he help coming on rock that was only three or four feet down when he was building his trestle?—A. If he did he would not make that agreement.

By Mr. Gutelius:

Q. They evidently discovered it in the first steam shovel cut?—A. Yes, I was there myself before work was done.

By Mr. Staunton:

Q. Do you put the blame on the Commission for that proposition?—A. I say we agreed to the proposition.

Q. Do you put the blame on the Commission for not having ascertained the conditions around there before they made this mess of the Coal Creek proposition?—A. I would not say whether the blame was there or not, the same rule would apply to all the work, there were no soundings taken.

Q. If you were chief engineer on that road and you had got into this scrape, would you not think it was because the proper precautions were not taken to ascertain the conditions?—A. Personally, I should have lengthened the steel trestles. I should not have attempted to make a fill, but when it was brought up to our manager that that fill could be made, at no greater cost than the original plan for a steel viaduct 1,100 feet long, which I always considered should have been lengthened 500 feet at least.

Q. I understand from you that the Commission represented that it could be filled with ordinary material, clay, is this right?—A. They assumed the earth filling in the excavation at \$1.30 a yard.

- Q. And that the material was at hand for that purpose?—A. Yes, sir.
- Q. Before an engineer makes a statement like that is it not his business to look below the surface of the ground and see what he has to expect there?—A. Practically speaking, yes.
- Q. Is it not absolutely his business?—A. It was not in this case or in many others.
- Q. Has a man any justification to assume that if there is clay on top it will continue down below in any part of the country?—A. The assumption was made.
- Q. Is it not a reckless assumption?—A. We know now that it was.
- Q. Would you do it tomorrow?—A. Oh no, I have learned considerable since I have been on the Grand Trunk Pacific and I had been engineering a good many years before I came there; in fact all my life I have been on public works.
- Q. That is the point, I asked you if with your years of experience you would not see what the material was before you bid on it?—A. You naturally would, and the contractor went and looked at that.
- Q. The contractor knew what this was?—A. He knew the same as the engineer knew.
- Q. You say the engineers, when they made this report, did not know what they were talking about. They made a report of which the Grand Trunk Pacific accepted, and they did not know what they were talking about, is that right?—A. As later ascertained, yes.
- Q. Not as later ascertained at all?—A. I do not want to throw discredit on the engineers any more than was necessary, because as was later ascertained they did not know what they were talking about. I would not throw discredit on the engineers in that particular instance.
- Q. You have to throw the credit or the discredit where it belongs; somebody did not know what he was talking about; it was all guess?—A. Had they waited and taken the necessary borings, which you say could have been done, they would not have commenced that work for years.
- Q. Had they taken the borings for three feet they would have done it in half a day?—A. They would not take any borings for three feet.
- Q. They could have dug it out with a shovel?—A. As afterwards ascertained, yes.
- Q. At this Coal Creek there was a contemplated expenditure for fill of \$400,000 or \$500,000?—A. No.
- Q. What was it?—A. About \$200,000.
- Q. Well we will put it at \$200,000; there was a contemplated expenditure of \$200,000, if you wish, for the fill at Coal Creek, the engineers were on the ground, and the Grand Trunk Pacific was on the ground. Now then you say that none of them ascertained that there was only a layer of three feet of sand and clay over the rock, and that they did not ascertain that fact until they had built the trestle; was it not somebody's duty to ascertain that fact? Before they made the contract or the change?—A. I have answered that question before; I say yes, in the light of subsequent events; they did not know what they were talking about in the light of subsequent events. There was nothing to indicate rocks in the stream itself in that creek on either side in the immediate vicinity.
- Q. As an engineer if you did not see any indications of rock in the vicinity, you do not look for it?—A. Ordinarily we do.
- Q. But when the Government is paying for it, they do not look for it?—A. It is not that.
- Q. That is what it seems to me, I do not know that I have met anything like it in my experience before?—A. There was so much money to be expended there anyway, and the proposition was, could it be done in any way that would give us better results, because we all know that a solid road bed is better than a steel structure, and that is why the change was made.

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By Mr. Gutelius:

Q. When it was discovered that this railway was costing more than originally contemplated in the interests of economy, and having in mind the possibility of improving the gradients and curvature, would you not, Mr. Woods, as an engineer, have introduced the velocity grades and sharper curvature, on the more expensive portions of this railway?—A. Had I been engineer for the company, I would undoubtedly have made suggestions of that nature, but I may go further. I would first cut out that line between Quebec and Moncton, which I always thought was unnecessary, and a very expensive proposition. I should have considered that a greater saving than any small reduction which might be made by increased curvature or a larger reduction by momentum grades.

By Mr. Staunton:

Q. You cannot see any commercial use for that portion of the railway east of Quebec?—A. There will be a certain commercial use by opening up a certain country, but nothing in comparison with the cost of it. That was a fixed thing which we looked upon as having been fixed politically, and that our company could not change.

Q. You had nothing to do with that?—A. Nothing.

Q. You say that was a matter of the policy of the Government?—A. Yes.

By Mr. Gutelius:

Q. The idea of abandoning the construction of the line east of Quebec, after you learned how expensive it was going to be, was it ever discussed between the officers of the Grand Trunk Pacific Company?—A. And the Commission.

Q. I want you to tell me, first, was it discussed between the officers of the Grand Trunk Pacific Company?—A. I distinctly remember a conversation I had with President Hays on that subject, in which I laid my views before him.

Q. What were your views?—A. That the cost of that line was entirely out of proportion to any results to be had by the construction and operation of it. His reply was that it was a point fixed by the Government and that he never was in favor of it, but he saw no way to change it.

By Mr. Staunton:

Q. If the Transcontinental Railway Commission had endeavored to make arrangements to enter different cities over other railroad tracks and have common terminals in different cities and towns, that would have saved a great deal of money?—A. Yes.

Q. Would it not have been the part of common prudence to have joined terminals with other railways, at least for some years, until they found what sort of traffic was going to develop on this railway?—A. There was little chance for joint terminals.

Q. I mean if they were obtainable and practicable. Take Moncton, for instance, would it not have been the part of prudence to have joined terminals with the Government Intercolonial Railway at Moncton?—A. It was always expected there would be a joint terminal there in the beginning.

Q. As a matter of business there should have been?—A. Probably there should have been.

Q. They would have saved a lot of money and instead of the Government owning two terminals at Moncton they could quite easily have got along with one for the Intercolonial and the Transcontinental?—A. Yes, if the Grand Trunk Pacific had known that there might not be a change in the Intercolonial; they had no assurance of that.

Q. But you could build terminals at any time?—A. Yes.

Q. If the Grand Trunk Pacific had owned the Intercolonial they would never have thought of constructing another road, to have separate terminals?—A. Surely not.

Q. The Government owned the two roads and they should have followed out that policy, should they not?—A. They possibly should. But when you come to an established policy of the Government, we had nothing to do with that.

Q. I am not talking about the Government policy, I am talking about the railroads and as a business proposition?—A. Yes.

Q. And when you come to Quebec, why should not that road come in on the Intercolonial at Levis and pass on the ferry to Quebec?—A. Because the Quebec bridge was under construction before this agreement was made and that brought the line where it was finally located.

Q. Speaking from an engineering point of view, what do you think?—A. I have told you before that I considered the line from Quebec east should not have been built.

Q. If you were building this road and you were going to Moncton, would not the natural thing have been to go into Quebec at the Louise basin?—A. No.

Q. Wait till you hear my question—would not the proper way have been for you to make an arrangement with the C. P. R. to have entered by the Louise basin, to cross by ferry, and to have gone out by the I. C. R. from Levis?—A. I want to answer that question by saying that it would have been, but that was not the policy of the Government.

Q. I am not asking you as to Government policy, I am asking you as an engineer and railway man?—A. I do not know what bearing that has on the case?

Q. Will you answer it?—A. No, I won't answer that question. I do not feel like answering that question; I do not feel that it has any bearing on the question under discussion between us; it is entirely foreign to the matter. I do not think it is a pertinent question to ask me. The location of the Transcontinental was placed where it was, adjacent to Quebec, simply because the Quebec bridge was under construction at the time this agreement was made. There was not any question then of crossing below, on the island, there was not any question of crossing above.

Q. Don't you know that before this road was built to either side of the river the Quebec bridge had fallen down?—A. Not before construction.

Q. How much was built?—A. We had been at work for two years. The Cap Rouge Viaduct, which cost \$800,000 was built before the Quebec Bridge fell; the Chaudiere River Bridge, which cost three-quarters of a million dollars, was built before the Quebec Bridge fell down.

Q. Would you have taken that location if the Quebec Bridge was not there?—A. I do not know that we would. I think that was a distance of forty-five miles that should have been examined into, and I think a better point could be found. I do not know that by actual examination, but I have every reason to believe it might have been.

By Mr. Gutelius:

Q. River du Sud is east of the Quebec Bridge; it has a forty foot arch and fill, and the cost of the forty foot arch and fill was \$246,551. Mr. Uniacke estimated a steel viaduct might have been constructed across that ravine at a cost of \$91,391 or a saving of \$155,000 in that one structure. Did you or your engineers make a study of the methods of crossing this river?—A. We did not.

Q. You simply accepted the design?—A. We accepted the design, supposing that that design had been worked out by the bridge engineer, Mr. Uniacke, and I personally did not know anything about it until the foundations of the arch were in and I visited the works and found a forty foot arch being constructed there, the foundation of which was considerably advanced at that time. I then asked if a steel structure might not have been built there more economically, but my recollection is that it was a large sand cut on the east in close proximity and on the west it was solid rock, and Mr. Doucet's explanation was that with that sand cut for filling no trestles would be necessary and that the simple price for common excavation would be paid; that it was equally as economical as a steel structure.

Q. Mr. Uniacke, in his estimates, states that 20,000 yards of common excavation would have been wasted in the event of the steel structure having been used at this point, which would have reduced the lump saving to \$149,000 instead of \$155,000?—A. There was a large cut there that would have been wasted. I never went into the figures and I merely recall that on the western side a fill would have to be made.

Q. If you had gone carefully into the figures at that time, don't you think in the light of what we all know now it would have paid to have abandoned the work you saw done at that arch?—A. It probably would. It would, however, require a long span. I presume Mr. Uniacke took that into consideration in his figures. That was a very rapid, turbulent stream. During construction the water came up from 15 feet to 20 feet in one night and washed away forms and caused some damage. It would require a considerable longer span to protect it.

Q. What have you to say about the crookedness of the stream and the size of the arch in connection with the possible height of water that may occur in this river, do you think there is sufficient waterway there now?—A. I think there is, protected as this is, both above and below by a retaining wall.

Q. And you are satisfied to accept that structure as good engineering, and if it washes out the expense of replacing it will be a maintenance expense and not one chargeable to deficiency in construction?—A. I would not agree to that.—You are tying me down there. But I have no fear of that washing out. I confess I am absolutely surprised at the cost of the arch.

By Mr. Staunton:

Q. It is an enormous arch?—A. Yes, but there is another forty foot arch a few miles from there and it only cost half as much.

By Mr. Gutelius:

Q. This is the arch where the 1 by 2 by 4 concrete was used?—A. Yes.

Q. Where would you construct the right of way fencing on a railway of this character?—A. Through the settled country; through the unsettled country where the farmer settlers were coming in, simply covering their farms.

Q. You would only protect against cattle where?—A. In civilization.

Q. Would you expend any considerable amount of money for the sole purpose of draining borrow pits in that north country?—A. Not for draining borrow pits but for draining the country, yes.

By Mr. Staunton:

Q. What has the railroad to do with draining the country?—A. Where you have the solid road, that is in danger from water all the time, you would drain the country, I mean draining the country passed over by the railway.

By Mr. Gutelius:

Q. An undertaking was entered into, between the Commissioners and the Grand Trunk Pacific, whereby the Commissioners are utilizing eleven miles at the west end of the Lake Superior Branch. The Commissioners gave the Grand Trunk Pacific actual cost for all the work that has been done on these eleven miles. You are familiar with this contract, are you not?—A. Yes sir.

Q. In deviating the main line so as to obviate the necessity for duplicating these eleven miles, the Commissioners lengthened the main line of the Transcontinental, one and four-tenths miles, is that right?—A. Probably it is about right, I thought it was less than that, but I won't be sure. I know the distance was about that.

Q. We find in the estimates that the shorter line could have been constructed for \$197,000 less than was expended on the eleven miles taken over from the Grand Trunk Pacific, that is, less than the estimated cost of the eleven miles. The point I wish to make is, that in making this deal the Commissioners should have received value from the Grand Trunk Pacific for the \$197,000, would that have been an unreasonable demand on the part of the Commissioners?—A. I certainly think it would be, because you have to know the value or the cost of the eleven and a half miles, you have as a matter of fact the known cost of that, but you have only the approximate value of the cost of the shorter line. The approximate values never come out under the Transcontinental Railway Commission.

Q. We had the approximate value in both cases at that time?—A. Well no, the eleven and a half miles was built at that time, and we knew that exact cost of it. We had nothing but the approximate cost of the other.

Q. What percentage of the grading was done at that time?—A. It was all done. We had paid so much for that and rendered a statement showing the exact amount we had paid, Foley, Walsh & Stewart for that to the Commission before it was taken over by them.

Q. How much money was involved?—A. I made a return to Mr. Lumsden of the money we had expended there, and he gave us, as I recall it, that amount less ten per cent. Later on the work was carried on by Mullarkey, O'Brien & Fuller, and we did some of that work and the Commissioners paid for it.

Q. The portion of the work actually done was as \$331,000 is to \$1,470,000?—A. Since that time track-laying and ballasting that double-track bridge over the river have been added to that, and all the work done in the yard at Graham.

Q. Should not the Commissioners have received some return for lengthening their line one and four-tenths miles to lessen your branch line by eleven miles?—A. No, I think it would be utter folly to build two lines parallel within a mile of each other. The railway would not have been as good and we could not have connected with the Transcontinental as well.

Q. But the Commission actually paid for and built one and four-tenths miles more railway than it would have required in order to save you people from building a second track, and you gave nothing for it. Was there not some middle ground they should have reached in connection with this transaction?—A. I always took the ground that that was hardly a debatable subject. The additional cost of that section there, you must remember, takes into consideration the yards at Graham, the engine house, and all that sort of thing, which would have been built by the other line, and it is questionable if there was as favorable a point at which it could have been built.

Q. Assuming it was definitely known that the Commissioners were going to expend \$194,000 more than it was definitely known was necessary, and in expending that amount of money they paid the Grand Trunk Pacific something like one million dollars, ought not the Commission have been recouped for the \$195,000?—A. If that were true, yes, but I think that statement is very far from being true, always considering that the Commission paid nothing more than they should have paid there. I have always considered it was folly to build another line parallel to them.

MR. STAUNTON: I don't see why they didn't let you continue to own it.
The witness was not further examined.