(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN ON TRAIN AT EDMUNDSTON, JUNE 22nd, 1912.)

R. M. CHARLTON, sworn:

By the Chairman:

Q. You are an engineer by profession?—A. Yes.

Q. And have been engaged in your profession for how long?—A. Fifteen years.

Q. You are divisional engineer on this road in what division?—A. Division one.

Q. What mileage?—A. 150 to 203.

Q. And where were you engaged in railway construction before you came on to the Transcontinental?—A. On the Quebec Central Railway, Toronto Belt Line Railway, Chateauguay and Northern Railway, and Montreal Terminal Railway.

Q. How long have you been in the employment of the Transcontinental?—A. About May, 1905.

Q. Have you been engaged on this division all the time?—A. I was on location.

Q. First on location?—A. Yes.

Q. After the location did you come into this division?—A. No, I came into division three.

Q. You were there for how long?—A. A part of a season.

Q. How long have you been on the present division?—A. 1909.

Q. In making your classification what do you classify as solid rock?—A. Ledge rock and mixed material. Mixed material is boulders in masses.

Q. Divide each of them; what do you mean by boulders?—A. One man stone up and any size in masses.

Q. What is a one man stone?—A. A stone that one man will handle.

Q. When you speak of a stone that one man will handle, you mean that he is able to handle?—A. Yes.

Q. And in masses; what do you mean by that?—A. Well, touching one another.

Q. You do not mean held firmly together?—A. Well, they might be held firmly together.

Q. But you do not mean necessarily held firmly together?—A. No.

Q. If you see a pile of stone which you consider is such a size that one man can only conveniently handle one stone at a time, that is solid rock in your estimation?—A. Yes, all the stones could be handled by one man.

Q. I say where each rock could be conveniently handled by one man?—A. No.

Q. What do you mean?—A. I mean from the size one man could handle up; but if there was only one stone one man could handle I would not classify it as solid rock.

Q. Do you classify as solid rock a mass of stones that one man can handle?—A. No.

Q. Why did you say you did? I wish you would give me your definitions without taking them back, because you said so in the beginning. It is a matter of indifference which it is, but I want you to be definite about it?—A. Allow me to say, a stone that one man will handle in size up to three or four yards.

Q. Then my question to you was, if you find a pile of stone touching each other, each of which one man can conveniently handle, do you classify that as solid rock?—A. No.

Q. What do you class it as?—A. Loose rock.

Q. Then do you adhere to the specification——A. Yes.

Q. Wait a moment; do you adhere to the specification which says that all stones and boulders measuring one cubic foot and less than one cubic yard shall be considered loose rock?—A. I adhere to that when you get one boulder in one place—isolated boulders.

Q. Do you adhere to that when there is more than one boulder in one place?—A. No, I follow instructions issued by Mr. Lumsden.

Q. Do those instructions contradict what I have read to you?—A. No, they interpret it.

Q. Have you those instructions by Mr. Lumsden?—A. I have not them with me.

Q. I wish you would explain to me frankly what you mean by that. Tell me what stones you do class as solid rock?—A. In a cut where it may be all common and a few boulders, if the boulders measure one cubic yard they are solid rock; if they measure three feet they are loose rock, and anything under that is common.

Q. Then you do not classify boulders of less than a cubic yard as solid rock?—A. Except where they appear in masses.

Q. And in what condition are they when they appear in masses?—A. A mass of irregular rock of varying size from half a yard up, or a stone that one man will handle, up.

Q. Which may or may not adhere together?—A. Yes.

Q. How big a stone can one man handle?—A. Usually a stone weighing about 200 pounds.

Q. How big is that?—A. I imagine a stone that would cube a foot and a half, say.

Q. Is that the instruction given to you by Mr. Lumsden?—(Producing instruction.) A. Yes.

Q. Will you show me under that where you get your one man stone?—A. One man stone right in here. (Pointing.)

Q. Is it number 5?—A. Number 5.

Q. Then number 5 on this blue print is rock in masses of over one cubic yard, assembled rock which, in the judgment of the engineer, can be best removed by blasting. Do you allow him any rock in masses which does not require to be blasted?—A. Nothing except boulders, which are removed by a derrick, or something of that kind—stone boat.

Q. You do not blast rock which is not joined together, do you?—A. Yes.

Q. Do you blast rocks which are just packed together, without anything making them adhere to each other?—A. Yes.

Q. That is to say, small boulders?—A. Yes.

Q. You put a charge in among small boulders?—A. To loosen them up, yes.

Q. When they do not adhere to each other; is that right?—A. That is right.

Q. Will you tell me where you find any of that class of solid rock on your division?—A. Do you want a number of instances?

Q. Yes, give me specific instances?—A. Station 8726 to 8735.

Q. What mileage is that?—A. Mileage 165.4.

Q. What do you find there?—A. Pockets of rock and mixed material on the top.

Q. What is the classification in quantities?—A. The percentage of classification in that cut works out to 55 and 45.

Q. 55 what?—A. Per cent.

Q. Of what?—A. Solid, and 45 per cent loose.

Q. No common?—A. No common.

Q. Do you ignore the covering of earth, or do you always take it into consideration?—A. I ignore the first foot of soft stuff on the top, where it is mixed with roots and stone; that is land that has not been ploughed.

Q. What do you allow that as?—A. Loose rock.

Q. Where do you find that authority in the specification?—A. I find where it says that the land cannot be ploughed.

Q. We will deal with that later. Now, where else is there assembled rock?—A. At mileage 171.9.

Q. What do you say about that?—A. The former remarks about pockets of rock apply here also.

Q. Do you say there is no common there?—A. No common.

Q. My note is that there was about a third of that common; you say there is none whatever?—A. I have not returned any common.

Q. Did you examine it yourself?—A. Yes.

Q. Part of it is assembled rock?—A. Yes.

Q. Will you tell me where else there is assembled rock?—A. Shall I give you the ten miles from Long Lake?—A. Yes.

Q. Assembled rock occurs in different points, mile 180 to mile 200—that includes 20 miles.

Q. Can you give me anything where I will find any large quantity of it? Give me two or three instances where it is in large quantities?—A. Station 10,071, mile 190.7, the classification figures out 61 and 39 per cent.

Q. No common?—A. No common.

By Mr. Gutelius:

Q. Was that 61 per cent assembled rock?—A. I have not the details of that here. I have just got the gross quantity. I could safely say, though, that if there were any boulders in the cut, or ledge, it would be included in the 61 per cent. I am not prepared to state whether there is any ledge in that cut or not. I have no notes of it here.

Q. Is the information you are giving based on your personal knowledge, or what you have taken from your books?—A. This information is based on my inspection of the work at different times during the month, while it was in progress.

Q. Is there assembled rock in the cut at mileage 197.5, and if so, how much? A. There is ledge rock 743 yards.

Q. How much assembled rock?—A. Assembled rock, 1,000 yards.

Q. And the cut at 191.8, how many yards of assembled rock?—A. I am taking these notes from a final estimate, and if you will confine yourself to Residency one, I can give you the details; if you require other Residencies, I have not the final.

Q. Where does Residency one run?—A. From mileage 193 to 203.4.

Q. What assembled rock was there in the cut at mileage 1904?—A. I will have to correct that again. I have just got one contract here final, contract from Long Lake Narrows, and it is from mileage 195.

Q. What assembled rock is there in the cut at 197.5? The cut seems to contain about 4200 yards all told?—A. I have a cut here of 3900 yards; is that the one?

Q. It is given here 1,000 yards solid and 2,300 yards loose?—A. Yes; 4272; the ledge is 239 yards and the assembled rock material 635.

Q. Is there any other solid?—A. Yes, there is sub-grading 74 yards; there was ledge in the bottom of that cut and ten yards in the cut ditch; surface boulders 89 yards. I am not giving you the fraction of a yard.

Q. 196.4; what are the various kinds of solid rock?—A. Ledge rock 1725 yards.

Q. This cut only has 1700 yards in it?—A. This is 196.4; ledge rock 1725 and rock outside the slopes 705; that is still ledge.

Q. That is like overbreak?—A. Yes.

Q. Which was allowed?—A. Yes. Sub-grade 373 yards of solid and a cut ditch 12 yards of solid and 39 of boulders.

By the Chairman:

Q. Was there any common there at all?—A. No, no common in that cut.

Q. And no assembled rock in that cut?—A. I gave you the assembled rock, I think 1096 yards.

Q. No, there is no assembled rock?—A. Oh, no; there is no assembled stuff. If it is not large enough to be classified as solid rock it goes in as loose; there is 1096 yards of it.

Q. Do you classify all the shale in your district as solid rock?—A. Yes.

Q. All shale?—A. Yes.

Q. Is there any of the shale that could be taken out, or was it taken out without blasting?—A. No.

Q. Not any on top even?—A. I do not know of any. I would have seen it if it had been possible to take it out.

Q. Have you any conglomerate in your district?—A. Will you define the term?

Q. I am taking the instructions, conglomerate rock and plum pudding stones, number three of this blue print?—A. Is that cemented?

Q. I do not know. Have you found anything that you bring within that definition?—A. I have seen such material.

Q. Is there any in your district?—A. Yes.

Q. Where?—A. It applies to pockets in these cuts you have already information on.

Q. Can you tell me which they are? I want it specifically. I will ask you to give me a reference to one or two of them?—A. At about mile 171.9.

Q. Is that rock cemented together?—A. I should not like to say that it is cemented together, but it is pretty solidly packed with material between it, very hard. It will stand—a face will stand.

Q. But it is not cemented together?—A. It is cemented to a certain extent.

Q. Is it cemented or is it not? You are swearing to this. You know, as an engineer, what cemented is; is it cemented together?—A. I would like to find you a good instance.

Q. I should like you to answer the question?—A. I am trying to think just how that material is there. I know the rock is there in pockets, but it is very difficult for me to say from memory just if it is cemented or not. I know that it will stand a face.

Q. Will you class it as conglomerate if it is not cemented together?—A. Allow me to say that I would classify the rock that is in pockets there under either three or five of these instructions.

Q. That is not the question I am asking. Will you classify rock as conglomerate which is not cemented together?—A. No.

Q. Will you classify rock as masses which is not cemented together?—A. Yes.

Q. Will you classify rock as solid which lies in masses not cemented together, but embedded in other material?—A. Yes.

Q. Will you tell me where you have done that?—A. I have done it in all instances of those cuts, the notes of which you have taken so far.

Q. Which cuts do you speak of?—A. I have not kept a note of them.

Q. You mean that I have taken so far to-day?—A. Yes.

Q. Then you necessarily measured as solid rock the material in which these stones are lying?—A. Yes. If a stone is isolated, the stone is measured; it would be a boulder; if it were in masses, the mass is measured.

Q. Including in the measurement the material lying between the stones?—A. Yes.

Q. And how are those stones taken out?—A. They are, first of all, blasted, to loosen them. The large ones are bulldozed.

Q. What does that mean?—A. That means exploding powder on the top of them, or drilled.

Q. And then?—A. Then they are removed in some instances by derrick on to cars and carried to the dump.

Q. And in others?—A. Put on waggons, dump carts, broken up small enough for several men to handle; they are put on a stone barrow.

Q. Those are all very large stones you are speaking of?—A. I am speaking of the classification such as I have described to you.

Q. Do I misunderstand you when I infer that you mean that you allow as solid rock stones of any size lying embedded in other material which requires blasting?—A. Well, I have no instance of that.

Q. The stones you speak of are how large?—A. From one and a half cubic feet up; it might be two or three hundred cubic feet, four or five or six yards.

Q. You told me that you ignore the earth covering when it is full of roots? A. Yes.

Q. They prevent it from being ploughed?—A. Yes.

Q. Do you allow grubbing in that material?—A. No; grubbing is allowed according to the specification; I think it is there feet.

Q. You allow grubbing in that material; does not the grubbing take the roots out?—A. Yes, the grubbing takes the roots out.

Q. Could you plough the material?—A. If it were grubbed?

Q. Yes?—A. In some instances, if there were not too many surface boulders.

Q. I am not talking about surface boulders; you told me you disallowed it as common when it was full of roots?—A. Yes.

Q. Now, you pay the man for taking the roots out, do you not?—A. You pay the man for grubbing up to two feet.

Q. I am speaking of earth which is lying over the top of the rock and may go two or three feet in depth. I want to know if you ignore that, and you tell me you do when it is so full of roots that it cannot be ploughed?—A. Yes.

Q. The man gets paid for taking the roots out, does he not?—A. Yes.

Q. When he takes the root out the material is left there?—A. Yes.

Q. Then the material has to be removed. Do you put that in as common? —A. No.

Q. What do you put it in as?—A. It goes in possibly with the balance of the cut, whatever it is classified.

Q. That may make a serious difference in the classification, may it not?—A. It will make a slight difference.

Q. You should not do it, should you?—A. I believe I am doing right.

Q. By what authority do you say that?—A. Because it is impossible for a man to plough perhaps ten or fifteen feet.

Q. What do you mean by ploughing ten or fifteen feet?—A. Well, he would run up against boulders he would have to get round; he could not get his plough in to plough it.

Q. Do you mean to say that, although the material itself is ploughable, that because a man will encounter the boulders on his way, that you allow that as solid material?—A. Stripping, yes.

Q. I pointed out to you, did I not, the place where, at about mileage 194, there was 19,700 yards of solid in that?—A. What information do you desire in that cut?

Q. You remember you and I examined that spot together?—A. At mile 194?
Q. Yes?—A. Yes.
Q. Do you remember my asking you at that time whether there was not one to two feet of common excavation on top of it?—A. I will just give you the account of it—
Q. Did I not ask you on the ground if there was not one to two feet of common on top of it? Do you remember my asking you on the ground, when we were examining it, whether there was not one to two feet of common on top of that?—A. I do not remember the question particularly.
Q. Don't you remember me asking as to that one place?—A. I remember you asking me at one place; I do not remember if that was the cut.
Q. Do you remember my asking you at one place at which you said there was?—A. No.
Q. You do not?—A. I remember saying at several places that there was; I do not remember you asking me the question.
Q. Do you remember my asking you at any place if that was not common on top of that rock from one to two feet, in which you answered to me that it was so? I hope you are going to be candid?—A. I desire to be candid.
Q. You know you and I went over that very place, and I went up on top of it and examined it, and pointed it out to you, and you agreed; you remember that, do you not?—A. I do not remember that.
Q. Do you remember my pointing it out to you and your saying that there was a quantity of common on top of any cut?—A. Yes, I think I remember saying something about that.
Q. I suggest to you that it was at 194; how much common did you allow there?—A. I think it was 150 yards of common.
Q. If there is a foot of common over that cut how much should you have allowed?—A. It is a pretty long cut. I should figure it for you. That cut is just about 1,000 feet long.

By Mr. Gutelius:

Q. About what would the average width be?—A. It is rather difficult to say; it is not one you can average very conveniently.
Q. Say that it will average 12 feet high; fifty feet wide on top?—A. Well, following out that, it would be two yards to a foot, approximately, or 2,000 yards.

By the Chairman:

Q. If I am right in saying that there is a foot of common on there, your classification is entirely wrong, is it not, at that place?—A. If you are right, I am wrong.
Q. You are entirely wrong, to a very great extent. Would you look up and tell me in your book what the total classification of that cut is?—A. 13,600 yards solid and 150 of common. You might make a note that my quantities do not correspond with your quantities. There may have been a subsequent estimate. I have not a note of it here.

By Mr. Gutelius:

Q. Both estimates agree in the 150 common?—A. Well, then, there is a subsequent estimate, and I am inclined to say that your figures are correct.

By the Chairman:

Q. Have you your resident engineer's book on that?—A. No.
Q. Did the resident engineer make that classification?—A. Yes, assisted by myself.

Q. Did he keep a record of it?—A. That I cannot tell you; he should have kept a record.

Q. Is it not his duty to do so?—A. Yes.

Q. Did you go personally over the classification with the resident engineer?—A. Yes.

Q. Did you govern in the judgment?—A. Assisted by him.

Q. Did you govern?—A. Certainly I governed.

Q. He did not make an estimate himself and return it to you and you afterwards go and examine it?—A. I examined it before.

Q. Did he make a classification of any of this division independently of you?—A. Yes.

Q. Of this particular part, did he?—A. Yes.

Q. And did he put it in writing?—A. No. I have asked him in walking over the line, "What is your classification for this material in a certain cut?"

Q. I want to know if the resident engineers made any independent classification in writing in their residencies?—A. No.

Q. Did they keep any records themselves of classification?—A. Yes, they kept records.

Q. Were those records dictated to you or made by themselves, without your intervention?—A. Made by themselves.

Q. Then they did keep records and they did make them independently of you?—A. Yes.

Q. Who is the resident engineer in this place?—A. There are three.

Q. Who are they?—A. G. Lemesurier, J. H. Laflamme and J. P. Menard.

Q. Where are these men now?—A. I do not know where Lemesurier is, or where Laflamme is; I understand Laflamme lives in Quebec. He can be reached. Menard is on the work.

Q. Up here?—A. Yes.

Q. What becomes of these men's record when they leave the work?—A. Supposed to turn in their records.

Q. Who has them?—A. They would be turned over to the man who takes the Residency. You see Laflamme would turn them over to his successor.

Q. Are there any resident engineers on these works now?—A. Yes.

Q. And they are supposed to have them?—A. Yes.

Q. Will you ask the resident engineer on this section to send in the resident engineer's record of this cut 194?—A. Yes.

By Mr. Gutelius:

Q. Who was resident engineer at the time you made the classification on this cut 194?—A. There were two men at different times. Le Mesurier was first and then Laflamme.

Q. I understand you to say he would have his own independent record of this cut?—A. Yes.

Q. Did you correct any of their classification?—A. Yes.

Q. Did you raise their classification?—A. In instances.

Q. Can you recall any important instances in which you did?—A. No. Wherever I thought the classification was not sufficiently high, I instructed the resident engineer to give them what I thought was proper.

Q. Take 190.9; how did you make up the solid rock there?—A. That is not final, and I have not the notes of it in detail, such as I have of the other Residency.

Q. What can you give me in that?—A. All I can give you there is the general classification, which is 61 per cent solid and 39 per cent of loose.

Q. I have got it very much different from that; I have it 14,300 yards of solid, 2,400 of loose, and 791 of common?—A. Perhaps we are not on the same cut.

Q. This is cut 190.9?—A. It is the adjacent cut; instead of 190.09 it is 191.1.

Q. What have you there?—A. I have 14110 of solid, 1330 of loose, and 791 of common.

Q. Can you tell me what the solid is there? My note is that this should be all common and loose. It is cleared behind it, and I saw no solid in it at all?—A. Well, I have not got any further detailed notes of that cut.

Q. You have nothing that you could enlighten me on in that?—A. No, I have nothing.

Q. When you make up your final what do you do? Go over it again?—A. No, it is taken from the field notes.

Q. Who has the field notes?—A. The resident engineer.

Q. Those field notes are what we want to see. Are those field notes made up in consultation with you, or independently of you?—A. By my instructions, and sometimes independently of me, if it is an important cut.

Q. Why does he not do it himself and then submit it for your revision?—A. Well, it would entail too much work, possibly, if he had to revise it.

Q. Is there any use of his being there at all? What use is the resident engineer?—A. The resident engineer lays out the work and conducts it.

Q. He is no use in regard to the classification at all, is he?—A. Yes, he consults me about his classification, and I ask him what the material has been since my last visit, and we decide what is going to be the classification for the work that has been done so far.

Q. As to overbreak; did you make any deductions for overbreak?—A. Yes.

Q. In many cases?—A. In all instances where the overbreak could have been avoided.

Q. How did you judge as to whether it could be avoided?—A. Well, where it was a elide or vein or bed.

Q. Did you see it done yourself?—A. No.

Q. Had you any more opportunity for judging it than anybody else has?—A. No.

Q. Then you had to exercise your best judgment, viewing the cut afterwards?—A. Yes.

Q. I understand from you that some of your fills are made with rock borrow; that is right, is it?—A. One fill.

Q. That is the fill along Long Lake?—A. Yes, Long Lake Narrows.

Q. And for that the contractor was paid the price $1.65?—A. $1.85 a yard.

Q. For that borrow?—A. Yes.

Q. On what authority was he paid that money?—A. An extra work order.

Q. Have you a copy of the extra work order?—A. No, there is a copy attached to the progress estimate. It was made in duplicate, I believe, and there is a copy in Ottawa and a copy in Quebec.

Q. By whom was that extra work order made?—A. Mr. Grant, I think.

Q. The engineer in chief?—A. Yes.

Q. But, at all events, wherever you made that allowance, it was made under the authority of that order?—A. Yes. I am not quite certain, but I think the number of the order was 196, if that would assist you in hunting it up.

By Mr. Gutelius:

Q. Refer to the profile, 201 to 203. In the interest of economy, could the grade have been laid lower than it was built?—A. I do not like to criticise this work, Mr. Gutelius. I did not do the location. I have not studied that question.

Q. Would lowering the grade of the profile have reduced the quantity of material in those fills?—A. If it had been possible to reduce the grade, the

quantities in the fills would have been reduced and the quantities in the cuts increased.

By the Chairman:

Q. The quantities in the cuts increased?—A. Yes.

By Mr. Gutelius:

Q. And the relative amounts of filling are very much greater than the relative amount of cut?—A. Yes, that is as it appears on the profile.

Q. It would be possible for our engineers at Ottawa to figure in dollars what the difference would be from the profile and cross-section?—A. Yes.

Q. You remember the cut in which the photograph was taken, assembled rock, 189.42; 4,000 yards of solid, 200 loose and 300 common?—A. Yes, I have it here.

Q. You remember the cut at 189.4, where a photograph was taken of some assembled rock, in which your picture and those of the Commission appear?—A. Yes.

Q. The boulders embedded in that clay-like material were about what you would call one man stone?—A. Yes.

Q. Is that a fair sample of assembled rock under your classification?—A. Yes.

Q. Those individual stones on that hill side could have been taken out with a pick and bar?—A. Yes.

Q. Was all overbreak in the shale rock cuts on your division turned in as solid rock, or all loose rock?—A. Would you like an instance?

Q. Better answer me generally, if you can. Could there have been any overbreak in shale that came down that you would call solid rock?—A. Yes, and there is some came down that I would classify as part loose. You mean overbreak?

Q. Yes?—A. From excessive use of powder?

Q. Yes; was there legitimate overbreak classified as solid rock, regardless of its condition when it fell into the cut? Did you give him it all as solid rock?—A. Yes.

Q. Where it was legitimate overbreak?—A. Yes.

Q. Regardless of the condition in which you found it in the cut?—A. Yes. Of course you could not tell what part of it came off there, because it left it and dropped. It was not taken out in benches.

Q. After the shale was broken up by powder, was it not frequently easier to handle than loose rock?—A. Some of it came down like little laminations, that you could shovel right into the cart?—A. Yes; some came down in masses, which required other blasting.

Q. But there was a portion, after the blasting was over, that was small enough to handle immediately with a shovel?—A. Yes.

Q. You did not take that into account; you gave them solid rock?—A. Yes, gave them solid rock.

Q. Both for the centre cut and for legitimate overbreak?—A. Yes.

Q. That is, you gave some legitimate solid rock overbreak which in the cut was loose rock?—A. I do not quite understand that. Where the form of the cut is solid, take legitimate overbreak, say on a seam or something of the kind, coming into the cut on overbreak—that is overbreak, and it is paid for as solid rock.

Q. And it loosened it up so that it could be taken out with a steam shovel, and much of it with a hand shovel, still you gave the overbreak as solid rock?—A. Yes.

Q. The specification in the matter of overbreak reads——A. I think it is the classification of slides, is it not? I remember it.

Q. Clause 38 of the specification 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?" Do you understand that that means its condition after the shot has been fired?—A. Regardless of previous conditions, yes; previous conditions means previous to the shot being fired.

Q. Then you have classified in legitimate overbreak solid rock which, under this classification, ought to have been called loose rock?—A. Well, a percentage of it. I can give you the percentage.

Q. You have given some percentages of loose rock?—A. Yes.

Q. In legitimate overbreak?—A. In legitimate overbreak. I can say generally always 25 per cent.

By the Chairman:

Q. You said distinctly you classified it as solid rock?—A. I understood Mr. Gutelius to ask me if solid rock had been given.

Q. Stuff that could be moved by shovel?—A. Solid rock that had come down in a cut in a slide, and some parts of it could be handled with a shovel, and he asked me if I had given solid rock classification.

Q. You should not have answered the question till you understood it. You were asked distinctly whether or not you had given solid rock classification for material which, after a shot, could be moved by shovelling, and you said yes. What do you say now?—A. I still say yes. I would like to clear it up. Take legitimate overbreak: take, for instance, a cut; it is not a seam, but it is a foot or so wider than our diagram classifies; it is a little more than a quarter to one slope, and where the man has broken that, and say a foot or two feet wider, I have given solid rock.

Q. No matter whether it was pulverized when it fell into the cut?—A. No matter whether it is pulverized when it is in the cut, because I consider the cut has been taken out as closely as it is possible to work. That would cover the places where the solid rock has been given in overbreak.

By Mr. Gutelius:

Q. Then in those shale cuts where blasting reduced the material so that it could be shovelled without picking, you did give legitimate overbreak as solid rock?—A. I would like to give you one instance.

Q. Answer the question?—A. I cannot answer it in a general way.

Q. Better try and answer it?—A. I have allowed solid rock in overbreak where the overbreak has not been excessive and beyond the control of the contractor, and in small quantities or in small cuts, some solid rock has been allowed.

Q. Regardless of its condition after the shots are fired?—A. Yes. Can I go on, further?

Q. Anything you like?—A. In a number of instances where considerable overbreak occurred, it has been returned at a percentage of loose rock. You understand what I mean is that some solid and some loose has been given. It has been classified. Is that clear to you?

By the Chairman:

Q. I think I understand you, that you have not allowed overbreak, excepting legitimate overbreak, at all: is that right?—A. Yes.

Q. That you have described to us what you consider legitimate overbreak, I am talking now of shale cuttings?—A. Yes.

Q. And that, although that overbreak has come down into the cut after the shot in such a condition that it may be moved by shovels, you have sometimes allowed it as solid in small amounts?—Yes.

Q. And in others you have allowed it as loose rock?—A. Yes.

Q. Why did you allow it as loose rock if it could be shovelled like earth?—A. I should say common practice.

Q. What you have done you have done, and we want you to tell us. Your judgment may have been wrong and it may have been right. There is a man above you always to see your classifications are properly supervised, just like you are above the other men. I am not making any reflections upon you. I am asking you just to ascertain what you did do. It is your judgment, it is your classification, and if they do not like it they have a right to revise it, so that there is no use in not being candid about this matter. You say in that case you allowed it because you considered it is the custom to do so?—A. Yes.

Q. Do you say that where you allowed that what I consider is a substantial matter, where you allowed this earth on top of these cuts as solid, where you say the roots were in it—do you say you were following custom in doing that?—A. Yes. You might correct that. There is a certain part of that material in all those cuts which is loose rock.

Q. What I am speaking of is the plain case, that any man can see, that I went over myself?—A. Soft material overlying the hard rock?

Q. Yes, it is not only soft material, but a light sandy loam, and the fields are actually ploughed alongside of it, and there is no common allowed there. I want to know why that is done?—A. Well, I am following common practice.

Q. And if the fields could be ploughed that could be ploughed, could it not?—A. It certainly could. You refer still to that big cut?

Q. I refer to half a dozen that I found in that condition?—(No answer.)

By Mr. Gutelius:

Q. Is your classification entirely in accordance with your personal ideas as an engineer based on these specifications?—A. My classification has been made according to my best judgment and reading of the specification, and has, in some instances, been revised and reduced by my superior officer.

Q. Was it ever increased by your superior officers?—A. Yes.

Q. Will you give us an instance?—A. Cut, mile 165.4, my classification was increased in that cut.

Q. What was done?—A. My classification was increased.

Q. What did it consist of?—A. The overlying stuff over the rock. There was ledge in the cut; it was mixed with boulders; pretty hard material.

Q. The solid rock was increased?—A. Yes.

Q. How much?—A. About ten per cent.

Q. Were there many instances of that?—A. One or two. I think I can give you another one here, a cut that you noticed particularly, at mile 167.5; that is that big cut on the east side of the Boucanne River: the overlying material was classified by the inspection party; my classification was increased slightly.

Q. More loose rock?—A. More solid rock.

Q. This was a shale cut—shale rock?—A. No, that is pretty hard rock.

Q. The solid rock was increased?—A. Slightly.

Q. Can you give no idea of the number of yards?—A. I can give you a better idea of the percentage. It would make a difference of 1400 yards in the cut.

Q. Increase of 1400 yards possibly of solid?—A. Yes.

Q. You spoke of your superior officers coming along over the cuts. Did they make a special trip on classification?—A. No. My work was visited.

Q. Who were the people who revised your classification by examining the ground?—A. I received my instructions direct from Mr. Doucet.

Q. Who was with him on that trip?—A. I am speaking generally of several trips.

Q. Well, usually?—A. Mr. Huestis and the G.T.P. inspecting engineer, Mr. Fotheringham.

Q. Did the G.T.P. engineer object to this increased classification which you have told us of?—A. No.

Q. He concurred?—A. Yes.

Q. If left to yourself, you would not have given that extra classification?—A. No, I would like to qualify that. I wanted some instructions on that material, because I had difficulty in classifying it. I could not make up my mind just what I should return it as.

Q. You were the engineer in charge of the location of the one per cent pusher grade?—A. I ran a preliminary line.

Q. Not more than the preliminary?—A. No.

Q. Who ran the final location?—A. E. B. Bartlett.

Q. At mileage 168 to mileage 170; in the interest of economy, could the railway have been built cheaper by laying further south along the hill; just say generally?—A. The fills may be reduced by removing the line up hill.

Q. The amount of yards and money to be saved could be figured from the data that they have in the office?—A. Yes.

Q. Contours and profiles?—A. Yes.

Q. Did you ever consider in the specification that the clause with respect to ploughing was merely a test of the hardness of material?—A. No. I consider it as a method to take out the material.

Q. If you had been instructed that this ploughing clause was a test only, would it have influenced you in your classification?—A. No.

Q. It would not have influenced you?—A. I do not think so. I followed the general practice.

Q. You would not adopt a specification whose wording varied from the general practice?—A. Certainly I would adopt the specification where it varied from the general practice.

Q. But in this case you paid no attention to the plough test?—A. No, I considered it impossible to plough it—to take out the cuts by ploughing.

Q. But we read this to be a test of hardness of material, the same as driving a pipe into material would be a test?—A. Yes.

Q. But you threw it aside?—A. Let me read the clause. (Witness reads clause).

Q. If it was a test, you did not use it?—A. No, we did not.

Q. In the assembled rock it says "Which, in the judgment of the engineer, can best be removed by blasting." You paid no attention to the blasting feature in connection with your assembled rock?—A. Will you explain what you mean?

Q. You allowed assembled rock where rock was found in masses, whether it was taken out by blasting or not?—A. The method of the removal of the rock did not influence my classification.

Q. Mr. Lumsdon in his instructions says "Which, in the judgment of the Engineer, can best be removed by blasting"?—A. Yes.

Q. The blasting feature cut no figure with you?—A. Let me qualify that. For instance, if there was a rock of twenty cubic yards, a boulder, I classified that as solid rock. If the contractor desired to take a derrick and take it out, or roll it into the embankment, or remove it in any way without using powder, it did not influence me. I classified according to the material.

Q. But give us an instance in assembled rock where it was taken out with a pick without blasting, and still allowed as assembled rock?—A. There is no instance of that kind.

Q. Then the case where the picture was taken is not a typical case of assembled rock?—A. Those rocks right on the side there would have to be loosened and have been loosened by blasting.

By the Chairman:

Q. That sort of stuff?—A. Yes.

Q. I am astonished that you say it would have to be blasted. It is common earth in between?—A. Well, it would have to be loosened; that is the cheapest way.

By Mr. Gutelius:

Q. Could that stuff not be worked out of a face, one rock after another, rolled down in there and rolled on to the stone boat, and taken out without any shooting? There is always one loose rock in a face that you can get at?—A. Yes.

Q. And then its neighbour loosens?—A. The stuff surrounding the rock is so hard that a man would move very little of it in a day picking, if he could pick: and imagine, before these things are lossened by powder, how tightly they are packed together. Men cannot get hold of them: some of them we had to blast.

Q. Only some of them had to be blasted?—A. Yes.

Q. The great majority of assembled rock on your district could have been removed without blasting: is that not so?—A. No.

Q. I say "could have been removed": the great majority of it could have been picked round and pried out with bars? Be candid with us?—A. A percentage of it.

Q. I am not after you: I am after the facts. I will go one step further. Could not every yard of assembled rock that you passed on your division have been taken out by picks and bars and derricks, without a stick of powder?—A. No.

Q. Could you not remove a mass of rock less than a cubic yard without powder?—A. Yes.

Q. Was not all assembled rock less than a cubic yard?—A. No.

Q. In the individual pieces?—A. No.

Q. Did you disregard your solid rock specification in rock larger than a cubic yard?—A. In what way?

Q. By not classifying as solid rock boulders or pieces of rock larger than a cubic yard?—Are they not all solid rock?—A. I do not quite catch the idea?

Q. You are not following me—apparently unwilling—A. Well, I am desiring to give you everything that I possibly can.

Q. Every boulder rock larger than a cubic yard is solid rock under the specification?—A. Yes.

Q. Then it necessarily follows that it is not assembled rock?—A. Well, I am classifying it differently. I am calling it ledge and boulders. It does not matter to me whether the boulder is as big as the car: if it is a boulder, it is a boulder.

Q. Ledge and boulders are clearly distinct from assembled rock in your classification?—A. The assembled rock is boulders, is it not, under a yard size.

Q. If it is over a yard it is solid rock?—A. Yes, if that is the way you interpret the specification.

Q. I want your impression of it?—A. When I go into a cut, and there is a mass of boulders there, independent of their size, I classify it as mixed material, assembled rock, and if there were two or three boulders measuring a yard or over a yard, I would pick them out and set them aside as solid rock, to be counted in with ledge. I would take them all in with my mixed material as assembled rock.

Q. If this term assembled rock had never been created, how would you classify a mass of boulders and small stones such as you have described?—A. Boulders.

Q. You would measure those over a cubic yard?—A. Yes.
Q. And under a cubic yard?—A. I would follow the specification.
Q. And that would be?—A. Loose rock.

By the Chairman:

Q. Then it comes down to this: that if you have classified that material described by Mr. Gutelius to you as solid rock, it is because you were so directed by numbers three and five; and if three and five had not been in the sheet accompanying Mr. Lumsden's instructions, you would have classified it as loose rock?—A. The proportion under three feet would be loose rock and the other solid.

By Mr. Gutelius:

Q. Was that Boucanne crossing where the tangent was on the bridge?—A Yes.
Q. You are familiar with the bridge and approaches over the Boucanne River?—A. Yes.
Q. If curvature had been allowed on that bridge, could a more economical location have been secured?—A. I believe so.

By the Chairman:

Q. You do not want to go any further?—A. I do not want to make any suggestions.

NATIONAL TRANSCONTINENTAL RAILWAY INVESTIGATING COMMISSION.

Before George Lynch Staunton, K.C., Chairman, and F. P. Gutelius, C.E., Commissioner.

(Evidence taken on the train, on the line of the N.T.R., near Allen Siding, at mile 41. July 13th, 1912.)

PETER WARREN WENTWORTH BELL, sworn

By Mr. Gutelius:

Q. Give us a short resume of your education and experience?—A. I was three years at the Royal Military College. Earlier than that, I was educated at Port Hope, and I was about three years with the C.P.R. on various works, the survey from Renfrew to Parry Sound, and then on construction on the Lake Temiskaming Colonization Railway.

Q. As resident engineer?—A. No, I was just ordinary leveller. I was leveller for the Kingston, Smiths Falls and Ottawa under Mr. Nash for a summer—four or five months, I do not exactly remember—and I was a year with Mr. Leonard on the St. Lawrence and Adirondack as resident engineer, and went out west, and eight or nine months on railway work with the Horne Payne outfit, private syndicate, of British Columbia, and I was engaged in placer work for a couple of years as assistant engineer, with a man named Carey, who was doing some work for an English syndicate. I went out to Africa with the troops, and was engaged in working under Major Hodgins for a year and a half or two years, I am not sure which, and then was employed as Superintendent of Construction by the Relief Works of the Orange River Colony Government, going in

railway construction. I also worked with the Johannesburg municipality, and for a contracting firm called Wills & Lyles; came out here in 1906, and have been with the N.T.R. ever since, as resident and divisional engineer; resident engineer since December, 1908.

Q. What Residency have you?—A. I have division Number Two.

Q. With reference to the cut between stations 1260 and 1270, mileage 1624—you know the cut?—A. I know the cut.

Q. That cut was classified as having 90 per cent solid rock?—A. Yes.

Q. From its appearance, it would seem that this solid rock must have consisted of many boulders less than a cubic yard: what have you to say about that—A. Well, it would appear so, from the appearance of the cut now; but, as I told you, our classification in that cut was raised, and was raised on the understanding that the solid rock occurred in masses. Masses of boulders were treated as solid rock.

Q. But if those individual boulders less than a cubic yard had been taken out individually, you would not have allowed as much solid rock as this estimate shows?—A. No, possibly not. When this cut was first classified the resident engineer and myself thought that sixty per cent solid and forty per cent loose would be about right. In my judgment, I thought as we did it, that it seemed fair enough, but then Mr. Poulin was a man of considerable experience, probably far more experience than I had: al. he was my superior, and, naturally, I was willing to bow to his judgment, especially, as I say, the Grand Trunk engineer, I am practically positive, agreed with him to that classification, and I changed the classification, under the direction of Mr. Poulin, from sixty to ninety per cent solid.

By the Chairman:

Q. Had you any reason to change your own opinion from what you saw at any time throughout the work in that cut?—A. Well, there was not a great deal remaining: there was not much room for change in opinion: there was not at any time, from that time on, a great mass of material to come out.

Q. Then you simply deferred to your superior's judgment?—A. Yes, pretty well.

By Mr. Gutelius:

Q. With reference to the cut at mile 26, was that cut classified in the same manner as the one you have just described?—A. Well, no, I should not say so. This cut in question here was classified, as nearly as possible, the amount of boulders; first we practically came to the conclusion that it was pretty nearly impossible to keep track of the boulders, to accurately measure them as they were shot out. In the coyoting and blasting there were some broken and some blown out, and it was pretty hard, after that mass was lying there, to measure up the boulders. The boulders in a certain portion of it were measured, and two or three times I believe this was done, and that proportion of rock was taken as going through the cut.

Q. Do you feel that that was the same classification as you would have made had the cut been taken out by picks and bars, and each individual boulder being measured?—A. Well, it is pretty hard to say that.

Q. Do you feel that that is about right?—A. My opinion is that that cut is correctly classified. I do not think that there is too much rock in it.

Q. I refer to 29.1. The impression which I received in looking over that cut is that the item of loose rock is high. It looks at present like a gravel bank. What do you say as to the 5800 yards of loose rock?—A. Well, I say that the whole of the west end of that cut consisted of masses of boulders, small boulders, and, further that in many places those boulders were practically tied together with what was almost cemented gravel. It was very hard to take out. Possibly many

of those boulders might measure a foot, but under the interpretations that we have been accustomed to as regards that loose rock classification, I hold that I was perfectly justifiable in returning that as loose rock.

Q. But you think that a trench six feet deep on the high side of that cut would expose the class of loose rock that you have described?—A. Down the face of the cut?

Q. Back from it, on the side?—A. Do you mean from the top of the face down, and trench up the cut?

Q. Yes.—A. I would prefer to see it tested parallel with the cut.

Q. Answer it in a general way: six feet in?—A. I would prefer the test to be more thorough than that. Do I understand you that that trench starts at the top and going down the face of the cut?

Q. Yes, and six feet in. Should that expose this class of material?—A. I should think that would show up considerable. I further think that a test parallel to that existing cut would be a fairer test and would tend to show up the material the cut is composed of better.

Q. It is proposed that you, with Mr. Aldred, make a test of that portion of the cut, using both of these methods?—A. Those methods only—just confining ourselves to those methods?

Q. I do not care. I want Mr. Aldred to say that he concurs, or that he does not, as a result of actual working on the job?—A. Yes.

By the Chairman:

Q. I understood that you made the classification of stones which were smaller than a foot because they were lying in masses. I want to see if I understand you correctly? State it in your own way?—A. If I found, as I said to Mr. Gutelius, the boulders were, many of them, 18 inches through, and some of them two feet, and others smaller, from seven and eight to ten inches up, and they were lying together, it was impracticable to do anything else with them, in my opinion, but hand them in as loose rock.

Q. Did you do that in your own discretion, or under any instructions that you got? Were you acting on your own judgment, or were you endeavoring to follow any instructions that had been given to you outside of the specification?—A. Well, I cannot remember any definite instructions. My idea about that was that it was impossible to plough that material, it was loose rock.

By Mr. Gutelius:

Q. Under the specifications?—A. Yes.

By the Chairman:

Q. If you had a collection of stones which were, half of them, less than a foot, and half of them more than a foot, would you classify all those as loose rock because you could not plough them?—A. I think so.

Q. What do you make of the specification which says in 35, "All large stones and boulders measuring more than a cubic foot and less than one cubic yard shall be classified as loose rock"? and then, second, "All loose rock, whether in situ or otherwise, which may be removed by hand, pick or bar": how do you read those two statements in 35?—A. Well, I read it this way: I read it practically there as it is written, it seems to me.

Q. Take each one by itself?—A. "All large stones measuring more than a cubic foot and less than one cubic yard"—those are measured stones.

Q. Those are stones that are to be measured?—A. Yes—all loose rock, whether in situ or otherwise.

Q. What do you call that?—A. I think I would be justified in calling that, if that came in such shape that it could not be ploughed, I would be justified in calling material of that description loose rock and classifying it as such.

Q. Where does it say that it is to be ploughed at all? That is the trouble I have?—A. Where does it say it is not to be ploughed?

Q. But where does it say it is to be ploughed? Do you read the statement "all large stones and boulders that cannot be ploughed" as one? Do you think the man who drafted this meant that?—A. If he did not he should have altered it.

Q. Do you think he did?—A. Certainly, by the way he has written it.

Q. I understand you, first, that you consider that the plough test applies to stones?—A. I think I am justified from this specification.

Q. I want to find out?—A. I think I am justified in saying yes.

Q. I want to find out how you were informed when you made your classification. Then you think that your first enquiry would be to see whether these stones and boulders could be ploughed?—A. No, not of necessity. For instance, if they were scattered through there—

Q. Take stones and boulders: the plough test applies to stones and boulders?—A. What is your question?

Q. I ask you if you consider that the plough test applies to stones and boulders under your construction of section 35?—A. Well, no, but I cannot imagine—

Q. Do not depart from it: let us stick to that. You do not consider it applies to stones and boulders?—A. Not under all circumstances.

Q. Do you think it applies to stones and boulders under any circumstances?—A. I think so, yes.

Q. Tell me where it applies?—A. There is bound to be a certain amount of material connecting those stones and boulders.

Q. It is not the material we are talking about; it is the stones and boulders?—A. I am explaining why I think that the plough test would apply to stones and boulders, and under these conditions.

Q. I thought the stones and boulders had to be measured and not ploughed?—A. If these stones and boulders are lying so thickly that it is practically impossible to measure them, and yet they cannot be ploughed—I took that position, that that was loose rock.

Q. Would you call a boulder loose rock?—A. Certainly.

Q. You would under the definition, but stones and boulders in a pile, with no earth in them at all, because they are so thick—A. I have not seen any case like that.

Q. Is it not the earth that is to be ploughed and not the stones and boulders? Is it not the most elementary reading of that section that boulders are not to be measured?—A. No, I do not see that.

Q. I take it that I am not stating unfairly that you think the plough test does, in some circumstances, apply to stones and boulders?—A. To stoney ground.

Q. I am not talking about stoney ground: I am speaking of stones and boulders?—A. I was trying to say I thought it applied to stoney ground.

Q. But you do not think it applies to stones and boulders?—A. Naturally, if the boulders were so scattered you could measure them, you would do so.

Q. Why can you not measure them?—A. There are too many of them.

Q. It would take you too long?—A. You could not do it.

Q. It would take you too long?—A. You would have to be stopping the work: you could not go on with the work: there would be nothing done in that cut.

Q. You mean it would take too long a time?—A. I do not mean it would take up too much of my time, but it would take up too much of the cut's time.

Q. It would stop the work—A. Yes.

Q. Do you not think that there is a difference between loose rock and stones and boulders?—A. Certainly.

Q. Spoken of in that sentence?—A. Well, it is pretty hard to say what the man who wrote that had in his head.

Q. In your head, is it not clear he meant——?—A. I am pretty well trying to go by that clause.

Q. How did you go by that clause? I will not ask you to construe it, but did you, in your work, make any distinction between the words "loose rock" in that paragraph, and "stones and boulders?"—A. No, I do not think I did.

Q. Then you did put in rock which was made up of stones smaller than a foot as loose rock?—A. Yes, where they came in conjunction with larger stones, so that the whole was impracticable to be moved if the plough test had been applied.

Q. On your whole territory is there any cemented gravel?—A. No, not that I know of, not what I would call real cemented gravel. The nearest approach to it was patches of very very hard material in a cut.

Q. Is there any indurated clay?—A. No, not that I know of.

Q. No clay in this country at all?—A. There may be patches; certainly no indurated clay on this work.

Q. All the material which we see in this right of way is either stone or sand, is it not?—A. Yes; there is gravel.

Q. Stone, sand or gravel?—A. I do not know of any clay.

By Mr. Gutelius:

Q. Referring to cut at 39.1, which we examined this morning said to contain 77 yards of solid rock and 820 of loose rock; in examining this cut with Messrs. Macfarlane and McGillivray, we all practically agreed that there was some common excavation?—A. Yes.

Q. I would ask you, with Mr. Aldred, to go into that classification again and, between you, give us a re-classification?—A. Yes.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN ON TRAIN, JULY 13th, 1912.)

H. N. BUCKE, sworn:

By Mr. Gutelius:

Q. How old are you?—A. Thirty-three.

Q. Where were you educated?—A. At London and Kingston, Royal Military College at Kingston.

Q. What experience have you had in construction work, shortly?—A. I was instrument man and resident engineer on the Cape Breton road for six and three months; at Sydney on waterworks business for seven months, and I have had about four years' experience on the Transcontinental.

Q. What position?—A. Construction.

Q. What positions did you fill on the Transcontinental?—A. I was resident engineer for a year and division engineer for three years.

Q. Prior to your becoming resident engineer, did you ever have a position where you interpreted specifications for grading?—A. Yes.

Q. What railway work?—A. On the Cape Breton road.

Q. What classifications did they use on the Cape Breton road?—A. Solid rock, loose rock and common excavation.

Q. Was it quite similar to the one you have been working on here?—A. Yes, it was.

Q. Just in a general way?—A. Yes, the same on the waterworks.

By the Chairman:

Q. What waterworks?—A. Pipe line and construction work.

By Mr. Gutelius:

Q. Where does your division begin?—A. At mile 40.

Q. Referring to the first cut at mile 40.1, in looking over that cut, it was pointed out that there was some common excavation in the cut, although none has appeared on the progress estimates. Do you remember the case?—A. Yes.

Q. And in discussing it, you thought there was a portion of common excavation there?—A. Yes, small pockets.

Q. And that you would rectify the classification in that respect; is that right? A. Yes.

Q. And similar cuts in that vicinity where the same character of material exists you would treat in the same way?—A. Yes.

Q. On the banks or on top of the cutting at 47.1 a quantity of wasted material was noticed, and you advised me that you were measuring that up, and deducting it as waste from the solid rock?—A. Yes.

Q. In the cut at mile 52.5, the record shows that of the 22,600 yards of solid rock that there was some 6,700 yards of overbreak; can you verify those figures?—A. Yes, I have it here.

Q. First, take the overbreak at 51.4; the overbreak in that cut amounted to how much?—A. 54 per cent. The inside quantities are 5918 and the inside 3189.

Q. Where was that material used?—A. It was used in fill 578 to 585.

Q. Was any of it taken west?—A. No, there was none taken west.

Q. So that none of that cut was wasted?—A. There was part of the west end taken, that yellow on the profile, it was mostly all hauled east; there was a small portion of it hauled west. There are the two colors in the cut east and west of that rock fill. It was practically all hauled east.

Q. Was there any waste in any of the cuttings mile 51 to mile 52, I mean dumps along the track of wasted material?—A. Yes, there is a lot of excess material there. The dumps are very wide. The dump at 578 to 585 is wide.

By the Chairman:

Q. You mean the grade was very wide?—A. Yes.

By Mr. Gutelius:

Q. Why was not that extra material used in the big fill at mile 52?—A. It was a very long haul. The work was started from both places at once, and it was a case of time getting Heathcote Lake filled. All that work was going on at once, and they worked at both ends.

Q. And to gain time you wasted; have you any idea of the material?—A. It was considered that that bank would go down considerably. I considered that the bank at 578 to 585 was soft and the lake would go down considerably.

Q. But this did not happen?—A. No.

Q. So that you had an excess of material there?—A. We had an excess of material there.

Q. That excess of material was wasted?—A. Was wasted, yes.

Q. And the same applied to the next three cuts?—A. No, the next three cuts were taken into the fill.

Q. You got those into the fill?—A. Yes; it was also a case of time as well as that bank I speak of.

Q. If the excavation for the cut at 588 had been delayed until the other four cuts were completed, you could have taken all of that material into the fill at mileage 52?—A. Yes.

Q. That, however, would have delayed the work a couple of weeks?—A. It would have delayed it more than that; it would have delayed it five or six months —well, say, four months.

Q. So that is the reason why you wasted that material instead of taking it down into the fill which was made up largely of rock borrow?—A. Yes.

Q. To waste that material was an unusual thing on the part of the division engineer. What authority did you have for doing it?—A. Authority from the district engineer.

Q. The late Mr. Poulin?—A. Yes.

Q. In the matter of location on your division, did you have any discretion in connection with location?—A. No, I arrived there after the work had been opened up.

Q. Turn to mile 52 and 53; it is suggested that a momentum grade be placed between these two points, whereby the cut at mile 53 would be reduced to practically nil. Suppose a one per cent grade had been introduced there instead of six-tenths, beginning on the fill below, would a considerable saving have been effected?—A. Yes, I think it would. I would have to figure it out. You mean by starting the grade here? (Indicating.)

Q. Yes?—A. Yes, there would have been a saving effected.

Q. But you were limited to the six-tenths, which was the approved profile?—A. Yes.

Q. Were momentum or velocity grades discussed at all, as far as you were concerned?—A. They were discussed some five years ago, or six years ago, in location. I wrote asking permission if I could use velocity grades, and it was discussed at Ottawa, and I got instructions not to use them.

By the Chairman:

Q. From whom?—A. Major Hodgins was district engineer at the time.

Q. Is this the district which his examination was about?—A. Yes, this district.

By Mr. Gutelius:

Q. You advised me in conversation to-day that where the overbreak was less than 25 per cent on the quantities inside slope stakes, that you passed it without any special attention, on account of the fact that the district engineer's office and the Grand Trunk Pacific engineer would be satisfied, so long as it did not exceed 25 per cent?—A. Yes.

Q. Was there any of this discussion in writing?—A. No.

Q. At mile 64.3 the cutting contains 10,600 yards of solid rock and about 1,200 yards of loose rock. Can you tell me how much overbreak there was in that cutting?—The station is about 325?—A. Station 317 to 328.

Q. Yes?—A. 22 per cent overbreak.

Q. There was 22 per cent overbreak paid for in your progress estimate as solid rock excavation?—A. Yes.

Q. Plus overhaul, if any?—A. Yes.

Q. I have a memorandum here, "It would seem that the overbreak should have been paid for at its equivalent in train fill, on account of its having been used in a fill where rock borrow was not necessary." Why did you not give them train fill for it?—A. They cannot take a rock cut to stand at the sections, and I was given to understand it was all right to allow a certain percentage, as I said, 25 per cent in a rock cutting.

Q. If that ruling had never been given to you, and you had been working on this specification, and your general knowledge as an engineer, would you have made any change in that method of classification?—A. Yes, I think I would.

Q. What would you have done with that overbreak?—A. I would have classified it as train fill, allowing ten and fifteen per cent, unless the specifications read that there was no overbreak.

Q. That is, you would have reduced what you allowed as legitimate overbreak to ten or fifteen per cent, and called the balance avoidable overbreak and allowed it as train fill at its equivalent yardage in train fill?—A. Yes.

Q. I was struck with the absence of loose rock in the matter of overbreak, remembering that the material in overbreak should be classified as it is found in the cutting after the shot is fired. Why don't we see some overbreak as loose rock in your estimates?—A. This question of overbreak was taken up with the Grand Trunk engineers and our own engineers, and decided on the way it was. It has been a debated question ever since the work was started here.

Q. That is the reason for your not having classified any of it as loose rock? —A. Yes, following the instructions.

Q. Aside from the instructions of these engineers, was there any material in those cuttings which you classified as solid rock which was broken up small enough to be loose rock?—A. Apart from that?

Q. Yes, apart from their discussion?—A. It was discussed generally; different cuts were gone over.

Q. If you had followed the specifications which require that material be classified as it is found in the cut after the shot, would you not have found some loose rock in the overbreak?—A. Certainly.

Q. Then, if you were hewing to the line, you would have been compelled to give some loose rock in this overbreak?—A. Yes.

Q. And the only reason you did not do it was because of the discussions and the instructions?—A. Yes.

Q. Where does your division terminate?—A. At mile 78.

By the Chairman:

Q. At mile 42.95 it struck me that there was too much solid rock allowed there. I asked you if you had measured it, and I think you told me that you had. Did you mean you had measured it yourself?—A. It had been measured by the boulder measurer.

Q. Explain what you mean by that?—A. There are boulder measurers put on the work under each resident engineer, to measure this rock.

Q. And they made the measurement?—A. Yes.

Q. And returned it to you?—A. They returned it to the resident engineer, but I checked it up and was responsible for such rock as had gone in as such.

Q. Right there, there are two ditches on the north side?—A. That is at station 95?

Q. I do not know the station, but it is mileage 42.95. There are two excavations which look like ditches; one is a ditch and the other is a borrow?—A. Yes.

Q. Why did you not use the waste from the ditch instead of making an extra borrow there?—A. I did not consider that it was good practice to make muskeg dumps.

Q. But both the ditch and the borrow are muskeg?—A. But the borrow was put in later, just before the track was laid, to enable the track to get over it. There was a small quantity put in over the stumps.

Q. Did you not use muskeg at all?—A. There was muskeg used in one place in the division, but it was before my time.

Q. Since you came you have excavated muskeg, and not used it?—A. Yes.

Q. At mileage 44.4 there is a ditch. What did you allow that ditch at? There is a big stone in the middle of it?—A. That ditch is under construction now.

Q. It has not been estimated yet; there was a big stone in the middle of it? A. It is a ditch with a stone sticking up?

Q. Yes.—A. That ditch is under construction.

Q. At 45.9 there is a lot of overbreak, and you say it was equalized in the return; what did you mean by that?—A. I do not understand you.

Q. I made a note that you said to Mr. Devenish, "It is equalized in the return". What did you do at 45.0 there?—A. These cuts are taken out and put both ways in the muskeg, to make dumps.

Q. Explain that?—A. There was 2,000 cubic yards taken from the overbreak and returned as 3,000 yards of train fill.

By Mr. Gutelius:

Q. For the reason that the overbreak expands and is equal to that amount of train fill?—A. Yes.

By the Chairman:

Q. At 46.1 mileage you returned this all as solid, and there is 47 per cent overbreak?—A. It was considered to be all necessary in the fills; there was soft muskeg fills on each side of the cut.

Q. I understand that, under those conditions, you should measure it as it lies in the cut, after the shooting?—A. It was considered in this case that it was the best material to make those fills, and looked at as rock borrow.

Q. Do you consider that it was necessary to use rock in that place?—A. Yes, I think that is the best material to make those fills with.

Q. It did not all go into that fill to the east, did it?—A. No.

Q. Did you not waste some of it?—A. No, it was all put in the bank.

Q. Should it be called solid where it was put? Should it not be measured as it fell into the cut after the shot?—A. There were soft muskeg fills on each side of it where this rock went in, and I consider rock would make a much better fill than muskeg or anything else.

Q. Am I correct in my understanding that, following your instructions, that overbreak used in any fill was measured as solid rock?—A. Not in all cases; there are some cases where it has been deducted.

Q. No, I say, "used in any fill"; is it measured as solid rock?—A. It is measured as solid rock in a great many fills.

Q. Irrespective of whether it was necessary to use rock in that fill?—A. No. The fill was always considered, whether it was necessary to fill it with rock, or whether it would be filled with other material.

Q. If you used in a fill where it was not necessary to use rock, how did you measure it?—A. It was measured as solid rock and in some cases train fill—deducted and returned as train fill.

Q. It is shown on the return whether it was measured as train fill or measured as solid rock?—A. Yes.

Q. Do you say that in some cases where it was not necessary to use rock, you measured it as solid rock?—A. Yes.

Q. Now at 47.1, I understood you to say that where there was 32,700 solid rock you treat it as a rock borrow pit because you had instructions before the rock was taken out, that instructions received from the district office advised the contractor that it would be so treated?—A. Yes, the district office.

Q. Have you ever had any experience on other railways where such a practice was followed?—A. No, I have not had any experience, but I know it to be the case.

Q. But it is only, is it not, the practice on other railways to allow such rock as solid borrow where it is arranged with the contractor, before he takes the material out?—A. I believe it to be the case.

Q. But you personally have not had any actual experience of that?—A. Not off this road, no.

Q. Was there any other place in your division where that was done?—A. Where there was rock borrow used, do you mean?

Q. Yes?—A. Yes.

Q. Rock borrow taken out of the cut?—A. Yes; the lake fill at 40.9, there was rock borrow; there was a considerable quantity borrowed, besides what came from the cut, and also at Heathcote Lake.

Q. At mileage 47.9 the overbreak is all returned as solid rock. Was it used where train fill would do? Station 402 to 408?—A. Rock borrow was the best thing to fill it with.

Q. Would not train fill have done?—A. Yes.

Q. Rock borrow is always best for fill?—A. Yes.

Q. It is better than anything?—A. Yes.

Q. But it is not always necessary to use rock borrow where it is expensive?—A. No.

Q. Is there not a large amount of waste dumped on top of the bank there?—A. I do not remember.

Q. Is there a large dump of rock near by there?—A. Yes, it is cut 8; it is at 48.7.

Q. There is a large dump there; was there any deduction made for that?—A. Yes. There is the 400 cubic yards.

Q. Did you allow him anything for that 400 yards?—A. No, that was deducted.

Q. At 50.2 mileage; just before this cut there is a very wide fill. You agreed with me that it was too wide. Did you make any deduction for that waste there?—A. No.

Q. Why not?—A. It was used for lake fill in this place. It was thought that it would go down some, and that the width of fill would receive the train fill and ballast. It did go down a little.

Q. Did it go down since?—A. No, it has not gone down; it went down a little on construction, but it has not gone down since.

Q. 51.1 is all returned as solid; this was put into the waste fill and is very wide. Are you not over generous there in your allowances?—A. That cut was hauled both ways.

Q. You have 3,100 hauled the other way; but is it not too much in there?—A. Yes, it is a very wide bank; that is another case of where it was expected to go down considerably, another lake fill.

By Mr. Gutelius:

Q. Was this extra wide filling at the points just mentioned made with your knowledge and consent?—A. Not altogether, no.

Q. The contractors made the fill and you thought possibly it would settle and let it go?—A. No, I did not. It was taken up with the inspecting engineer going there, and he said it would be advisable to put in wide banks at these places.

Q. You had them made wide under instructions from superior officers?—A. Yes.

Q. Who were they?—A. Mr. Poulin was district engineer.

Q. And who was the inspecting engineer to whom you refer?—A. Mr. Balkam, and the Grand Trunk engineers.

Q. Who were they?—A. Mr. Heman and Mr. Featherstonehaugh. Mr. Heman was at one time and Mr. Featherstonehaugh replaced him.

Q. You are quite sure the Grand Trunk engineers and inspecting engineer asked you to make those banks as wide as that?—A. Yes, it was agreed upon to do that.

By the Chairman:

Q. At 52.50, 6,700 yards all returned; is this not very wide too?—A. Yes.

Q. More than appears to be necessary?—A. Yes. The material was wasted from this cut in order to get it out in time.

Q. Did you say instructions were given by the Grand Trunk engineers?—A. They were not instructions from the Grand Trunk engineer; it was instructions from the district engineer which were agreed upon by the Grand Trunk engineer; they were all going over the line together.

Q. You did not receive instructions direct from him, although you know he agreed with the district engineer?—A. Yes, I know he was agreeable. The waste at this place you speak of is mostly clay. It is considered of no use to fill the Heathcote Lake fill.

Q. At 65.9 there is about 43 per cent of this in as solid, is there not?—A. There is 5,677 yards of solid and 458 yards of loose.

Q. It is all allowed as solid, is it not?—A. No, there is 458 yards of loose.

Q. But all the overbreak is allowed as solid, is it not?—A. Yes.

Q. Why did you do that?—A. It was needed to make the fill.

Q. The fill need not necessarily be rock, need it?—A. No, not necessarily.

Q. It was just for the same reasons that you gave before?—A. Yes.

Q. You have a place where you have, at 67.50, widened the cut for drainage purposes?—A. Yes.

Q. How wide did you make the cut?—A. An extra two feet, if I remember, were taken off for drainage.

Q. On both sides?—A. No, on the south side. I could tell you better with the cross-sections.

Q. There is a ditch on both sides, though?—A. Yes.

Q. You have put the track in the centre?—A. Yes.

Q. If you did not need to widen it on both sides, why did you widen it on either?—A. It is a very wet cut; from station 492 there was the drainage came in, and it was widened to look after this drainage.

Q. Why did you not turn the drain and have it only on one side?—A. Because the drainage came in in the middle of the cut at station 492, and it was to enable us to carry this water, this outside drainage, off, that the ditch was put in.

Q. Why were there two ditches put in the cut?—A. It was necessary to drain the cut.

Q. Could you not have crossed over and drained in?—A. It would not drain the cut as well.

Q. You say it was coming in on both sides?—A. No, I say that on one side the drainage was coming in at station 492. This was extra drainage, apart from the cut drainage.

Q. You say in any event you would put the drainage on both sides?—A. Yes, according to specifications.

Q. Then you widened it and made the ditch bigger?—A. Made a larger ditch on the south side to look after outside drainage; it was a small brook coming in. It was a long cut, and from the centre of the cut down it was widened for drainage.

Q. You only widened it about two feet?—A. About two feet.

Q. How much is the overbreak there then?—A. The overbreak is not worked out. There is 14,450 yards inside slope stakes, and 6,286 outside of slope stakes.

Q. Is there any unnecessary overbreak in that cut?—A. Very little.

Q. Did you deduct any?—A. No, very little, if any.

Q. At mileage 72 you say you widened it for drainage; my note is there is too much loose here, and there is a great amount wasted on the side dumps. Why is it widened on both sides? In the first place, how much loose is there—A. 27,447 yards of solid and 11,280 of loose and 11,410 of common.

Q. I thought there was too much loose there and it should have been common. Did you cross-section that?—A. Yes, the resident engineer did.

Q. Were you with him?—A. No, I was not with him when he cross-sectioned it.

Q. How did you arrive at your figures?—A. By taking notes and classification. I also checked the cross-sections up afterwards.

Q. The resident engineer did it, and you checked up his cross-section?—A. Yes.

Q. That is the ordinary practice?—A. Yes.

Q. But he did cross-section it?—A. Yes.

Q. There is a great amount wasted on side dumps?—A. There is a lot of material wasted there.

Q. Did you make any deductions there?—A. No. There is both common, loose and solid wasted there.

Q. Was there any train haul in that vicinity at all?—A. No.

Q. You had no use for it then, had you?—A. No.

Q. Did you widen it on both sides, or how much?—A. My remembrance is that it is just widened on the south side.

Q. How much have you widened it?—A. We put a ditch in there three or four feet at the bottom.

Q. And how much is the excavation there outside the stakes?—A. I could not tell you that.

Q. You have not a memorandum?—A. No, not here. I could get it for you off the cross-sections.

Q. I have got down here—I may be wrong about it—within two miles I have got train haul; is that too far away?—A. Yes.

Q. Too far to haul that stuff?—A. Yes.

Q. What would the charge be for train haul there?—A. Well, your material from the cut would be a cent a yard per 100 feet over 500 feet.

Q. So that it would cost you about 80 cents to haul it down there; it would cost you nearly a dollar?—A. It would cost $1.01.

Q. But it would not cost you that if it was taken down there for train haul?—A. It could not be used as train haul, because they could not work the shovel in that cut.

Q. That material was wasted. In many cases you carried similar material out by train and put it into fills, did you not?—A. No.

Q. You took out rock and put it into fill?—A. No, not by train.

Q. How was it taken out?—A. Horses, cars and stone boat.

Q. You did not put any of that on the train?—A. No.

Q. It is carried out on the donkey cars?—A. Yes, and light rails.

Q. 76.6; what did you do there?—A. In the fill?

Q. No, there is a rock borrow; station 980 my note is that you said there was 10,000 yards required. I queried that. I do not know whether I am correct in that or not?—A. I do not remember saying it, but rock was required to fill the lake fill east of that point.

Q. How much rock borrow did you take out there?—A. About 10,000 yards; 9,700, to be exact.

Q. There is a lot of that piled up on the hill on the south side wasted there that is the place?—A. That is to be measured.

Q. You did not deduct that?—A. No, it was not deducted.

Q. Mileage 77 to 77.05; I have a note, great amount of waste rock piled up both sides. Perhaps this is what Mr. Gutelius asked you to measure. I understood from you that you were instructed to waste this, in order to save time?—A. Yes. It was done to expedite the work, to save time.

Q. You were instructed to waste this?—A. Yes.

Q. Otherwise, it could have been used in that fill at 78?—A. Yes, with a long haul.

Q. It would not have been very long?—A. I am not sure how far they can make a contract to haul material.

Q. Anybody can make that up from the profile?—A. They could have filled it with a long haul.

Q. Whether or not it would have paid you are not prepared to say at the moment?—A. No.

NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION.

GEORGE LYNCH-STAUNTON, K.C., *Chairman.*
F. P. GUTELIUS, C.E., *Commissioner.*

Parent, August 15th, 1912.

(Evidence taken on train.)

ALAN TIMBRELL, sworn:

By the Chairman:

Q. What is your age?—A. I am thirty-five.

Q. You are a practising civil engineer?—A. Yes.

Q. Educated where?—A. At the Blundell School, in England.

Q. What is your position now?—A. I am division engineer on Division 11.

Q. You have been practising your profession for how many years?—A. Well, I was surveying in the Old Country, and mining engineer.

Q. How long have you been practising your profession as a civil engineer, in connection with railway work?—A. Since I have been on the Transcontinental.

Q. This is your first?—A. Yes.

Q. Then on the Transcontinental you acquired all your experience in classification?—A. Yes.

Q. When were you first engaged on the N.T.R.?—A. It was March or April, 1905, I am not quite sure.

Q. And in what capacity?—A. Topographer.

Q. And you continued as topographer for how long?—A. Up to November, I think. That was the month Mr. Grant was made assistant engineer.

Q. You can say for several months?—A. Yes.

Q. Then you were advanced, were you?—A. I was made draftsman.

Q. And from that?—A. I was instrument man with another party.

Q. That was in location?—A. Location on survey.

Q. After that?—A. Then I was instrument man on Residency 26 for about three months.

Q. In what district?—A. The same district, La Tuque.

Q. So that you have been continuously engaged, in one capacity or another, upon the part of the line between Quebec and Parent?—A. No, beyond Parent.

Q. Quebec and Lake Nipigon?—A. Oh, yes, that covers it, the north section of the district.

Q. After you were instrument man, what did you become?—A. Resident engineer on 28.

Q. On Residency 28. in what district?—A. District B.

Q. Whose contract?—A. Hogan and Macdonell, I guess it was.

Q. Contract number what?—A. 10, I think it is.
Q. With headquarters where?—A. At Ludgernoel. That is mile 142 or 141.
Q. How large was your residency?—A. About nine miles; it may have been nine and a quarter, or something around there.
Q. When were you on that residency? Over what period?—A. It was either April or May, 1907, till about the same month in 1908.
Q. And after that?—A. Then I was moved up to Residency 31 in the same district.
Q. And after that?—A. Then I was moved up to Residency 31 in the same district; it is contract 11.
Q. Whose contract was that?—A. Grand Trunk Pacific.
Q. Did they do the work themselves?—A. No, no, Macdonell & O'Brien were doing it.
Q. At what mileage was your headquarters?—A. 170.
Q. You continued there for how long?—A. I was there for a year—oh, over a year: from May, 1908, till Christmas, 1909.
Q. You were there until when?—A. It was the Christmas of that year, 1909, I think.
Q. After that what did you do?—A. I moved up to this residency, Residency 39.
Q. On what contract?—A. I think it is 12.
Q. Have you, then, been resident engineer on these three residencies during all the time you have spoken of?—A. I have.
Q. And, as such, your duties were to do what?—A. To see that the work was done properly, classifying under the division engineer's orders—not his orders exactly.
Q. His supervision?—A. Yes.
Q. Did you receive any copy of the contractor's contract for the particular residency in which you were from time to time?—A. The general specifications.
Q. No, the contract?—A. That includes the contract.
Q. You did receive the book which included the contract and general specifications?—A. Exactly.
Q. Did you make yourself familiar with them?—A. I did.
Q. Before you commenced your work on your Residency 28, did you read the specification for classification?—A. Yes, sir.
Q. Of excavated material?—A. Yes.
Q. And did you consider that you understood it?—A. Yes.—well, it took me some little time to understand it.
Q. Did you consider that you mastered it then to your own satisfaction?—A. We had some trouble with the meaning of the terms when we first started—the meaning of the terms in the specification for solid rock.
Q. In the first place, the specification for solid rock excavation is paragraph No. 34, and is as follows:—"Solid rock excavation will include all rock found in ledges or masses or more than one cubic yard, which in the judgment of the engineer, may be best removed by blasting". Had you any difficulty in understanding the meaning of that?—A. There was some slight difficulty in the matter of the masses.
Q. You had difficulty in understanding what the meaning of "all rock found in masses or more than one cubic yard" was?—A. Certainly.
Q. You mean certainly you had?—A. Yes.
Q. What was the difficulty you found there?—A. Well, when we first started in—
Q. I am speaking of reading them? What did you find difficult about that?—A. What "masses of rock" meant, whether it was a mass or rock as rock, or whether it was that other material with that rock made a mass.

Q. What is there to make you conclude it means anything more than rock in masses?—A. It says rock excavation.

Q. Were you told you ought to read in the caption to that, "solid rock excavation"?—A. Oh, no, we were not told that we should.

Q. Why should you read it?—A. It seems plain in there; it says "rock excavation".

Q. It does not say anything about rock excavation?—A. On the heading it calls it "solid rock excavation".

Q. That would not mislead you; that meant the excavation of solid rock, did it not?—A. It might mean that, but then it says—

Q. Take one thing at a time. I do not want to catch you, but I want you to explain the meaning, and you say the heading gave you some trouble. The heading has the three words, "Solid rock excavation". To your mind, I should think, as to any other person's mind, not reading any further, that meant the excavation of solid rock?—A. Yes.

Q. And nothing more?—A. Nothing more.

Q. So that, so far, it was perfectly clear.—A. Yes.

Q. That would not confuse any engineer, I should think, would it?—A. No.

Q. Then we come to the words that you mentioned first, "All rock found in masses"—I am leaving out, for the moment, ledges—"All rock found in masses"; did you think that meant something else found in masses than rock? If you did, say so?—A. I certainly did.

Q. You thought it meant what?—A. I thought it meant rocks—I do not know how to explain it very well.

Q. Explain what impression it left on your mind?—A. Well, it mentions rock in ledges and it mentions rock in boulders.

Q. No, excuse me, it does not mention rock in boulders?—A. No; it is pretty hard to explain what it meant.

Q. You had had no experience before in classification?—A. No.

Q. And you say that that expression left a confused impression on your mind? A. Yes.

Q. And what did you think you should classify under it?—A. I primarily thought that it meant just solid rock; I primarily thought that.

Q. Did any outside influence—I do not mean improper influence—or argument lead you to think it meant anything else?—A. We discussed it with the division engineer, and, to the best of my recollection—I may be mistaken on that—I think he said that it meant masses of rock. I do not know that it was cemented together, but masses of rock. That is the best of my recollection. I would not be sure of that.

Q. Who was that gentleman?—A. That was Mr. Bourgois.

Q. Benjamin Bourgois?—A. Yes.

Q. He did not tell you it meant anything more than rock, so far as you have informed me at present?—A. It meant masses of boulders; that is what he instructed me, as far as I recollect; that is, more than one rock.

Q. Is that all the information he gave you?—A. It is so long ago that I really could not recollect what he did say.

Q. That is the impression you have, but you would not like to say definitely?—A. No.

Q. Then before you got any other instructions, or any other enlightenment, as to the meaning of this phrase, did you commence to classify it?—A. Yes, I believe so.

Q. Will you be kind enough to tell me how you commenced classifying under the heading, "Solid rock excavation"?—A. Well, we measured all the—

Q. Say what you did?—A. Well, I did. I measured the ledge rock and the big boulders—no, we did not measure the big boulders on that St. Maurice side hill cuts—we could not do it.

Q. Tell me what you did, and I will ask the reasons afterwards?—A. We measured the ledge rock, and we estimated, as far as we could, stone by stone, the amount of boulders that were on those St. Maurice side hill cuts.

Q. When you say you estimated the boulders, I understand from that that you counted the boulders?—A. As near as we could get them, roughly.

Q. And among those boulders did you count any boulders which, in your judgment, should not pass for a cubic yard or more?—A. We took no boulders that were, as far as I could judge, less than a cubic yard, or thereabouts.

Q. Less than about a cubic yard?—A. Yes, thereabouts.

Q. So that you professed to only include in those boulders such as you thought would fairly come within the description of a boulder which measured one cubic yard—fairly come within that?—A. Yes.

Q. Did you keep a record of those boulders?—A. I think there was a record kept.

Q. But did you keep a record of them?—A. I had a notebook.

Q. In which you——A. In which I kept a note of different cuts.

Q. Was that kept fairly accurately?—A. Pretty well, I think, to the best of my recollection.

Q. You professed to keep a record, at all events, did you?—A. To aid me in getting out the quantities in the cut; I had to do it.

Q. It was your duty to do it, was it not?—A. Yes.

Q. And you professed to perform your duty fairly carefully?—A. As well as we could do it.

Q. As well as you could do it would be to put them, every one, down, but fairly carefully would mean that you got them nearly all down?—A. Well, that is it.

Q. Did you follow that practice in each of your three residencies from the time you first entered on your duties on your first residency up to the present time?—A. As to measuring of boulders?

Q. And keeping a record of the boulders we have been talking about?—A. Yes, sir.

Q. Are those records accessible to you now?—A. I do not think they are; I do not know where they are.

Q. Why are they not accessible?—A. Because I left any records I had behind on the different residencies, and where they are now I cannot say.

Q. They should be in the residencies?—A. They may be, I could not say.

Q. Did you give a true report of the number of those boulders or of the quantity of those boulders?—A. You mean, did I exaggerate?

Q. Did you give a true report?—A. Yes, certainly, as far as I could.

Q. What became of those reports? What did you do with them?—A. You mean, to whom did I report?

Q. Yes?—A. Oh, they would be in the estimates, in the forms.

Q. You wrote them down on the form supplied to you?—A. Yes.

Q. And forwarded those forms to whom?—A. To Quebec.

Q. To Mr. Doucet?—A. To the division engineer; I was resident engineer.

Q. Did you keep duplicates of your estimates?—A. Certainly.

Q. Have you them now?—A. No, sir.

Q. What has become of them?—A. They are left along with the records of the residencies.

Q. And, in all probability, they are there now?—A. As far as I know.

Q. So that there is in existence a record showing the boulder measurement of the boulders of a cubic yard or more, unless your reports have been lost or destroyed?—A. Unless they have been lost or destroyed.

Q. Will those records show, separately from all other material, the quantities in the boulders we are speaking of?—A. I think they will, as far as Residency 31 and 39 are concerned; I would not say anything about 28.

Q. You are uncertain as to 28?—A. I am.

Q. Why?—A. Because it is so far back that I do not recollect.

Q. You cannot charge your memory with it? Is that it?—A. That is it.

Q. Then I take it you have classified as solid rock excavation all rock found in ledges?—A. Yes.

Q. Then you have classified as solid rock excavation all boulders of a cubic yard or more?—A. Yes.

Q. And, thirdly, you have classified some other rock material under the head of masses of more than one cubic yard?—A. Yes, sir.

Q. Have you pursued the same course in your three residencies in the classification of the last-mentioned material?—A. Yes.

Q. I notice that in this district the words "massed material" is used?—A. Yes.

Q. Did you always, in your classification, appropriate that term "massed material"?—A. I could not say when it first came in. As far as the last two residencies are concerned—31 and 39—yes, but I do not remember when it first came up.

Q. What did you classify under "massed material"?—A. We classified all assembled rock. That was, all rock in boulders, in masses, that could be best removed by blasting.

Q. You exclude, do you not, from massed material, or do you exclude from massed material, boulders of a yard or more?—A. We did not exclude boulders of a yard or more that are in the mass; they are measured in the mass, but if there are boulders in loose rock adjacent, we exclude that from the massed material.

Q. I have found out from you now that you kept a record of the boulders of a yard or more, and I understand that to mean that you included in those, those in the cross-section and above the cross-section?—A. Yes.

Q. Under massed material, though, you placed the boulders which were of a yard or more?—A. Yes, sir.

Q. In a sub-heading?—A. I do not remember about the first one.

Q. Do you happen to have here one of your estimates?—A. I have not.

Q. Under the heading of massed material you would first put the quantity of boulders of a yard or over?—A. Yes.

Q. And if, in that same estimate, you wished to include other material, such as fragments of rock and small boulders, which were in your judgment, cemented together, you would also include those?—A. Yes.

By Mr. Gutelius:

Q. Have you not a record, such as we saw to-day, which actually divides up this cutting in this manner?—A. Yes.

Q. Can you produce one of those now?—A. I have one in my pocket. To make myself clear, I produce my classification book, cross-section book 10 by 10, District B., Division number 11, Residency number 44, in which the following entry occurs: "March L. 350, S.G. 70, B. 30, C. 70, total 520, which means ledge rock 350, sub grade 70, boulders 30, classified assembled rock 70.

By the Chairman:

Q. What you have placed under C, assembled rock, 70, includes what?—A. Includes small fragments of rock, and any cemented material that is not included otherwise.

Q. It includes small fragments of rock in cemented material?—A. Yes.

Q. Does it include small boulders in cemented material?—A. Certainly.

Q. And is this characteristic of all the entries under solid rock excavation throughout your books?—A. We did not have them down on 28; we had them on 31 and 39.

Q. That is a sample entry in the book?—A. Yes, that is the resident engineer's book.

Q. In that 70 is included cemented material?—A. Yes.

Q. What do you call cemented material?—A. Any material that is cemented together, with more than 50 per cent of stone in it.

Q. What do you mean by cemented material?—A. Well, the stone is cemented together.

Q. You, as an engineer, should know better than that; a stone is a stone, and cemented material is something else?—A. You mean cementing material.

Q. Yes, that is better?—A. Well, it may be clay or lime, or any material that is cemented, any matrix or sticky substance.

Q. Any matrix that will hold the rocks together?—A. Yes.

Q. You said just now that when you included this body of material made up of fragments of rocks, small boulders and the matrix or cementing material, that you only did so when there was at least 50 per cent of rock of either description in the mass; is that correct?—A. In most cases, yes.

Q. Then there were some cases in which you had a smaller percentage of rock in the mass?—A. Some special cases that were not really rock, and yet was removed by blasting, and was similar to rock.

Q. It was not rock?—A. It was not exactly rock; you could not call it rock from a geological point of view.

Q. Then do I understand you that you did include under solid rock excavation a mass of material in which there was no rock?—A. No rock as you may call a stone.

Q. Can you give me any idea of what per cent that would be over your whole classification?—A. I cannot.

Q. Would it be large?—A. It would not be large. There were very few cases over the whole thing.

Q. Can you recall one?—A. There is one down at—I cannot tell the stations.

Q. State the locality?—A. Somewhere down near Windigo; there is one on Residency 31. If I had the profile I could show you pretty well. (Profile shown witness.) To the best of my recollection, that is a side hill cut, and it is right there at station 1034, mileage 169.5.

Q. Any other places?—A. There were other places, but I do not remember them.

Q. Then at mile 169.5 is the S.R.M. 6962, the material you are speaking of?—A. Not the whole of it; it is included in that.

Q. What else was in it?—A. There must have been boulders in it; I am speaking from memory.

Q. You are speaking of a place where there were no stones in it?—A. Oh, that is a big cut.

Q. There is the mass, and you told me that you put in as solid rock excavation a mass without any rock in it?—A. Certainly.

Q. Now, what was it?—A. In that particular mass?

Q. Yes?—A. It is hard stuff to describe.

Q. It was a bluish material?—A. It is like a blue sandstone, to the best of my recollection.

Q. Is it a sandstone or is it a clay?—A. No, I should not call it clay.

Q. Do you know what it is?—A. I do not; I know how it was classified.

Q. You told me how it was classified, but you do not know what it is?—A. No.

Q. Did you include under the massed material any material in which there were stones, but which were less than 50 per cent of the whole?—A. Not to the best of my recollection.

Q. You did not intend to do so, if you did?—A. No.

By Mr. Gutelius:

Q. Are you sure that in this cutting you have just described some of these cubic yards which you classed as assembled or massed material did not have stones in them?—A. Some of them had stones in them, certainly, but not—

Q. You classified them because of the hardness of this clay, sand-like material, rather than the stones?—A. Yes.

By the Chairman:

Q. What was the average percentage of rock, in your judgment, in the massed material, over your whole experience as a classifier?—A. I could not answer that; I could not tell you that at all.

Q. What was the average experience in the last month that you have been supervising classification, roughly?—A. I could not say.

Q. Would you say it was as much as between fifty and sixty per cent of rock in the massed material?—A. Oh, no. You mean that half what they got out was massed material? No.

Q. Do you know what I am asking?—A. You are asking whether half of the solid rock returned was——

Q. No. I asked you to direct your mind to your returns of massed material, and I asked you if you would say that the contents of stone in that massed material amounted to as much as from 50 to 60 per cent?—A. I should say not.

Mr. Gutelius:

Q. That is the massed stuff that you classified as massed material, solid rock price?—A. Yes.

Q. Was the quantity of stone in those masses as much as 50 per cent of the mass?—A. Yes, there would be about that.

By the Chairman:

Q. I want you to tell me, keeping all the time now to solid rock excavation, whether you had any written instructions during your tenure of the office of resident engineer in any of these residencies, as to how you were to classify solid rock excavation?—A. We had this blue print.

Q. This is dated January 10th, 1908, signed by Hugh D. Lumsden, chief engineer; is that right?—A. Yes, sir.

Q. Did you get a letter along with it?—A. I do not remember anything about that. I remember the blue print. I do not remember the letter.

Q. Surely you kept your instructions, did you not, when you were continuously at this work?—A. I could not tell you.

Q. You got the blue print, and I suppose you kept it, did you not?—A. Yes.

Q. You got a letter of instructions with it?—A. I do not know anything about the letter of instruction at all; I do not remember it.

Q. Did you get any verbal instructions from Mr. Doucet?—A. Yes, over and over again.

Q. About the time you got the blue print, did you?—A. I do not know when I got that document. I do not remember when it was.

Q. After you received this blue print did you change your method of classification?—A. No.

Q. So that the blue print had no influence upon you, or did not convey to your mind any other information than that which you already had as to classification?—A. No.

Q. You have described to me, then, the way you classified this material from the beginning of your work up to date?—A. Yes.

Q. And if I asked you to-morrow to make me up a record showing the amount of massed material which you have classified, if the records are get-at-able you could do so?—A. Yes.

Q. And if I asked you to make me up a record of the boulders you had classified, and the records are obtainable, you could do so?—A. Yes.

Q. Showing, under each of these heads, the quantities separate one from the other?—A. Yes, sir.

Q. And you think that that record would show, under the massed material, that the cementing material would amount to about 50 per cent of the massed material?—A. Yes.

Q. Under loose rock, you were told in the specification to classify all large stones and boulders measuring more than one cubic foot and less than one cubic yard; that is correct, is it not?—A. Yes.

Q. And I understand from you that you did not classify such stones and boulders, where they were found cemented together in masses of more than one cubic yard——A. Yes, sir.

Q. Then did you classify all such stones and boulders, where they were cemented together in masses of less than one cubic yard as loose rock?—A. Yes.

Q. Then did you classify as loose rock all large stones and boulders which actually measured more than a cubic foot, which you thought were too small to be put in as one cubic yard?—A. I did.

Q. I want you to be very careful about this. Where you found such stones and boulders as I have described to you in a sand cutting, that clearly were in loose sand, did you really and truly classify those as loose rock in all cases?—A. To the best of my recollection, I classified them as loose rock.

Q. You would not classify any such stones, would you, as solid rock in any of these loose sand hills that we have been going through to-day?—A. Any such stones, no.

Q. And if you did, it was an error?—A. Yes.

Q. And should be rectified?—A. Yes.

Q. Because it was unintentional on your part?—A. Yes.

Q. Did you classify as loose rock what is described in 35, "All loose rock, whether in situ or otherwise, that may be removed by hand, pick or bar"?—A. Yes.

Q. Will you describe the rock that came under that head, if you can? I take it that, for instance, if you came under that head, you would classify the small fragments you found at the foot of a mountain, or at the foot of a rock hill, which had, in the course of ages or years, been broken off and tumbled down and gathered in a mass, or gathered in heaps at the foot of a hill?—A. Yes, loose rocks.

Q. That is what you understand by that?—A. Yes.

Q. Then you would put those piles of rock, if there were any, under loose rock?—A. Under loose rock.

Q. Now, then, did you find any cemented gravel?—A. Yes, sir.

Q. Where is that?—A. I cannot recall just now. It is in lots of different cuts along the line. I do not know of any cut that is absolutely all cemented gravel. It occurs in chunks and pieces and seams in cuts.

Q. But there were quantities of it?—A. Yes.

Q. And you did classify that cemented gravel as loose rock?—A. Yes.

Q. Or intended to do so?—A. Yes.

Q. Did you find any indurated clay?—A. I think there must have been some, but I do not recall any to mind just now.

Q. Do you know what indurated clay is?—A. Yes, sir.

Q. What is it?—A. It is very hard clay.

Q. It is what it says it is, hard clay?—A. Yes.

Q. Did you have any other materials that you classified as loose rock?—A. Yes. We had a sort of iron stone, such as we saw this afternoon.

Q. Do not tell us what we saw?—A. I cannot describe it otherwise very well.

Q. It is a brownish hard material?—A. Yes, impregnated with iron.

By Mr. Gutelius:

Q. Sand impregnated with iron?—A. Yes.

By the Chairman:

Q. You classify that as loose rock?—A. Yes.

Q. Is that the only other material that you recall?—A. No.

Q. There was no other?—A. No, I do not think so.

Q. When you were classifying cemented gravel and indurated clay and other materials as loose rock, you did so, I imagine, on account of their hardness?—A. Yes.

Q. And how hard had they to be before you put them under that heading?—A. Well, they would require picking. They would not be free shovelling; that is, a man could not go in with a shovel and shovel it out, or knock it out with a shovel. He would have to take a pick or a bar.

Q. Would you put under loose rock material which a man would pick out, although, perhaps, one pick man would keep half a dozen shovellers going?—A. Oh, no.

Q. Did you think about the plough test at all?—A. There were very few places you could put a plough.

Q. Did you think about it?—A. Yes, always.

Q. You are swearing to it; did you make up your mind, or did you not, that if there were, for instance, half an acre of that material, it could not be ploughed?—A. Yes.

Q. Or did you say to yourself, "Well, I will put that in as loose rock, because, by reason of the boulders scattered among it, a man cannot go in with a team and plough it, although I know he could plough it if the boulders were out"?—A. That would certainly influence it.

Q. Then you were not guided by the hardness in all cases?—A. Whether it would be practicable to plough it.

Q. Whether the material itself could be practically ploughed, or whether——A. The material itself.

Q. We will imagine a case. You have before you half a mile of right-of-way, and we will imagine that you could go along, like they do with a magnet in iron, and take out all the boulders, just lift them right out and leave the material unbroken and unshaken by that process?—A. Yes.

Q. And if, the boulders being lifted out, and the material being left unchanged by the process, you were certain a man with six horses could plough that material, would you put that in as common excavation, or as loose rock?—A. The material that was left, after the boulders were lifted out?

Q. Yes, and, mind you, the material is unshaken and unmoved by taking out the boulders, and it is just as hard as it was before, if you could plough it, would you put it in as loose rock?—A. No, I do not think so.

Q. What should it go in as?—A. It should go in as common excavation, because you could plough it.

Q. And certainly, if you are giving a correct answer to that, if you had such material that, by occasional blasting, you could shake it up, so that it could be ploughed, you would have classified it as common excavation?—A. Though you occasionally blast it?

Q. Yes?—A. No.

Q. Does it not mean that you shall classify as loose rock all cemented gravel which cannot be ploughed without continuous blasting, but you shall not classify as loose rock cemented gravel which requires, in odd places, to be blasted before the whole mass can be ploughed? Do you agree with that?—A. Yes.

Q. Your attention has been drawn to a case where that actually happened just now?—A. Yes.

Q. And of course that applies to indurated clay and to any other material?—A. That can be ploughed, yes.

Q. All other material than those I have been discussing with you is put in as common?—A. Yes.

By Mr. Gutelius:

Q. Did you ever see a railroad contract and specification before you saw that one?—A. No sir.

Q. How did you get your first information as to how to classify?—A. I think I got it from Mr. Bourgois, but I really cannot remember.

Q. Was there anyone else in the party?—A. Mr. Grant came up when I was there two or three times, and I asked him and he showed me. Mr. Grant was then assistant district engineer.

Q. He taught you?—A. Yes.

Q. Did you have any experienced man in your own party on the Residency?—A. No.

Q. You knew more about it than anyone else in the Residency?—A. Yes, I suppose so.

Q. How did you get your job here in the first place?—A. I went to Ottawa and was introduced to Mr. Lumsden, and he sent me down—sent a letter to Mr. Doucet.

Q. When you were resident engineer were any of your classification reports or estimates corrected by the division engineer and sent back to you?—A. Not after they had been final; that is after I had written them out fair.

Q. Did he go over them with you?—A. Sometimes, yes.

Q. Don't you feel that every classification you ever made as a resident engineer was concurred in by your division engineer?—A. Yes, certainly.

Q. And you depended on him?—A. Yes, certainly.

Q. On account of your lack of experience?—A. Yes.

Q. To see they were right?—A. Yes.

Q. And you depended on him and the other engineers who came to see you to set you right?—A. Yes, quite so.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION, EVIDENCE TAKEN IN TRANSCONTINENTAL OFFICES, QUEBEC, AUGUST 17th, 1912.)

ARTHUR DICK, sworn.

By the Chairman:

Q. What is your position?—A. Division engineer.

Q. You have been division engineer for how long?—A. Since 1st July, 1909.

Q. Your division is from mileage 12 to mileage 102?—A. Yes.

Q. What division?—A. Quebec Bridge easterly.

Q. Who are the Residents under you at present?—A. The Residents are A. O. Bourbonnais, from mileage 12 to mileage 47, R. Martin, from mileage 47 to 68, A. A. Paradis from mileage 68 to 102. These are the resident engineers who are on the work now.

Q. You were formerly Resident west of the river, were you not?—A. Yes.

Q. For how far?—A. I cannot be sure of the exact mileage, mileage 52 to 163, I think, Residency 30.

Q. Were you Resident there?—A. Yes.

Q. And then you were promoted from that to your present position?—A. Yes.

Q. You accompanied the Commission on their inspection over your own district lately?—A. Yes.

Q. And also on the inspection west of the river?—A. Yes.

Q. As far as the end of steel?—A. Yes.

Q. In the classification of the material east of the river, how long had you been taking part in the classification of the material from the Quebec bridge to the end of your present division? How long have you been supervising the classification?—A. From July, 1909, till it was finished—not from mile 12 to 102; I first of all got division 2a, from mileage 68 to 102.

Q. From mileage 68 to 102 east of the Quebec bridge you supervised the classification for how long?—A. About three months.

Q. Commencing when?—A. July, 1909.

Q. And ending October?—A. In the fall; the grading was done then.

Q. You stopped because the grading was all finished?—A. Yes; there was some grading of one or two little cuts.

Q. You supervised the grading on the rest of your division for how long?—A. There was no grading to do, as far as I remember.

Q. After you became divisional engineer there was only three months' grading done on the whole division, practically speaking?—A. Yes.

Q. Who supervised that classification on your district before you went there?—A. On division 2a, it was Mr. Garnet; on division 3 it was Mr. Charlton, then Mr. Hurtubise; then I am not sure whether there was any more done during D'Abbadie's time or not. Then on division 4 I think it was all done by Mr. D'Abbadie.

Q. You cannot tell us very much about the classifying of the material on what is now your district?—A. No, sir.

Q. But the small amount that you did classify you can tell us about?—A. Yes.

Q. Who were the resident engineers on the part that you supervised the classification east of the bridge?—A. It was G. H. Parker on Residency 10, A. A. Paradis on Residency 9, and E. H. Lippe on Residency 8.

Q. What did you think of the ability of these Residents to classify?—A. Well, the classification I saw done, I thought they did it all right, according to our instructions.

Q. Then you thought they were competent?—A. Yes.

Q. Were they given any more instructions than a copy of the specification to go by?—A. They had Mr. Lumsden's blue print.

Q. Each one of these men had Mr. Lumsden's blue print?—A. As far as I know.

Q. You believe?—A. Yes.

Q. Had they anything else besides that?—A. They had the guidance of the—

Q. I mean in writing. You think they had the blue print?—A. Yes.

Q. Tell me, if you can, shortly, your practice in classification; what did you do? You had to classify the common excavation?—A. Yes.

Q. The loose rock and solid rock excavation?—A. Yes.

Q. Tell me how you handled the whole proposition?—A. Well, I classified solid rock in ledges or masses by measurement. You can arrive at the classification by measurement if it is in ledges or masses as a rule; sometimes you cannot, if the masses are isolated in the face of the cut.

Q. What did you do about boulders?—A. I estimated them on a percentage in any work.

Q. You did not measure them?—A. I tried measuring and I gave it up.

Q. You did not do it anyway?—A. No.

Q. And how did you treat loose rock?—A. Anything not classified—

Q. How did you get at the quantities?—A. If it were not defined, I estimated it on a percentage basis too.

Q. Do you mean to say if it were defined—? A. Defined means so that you could see it on the profile; I estimated it on a percentage basis.

Q. And how did you get at the common?—A. All material not classified as solid.

Q. How did you get at the quantities?— A. If it were in pockets, I would measure the pockets, and estimate the size of it as near as possible. It is only approximate, measuring the pocket, and a well defined line, I would measure it up, the same as I would measure up any other work.

Q. Do I understand that in all cases you did measure ledge rock?—A. Where ledge rock was defined, yes.

Q. It is always defined, is it not?—A. It might be detached.

Q. Ledge rock not detached you measured in all cases?—A. Yes.

Q. What do you call masses; what do you mean by masses?—A. Well, boulders cemented together, or ledge rock in masses—masses measuring over one cubic yard of boulders cemented together, conglomerate.

Q. Have you ever seen a face of ledge rock which, on the top, was shattered, not by dynamite, but by some force of nature, for, we will say, just for example, two or three or four or five feet from the top, but remained in its original position?—A. Yes.

Q. You have seen that?—A. Yes.

Q. And then, from that down, it was in an unshattered ledge; that is a common appearance, is it not?—A. I do not know if it is common; I think I have seen it.

Q. That is a common appearance, is it not, in limestone ranges?—A. That is common in limestone. I thought you were asking if I had seen it on the work.

Q. I mean generally?—A. Oh, yes.

Q. That is a common appearance in limestone ranges.—A. Yes.

Q. If you were going to build a railroad through a country of that kind, and you had present in your mind that there were boulders in that country, and you had also present in your mind that there was ledge rock in that country, and that there was shattered ledge, as I have spoken to you of, in that country, or broken ledge, would that not be a very apt way to describe it, as rock in ledges and rock in masses and boulders?—A. Yes.

Q. It would be an absolutely correct way to describe it, would it not?—A. Yes.

Q. Is that specification not to you susceptible of the interpretation that it does not include anything but rock when you look at it?—A. The specification, yes.

Q. Clause 34 "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": Is not the specification exhausted literally when you have included in it boulders and solid ledges and the broken and the cracked ledges?—A. Yes.

Q. Can you conceive of anything else being included in it, if you confine it to rock?—A. No.

Q. But you did include something else in it, did you not?—A. Yes.

Q. In your personal opinion, ought there to be anything else included in it? —A. Well, I have just classified according to my instructions. We got instructions supplementary to the specifications, giving the chief engineer's ruling, and we were guided by those instructions.

Q. That seems to have been the impression that was got by the whole staff, that the proper interpretation of that clause was that it should include something besides rock?—That seems to be the impression which the whole engineering staff had, is it not, that something else besides rock might enter into the solid rock excavation?—A. I think so, yes.

Q. Were you ever told that you should not classify in that way—that you should not classify material which was not rock as solid rock excavation?—A. No.

Q. You were not undertaking to put an interpretation in the specification at all, were you? You were simply following your instructions?—A. Yes.

Q. And your immediate superior, when you were resident, was whom?—A. Mr. Darey. When I took over that work, I think probably a month or thereabouts after I got there, this blue print was first brought out, Mr. Lumsden's interpretation of 34, 35 and 36.

Q. Were you ever in the work when Mr. Lumsden was there?—A. No.

Q. Never saw him on the work at all?—A. No.

Q. Were you ever present when Mr. Schreiber was there?—A. No, sir.

Q. Describe to me, will you, what you classified, or what you know was classified, as solid rock excavation under the heading of masses?—A. Assembled rock containing 50 per cent or over of boulders, with the cementing matrix in between.

Q. When you say assembled rock, you mean rock of what size?—A. It might be of any size, provided the mass contains more than 50 per cent of rock.

Q. It might be as big as a pea?—A. No, no, assembled rock.

Q. Yes?—A. Beg pardon, rock measuring over a cubic yard cemented together.

Q. I think you had better take another run at that?—A. No, sir, boulders over a cubic foot, when the mass contains 50 per cent or over of rock.

Q. Do you use the word "over" advisedly?—A. Fifty or over.

Q. In your experience would you say that over the whole classification the average of rock was more than 55 per cent?—A. Yes.

Q. Where can you refer to me that it was?—A. To the profile, mile 160.

Q. It will be sufficient if you tell me that you have in mind one, about where?—A. About mile 160.

Q. 160 west of the Quebec Bridge?—A. Yes, about 160.

Q. Have you any other in mind?—A. It is hard to say at present. You see it is four years since I left that work. Here is a place at 161½, at the west end of the cut: 161.5.

Q. What was the east end?—A. Sand, and this was loose rock, with a percentage of boulders.

Q. You say that one would be over 50 per cent?—A. Yes, at that point in that cut.

Q. Take the whole of the assembled rock throughout that cut: what would you say the percentage of rock in the assembled rock amounted to?—A. I should say about 60 and 70 per cent of the assembled rock was rock.

Q. Have you any other cut in mind where you think it was over 50 or 55 per cent?—A. No, I cannot say that I have. I cannot remember it, anyway.

Q. Will you describe to me the cementing material that you have been speaking of as being in the assembled rock?—A. It might be that hard blue clay which had been turned in as solid rock, or—I do not know what the proper name for the clay is, but it is a yellow clay you often find in conglomerate, cement in the clay.

Q. Where was there any of the yellow clay? Can you tell me one of the cuts? Can you refer me to where I have seen any of it?—A. No, I do not know that I can.

Q. But generally speaking, what was the cementing material?—A. That blue material.

Q. It was always clay, was it?—A. Well, it was of a clayey nature.

Q. It was either clay or sand: it could not be anything else, as far as I can see?—A. It could not be sand; sand would not cement; I would say clay.

Q. Clay alone?—A. Yes.

Q. You accompanied the commission during this week over the portion of the railway that has the steel on it from mile 7 to mile 290?—A. Yes.

Q. And part of that was under construction?—A. Yes.

Q. Part of it was completed?—A. Yes.

Q. I suggest to you that, for nearly the whole of the distance, the material which is not rock was nearly all sand, or sand and clay mixed; what do you say as to that?—A. Well, judging from what I saw of it, there is quite a lot of material there, rock in masses.

Q. I am saying that the material other than rock of every description was sand, or sand and clay?—A. Well, I cannot say. I did not go out to examine it.

Q. From what you saw, I mean; you saw it from the train and got out where you got out?—A. Not very often; I did not get out any oftener than I had to.

Q. You were not well, but from what you saw, what would you say?—A. Judging from the slopes, I saw quite a lot of sand in the slopes.

Q. You were not well enough to get out, and did not get out and examine it on many occasions?—A. No.

Q. Would you not like to give a general opinion on it?—A. No, I did not go out and examine the pits or anything.

Q. In your opinion, I draw from what you said, that sand and clay mixed would not make cementing material?—A. Oh, it might; I would not say it would not.

Q. Have you ever seen it where it did?—A. Yes.

Q. Where?—A. In two cuts, one at mile 155 and one at mile about 157, Quebec Bridge west.

Q. What do you mean by cementing material? Do you mean material which will fasten the pieces firmly together?—A. Yes.

Q. That if you take up, for example, a piece of rock which weighed ten pounds, attached by this cementing material to a piece which weighed five, that the two of them would adhere together?—A. Yes.

Q. Did you see anything this week that would do that.—A. Well, you would have to have sufficient pressure to make them cemented material.

Q. But if you take two pieces of rock and put them together with cement, the cement will hold them together?—A. Yes.

Q. And you have to break them apart?—A. Yes.

Q. If you take two pieces of rock put together under any pressure, you may pull them apart without breaking the clay at all, may you not?—A. Yes.

Q. They are simply held there in the same way as if you drive a knife into a piece of board, by pressure?—A. Yes. What I mean is this, that if you take a piece of cementing material out of a cut, say of two feet length, that mass would always be cemented together; you could hold it by the end.

Q. You could not lay bricks in it and make the wall stay up?—A. I do not know.

Q. You would hate like poison to pay some person for doing it, would you not?—A. I do not think so.

Q. Is there any of that material that would take the place of mortar and cement in a building?—A. No, if it were exposed to running water it would break away.

Q. If it were exposed to air, it would crumble away?—A. I suppose it would.

Q. If it became dry it would crumble away?—A. No, I do not think so.

Q. Did you see a cut dug out last night?—A. No, sir.

Q. All that material, I suggest to you so far as you have seen, when it was exposed to the air, became dry and became disintegrated. Did you ever see cementing material used in buildings that did that?—A. I have seen mortar exposed to the water and frost.

Q. Too much sand in it and not enough mortar, was that not the reason?—A. I saw one instance in my own house.

Q. You would not have paid for it, if you had known it was there?—A. I would not like to have paid for it.

Q. It was not mortar?—A. It was not good mortar.

Q. It was not mortar as commonly understood; there was not sufficient lime in it to make it cement the bricks or stone together?—A. No.

Q. You did not examine these cuts sufficiently to form your opinion as an engineer as to whether or not they were very highly classified, did you?—A. No.

Q. By reason of your not being well?—A. Yes.

Q. Where you made the estimates, or revised the estimates, did you return the boulders of a yard or over separately?—A. In the monthly estimates?

Q. Yes.—A. In the sum total of all the boulders turned in that month, it was put in as a lump sum.

Q. When I say separately, I mean separated from the other solid rock?—A. From ledge rock?

Q. Yes.—A. Yes, sir.

Q. And from assembled rock?—A. I would not be sure about that.

Q. In your returns ledge was one division of solid rock?—A. Yes.

Q. And boulders under a yard and over a foot cemented together, which, in the mass, made up more than a yard, was another heading, was it not?—A. Yes, assembled rock.

By Mr. Gutelius:

Q. Did the character of the material between the rock fragments have anything to do with your classification?—A. Yes.

Q. How would you classify a volume of boulders and rock fragments generally over a foot in size, which had its interstitial spaces filled with free sand?—A. Loose rock. Excuse me, I was referring only to the boulders and rock. I classified that on a percentage basis. I misunderstood your question. I was answering for the boulders over a cubic foot and under a cubic yard; that would be loose rock, and I would classify it on a percentage basis, and estimate on the face of the cut what percentage of the boulders were loose rock, and what percentage of the sand made up the common.

Q. If there were no stones in a cut of that character larger than a cubic yard, how would you classify?—A. If there were no stones in the cut larger than a cubic yard—that is, not as large as a cubic yard?

Q. Yes?—A. I would classify it in the same way, percentage.

Q. There would be no assembled rock in a cutting, unless it was cemented together?—A. No.

Q. If the material was loose rock sizes?—A. In the same cut, sand and loose rock?

Q. Yes?—A. On a percentage basis, I would return the boulders of loose rock size as loose rock, and the remainder as common excavation.

Q. If this same mass of loose rocks should have its interstitial spaces filled with hardpan, how would you classify it?—A. Solid rock.

Q. If the interstitial spaces should be filled with a material that, on account of its compactness, was difficult to pick, and yet, by working on a vertical face in a cutting, the rocks dropped out by a little movement with a pick or a bar, what would you call that?—A. Well, it depends how much labor it took to get the rocks to come out; if, in my opinion, the cut had best be removed by blasting, I would classify it as solid rock, and if I thought it could be worked just as satisfactorily by pick or bar, I would classify it as loose rock.

Q. Would you be influenced by the cost of removing it, either by hand, working from a face, or by shooting the whole cut?—A. No, sir.

Q. What is the basis of practicability?—A. If the contractor told me he thought the best way to take that cut out was by constant shooting, and I was under the impression it could be removed just as practicably by hand, pick, or bar, I would classify it as loose rock, unless I was assured the best way to take it out was by shooting, because I imagine a contractor might say that shooting was the only way to take it out, for the sake of the classification.

Q. Is not practicability, when boiled down, what it will cost? The most practicable thing is the cheapest thing?—A. Yes, sure, but that is a matter of argument sometimes between the engineer and the contractor.

Q. Did you ever have a case where the contractor shot this material and you thought he could take it out without shooting?—A. Yes.

Q. Were there many such cases?—A. No.

Q. Don't you think, really, that they put powder into many of these cuts, not that it was necessary, but that it just loosened up the thing and made it easier to take it out, and gave them an opportunity to say it was shot? Was it the practice of the contractors to try and lead you on by shooting in many of these cuts?—A. Not as a rule; there were one or two cases where it was done.

Q. Have you one such case in mind that you could tell me the story of?—A. In this cut at 160.4.

Q. Just tell me the story about it, shortly?—A. Well, the contractors claimed it was a cemented cut, it was all cemented material, and they claimed it was solid rock, and they kept all the old powder cans to show me how much powder they had been using in the cut, and wanted classification as solid rock on that account.

Q. Did they kick hard for it?—A. They did for a while.

Q. And what was finally done?—A. I could not tell you what the classification was without seeing the profile.

Q. Those are sand cuts?—A. Sand here.

Q. But generally it is sand country?—A. Yes, that portion.

Q. And they wanted solid rock for the boulders in that portion of this cut?—A. Yes.

Q. What do you say as to this classification of that cut; solid rock massed 11,000, loose rock 24,191, common excavation 18,693?—A. That is the final classification.

Q. What do you say to that 11,000 yards of massed material?—A. That is all right; that was arbitrated upon; I do not know whether there was a cut made in it.

Q. Do you believe there was 11,000 yards of material in there hard enough to be classified as solid rock?—A. Yes.

Q. Why did you tell me you did not allow it?—A. I did not allow it all. They wanted solid rock all through that cut for shooting; they claimed it was all cemented.

Q. I have noticed two separate kinds of cemented material on this district, one in which two stones twice the size of your hand would adhere together, if broken up in a large mass, and the other stones the size of an egg or less which would not

hold together, in what has been classified as assembled rock. Did your experience over your own district coincide with that suggested?—A. Not cemented together—no, sir.

Q. Everything that you have seen classified as assembled rock you think was cemented together?—A. Yes.

Q. You recognize from this blue print that the cementing is not an essential?—A. It does not say so there.

Q. Did you ever work under any other specification than this one?—A. No, sir, not in this country.

Q. Does it seem right to you, under this assembled rock classification, that the cementing material, which, in itself alone, in masses, would be classified loose rock, should, when it has stones in it up to 50 per cent, be paid for as solid?—A. Yes, because I think it could best be removed by blasting.

Q. As an engineer, does it strike you that that interstitial stuff, when it amounts to 49 per cent of the whole amount, should be paid for at solid rock prices?—A. I think it is a liberal classification—generous.

(N. T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN IN THE TRANSCONTINENTAL RAILWAY OFFICES, AT QUEBEC, AUGUST 19th, 1912.)

J. H. HOLIDAY, sworn:

By Mr. Gutelius.

Q. How old are you?—A. Thirty-three.

Q. What division are you on?—A. Division 2.

Q. Where were you educated, and what was your experience prior to being employed on the Transcontinental?—A. Educated in England, and articled with the Great Northern Railway in England, and then I was contractor's agent after that. I was with the Great Northern for five years and contractor's agent for three years after that, and then I came out here, and then on this railway ever since.

Q. What year did you start here?—A. Started here seven years ago, 1905.

Q. This was your first railway work in this country?—A. Yes.

Q. You were resident engineer at Residence 20 while it was being graded?—A. Yes.

Q. It extends from mileage 36 to 52?—A. Yes.

Q. West of the Quebec Bridge?—A. Yes.

Q. In travelling over that portion of the line I noticed several road crossings that were supported by cribs on either side?—A. Yes.

Q. How did you happen to use that method of construction for those road crossings?—A. They were built after I left; I did the grading and they were built afterwards.

Q. Did you as resident or divisional engineer build any such crossings?—A. No, those are the only ones I saw on the line.

Q. You do not care to venture an opinion as to whether that was good railroad construction?—A. If I were asked, I would.

Q. If you were building them would you have built them that way?—A. I would have built them with fill.

Q. Looking over Residency 20, it occurred to me that considerable saving might have been effected by throwing the line at mileage 37 further north. Here is a fill about a mile in length?—A. Yes. I think they might have saved something there.

Q. You might have saved considerable filling by introducing another curve?—A. Yes. I think two or three curves.

Q. Did you do any locating on this railroad?—A. No, my first position was field draughtsman, and I went out as transit man. I never had charge of a party.

Q. I also noted that between mileages 42 and 43 that sub grade might have been lowered one to two feet, without interfering with the grade or the line?—A. Yes, I think that was raised on account of snow, to avoid the snow.

Q. It was not raised on account of water?—A. No, sir.

Q. Did you have anything to do with the establishing of the elevation of the sub grade there?—A. Nothing; it was all fixed when I went there.

Q. Did you make any recommendation in connection with lowering, or discuss the matter with your higher officers?—A. Not to my recollection.

Q. Did you know that you were expected to make suggestions in the interests of economy?—A. Yes.

Q. And you felt that, on account of the difficulties that might be encountered with snow, that it would be all right to leave that bank up that high?—A. Well, I thought we should have to ditch in any case in that kind of country, and the material we took from the ditch would just about make the embankment.

Q. Do you remember that that fill was made up of ditches from the side?—A. Yes.

Q. That would have been necessary in any event?—A. Yes. I had a great deal of trouble all through there with the farmers about the ditching and water rights. You cannot get rid of them at all.

Q. There was no train fill then?—A. No.

Q. Nor no borrow?—A. No, all made from the side ditch.

Q. And that reason applies to the whole distance from mileage 42 to 44?—A. Yes, sir.

Q. The cutting at mileage 41.4 is said to contain 1481 yards of solid rock, massed or mixed material?—A. That was not done in my time.

Q. Do you know what character of material that was?—A. No. I never did any work there at all; it was being completed when I left.

Q. You left before the work was started?—A. Before the cut was started.

Q. Was the cut at mileage 50.5 under construction while you were in charge?—A. Yes.

Q. What was the class of material that I see shown as 7,344?—A. That was mostly boulder.

Q. What was the material that was not mostly boulder?—A. Well, there were some portions that I classified as assembled rock, a portion perhaps 20 feet by 8, or something of that kind. There was a large mass of material there.

Q. That mass would be made up of small boulders?—A. No, fairly large boulders cemented together.

Q. A large proportion of the mass would be boulders of sufficient size to call a yard?—A. Yes, about 60 per cent of it would be rock.

Q. And what was the other 40 per cent?—A. Cemented material.

Q. If that 60 per cent were separated into loose rock, what would these two materials be classified as?—A. If the cemented material could be taken from the stone?

Q. Yes?—A. As loose rock.

Q. So that that 60 per cent, if separated, would be loose rock?—A. Yes.

Q. And when they are combined?—A. They would make solid rock under your assembled rock clause. Probably some of the rock would run over a yard.

Q. Now, if there were no item of assembled rock appearing in your instructions, and you had classified that material according to the book, could you consistently have made any solid rock of that clay and those small fragments of rock that were mixed?—A. A small proportion of it, possibly ten per cent.

Q. Could you consistently have given any?—A. Yes.

Q. Could you consistently have given any solid rock for that material which was composed of clay and sand, which we call cementing material, and stones less than a cubic yard?—A. No, sir.

Q. So that the instructions and the assembled rock clause is your authority for calling this material which is composed of loose rock, clay and sand, solid rock?—A. Yes.

By the Chairman:

Q. You have been divisional engineer for how long?—A. Four and a half years.

Q. And, as such, you have supervised the classification over all the Residencies?—A. Residencies 4, 5, 6 and 7.

Q. Does what you have said to Mr. Gutelius respecting assembled rock apply over all those residencies?—A. Yes.

Q. So there is nothing to be gained by my taking you over each one, to get your view on it?—A. I do not think so.

Q. Taking the mixed material over all your district that was put in as solid rock—you understand what I mean?—A. Yes.

Q. What was that composed of?—A. Well, in some cases——

Q. Generally, what was it composed of?—A. Boulders chiefly.

Q. Boulders and cemented material?—A. Yes.

Q. There was no fragmentary rock in it?—A. Generally speaking there was not.

Q. Was there a boulder measurement kept in your district of the boulders of a yard or upwards?—A. Yes, sir, in many cases.

Q. Was it the general practice?—A. We were not taking boulders regularly every day.

Q. Was there a record kept? I am not asking you now whether you counted them or estimated them or anything else. Was there a record kept, more or less accurate, of the boulders of approximately a yard and upwards?—A. Yes.

Q. You professed, then, to show separately the quantities of boulders of approximately about a yard by themselves?—A. In most cases, in many cases.

Q. Did any of those boulders creep into the mixed material measurement?—A. Oh, no, sir.

Q. Then the material returned as mixed material or massed material — which did you return it as, mixed or massed material?—A. Assembled rock.

Q. Am I correct, then, in saying that the material returned as assembled rock consisted generally of boulders of the loose rock size and cementing material?—A. Yes, sir, fairly large rock.

Q. I say loose rock size generally; I suppose there was a quantity of boulders of less than loose rock size in that?—A. Possibly in cementing material, yes.

Q. And that would be a large or a small percentage?—A. Small per cent.

Q. And I suppose there were occasional boulders of a yard and upwards?—A. Yes.

Q. But that would also be a small percentage of boulders of a yard and upwards in the assembled rock?—A. Yes. If I had gone through and taken out all the stones in the assembled rock which were under foot, I judge I would take out perhaps 20 per cent.

Q. If you had gone through and taken out all the big fellows of a yard and upwards that crept into the assembled rock, what would they amount to?—A. Oh, possibly ten per cent.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN AT TRANSCONTINENTAL RAILWAY OFFICES, QUEBEC, AUGUST 19th, 1912.)

ALEXANDER FERGUSON, sworn.

By the Chairman:

Q. You are a divisional engineer?—A. Yes.

Q. On the N.T.R.?—A. Yes.

Q. Your division extends where?—A. At present from Quebec to mile 91 on the north shore, and from the Chaudiere bridge to mile 12 on the south shore?

Q. And before you were in your present position what office did you occupy?—A. Divisional engineer on Number 9 division.

Q. What mileage was that division?—A. Mile 181.5 on the north shore to mile 26.5 on District C.

Q. Before that had you a Residency?—A. No.

Q. You never had a Residency?—A. No.

Q. Were you employed by the commission?—A. Yes.

Q. As locating engineer?—A. Yes.

Q. You located the line between what points?—A. Between the Quebec bridge and mile 22 on the south shore on first location, and between La Tuque and Weymontachene on the north shore.

Q. You located all along the St. Maurice River?—A. I ran some parts of that, but not continuously.

Q. Did not Mr. Grant locate part of that?—A. No.

Q. Did he locate any of this line?—A. He located from Quebec going west to Hervy Junction.

Q. I thought he was responsible for part of the location along the St. Maurice River?—A. I believe he was assistant.

Q. When did you have experience in classification before you became divisional engineer?—A. I did not have any experience as responsible engineer.

Q. Did you have it as an irresponsible engineer?—A. Well, I have seen classification in the old country.

Q. You were educated in your profession in Scotland?—A. Yes.

Q. And you practised it on the British railways before you came here?—A. No, sir, not on British railways. I was with a private civil engineer whose practice consisted of different works, waterworks, sewage works and small railway work—different works of that description.

Q. In Great Britain they classify all their work before they let their contract, do they not?—A. To a great extent.

Q. And then they let it on the estimates made before the work is done, upon the amount of material as classified?—A. Well, the quantities are more particularly taken out there; the materials are more carefully determined before any contracts are let.

Q. They are not determined here at all, are they?—A. No, sir, you could not say they were determined here.

Q. Over what portions of your divisions had you any actual supervision of the classification; that is to say, what classification was there done after you became divisonal engineer?—A. On division number 9, practically all of it.

Q. That division lies between what points?—A. 181 to 196.

Q. To what place?—A. Well the name of the place at the beginning of it is Bonhomme; that is a very local place. I do not think you will find it on the map at all; it is a Hudson Bay cache.

Q. How much above La Tuque is it? Is it on the Manuan River?—A. No, it is not as far as that.

Q. The Flamand river?—A. It is beyond the Flamand River; it is about six miles beyond the Little Flamand River.

Q. It commences about six miles beyond the Little Flamand and goes to where?—A. To the second Ribbon crossing.

Q. I will ask you first about the south side; you were divisional engineer over the Chaudiere cut?—A. Yes.

Q. Was there any assembled rock in that cut?—A. Not as I know of, assembled rock.

Q. What was the solid rock in that cut?—A. Ledge rock.

Q. There is no doubt about it; it was not, as you know, assembled rock?—A. No.

Q. It was pure ledge rock all through?—A. It was ledge rock on the bottom of the cut; above the ledge rock, up to from one to three feet from the top, was loose rock.

Q. I am speaking of the solid; all the solid that has been returned was what?—A. Was ledge rock, as far as we could measure it, as closely as we could measure it.

Q. You did not profess to return anything but ledge rock as solid?—A. Not while I was there.

Q. You were there all the time?—A. No.

Q. How long were you there?—A. I was only there from June of last year.

Q. Had you any reason to believe or understand, from anything you know, either since you have been divisional engineer, or before that there was any assembled rock in that cut?—A. No, sir. I have no reason to believe it.

Q. You believe that all the solid rock was ledge?—A. Yes; that is as closely as it could be measured.

Q. The resident engineer put in a lot of it as assembled rock?—A. Yes.

Q. Did you revise the classification on the south side?—A. No, sir.

Q. You looked over it; I do not mean you revised it down or up, but you revised it?—A. Well, I classified the material which came out after I went there.

Q. I am speaking since you have been responsible for it?—A. Exactly.

Q. Did you raise it, or lower it, or leave it as the resident had put it?—A. In the Chaudiere cut the material was classified after I went there, so far as I know, similarly to what it was done before.

Q. Did you raise it or lower it?—A. I did not raise it or lower it, because I could not see how it could be altered.

Q. You were satisfied with it, then?—A. Yes, I was satisfied with that classification.

Q. Your western division commences at mile 181?—A. Yes.

Q. In that division sand predominates, does it not?—A. Yes.

Q. And right at the first cut, 181, it is classified as assembled rock, is it not?—A. In one portion of the cut——

Q. Have you the quantities in that Residency?—A. No, I have not; I think there must be a statement somewhere; they are not on my profile.

Q. Your division commences at what point?—A. 181.32; that is the first cut on my division, Residency 33.

Q. 181.5 is assembled rock, is it not?—A. No, sir, only part of it assembled rock.

Q. And loose rock and common excavation?—A. And solid rock and mixed material.

Q. Assembled rock covers all the mixed material, does it not?—A. No.

Q. Well, there is no ledge rock in it?—A. No.

Q. Describe that cut to me, how it is made up. In the first place is the matrix in that sand?—A. The matrix is a very compact sand, containing a percentage of clay in it.

Q. Is there one per cent of clay in it?—A. I could not estimate the percentage of clay.

Q. You know pretty well whether there is large or small amount of clay?—A. In the sand, but it is intermixed.

Q. There is a small amount of clay in it?—A. The clay covers the particles of sand.

Q. You would call it a sand cut?—A. No.

Q. What would you call it?—A. I would call it more or less of a hardpan cut, as near as I could get at it.

Q. Is it sand or clay?—A. It is neither.

Q. Could you call it clay?—A. No, and you could not call it sand, but I think, if anyone were looking at it he would say it is sand.

Q. And it is a sort of slaty quarry sand, more like quicksand than anything else?—A. Not like a quicksand.

Q. It is a very fine sand?—A. Yes.

Q. And how does it differ from the quicksand?—A. That sand, as it is in the cut, is very hard.

Q. In what does it differ from the quicksand?—A. It does not differ very much from the quicksand.

Q. It does not differ at all, does it?—A. I could not say that it did differ, under certain circumstances.

Q. Circumstances do not make any difference in the said sand; it is either one thing or the other; it is either a coarse sand or a fine sand, or some class of sand, under all circumstances?—A. I would describe a quicksand as a sand that you would sink in if you walked in it.

Q. If you had that sand wet enough you would go down over your head before you knew where you were?—A. No, not by any means.

Q. If it were wet enough?—A. I have never seen it in that condition.

Q. What I am trying to find out from you is whether or not that is a very fine sand?—A. It is.

Q. It would not pack if it was not?—A. No, it would not.

Q. And it is of a bluish tint?—A. Yes.

Q. And you can find, if you look at it and examine it, a trace of clay in it?—A. Yes.

Q. That is a fair description of it?—A. It is a very fair description.

Q. And is there any rock at all in that cut?—A. Yes, sir.

Q. What is the rock that is in it like?—A. It consists of boulders.

Q. Of what size?—A. All sizes, varying from the size of a man's head, or a little smaller, to several yards.

Q. Will you tell me approximately what percentage of the excavated material from that whole cut is boulders?—A. About 50 per cent.

Q. Will you tell me approximately what percentage of those boulders are of solid rock sizes?—A. I should say probably 50 per cent of those.

Q. Did you return any of that cut, or was there any of that cut returned as boulders?—A. Yes, sir.

Q. Not as mixed material?—A. If I had the cross-section I could tell you.

Q. Brown said, I think, that 50 to 55 per cent was solid rock; what do you say?—A. It is impossible to say. The percentage of cementing material in that cut would not be more than 25 in that cut, in the mixed material. The boulders were so closely packed together that I do not think there would be any more than that.

Q. Divide it up on paper and show me how you divide that cut up in your own way. In the first place you have common excavation about a fourth of the cut?—A. Yes.

Q. Then loose rock?—A. Yes; that loose rock represents the material in between the boulders—that is the matrix and the small boulders in the west end of the cut.

Q. There is no matrix at all where there is loose rock?—A. Oh, yes.

Q. What does this section of the cut show (producing cross-section)?—A. This section shows here at the entrance from the east assembled rock.

Q. As you enter the cut?—A. Yes.

Q. And then the next shows assembled rock?—A. Yes.

Q. And the next shows assembled rock?—A. Yes.

Q. How far does that assembled rock extend through the cut?—A. From 1677.93 to 1678.94, or 101 feet. That is all assembled rock, but it stops there.

Q. How long is the cut?—A. 1,500 feet long.

Q. How many feet of common excavation is there?—A. 206 feet.

Q. Then you come to mixed material for the rest of the distance, do you not?—A. Yes.

Q. Is all your assembled rock in the first hundred feet of the cut?—A. Yes, all in the first 100 feet.

Q. What percentage of that assembled rock is boulders of the solid rock class?—A. Not more than 50 per cent.

Q. Is there 50 per cent?—A. Oh, yes.

Q. Why did you not return them by themselves?—A. Because we considered the material assembled rock as a whole.

Q. Then 50 per cent of those boulders in that are of the loose rock and common excavation size?—A. Yes.

Q. And the contents of that 100 feet is how much?—A. 2564 cubic yards.

Q. What do you say is the proportion of the matrix in that?—A. I should say not more than 20 or 25 per cent.

Q. Then you go along after you pass the common and you come to the mixed material?—A. Yes.

Q. What is the difference between the mixed material and the assembled rock?—A. The matrix in the mixed material is not so hard.

Q. What do you classify the mixed material as?—A. I estimate the percentage of solid rock boulders and return the remainder of it as loose rock.

Q. Then you do not return the matrix in that as solid rock?—A. No.

Q. But you do return the matrix in the east end as solid rock?—A. Yes.

Q. Do you return any of the boulders in the mixed material as loose?—A. Yes, sir.

Q. Were the boulders estimated in that cut in the mixed material portion?—A. They were.

Q. What quantity of boulders was there in that mixed material of the solid rock sizes?—A. In the mixed material I think we estimated about 60 per cent.

Q. Of what?—A. Of the whole mass.

Q. To be big boulders?—A. To be yard boulders.

Q. Yard boulders or over?—A. Yes.

Q. How much of that part of the cut was matrix?—A. I do not think there would be any more than 15 per cent of it.

Q. And the remainder was what?—A. Small boulders.

Q. It ought to be pretty nearly a clean rock cut of one kind or another, excepting the common excavation portion?—A. I do not quite understand you.

Q. There is very little of anything but rock in that?—A. It is nearly all rock.

Q. And do the sides now show?—A. No, sir, they do not.

Q. Did we make another cut and examination in there?—A. No, sir, we did not.

Q. That is 181.9?—A. Yes.

Q. Who is B.?—A. Brown.

Q. I have this note, "Brown says he will tell me when the soil differs. We examined in the culvert some very hard moist clay with a little sandstone; we also got sandstone from here". Was that when we went down into the hole?—A. Yes.

Q. Take 182.5; there is no common excavation in that at all?—A. I do not think so.

Q. How would you describe that cut?—A. That cut I would describe as being similar to the west end of the previous cut which we just discussed, I think—similar in materials that it contains.

Q. Is the S.R.M. all solid rock there?—A. Yes.

Q. What is the loose made up of?—A. The loose is made up of the small boulders and the remainder in between the boulders.

Q. The loose rock in that cut is nearly three times as much as the solid?—A. Yes, sir.

Q. So that it cannot be anything like the other cut?—A. It is very like the other cut, only that the boulders in it are smaller.

Q. What proportion of that cut was large boulders?—A. I think between 30 and 40 per cent, if I remember correctly.

Q. Not of the whole cut; that could not be right; you cannot be right on that, because there is not more than a quarter of the whole thing——A. Well, I may be confusing some of those cuts.

Q. If you do not recollect it, I will not ask you?—A. I cannot recollect the classification of all the cuts.

Q. How was that cut taken out?—A. Part of it I think was taken out with picks and shovels and part of it was blasted.

Q. Which part of it was taken out with picks and shovels?—A. I could not tell you that.

Q. Did you put that in as solid rock?—A. No, sir, not in that cut.

Q. Did they put in anywhere material that was taken out with pick and shovel as solid rock?—A. Never on my work.

Q. Was that which was blasted, blasted with dynamite or black powder?—A. When it was blasted in the cut it would be black powder principally, and then the boulders would be blasted with dynamite.

Q. That is what you call bulldozing?—A. Yes.

Q. I am not speaking of that, but I am speaking of the way the cut would be loosened up?—A. It would be loosened up principally with black powder.

Q. Did they not run a hole in under—dig a hole in with a shovel?—A. Yes.

Q. They dug the holes in with a shovel?—A. In all cuts on that division.

Q. On your division is that not the way it was done usually?—A. Yes.

Q. Taking a long-handled shovel, making a hole in the material, and then at the bottom of the cut put in your black powder and turn it loose?—A. Yes, although on some of the cuts they drilled it.

Q. But in the majority of them?—A. I know only of some four or five cuts where they used drills to drill the material.

Q. Is that not a common habit in sand pits?—A. Yes.

Q. So that the fact that they put in this black powder in little tunnels, if I may call it that, made with a shovel is no proof that it was very hard material?—A. Not at all.

Q. You would not be surprised to find that practice was adopted in ordinary sand pits used for building purposes?—A. I know it is the practice.

Q. And they just blasted this with black powder in your district, in the same way as they would a sand pit?—A. Yes.

Q. And that would bring out the whole face of the cut as far back as the powder affected it?—A. Exactly.

Q. You would not call that any more than occasional blasting?—A. I did not consider it any more than occasional blasting at any time.

Q. Then in your opinion, it was not necessary to use continuous blasting generally through your district?—A. On those cuts I do not think it was.

Q. I am speaking now in the material that was returned as solid rock?—A. I think there is only one place in my opinion where that material has been returned as solid rock.

Q. In this cut you returned a lot of solid rock, and the only blasting was in this cut at 182.5; the only blasting was as we have described it?—A. For the loosening of the material, yes, sir.

Q. Did you return a lot of that cut as solid rock?—A. Yes.

Q. Do you consider, then, that that material is sufficiently cemented that it will not break up with occasional blasting, to justify you in calling it solid rock?—A. We did not call that material solid rock.

Q. It is marked on your profile, if I understand it correctly, 1630 solid rock: S.R.M.?—A. Solid rock in mixed material, 1630.

Q. The blasting that was done in that material was done in the way we have spoken of just now?—A. The blasting to loosen the solid and the loose.

Q. But do you consider that the rock was cemented in that cut?—A. No, sir, I do not.

Q. So that it is a misnomer to call it S.R.M. then?—A. Not as we describe our material.

Q. Did you describe anything as solid rock material where there was no cementing matrix?—A. No, sir. That material is not what I consider assembled rock. I thought you were speaking of assembled rock.

Q. You classified under the heading of solid rock ledge rock?—A. Yes.

Q. And boulders of a solid rock size?—A. Yes.

Q. And cemented boulders?—A. Yes, which we called assembled rock.

Q. You called the cemented boulders assembled rock?—A. Exactly.

Q. Now, we have got rid of three classes; are there any more?—A. Not to my knowledge.

Q. What does S.R.M. mean?—A. Solid rock in mixed material, which represents the yard boulders in that material.

Q. Why do you not call it boulders?—A. Well, we have always understood that that description of solid rock in mixed material means boulders.

Q. But you have a column for boulders by themselves; did you return that as boulders?—A. We returned it as boulders.

Q. Purely and simply?—A. Purely and simply as boulders.

Q. Where can you find boulders in a section that is not in mixed material?—A. We have made a distinction between assembled rock and mixed material.

Q. Where can you find boulders in a section that is not in mixed material?—A. I do not know where you can find it, but we used that as a convenient term.

Q. It is a most inconvenient term to use three words where you need only use one?—(No answer.)

By Mr. Gutelius:

Q. In arriving at the cubical contents of solid rock in mixed material, did you measure the large boulders separately or estimate them?—A. We estimated them in the most of cases.

Q. Then where boulders are covered in mixed material, it is estimated yardage of boulders?—A. Estimated yardage of boulders, exactly.

Q. There is a classification, with which you are familiar, spoken of as solid rock masses, in which the rock is not solid rock size?—A. Exactly.

Q. You have in mind this distinction in giving your evidence?—A. I have.

Q. Is there not some solid rock classification on your division composed of mixed material in which rock masses are all less than solid rock size?—A. There is material returned on my division in which all the boulders are less than solid rock size.

Q. And paid for as solid rock?—A. Paid for as solid rock.

Q. What authority did you have for passing such material as that as solid rock?—A. We had the authority of the chief engineer's circular, I do not remember what date it was issued.

Q. The blue print with the five or six classifications?—A. Yes, exactly.

Q. That would come under his diagram number 5?—A. Yes.

Q. Which he calls in parenthesis assembled rock?—A. Yes.

By the Chairman:

Q. Then you will commit yourself to this statement that wherever you put down in an estimate solid rock in mixed material, you mean only boulders?—A. Exactly.

Q. Of solid rock size?—A. Yes.

Q. Excluding everything else?—A. Yes.

By Mr. Gutelius:

Q. Boulders and rock fragments?—A. Yes.

By the Chairman:

Q. So that in reading your estimates, we must bear always in mind that that is another name for boulders of rock size?—A. Yes.

Q. What do you mean by assembled rock; describe that?—A. Assembled rock is material which contains boulders which may be of any size, which are cemented together by some hard cementing material; then the whole mass of that is called assembled rock.

Q. Do you think that sand can cement anything in your district?—A. I think so, when it gets sufficiently hard.

Q. I am asking if that sand, or any of that sand, cements anything?—A. I think it can.

Q. Do you think it does?—A. I think it does.

Q. What do you mean by cementing?—A. Binding materials together—the other materials that are contained in it together.

Q. Then the boulders will, I take it, in some cases lie on the same plane, one next to the other, with cementing material between them?—A. They do.

Q. Supposing we removed all the material on the top and round the outside, and only leave that in which the bed and the cementing material lie between them, could we not lift them right out of that bed?—A. I do not understand the question.

Q. I will illustrate. I have your boulders here, and the blue paper underneath is the bed into which they sink, and the material is in contact with the whole base of those two boulders?—A. Yes.

Q. And the cementing material buried these boulders, and I have stripped it all away excepting that which is between the two boulders and that on which they rested, could I not lift that off the bed?—A. Not if it were cemented.

Q. But in that material. Of course if it were cemented I could not, but could I not lift it out of any of that material?—A. That material which you describe in those cuts?

Q. In any cut on your division?—A. I think when you get into material like that up at mile 15—

Q. But in any cut on your division, could I not lift it out and leave it like a man leaves his foot-prints in the sand?—A. I never studied that phase of it. I think practically in all the cuts you could do that.

Q. And just leave an impress like a man's foot would leave in the sand?—A. Exactly.

Q. And if I could lift up one boulder, and lift it away from the bed in that way, would the other boulder come with it?—A. Sometimes.

Q. Do you think that there is any sand in your cut which would make one boulder adhere to the other, so that they would lift up?—A. Not large boulders, but small ones.

Q. I am speaking of large boulders?—A. No, not the large boulders, by any means.

Q. They would come away from each other, as they would come out of the bed, would they not?—A. Yes, but in some cases they would come out so that there would be some of this material sticking to them with small boulders in it.

Q. Like wet sand would stick to anything?—A. No, I mean in its perfectly dry condition.

Q. Where would you find that?—A. I think you would find that up at mile 15.

Q. You would not find it generally through your division?—A. There is only, I think, perhaps one case I have in mind where I would find it.

Q. So that there are not in this cementing material that you speak of, excepting in that case, any cementing properties whatever, are there?—A. I am not describing that material as cementing material.

Q. You have assembled rock in here?—A. I have.

Q. And it must be cementing material according to your evidence?—A. I think only in two or three instances have I got cementing material.

Q. In your whole division?—A. In my whole division.

Q. Then there is no assembled rock in your division, excepting in two or three instances?—A. If I remember rightly.

Q. Will you tell me where those two or three instances are?—A. There is this instance that we have just examined at 181.9.

Q. Do you say that at 181.9, the boulder in the example I have already given to you, could not be lifted out of the bed, just as a man's foot would come out of the sand?—A. I think that it would lift out as you describe in that material.

Q. So that it is not cemented material?—A. Not in my opinion.

Q. But you have assembled rock in that cut?—A. Yes.

Q. How do you figure out your assembled rock where there is no cementing material?—A. That cut was classified as assembled rock by the district engineer.

Q. But you did not classify it as that?—A. I was not certain as to what to classify it.

Q. What would you classify it as now, with all the information you have now?—A. I think I would still be in doubt.

Q. Then in your division, assuming that assembled rock must be cemented together by some matrix, is there, in your opinion, any assembled rock?—A. There is.

Q. Can you tell me where?—A. I can.

Q. How much of it is there?—A. There are only a few yards. I could not tell you exactly how many yards, probably two or three hundred yards.

Q. In your whole division?—A. In the whole division there is so little of it that I could not give an opinion as to how much there is.

Q. It is as rare as the dodo?—A. Yes. You can figure it out in hundreds of yards instead of in the thousands. That is my opinion.

Q. You have seen all the district between the river and the west end of your division?—A. Yes.

Q. Is there any cementing material from the river up to the end of your division?—A. I could not say; I have not met with it, as far as I have seen.

Q. You have gone over it how many times?—A. I have gone over it a few times.

Q. Have you ever seen any?—A. I cannot recollect.

Q. Not that you recollect?—A. No.

By Mr. Gutelius:

Q. Referring to that number 5 diagram in the Lumsden instructions, this diagram is not drawn to scale?—A. No.

Q. It does not say anything about the material between the boulders?—A. It says nothing about the material between the boulders.

Q. Whether it is cementing material, or air, or water, or what not?—A. Exactly.

Q. Suppose you had a mass of small gravel, small fragments less than loose rock size that looked just like that blue print, could you, under this blue print instruction, classify that as solid rock?—A. You said nothing about the material in between?

Q. We first said that material in between could be anything, according to this?—A. I could classify that as solid rock under the blue print diagram, if the material could be more practically removed by blasting than by any other process.

Q. That is, under the blue print, you could classify as solid rock material which, under the general specification, is common excavation, provided the material in question is best removed by blasting?—A. Yes, I think that is right.

By the Chairman:

Q. Then if you saw a cut which, without testing it, appeared to be common excavation, and it resembled in appearance number 5 on this blue print, if you found on examination that you had to continuously blast that, would you consider under number 5 you could put it in the solid class; that is, if its appearance was the same as on the diagram?—A. Yes. Under those instructions I could classify it as solid rock.

Q. So, then, the instructions are not exact?—A. They are certainly not exact.

Q. Coyoting is putting powder into a hole such as dug by the prairie wolves? A. Yes.

By Mr. Gutelius:

Q. Have you made a study of the alignment in the vicinity of the Chaudiere cut?—A. No, sir, I have not done so. I have never had time since I came down here to do that.

Q. You were asked to pay special attention to excavations in the sides of cuttings at mileages 120.9 and 162.3 west of the river on our recent trip?—A. Yes.

Q. Will you tell me what you thought that material should be?—A. Well, at 162.3, that is material which I would classify as mixed material.

Q. And your mixed material is boulders en masse?—A. My mixed boulders consist of loose rock with the yard boulders returned as solid rock.

Q. And the remaining material you would return as loose rock?—A. Yes.

Q. And how about 120.9?—A. That was a very much harder cut. The matrix in it was very hard in the pit which I tested. I would have to describe that cut similarly to the other. The matrix is very much harder, and I would classify it as a mixed material cut.

Q. In the matter of curvature limitations, will you prepare a statement for me showing what savings could be effected, roughly, had the curvature been increased to ten degrees, covering 200 miles west of Quebec bridge? You will send this to me?—A. Yes.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN AT N.T.R. OFFICES, IN QUEBEC, AUGUST 19th, 1912.)

R. A. BLACK, sworn:

By Mr. Gutelius:

Q. What is your age?—A. Thirty.

Q. Where were you educated?—A. In Manitoba public schools, Winnipeg, and Manitoba College.

Q. What experience did you have before you came on the Transcontinental?—A. I joined the C.P.R. in the spring of 1898, and I worked with them till October 30, 1909.

Q. How long?—A. 11 years with the C.P.R.

Q. You held positions on the C.P.R. of resident engineer on construction?—A. Yes. Up to May, 1902, I was rodman, and instrument man, and in May, 1902, I got Residency, and I was Resident after that, in charge of work after that.

Q. You were employed on the N.T.R. in what capacity first?—A. I came on as locating engineer.

Q. What portions of the line did you locate?—A. I came in and we did not do any locating. I joined a party, and took a division on construction.

Q. What division was that?—A. Division 10, and I revised their old division.

Q. And you have been divisional engineer then practically all during your entire tenure with the N.T.R.?—A. Yes.

Q. Were you on the double track work between Winnipeg and Fort William?—A. Yes, I was there on location, two different times.

Q. What was the limiting degree of curvature on that line?—A. I do not remember.

Q. What were the sharpest curves you recall?—A. I think a ten degree, I am not certain.

Q. In any event, there were curves of that character on that double track?—A. Yes. I was running level, so that I could not say for certain what the curves were.

Q. What were the limiting grades that you were working on—maximum grades?—A. I think it was a one per cent; I would not be certain of that either; it is some years ago.

Q. Did you use momentum grades?—A. Yes. We put them on our profiles, whether they were built or not.

Q. In the classification on the C.P.R. work did you ever classify such material as is known on the present work as assembled rock as solid rock?—A. No, sir, not as solid rock.

Q. Did you ever know of any material which was not rock being classified as solid rock on the C.P.R.?—A. I never had a case.

Q. You never heard of anyone else, either, classifying mixed material as solid rock?—A. No, sir.

Q. How did the prices paid on the C.P.R. contracts that you were engineer of compare with the prices paid on the your division on the National Transcontinental?—A. They were low; that is all I can remember.

Q. The C.P.R. prices were lower?—A. Yes.

Q. So that, if this railway had been built under C.P.R. specifications and C.P.R. prices, as you knew them, it would have been constructed cheaper, at least to the amount of the difference between loose rock and solid rock for the portion called assembled rock in this contract?—A. Yes, sir, I think it would. Those prices I refer to were nearer the main line.

Q. It should be pointed out, however, that C.P.R. prices would doubtless have been increased, on account of the isolated position of the N.T.R.?—A. Yes.

Q. Did you ever know, in your experience, of location being influenced by a desire to secure straight track on trestles?—A. No, sir, I do not think so.

Q. Did you ever hear, in your engineering experience, of a rule that all steel bridges and steel trestles must be built on straight track on tangent?—A. I never had it in my experience.

Q. This was a new experience to you?—A. Yes.

Q. Did you ever do any locating prior to coming on this railway?—A. I have done revising.

Q. But in your revisions it would be necessary for you to follow the policy of the organization for whom you were working?—A. Yes.

Q. Did you ever have instructions that limited the curvature absolutely, without reference to cost prior to going on this division?—A. No, I had not.

Q. You always were provided with a valuation, sort of sliding scale schedule?—A. Yes.

Q. In the location here you were given definite instructions?—A. Yes.

Q. Six degree as an ultimate maximum?—A. Yes.

Q. An iron-clad rule?—A. Yes.

Q. Have you ever found it necessary in your previous experience to make fills of rock borrow?—A. No.

Q. Were these railways with which you were connected built with wooden trestles?—A. Yes, all of them.

Q. If wooden trestles have been used on your division, what savings would have been effected?—A. We would have saved the difference between the cost of wooden trestles and the cost of the permanent structure, whether it be bridge or culvert and train fills in cases.

Q. It would be possible for you to secure statements from the district and divisional engineers to show just what this saving might have been, would it not?—A. I think so, yes.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN IN OFFICES OF N.T.R., AT QUEBEC, AUGUST 10th, 1912.)

N. R. BEAUDETTE, recalled:

By the Chairman:

Q. We want the field books from you? Are they in English?—A. Yes. This is the first book, Page 53 has reference to the big cut.

Q. It is kept according to date?—A. Yes.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN ON TRAIN BETWEEN GRANT AND COCHRANE: JUNE 9th, 1913.)

G. L. MATTICE, sworn:

By the Chairman:

Q. You are an engineer by profession?—A. Yes.

Q. How long have you been an engineer?—A. Since 1897—fifteen years.

Q. And when you graduated as an engineer, what was the first engagement you had in your professional capacity?—A. I worked for about three years at electrical work, telephone, electric light and electric railway.

Q. Any construction in electric railways in that?—A. No.

Q. What next?—A. Then I started as rodman on the St. Lawrence and Adirondack.

Q. And served as rodman for how long?—A. One year.

Q. After that?—A. Instrument man.

Q. For how long?—A. Possibly two or three years, I cannot tell you exactly from memory.

Q. When did you first take up construction work? When did you first become connected with construction work?—A. When I went on as rodman.

Q. When did you first take up any work which required you to have any interest in or anything to do with classification?—A. In 1899.

Q. What were you doing in 1899?—A. I was resident engineer on the Rutland Railway.

Q. I thought you graduated in 1897?—A. I graduated in 1892, but did not really start work till 1897. I am wrong in my dates; it must have been 1894.

Q. Had you any experience in classification before you came on this railway?—A. Yes.

Q. Where?—A. Rutland Railway.

Q. How long?—A. Two years.

Q. And then?—A. Algoma Central Railway.

Q. For how long?—A. Two years.

Q. Do you recall what your specification was when you were on the Rutland Railway?—A. No, I do not.

Q. Do you recall what it was when you were on the Algoma?—A. Not in detail.

Q. Was it similar to the specification on this road?—A. I think we had a hardpan classification.

Q. Had you the ploughing classification, the ploughing test?—A. I think that is in nearly every specification.

Q. Had you that classification?—A. Probably.

Q. You do not recollect?—A. I do not recollect.

Q. How long were you on the Algoma Central?—A. Two years.

Q. In what capacity?—A. Resident engineer.

Q. Then you came from the Algoma Central to this line?—A. No, sir.

Q. Where did you go then?—A. To the C.P.R.

Q. Where were you employed there and in what capacity?—A. Resident engineer on grade reduction.

Q. Where?—A. Between Fort William and Winnipeg.

Q. How long did you continue there?—A. One year.

Q. Where did you go then?—A. Town engineer for Kenora.
Q. How long there?—A. One year.
Q. After that?—A. Locating engineer on this road.
Q. Then you came on this road in what year?—A. 1905, I think in the spring.
Q. How long did you continue as locating engineer?—A. A year and a half.
Q. Where did you locate?—A. From a point west of Lake Nipigon westerly about 75 miles.
Q. For the Government?—A. Yes.
Q. Did you use the G.T.P. material on that location?—A What kind of material?
Q. Their survey plans?—A. Never saw any.
Q. Did not use them in any way?—A. No.
Q. Did you locate the line as it was finally adopted?—A. No, I made the first location.
Q. How close did you come to the present line?—A. Oh, they used probably half of my location.
Q. It is in the same country?—A. The country that I developed was used, and revised; three men made this location, and in some cases more.
Q. Have they gone any distance from it?—A. No.
Q. After you got done locating what did you do?—A. I was given charge of a Residency on division 7, district F.
Q. Whose contract?—A. J. D. McArthur.
Q. Where is that division?—A. From Kenyon Lake to the Winnipeg River.
Q. That is not a country similar to this in which we are now?—A. Not at all.
Q. What is the general description of that country?—A. Rock.
Q. And after you finished on that, and you left that Residency, where did you go?—A. I was appointed divisional engineer in charge of that division.
Q. And after that?—A. I took charge of Division 3 on the same district.
Q. When did you come down in this country?—A. In October, 1909.
Q. October, 1909 you were transferred to where?—A. North Bay, as district engineer.
Q. Between what points?—A. The Ontario boundary and mile 248 west.
Q. That is the boundary between Ontario and Quebec?—A. Yes.
Q. From the Quebec line to mileage 248?—A. Yes.
Q. About where is mileage 248? Is it east or west of Grant?—A. It is sixteen miles west of Grant; that was the full extent of the district at that time.
Q. And have you continued as district engineer ever since?—A. No.
Q. How long did you remain district engineer?—A. One year.
Q. Did you get your present position after that?—A. Yes.
Q. What is your present position?—A. Assistant district engineer.
Q. Who is the district engineer?—A. Mr. Balkam.
Q. Does your present work extend over the same territory as it did when you were appointed district engineer?—A. It has, in a manner.
Q. So that it covers the old district, and has how much more added to it?—A. About 120 miles on the east end and 60 miles on the west.
Q. You ran into Quebec for 120 miles?—A. Approximately that, yes.
Q. What are your duties?—A. General inspection duties in the office and in the field.
Q. Have you anything to do with the classification?—A. Yes.
Q. What are your duties in respect to classification?—A. To consult with the resident and divisional engineers. These are my present duties as assistant district engineer you are speaking of.
Q. What were your duties as district engineer first?—A. As district engineer, to approve of the classification or not.

Q. To revise the classification?—A. To revise the classification; that is the better way to put it.

Q. Then, as such, during that year there was no classification done in your district that was not revised by you?—A. No.

Q. And as assistant district engineer, has there been any classification done that has not been revised by you?—A. Yes.

Q. Passed on by you in any way?—A. Passed on by me, yes, approved of.

Q. Plenty of it that has not been?—A. There has been none that I have not approved by signing estimates. There has been classification made that I have not seen personally made.

Q. Did you verify, so far as you thought necessary, to justify you in approving of it?—A. Yes.

Q. Are you familiar with the classification in your whole district?—A. Yes, except for a portion of the east end which was done under the former district engineer, before it was transferred to District D.

Q. Then are you familiar with the classification on that portion that you have last spoken of, that took place before you were made district engineer?—A. Just from seeing the estimates and going through the cuts.

Q. You are familiar with it, then?—A. Yes, I never saw the work done.

Q. Is that work classified the way you would have classified it?—A. Yes, I think so.

Q. So that I may take it that you approve of the classification from end to end of what now constitutes the district?—A. I think so.

Q. What did you classify solid rock excavation?—A. Ledge rock occurring in masses and in place, in situ, as the book says.

Q. I do not think it does?—A. I thought it did—rock occurring in ledges or masses of more than one cubic yard; is that not it?

Q. "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"?—A. Yes.

Q. You will notice that that does not include all rock that is in ledges or masses of more than one cubic yard, but only such as, in the judgment of the engineer, may be best removed by blasting?—A. Yes.

Q. What do you mean by rock in masses?—A. Large pieces of rock, and under Mr. Lumsden's ruling—

Q. Never mind Mr. Lumsden; I am asking you to describe a mass of rock which you consider solid rock excavation under this specification?—A. Nothing but what it speaks of.

Q. What does it speak of?—A. Ledge and masses of rock.

Q. What is a mass of rock? How will I know it if I go to see it?—A. It is either a boulder or large piece of rock which has been detached from its original place.

Q. Then you consider a mass is that which is—A. Which is geologically a rock.

Q. And which is one piece, either of boulder or of fragments?—A. That has always been my idea of rock.

Q. Or masses of rock?—A. Masses of rock I never saw until I saw that specification.

Q. You think a mass of rock is either a fragment or boulder?—A. That has always been my idea.

Q. Have you classified anything as solid rock excavation under the word "masses," other than boulders of more than one cubic yard and fragments of more than one cubic yard?—A. Yes.

Q. Why did you do so?—A. Under Mr. Lumsden's ruling, assembled rock.

Q. What was assembled rock? Describe such assembled rock as you classed as a mass?—A. It would be large boulders cemented together, that required blasting to remove—continual blasting.

Q. When you say remove, do you mean to separate?—A. To separate.
Q. Do you mean, then, that a mass of boulders means boulders which are fastened together by cement?—A. Yes.
Q. Not which lie with loose material between them?—A. No.
Q. They must be broken apart?—A. As a rule they are drilled.
Q. If I could lift them up, they would adhere to each other?—A. Yes, if you could lift them up.

Q. So that you are taking cemented together in the elementary sense?—A. Yes.

Q. Did you class anything loose as masses which, in the elementary sense, were not cemented together?—A. No.

Q. I suppose you classified as loose rock all the large stones and boulders measuring more than one cubic foot and less than one cubic yard, and all loose rock, whether in situ or otherwise, that could be removed by hand, pick or bar; is that right?—A. Yes.

Q. So that we will eliminate that. Did you find any cemented gravel?—A. Yes, there was some.
Q. Does it occur in large or small quantities?—A. Very little of it on this district.
Q. Did you classify as loose rock any clay of any description?—A. Yes.
Q. Will you tell me what kind of clay you classified as loose rock?—A. Indurated clay.
Q. What is indurated clay?—A. Hardened clay.
Q. Did you classify any hardened clay as loose rock which, in your judgment, could be ploughed with a ten-inch grading plough, behind a team of six good horses properly handled?—A. No.

Q. What do you understand by "Ploughed by such a team and such a plough"?—A. It would have to be loosened.

Q. Describe to me what you mean by it?—A. After the plough had passed through the material it would require to be in better condition for removal by hand shovelling or scrapers than it was before being ploughed.
Q. Do you find any such statement in the specification?—A. Not under the heading of loose rock.

Q. Why do you inject that qualification into it?—A. Because under the heading of solid rock it says "May be best removed by blasting." That is a qualification of solid rock. I think it possible should have said "May be best removed by ploughing."
Q. I am not asking you to amend the specification; I am asking you to construe it?—A. That is the way I construed it.

Q. Do I understand you to say this material could be literally ploughed?—A. I think a great deal of it could possibly have had a plough dragged through it by six good horses.

Q. That is not what I asked you. I asked you if it could be literally ploughed by such a team?—A. What do you mean by literally?

Q. Well, if it could be ploughed; if you had been sent there to plough it—if you had been sent there with a team of six good horses and with a ten inch grading plough?—A. A lot of it could have been ploughed.

Q. Wait for the question; if you were simply told that some person wanted you, for curiosity, to plough that material, with that team and that plough, and, so far as you know, nothing else was going to be done with it, do you think you could have ploughed it?—A. Yes, a great portion of it.

Q. Then you have classified as loose rock material which, in your judgment, could be ploughed, if nothing else was going to be done with it after the ploughing?—A. Yes.

Q. Then why do you consider that it could not be ploughed within the meaning of this specification, if you do consider it could not be ploughed within the meaning of the specification?—A. Will you repeat that question?

Q. Do you consider that that clay could not be ploughed within the meaning of the specification?—A. Not in my judgment.

Q. Why do you consider so?—A. Because I consider that the meaning of ploughing is loosening the material and improving its condition for further handling.

Q. Why is it necessary to consider whether or not the ploughing will improve it for further handling?—A. There would be no object in ploughing it, if it did not.

Q. But they never did plough it?—A. On this district?

Q. Yes?—A. Oh, yes.

Q. Did the contractors plough it?—A. In several places.

Q. For what purpose?—A. To try and scrape it.

Q. With what result?—A. Practically no results.

Q. With what result?—A. They ploughed it and scraped it, but they did not do it commercially to advantage. It cost more than any other method that you could adopt.

Q. Then you have not looked upon the ploughing merely as a test. You look upon the ploughing spoken of in this specification as part of the method used for removing it?—A. Yes.

Q. Do contractors in this district use a plough for material which can be ploughed to advantage?—A. They would.

Q. But do they, for material which can be ploughed to advantage?—A. No, they do not. May I say why?

Q. Oh, certainly. I want your answers to be full and complete?—A. Because there is not enough of that material on the district to make it worth while bringing ploughs, scrapers and horses into the district. It costs too much to feed the horses, for one thing.

Q. Do I understand you that wherever material can be ploughed it is?—A. No, sir.

Q. Wherever material is susceptible of being ploughed, as you say commercially, and there are large enough quantities, do they use ploughing?—A. Not on this work.

Q. In any work?—A. Yes.

Q. Do I understand that you do not regard the ploughing spoken of in the specification as merely a test?—A. Not by itself, no.

Q. As merely a test?—A. Or as only a est; do you mean only or merley?

Q. Which ever you choose?—A. No.

Q. For example, if the specification had said that you should consider as common excavation such material as you could drive a rod with a sixteen pound hammer into, and you had taken a rod and tried it in this material, and found you could drive it with a sixteen pound hammer, would you put this in as common excavation?—A. I think so.

Q. So that you do not regard the ploughing as a test at all; you regard it as part of the method to be adopted in removing the soil?—A. I think so.

Q. Where did you see them use a plough to plough any of the clay which you classified as loose rock?—A. I did not see it.

Q. Where did you see any of the material which you classified as loose rock after it had been ploughed?—A. The ploughing I speak of was done before I took charge of the district.

Q. So that personally you have never seen a test of that kind made?—A. No.

Q. Have you ever seen anywhere clay which you classified as loose rock ploughed?—A. I do not think I ever saw clay like this anywhere else.

Q. So that you have never seen it ploughed?—A. No, apart from the surface clay.

Q. I am speaking of the clay that you classified as loose rock?—A. I do not think I ever saw anything like it anywhere else.

Q. So that, so far as you are concerned, this is your first experience of this clay which you have classified as loose rock?—A. This particular brand of clay, yes.

Q. Did you classify any soft clay on this contract as loose rock?—A. Yes.

Q. Where was that?—A. It was at about six or eight different points, one in particular was at Mustongo River.

Q. Were there large quantities of it?—A. From memory, about 20,000 yards in one cut.

Q. What would it total over the whole district?—A. From 40,000 to 50,000 yards about.

Q. How do you describe it?—A. As a rubbery, tough material when fairly dry, say in normal condition——

Q. Say when it was excavated?—A. In normal condition, towards the upper layers of it; as it went down it became very plastic. I think that fairly well describes the material.

Q. What color was it?—A. Greyish blue.

Q. How was it taken out?—A. In different ways, generally by hand.

Q. How was the hard clay which you classified as loose rock taken out? What instruments were used?—A. Picks, shovels and powder.

Q. Is there any part of it where powder was continuously used?—A. I will have to think about that; yes, I think so.

Q. Where?—A. In the cuts close to Cochrane, west of Cochrane, and at the west end—the work we went over yesterday.

Q. You mean the work referred to by Mr. McBey?—A. Yes, on his residency I have particularly in mind.

Q. You are referring to what he pointed out to us yesterday?—A. I was not with you when he pointed it out. I have a knowledge of that myself.

Q. He was in charge of it?—A. He was Resident Engineer.

Q. And west of Cochrane you say there was some?—A. Immediately west of Cochrane four or five large cuts there.

Q. About how much would be in those cuts of that kind of material?—A. About 20,000 yards in each one.

Q. And there were in all about how many?—A. About four.

Q. Are they one after the other?—A. Yes.

Q. Starting where?—A. Almost in the town site of Cochrane.

Q. The rest of it did not need continuous blasting?—A. Not continuous.

Q. Where will I find recorded the information which will show me whether or not continuous blasting was used on any work in your district?—A. The Resident Engineers can furnish it.

Q. Is it recorded anywhere on the fyles of the Commission?—A. I think there is some correspondence about those four cuts I have mentioned close to Cochrane with Mr. Lumsden. I might say those cuts were taken out before I took the district. I have seen the correspondence and the Resident Engineer's record of powder consumed.

Q. You were here all the time?—A. Oh, no. This work was open for two years before I took charge of it. Mr. Macfarlane was in charge, and Mr. Poulin, who is dead.

Q. Did you take the cost of excavating to the contractor into consideration when making your classification?—A. Not to my knowledge.

Q. Why do you say it was more difficult and more expensive, if you do say so—and I understood you to?—Why do you put that forward at all as a reason for so classifying it?—A. That is in the soft material.

Q. In the hard material too?—A. The hard material I consider loose rock under this specification.

Q. And the soft material—did you take into consideration the expense there?—A. I think I must have.

Q. Where did you find in the specification anything to entitle you to classify soft material as loose rock?—A. I do not believe you can. May I look at it?

Q. Certainly? (Witness examines specification).—A. Probably the only reason was that it could not be ploughed, in my judgment.

Q. I am asking you, what was your judgment?—A. Well, that was it.

Q. Did you classify muskeg as loose rock?—A. No.

Q. Could it be ploughed?—A. No.

Q. But muskeg is not clay?—A. Muskeg is not clay.

By Mr. Gutelius:

Q. If you were to revise the profile, having in mind economy, could you reduce the quantities without increasing the maximums?—A. Yes, sir.

Q. Where and how?—A. By using a virtual four-tenths and six-tenths instead of the actual four-tenths and six-tenths that were used.

Q. What is the difference between an actual and a virtual grade?—A. An actual four-tenths grade never varies from four-tenths; I do not know whether I can make that clear; but is compensated for curvatures only. In using virtual four-tenths grade, the momentum of the train is allowed to carry it a certain distance up a grade of a greater rate than four-tenths. This distance is calculated; then the rate of grade is reduced to four-tenths again, or less, when the same process is gone through, and may be repeated indefinitely, to reach the summit.

Q. In other words, a locomotive will pull the same train over a virtual four-tenths that it would pull over an actual four-tenths grade?—A. Yes, barring accidents.

Q. By the introduction of virtual grades on your division, where would we look for reduction in cost of its construction?—A. At what points, do you mean, or in the schedule of classification?

Q. I want you to say in the fills?—A. In the fills by reducing yardage, and in the length of the culverts, making a saving of concrete.

Q. Would it have been possible to have reduced some of the cuttings by introducing virtual grades?—A. Yes.

Q. Did you give this subject any thought or study in connection with the location of the grade line over your division?—A. Not in this district; only on survey.

Q. As district engineer, why did you not take this matter up with the higher officers and recommend it?—A. It had been turned down by the higher authorities during the time I was on survey in 1905 or 1906, and I considered the matter had been dropped.

Q. What knowledge have you personally that the chief engineer, or the commission, refused to allow the use of virtual grades?—A. I think I must have had a letter to that effect.

Q. You do not know?—A. I do not remember now. The impression I have got is that I had, and that the matter was dropped then. Mr. MacPherson took it up first with us, or with the district engineer that I was under at that time.

By the Chairman:

Q. Would there have been any material saving if that policy had been adopted over your district?—A. I think the saving would have been quite large.

By Mr. Gutelius:

Q. Would you care to make a guess in a percentage way?—A. Perhaps 20 per cent. Is that too high?

Q. Well, say 15 to 20 per cent?—A. Yes.

Q. In passing over your division I have noticed that the sub grade on the level has been raised to what appears to be higher than was necessary to get over the muskeg, and in some cases grades introduced to get up on these higher banks; what defence is there for this practice?—A. I think that was a matter of policy, too.

Q. Can you direct the Commission to the source of this policy you refer to?—A. I know nothing in writing on the point.

Q. What has given you the idea that it is policy?—A. A conversation with Mr. Woods, assistant chief engineer of the G.T.P., for one thing.

Q. Were any of your profiles amended raising the grades?—A. Yes, all of them.

Q. By whom?—A. By myself and by Mr. Macfarlane.

Q. After you had passed on them and sent them up for approval, were they amended, revised?—A. Sent to whom for approval?

Q. The chief engineer's office. First, have these profiles of yours been approved of by officers higher than the district engineers?—A. Yes.

Q. Who approved them?—A. The inspecting engineer, representing the chief engineer, Mr. Macfarlane.

Q. Did he revise any of your profiles?—A. Yes.

Q. Did he raise these grades?—A. Yes.

Q. He represented the chief engineer of the Commission in doing this?—A. I took him to be. He raised these grades in consultation with me. It was not an arbitrary raising of grades by him.

Q. Have you a written approval from him of these grades?—A. No, I think not; it was all done in my office, he and I together.

Q. He did not sign any of them after you completed them?—A. Not as inspecting engineer, no.

Q. Would it not have been advisable, in the interest of economy, to reduce the height of many of these raised embankments?—A. Do you mean, would it not have been advisable or would it be advisable now?

Q. Would it not have been advisable, in the interest of economy, to have reduced the heights of some of these embankments?—A. Yes.

Q. Would it amount to much of a saving in dollars?—A. Yes, the saving would be considerable.

Q. You are more familiar with this division than anyone else. Can you give me a guess, in percentage, as to what saving might be effected in this manner?—A. There might be one-sixth of the total district.

Q. That would be how many miles?—A. Say, 70 miles.

Q. At 5,000 yards to the mile, it would be 150,000 yards, and it will average 33 cents; it would be a third of that?—A. It will average more than that; it will average 50 cents.

Q. That would amount to $175,000, then?—A. Yes.

Q. This idea is not a new one?—A. No.

Q. Did you do anything yourself towards reaching this economy?—A. Yes, I have lowered grades and changed the rate of grades.

Q. And you propose now to make such further reduction as can be made, where those higher dumps have settled?—A. Yes, we propose to plot a new profile of existing top of earth levels, and put a new grade line on that.

Q. And save as much of this extravagance as possible?—A. Excess material.

Q. And save as much extravagance as you can, from now on?—A. Yes.

Q. You have been instructed to do that since we were on the work?—A. I have heard it talked of that we were to be instructed. I have not yet got the instructions. They will come from the chief engineer, I suppose.

Q. On the Algoma Central and the Rutland Railway momentum grades were used?—A. The Rutland Railway used a very low grade, which, I think, was six-tenths, compensated.

Q. Were sags within the gradient limits ruled out?—A. The use of sags was discouraged, what you would call a bag sag—two maximum grades meeting—

Q. Short sags?—A. Short sags were discouraged.

Q. But sags of half a mile in length would have been considered good construction?—A. Yes.

Q. There are fills on your division of a half a mile or greater in length where sags could have been introduced, are there not?—A. I think so.

Q. The policy, however, required that you build straight grades?—A. The policy was not to what I call chop a grade; it does not seem to have been.

Q. Were you ever given any data on which to figure whether a straight grade or a sag would be used in crossing long fills?—A. Yes, it was given us in a blue print form.

Q. Tell me about the Algoma Central on this point?—A. The Algoma Central used one and a half per cent grades uncompensated, and twelve degree curves.

Q. Why did you not use twelve degree curves on this railway?—A. I understood that six degrees was the maximum.

Q. How did you arrive at that understanding?—A. I think there were instructions to that effect.

Q. Do you know positive that there were?—A. I could not place my hand on the instructions now. I must have had it in some form or another from somebody or I would not have adhered to it. Six degree curves, by the way, were discouraged, too.

Q. Why did you not use one and a half per cent grades on this railroad?—A. The instructions were to use four-tenths eastbound and six-tenths westbound.

Q. From whom did you get these instructions?—A. Probably from the district engineer, when I was working as engineer in charge of location.

Q. Have you a copy of those instructions?—A. No, I think not, no.

Q. Will you try to locate a copy of instructions governing curvature and gradients, and send them to the Commission over your signature?—A. I will.

Q. Write a letter which we can attach to it?—A. Yes. If I cannot find them I will write a letter to you, anyway.

Q. What was the character of the structures on the Algoma Central?—A. Wooden trestles, cedar culverts, and, in a very few cases, cast-iron pipes.

Q. Why did you not use cedar culverts and wooden trestles on this railway?—A. I understood from the time I was resident engineer on District F. that temporary structures were not to be used.

Q. In the interest of economy, and in accordance with ordinary railway construction in Canada, would temporary structures have been advisable?—A. Yes.

Q. If permanent wooden trestles had been erected originally over the various sink holes on your division, would the sink-holes which we have seen been prevented?—A. Certainly.

Q. Are there many of them?—A. Yes.

Q. How much money would have been saved at trestle 1,046?—A. 1,040 is the station.

Q. At 1,040, if a permanent wooden trestle had been constructed over that originally, how much would be saved? I think you said $150,000?—A. Probably $125,000.

Q. Were there many similar slides on your division?—A. Nothing so bad as 1,040 in the same distance; what I mean is short crossings.

Q. What percentage of saving could have been effected on your division if wooden permanent trestles had been constructed, the same as you were accustomed to on the Algoma Central? Just say roughly?—A. That is the percentage you ask for?

Q. Yes, in dollars, if you can remember what your bridges cost?—A. My impression is that it would have saved us perhaps a million dollars, but I am having information prepared which will give it exactly.

Q. Do you know what cement should cost in this country?—A. I have my own idea.

Q. What should cement concrete cost in this country per cubic yard?—A. I think it could be put in place at an actual cost of about $8 or $10 a yard.

Q. The prices paid to general contractors, however, are what?—A. From $10.50 to $16 for the mixture that is most used; that is 1-3-6.

Q. That is what you refer to as being put in place for from $8 to $10?—A. Yes.

Q. Referring to loose rock specification under classification, you have told us that you construed the reference to ploughing as being a method to be adopted in excavation?—A. Yes.

Q. The same as in paragraph 34, under solid rock, which says, "May best be removed by blasting"?—A. Yes.

Q. Then you read into the loose rock clause, "May best be removed by ploughing"?—A. My idea is that if that word "best" were there, it would explain that clause better.

Q. And that it would make clear what was intended?—A. Yes.

Q. That is, to make clear what you, in your interpretation, would suggest adding to this clause: "May best be removed by ploughing"?—A. If ploughing is kept in as a test, yes.

Q. Then, to arrive at your conclusion, it was necessary for you to assume something that was not actually printed in this specification?—A. Not actually printed, yes.

Q. It is a fact, then, that you did not take into consideration as a test only?—A. Yes; that is my judgment of the specification, and I consider it is left to my judgment.

Copy.

The Commissioners of the
Transcontinental Railway.

Ottawa, June 12th, 1912.
File 12,028.

F. P. GUTELIUS, ESQ.,
Investigating Commission.

Dear Sir:—

Yours of the 8th inst., re height of subgrade above the muskeg on District "D".

I have been unable to find any letters between myself and Mr. Woods, or between my predecessor and Mr. Woods, with reference to the raising of grades on District "D".

My recollection is that so far as I am personally concerned, there were verbal requests only.

Yours truly,
(Signed) GORDON GRANT,
Chief Engineer.

Copy.

West of Cochrane, June 8th, 1912.

GORDON GRANT, ESQ.,
Chief Engineer, N.T.Ry.,

Ottawa.

Dear Sir:—

In connection with the height of subgrade above muskeg on District "D". Your recollection was that it was at request of the G.T.P. through Mr. Woods. Will you kindly let me see any correspondence you may have in connection therewith.

Yours truly,

Copy.

COCHRANE, June 14th, 1912.

GORDON GRANT, Esq.,
Chief Engineer,

Ottawa, Ont.

DEAR SIR:—

During my examination by the Investigating Commission I was asked to look up and send to them my authority for the use of maximum grades of 0.4 per cent eastbound and 0.6 per cent westbound, also for the use of 6° curves as the maximum curvature.

The instructions regarding curvature are found on P. 38, Art. 26 of the book of Instructions, and those regarding grades are found on P. 45 (at the top) of the same book.

I will be glad if you will transmit this information to the Commission.

Yours truly,

(Sgd.) G. L. MATTICE,
Assistant District Engineer.
"C.D."

(NATIONAL TRANSCONTINENTAL RAILWAY ENQUIRY COMMISSION
OTTAWA, OCTOBER 25th, 1912.)

Present: G. LYNCH-STAUNTON, K.C., *Chairman.*

G. L. MATTICE, Assistant District Engineer, National Transcontinental Railway, examined:

By the Chairman:

Q. You are the assistant district engineer in district D?—A. Yes.

Q. And you have already given evidence to the commission at Cochrane?—A. Yes.

Q. Do you know Mr. Goodwin?—A. Yes.

Q. He is inspecting engineer of the Transcontinental Railway?—A. Yes.

Q. Did he pay a visit to Cochrane, lately?—A. Yes.

Q. When did he arrive there and when did he leave?—A. I can tell you when he left. I do not remember the day he arrived. He was there between September 18th and October 20th.

Q. Were you with him all the time he was there?—A. Just during the time he was out on the line.

Q. Do you recollect when he went out on the line?—A. We started from Cochrane on the 23rd of September, going east.

Q. And you went east how far?—A. We went east 158 miles, that day.

Q. Who are "we"?—A. Mr. Goodwin, Mr. Balkam, district engineer, and myself.

Q. Will you tell me the reason for that trip and what you did on it?—A. The trip was for Mr. Goodwin to inspect the classification.

Q. What was done on that trip; start at the beginning and tell me in your own words what was done on that trip?—A. The first day we ran 158 miles and slept at one of our Residency camps that day. It was the camp of Division Engineer Sunstrum, Residency No. 11. We did nothing but travel that day.

Q. On whose contract is that?—A. Contract 15; Macdonell & O'Brien. That is sublet to O'Brien & Martin who are doing the work.

Q. The next day, September 24th, did you do anything?—A. We went on the motor car to the end of steel and walked from the end of track to Belle River, beyond the end of steel, and we stayed at Residency No. 8 that night. We examined nothing that day. We were travelling to the end of the work to start back.

Q. Was there any work done or any information acquired by Mr. Goodwin before he left Cochrane?—A. Yes, we had all the classification notes copied out on sheets, each Residency by itself, ready for him to carry with him.

Q. He took with him the information necessary to familiarize himself with the classification that had been done over the ground he was about to inspect?—A. Yes sir.

Q. And that was furnished by you or by Mr. Balkam?—A. Both of us, by the office.

Q. We come now to the 25th of September, what was done on that day?—A. We started at Belle River and examined the classification through to practically the end of the grading.

Q. That is still going east?—A. Going east.

Q. Did you make any notes of what was done on that day that you have with you?—A. I noted in my diary that we started. I think we all took notes on the sheets.

Q. Can you give me any information about what you did that day?—A. I think the only thing we did was to raise the classification in one cut.

Q. You examined all the classification for about what distance?—A. About seven miles.

Q. Did you make any changes or pass any opinion on the classification in that district?—A. Just at one spot.

Q. The cut you are speaking of, is the cut between stations 835 and 839?—A. Yes, sir.

Q. Tell me what you did there?—A. We looked over the cut, got a pick and shovel, and Mr. Goodwin got a pick and shovel, and we talked to the resident and division engineer who saw the work done.

Q. Who is the division engineer?—A. Sunstrum.

Q. And who is the resident engineer?—A. Howe.

Q. What did you do?—A. After consultation, we considered it should be changed. The cut was originally classified "83 cubic yards solid rock, 653 cubic yards loose rock, and 1303 cubic yards common excavation." We decided that the mixed material should be classified about 65 per cent loose rock, and Mr. Balkam on returning to camp, instructed the resident engineer accordingly.

Q. What change did that make in the classification?—A. Apart from the solid rock excavation, the loose rock and common excavation were about reversed.

Q. Did you do anything more that day?—A. No, we came back to the camp and stayed the rest of the day there.

Q. Next day did you make any more inspection?—A. Next day, the 26th of September, it rained all morning and we walked back to Belle River Residence in the afternoon and inspected about half a mile west of Belle River and stayed in camp.

Q. Did you make any changes in that half mile?—A. No.

Q. On the 27th of September, what did you do?—A. We started where we stopped the day before at the half mile west of the Belle River and walked to the end, Clear Creek, beyond the end of steel. We practically walked to Residency No. 9, about twelve miles west of Belle River; that was just in the morning.

Q. In the afternoon, what did you do?—A. We continued with the motor car to Residency No. 11.

Q. Did you make any changes in the classification on that twelve miles?—A. No.

Q. Did you do anything more that day?—A. No.

Q. On the 28th of September what did you do?—A. We left Residency No. 11 and went over the track in the motor car and ran forty-five miles west to Robertson Lake.

Q. Did you investigate the classification on that forty-five miles?—A. One cut at mile 113½. Mr. Goodwin got a pick and shovel and dug some small holes in the side of the track. That is the first cut west of Peter Brown Creek.

Q. Did he make any changes in the classification there?—A. No.

Q. Whose contract was that on?—A. That was on contract No. 14, the Grand Trunk Pacific contract.

Q. Who is doing that work?—A. Foley, Walsh & Stewart, agents of the Grand Trunk Pacific.

Q. What else happened?—A. At two or three other points Mr. Goodwin did the same thing; we carried the tools with us.

Q. Were any changes made?—A. No sir.

Q. Did you continue along the railway next day?—A. The next day was Sunday. We stayed at Robertson Lake, Residency No. 15.

Q. What happened on Monday, the thirtieth of September?—A. We ran from Robertson's Lake to the Quebec boundary, approximately forty-one miles.

Q. Did you make any inspection on the way?—A. No particular inspection that I remember now. We watched the cuts as we went along, and Mr. Goodwin

made notes of the class of material, whether clay or sand or rock, but did not make any excavations.

Q. You slept that night where?—A. South River, Residency No. 17.

Q. On Tuesday morning what did you do?—A. We ran from the Quebec boundary to Cochrane, about seventy-two miles.

Q. Did Mr. Goodwin make any excavation along the road?—A. Yes, in one or two places.

Q. Did you make any changes in the classification?—A. No.

Q. You got back to Cochrane that night?—A. Yes.

Q. After you got back to Cochrane did you do anything further?—A. Not that day.

Q. The next day what did Mr. Goodwin do?—A. We were in Cochrane all day Wednesday, and Mr. Goodwin said he made arrangements to do some work the following day.

Q. What was done on Thursday, the 3rd of October?—A. On Thursday, we were in Cochrane all day, and Mr. Goodwin started his teams working at a cut on contract No. 14.

Q. What did the teams do that day?—A. Grubbing the stumps off the surface preparatory to making a plough test.

Q. Where was that?—A. That was on the Cochrane yard cutting.

Q. On the south side of the Cochrane yard cutting?—A. On the south side, on the Temiskaming & Northern Ontario property.

Q. What mile was that?—A. About mile 103 1-4.

Q. How far south was that from the edge of the old cutting?—A. About forty feet.

Q. And north of it is the Transcontinental line and south of it is the T. & N. O. railway?—A. Yes.

Q. It is between the two cuttings?—A. Yes.

Q. Were there trees on it?—A. No.

Q. It was a cleared piece of land covered with stumps?—A. Yes.

Q. And you got ready that day to plough it?—A. Yes.

Q. Was it ready to plough for Friday?—A. We went away on Friday, we went west with the motor car. We travelled seventy miles, going through the same procedure as the previous days, taking notes of the material in the different cuts and burrows.

Q. Did you make any changes in the classification?—A. No.

Q. It was merely an inspection trip?—A. That is all.

Q. What did you do then?—A. We slept at Residency No. 17 that night and we returned on Saturday to Cochrane.

Q. Then on Sunday, I suppose you did nothing?—A. No.

Q. What did you do on Monday?—A. On Monday morning we started west. We started west in the morning and ran through to Hearst, one hundred and thirty miles.

Q. In the meantime, had any ploughing been done?—A. They were ploughing all day Saturday.

Q. Did you see the work on Sunday or Monday?—A. I saw it Saturday afternoon.

Q. Tell me what you saw?—A. I think there were one or two teams ploughing material.

Q. Were they two horse or four horse teams?—A. Two horses and a plough.

Q. What were they ploughing with?—A. A grading plough.

Q. How much ploughing had been done when you saw it?—A. I think about a foot and a half in depth that day.

Q. From what you saw, can you tell me to what depth the plough went into the soil on the surface?—A. I did not see that.

Q. Describe the condition of the earth that was ploughed when you saw it?—A. It was clay.

Q. Was it ploughed?—A. Yes.

Q. Ploughed as you would see a field ploughed?—A. Yes.

Q. It was genuine ploughing?—A. Yes.

Q. How much had they done?—A. They ploughed about a foot and a half in depth.

Q. Had they done a day's work?—A. Do you mean what a farmer would consider a day's work?

Q. Yes?—A. I do not know about that.

Q. They set out to plough out an area of about how much?—A. About 100 feet long and 20 feet wide.

Q. Had they ploughed the whole surface when you saw it Saturday afternoon?—A. Practically all of it.

Q. Had they removed any of the material?—A. Yes.

Q. How was it removed?—A. With a scraper.

Q. How many horses on the scraper?—A. Two horses.

Q. Before ploughing the surface was grubbed?—A. Yes.

Q. After they grubbed it they put the plough on it?—A. Yes.

Q. After they ploughed it they put the scraper on it and removed the ploughed material?—A. Yes.

Q. Did they do anything else besides ploughing it and scraping it to remove it?—A. No.

Q. When they took the surface off, what next did they do? Did they plough it over again?—A. Yes.

Q. They took another lift off it with the plough?—A. Yes.

Q. Did you see that ploughing done?—A. I might have been there for ten or fifteen minutes.

Q. Was it apparently easy or hard ploughing?—A. Easy ploughing.

Q. They turned over the second lift then?—A. Yes, if you may call it a lift.

Q. Was that removed by the scraper?—A. Yes.

Q. Without any outside assistance?—A. Yes.

Q. Did they take another lift off, did they take a third lift off?—A. I did not stay there.

Q. Anyway, they ploughed the whole area to what depth?—A. On on average about four and a half or five feet. The deepest place is about six and a half feet.

Q. You are now looking at the cross-section?—A. Yes.

Q. Is that cross-section correct?—A. As far as I know, yes.

Q. You have no reason to think it is not correct?—A. No.

Q. It is certified by one of your resident engineers?—A. Yes, and by Mr. Goodwin.

Q. What was the material in this cut?—A. Clay.

Q. Was it clay to the bottom?—A. I think he stopped at sand, he struck sand in the bottom.

Q. That is where he stopped?—A. Yes.

Q. What was the sand like?—A. Very fine white sand.

Q. That completed all the tests that was made in that cut?—A. Yes.

Q. What else was done?—A. We are now up to Sunday, the 6th of October, that test was in progress all through the next week; we were away.

Q. Have you described to me everything that was done in that cut?—A. No.

Q. What else was done?—A. Some of that material in that particular spot was scraped without being ploughed.

Q. Tell me what portion of it?—A. About a foot and a half. The plough was away up in the other cut, and we scraped it out without going after the plough.

Q. So that part of the cut was taken out without the assistance of a plough?—A. About eighteen inches of it.

Q. Was that taken out at once; to what depth would the scraper go?—A. In thin layers of two or three inches.

Q. Can you tell me anything more about that cut?—A. No; I do not think so.

Q. That was all the work that was done there?—A. Yes.

Q. You and Mr. Balkam were away during most of the time this was being taken out? Inspecting along the line with Mr. Goodwin—A. Yes.

Q. Continue your account of your trip?—A. We made a similar inspection west of Cochrane as far as the end of the district, 200 miles, as we did east of Cochrane, and it took us from Monday until Friday to do that, five days.

Q. Did Mr. Goodwin make any other plough tests?—A. Yes.

Q. Where?—A. The first cut was west of Cochrane, on contract No. 15, mile 104.

Q. About what area did he have ploughed there?—A. The cross-section shows about 50 feet by 15 feet.

Q. How far was that from the edge of the cutting on the railway?—A. I did not see this place.

Q. Do you know the place?—A. Oh, yes.

Q. Is the clay there similar to the clay in the cut you have already described?—A. Not quite.

Q. Has any clay, like the clay in the cut you have already described, been classified as loose rock?—A. Yes.

Q. Is the clay in the cut you have first described, similar to the clay throughout the district?—A. It is the same physical formation.

Q. Is it in the same condition?—A. No.

Q. In what does this differ at the present time from the condition in which it was when the right of way was cleared and the work was commenced?—A. The clay is in a much drier state.

Q. Is it harder or softer?—A. It is the same consistency, but it is dry and brittle instead of being sticky.

Q. What has caused the difference?—A. Clearing the land for four years and draining it with the cuts on each side of it.

Q. In what condition was the clay in the cuts made by Mr. Goodwin, that you have first described?—A. Nice friable, dry material

Q. Was it dry down to all that depth?—A. Yes.

Q. Was the cut alongside of Mr. Goodwin's test cut classified as loose rock?—A. Yes.

Q. Did Mr. Goodwin make any tests other than those you have spoken of on the inspection, and at Station 835?—A. Yes; these two plough tests at Mile 103 (Station 428) and Mile 104; that is 103 miles east of Cochrane and 104 miles west of Cochrane.

Q. The next plough test is at Mile 104 (Station 500) and that is west of Cochrane?—A. Yes.

Q. Mr. Goodwin said he had a plough test made alongside the cut at Station 482-503, and ploughed with two horses and a grading plough to a depth of about five feet, is that correct?—A. I believe so; I did not see it.

Q. You did not see the cut all?—A. Not when he was ploughing it.

Q. Did you see it afterwards?—A. No, sir.

Q. He did not make any other plough test that you know of?—A. No.

Q. In his report he says, to summarize it, that he examined the classification of contracts No. 13, No. 14, No. 15, and No. 16 in District D?—A. He did.

Q.—He says that on contract No. 13, Macdonell & O'Brien, contractors on that portion of contract No. 13, which is in District D, all clay, muskeg, sand, and loam, is classified as common excavation?—A. Yes.

Q. And he says that mixed clay and boulders are classified, a certain percentage of loose rock according to the amount of boulders, and that no assembled rock has been returned on this portion of the contract?—A. That is correct.

Q. He says that on contract No. 14, the Grand Trunk Pacific Railway Company contractors, with the exception of some work done during 1908, practically all the clay on this contract was classified as loose rock, and that muskeg, sand and loam only, were returned as common excavation. Is that correct?—A. Yes.

Q. Listen to the way he classified it. He says: the clay on this contract can be divided into four classes—first, clay which can be ploughed with two or four horses and which, when ploughed, breaks up into such a way as to make it good shovelling or scraping?—A. That is his opinion.

Q. He does not say what quantity, but he says there was some clay of that kind?—A. Yes, that is right.

Q. Do you agree with that?—A. No, sir.

Q. As I say, he does not give the quantity, but he says there was some of that kind?—A. Oh, that is perfectly right.

Q. Then he says: second, clay that can be ploughed, but is either too tough or too soft for the ploughing to be any use as a means of handling. In some cases this clay is too soft and sticky to allow horses to be used on it, and in other cases it is so tough that though it could be ploughed, it would still have to be cut with shovels before it could be removed. Do you agree with that?—A. There is such material.

Q. In the third place he says there is a quicksand clay which can be ploughed, but which runs together almost immediately. This clay runs together so that it invariably has to be shovelled out of the cars or carts. Do you agree with that?—A. Yes.

Q. In the fourth place he says mixed clay and gravel; some of this class should be included in class No. 1, that is, clay which can be ploughed with two or four horses and which, when ploughed, breaks up into such a way as to make it good shovelling or scraping, as it can easily be ploughed and scraped or ploughed and shovelled, while a proportion would contain too much stone to allow it to be ploughed?—A. Yes; there is some of that.

Q. He next speaks of the cut at Station 54-58, Residency 9, will you tell me where that is?—A. Near the Abitibi River.

Q. He says it is a cut at Residency 9 and was mostly taken out in 1908 and 1909 with ploughs and scrapers, the scrapers loading through a trap into cars. Is that right?—A. I do not know anything about it, I was not there. It was before my time. I have no doubt it is true, because he was there. He was resident engineer, I think, at that time.

Q. Do you remember the place?—A. I know the place.

Q. Can you describe what the cut consists of?—A. It is a clay cut with boulders.

Q. Do you know the west end of the cut at Station 1063-1084, Mile 75?—A. I know that cut, it is Residency No. 7.

Q. He says it was taken out with a plough and grading machine in 1908, do you know anything of that?—A. No, sir. The grading machine is there, so, I guess, that is right.

Q. He says the material was clay and could come under Division No. 1, do you agree it was clay?—A. It was clay, yes, with sand in the bottom. We borrowed in that cut afterwards.

Q. Yes, he says the east end was sand and was used for borrows?—A. Yes, but I would not say it was the east end. The borrow started in the west end of the cut and went through right to the east end. I think he means the west end there. It is more the centre of the cut really.

Q. He next refers to the cut at Station 2165-2175, Mile 54, do you know that?—A. I do not remember that particular cut, but I know the general country there. It is all a clay country.

Q. He says: I understand from Division Engineer O'Leary that the first two feet of this cut was good scraper work, while the second two feet was only fair, and the balance tough clay, which I judge would come under Division No. 2. He says the cut was ploughed to a depth of six feet, that it was classified as 10,240 cubic yards loose rock, and 960 common excavation, do you know anything about that?—A. I do not remember that particular spot now.

Q. Then he says: I would judge that these cuts are typical of the whole contract, what do you say as to that?—A. I think at the time the classification was made, that every cut was considered by itself.

Q. But would you say they were typical cuts?—A. I cannot say that they were.

Q. You would not like to express an opinion on it now, at this date?—A. No, there is a similarity in all that country.

Q. He then says: Contract No. 15, E. F. and G. E. Fauquier, Contractors, the clay on this contract is very similar to that on Contract No. 14, except that perhaps there is a larger quantity of mixed clay and gravel, do you agree with that?—A. Yes, I think that is right.

Q. He says: On Contract 16, O'Brien and Macdougall, and O'Gorman, the material on this contract is very similar to that on Contracts Nos. 14 and 15; I would judge that the classification on this contract is not as high as on the other contracts. What do you say as to that, is that your opinion?—A. The material up there is a different material, it is more of a hardpan material.

Q. That is on O'Brien, Macdougall and O'Gorman's contract?—A. Yes. I speak now of the average.

Q. Would you expect it to be classified higher than the other?—A. The idea was to have it as uniform as possible.

Q. Would you expect from your knowledge of material in the two contracts that O'Brien, Macdougall and O'Gorman's contract would be classified higher than the other contracts, than No. 14 and No. 15?—A. No, I would not.

The witness was not further examined.

(N. T. R. INVESTIGATING COMMISSION: EVIDENCE TAKEN ON TRAIN AT BOUNDARY BETWEEN ONTARIO AND QUEBEC, JUNE 20th, 1912.)

HORACE LONGLEY, sworn:

By the Chairman:

Q. You are a civil engineer?—A. Yes.

Q. Had you any experience before you became connected with this road?—A. I was with Mackenzie and Mann in Nova Scotia for five years.

Q. On construction work?—A. I was resident engineer on two residencies.

Q. On construction?—A. Yes.

Q. And then you came on the Transcontinental?—A. I was their office engineer at Bridgewater, N.S., and then I came to the Transcontinental.

Q. What have you been employed at on the N.T.R.?—A. First of all, in 1905, until construction began in 1907, I was engineer in charge of a party on preliminary location.

Q. And since 1907, what have you been engaged at?—A. From 1907 to 1908 I was divisional engineer at Edmundston, and then in 1908 I was appointed assistant district engineer.

Q. Over what district?—A. I do not know.

Q. With Mr. Foss?—A. Yes.

Q. And you hold that office now?—A. Yes. There were two of us at first, you know.

Q. You were one of them?—A. Yes.

Q. You have gone over the road from Moncton to the Quebec line with Mr. Foss and the Commission in the last few days?—A. Yes.

Q. And you have been present to-night, and heard the evidence given Mr. Foss?—A. Yes.

Q. I do not wish to take you all over that evidence, but I would like to ask you whether or not you agree with the evidence given by Mr. Foss, and, if you do not, in what particulars do you disagree?—A. Well, anything on which I disagree with him is very trifling detail. There is only one thing that is in my mind at present. There were little things, but they do not affect the matter generally. I think that instruction about curves was two thousand feet instead of one. That is just in my mind now, but there were other little points which do not amount to anything. Substantially, I agree with what Mr. Foss says.

(N.T.R. INVESTIGATING COMMISSION: EVIDENCE TAKEN AT N.T.R. OFFICES AT QUEBEC, AUG. 20th, 1912.

J. W. PORTER, sworn:

Q. How old are you?—A. Thirty-four.

Q. Where were you educated?—A. Aberdeen, Scotland, Gordon's College.

Q. What engineering experience did you have before you came to this country, and what year did you come?—A. I served a pupilage of five years articled to the chief engineer in charge of the Great North of Scotland Railway. I was a year assistant to him, general assistant in the office, and I came to this country in 1902.

Q. What was your first engineering employment in this country; give me a short record of it, until you were employed on the N.T.R.?—A. I got a position from Mr. Tye, then chief engineer of construction for the C.P.R., as draughtsman in the office. I was there for nine months, doing general office work, and at the end of nine months I was sent out to Winnipeg, on the Winnipeg-Fort William double tracking. I was there five months as draughtsman, and afterwards I was leveller for two weeks, I think, and then I was transitman up till about October of that next year; that is October, 1903. Then I was on the Toronto Sudbury as transitman on preliminary survey work under Mr. Killally. I was there for a year and a half, and then I went over to the Walkerton & Lucknow, as assistant on location. Two parties were bunched together to locate that Walkerton line. Then I came back to the Toronto Sudbury as resident on residency 5.

Q. What stations were on that line?—A. Black, Midhurst, Utopia. I finished up that residency in about a year or nine months, and I was made responsible engineer of contract work for the erection of timber trestles, etc. I laid track up to Parry Sound in the capacity of resident engineer on track work, and afterwards I went over to the Georgian Bay and Seaboard branch, and opened up construction there as assistant engineer.

Q. As assistant engineer you had charge of how many residencies?—A. There was just one there, from Coldwater up. I was there for two months, and then I came back to the Toronto-Sudbury on fifty miles, where the ballasting, etc., was not completed, and the stations, tracks, etc., had to be built, and so forth.

Q. And you practically finished up that road?—A. I had charge till it was turned over for operation in the year 1909, and after that I took six months' holiday, after seven years' work, and I went home. After returning, I went with Mr. Grant on the Transcontinental.

Q. So you had seven and a half years' actual experience on the C. P. R. in Eastern Canada, east of Winnipeg?—A. Yes.

Q. And after those holidays, you took employment on the N.T.R., in what position?—A. Mr. Grant wired me he had a position for me, and I went up to see him, and he sent me down in the capacity of remeasuring work on District B.

Q. And reclassification?—A. No, just remeasurement.

Q. And after that remeasurement work was completed you did what?—A. I was made divisional engineer after Mr. Bourgois left. The division was extended and ran from mile 92 to mile 150 at that time.

Q. West of the Quebec Bridge?—A. Yes.

Q. On our recent inspection of your division a great deal of discussion occurred in connection with a sub classification known as assembled rock?—A. Yes.

Q. We opened up the sides of cutting at mileage 120.9 and 162.3 for examination, and I asked you to examine the material found in these openings, with the idea of securing from you your opinion as to how that material should be classified. What were your conclusions?—A. My conclusions were that it did not come under the impression that I have in my mind of cementing material between the rock. My idea of measuring that would be to measure the rock and return it as solid rock at mile 120, which you were speaking about just now, and the balance as loose rock. At mileage 120.9 I think the cut was about three times as hard and contained a great deal of rock. I did not think the material in between really was sufficiently hard to be called cemented: too much sand in it. I would have returned it the same way.

Q. So that both of those cuttings, in your judgment, should have been returned as loose rock, and all the solid rock that was in it?—A. Yes.

Q. Did you approve, as divisional engineer, of such classification as this which we have just spoken of as assembled rock, for solid rock prices?—A. I did not do any classifying, and I do not think I would call that assembled rock exactly.

Q. You do not think you called any material similar to that solid rock in any of your returns?—A. No, not all solid rock. What I mean is that at that cut mile 120.9, it seemed to me full of rock, and a certain percentage of solid rock, but I would not call it all solid rock.

Q. What I am after is, does this judgment which you have given me on these cuts coincide with the classification which you have given of the cuts on your own division?—A. I never classified any yet. I have never done any classification on the line at all. I was not there when the work was opened up, and consequently I did not have an opportunity of exercising that judgment.

Q. I should like to have you make some comparisons between the character of this railway and the method of construction, as compared with your experience on the Toronto Sudbury line of the C. P. R. That work was in progress at the same time that this work was proceeding?—A. Yes.

Q. How did the character of country south of Bala compare with the character of country covered by your division here?—A. It did not compare at all; different proposition altogether.

Q. Different kind of material?—A. Different kind of geological formation.

Q. There were deep cuttings?—A. Yes.

Q. And some deep ravines to be crossed?—A. Yes, exactly.

Q. How were the deep ravines on the Toronto Sudbury line crossed? A. Crossed by square timber trestles known as permanent trestles. We had some 35 of them on the Toronto Sudbury in 226 miles, varying from 15,000 feet board measure to 750,000 feet—three quarters of a mile.

Q. The only steel structures that were erected on that line were built where? —A. Over running streams, and just like Parry Sound, a town crossing, and crossing the G.T.R., and places like that.

Q. I would take it, then, that trestles were constructed at all points crossing fill over 20 to 30 feet in height, where there was not sufficient material in the adjoining cuttings to make the fill?—A. Trestles were erected, exactly.

Q. Did you have any experience on the Toronto Sudbury line with solid rock borrow?—A. None, sir.

Q. In the location of these trestles was there any hard and fast rule against locating them on curves?—A. None, sir. There were several of them on curves, some of them on four degree curves.

Q. It was a common thing to construct trestles on curves?—A. Yes.

Q. Do you recall any steel bridge located on curves?—A. I cannot recall any steel bridges located on curves.

Q. Reverting to wood trestles, were those trestles constructed in a country that was covered with forest trees?—A. No.

Q. No forest country around the Toronto Sudbury line?—A. In the north end there was pine limits.

Q. What I desire is, was the question of combustible material in the vicinity of a proposed trestle of any import as to whether a trestle should be built at that point?—A. No.

Q. What did they do to protect these trestles from fire from adjoining timberland or bush?—A. Sometimes they put a watchman there, and standard water barrels on a trestle, and they cleared a piece on each side, and took all the scrub and slash away, so that there would be no chance of fire to run, and sometimes covered the stumps with sand.

Q. And that special clearing extended far enough from the trestle so that you engineers believed that the bridge would be safe from a forest fire?—A. Yes.

Q. That was really the condition, was it not?—A. Yes.

By The Chairman:

Q. It is a wild, unsettled country from Sudbury down to where?—A. Down as far as Severn River, except for a small piece in between at Parry Sound; that is fully half the line, you might say, is settled.

Q. You were telling Mr. Gutelius it was not a forest country; you meant a timberland; you do not mean it was a settled country?—A. No.

By Mr. Gutelius:

Q. Was the Toronto-Sudbury division as high a class of railway in the matter of grades and curvature as the N.T.R.?—A. It was a higher class.

Q. What do you mean by that?—A. I mean to say that the maximum grade, the ruling grade, was three-tenths, and here it is four-tenths. The maximum grade in both directions was a virtual three-tenths.

Q. What do you mean by a virtual grade?—A. A virtual three-tenths means a grade over which a train of three-tenths tonnage can be hauled.

Q. What is the difference between a virtual and an actual grade?—An actual grade is one in which the grade is uniform, with curvature compensated. A virtual grade is one in which sags or momentum grades are introduced, whereby the actual rate of grade is increased.

Q. Is it possible for a locomotive to haul the same weight of train over a virtual three-tenths that it would haul over an actual three-tenths?—A. Yes.

Q. What is the object of introducing virtual grades?—A. The sole object of the introduction of virtual grades is economy in construction.

Q. Were the economies in the matter of virtual grades, which include momentum grades and sags, practised on the N.T.R.?—A. No, sir, not that I know of.

Q. Would it be possible for the engineers on the N.T.R. to estimate now the saving which might have been effected had virtual grades been used?—A. I think it probably would.

Q. They could, except where the location would have been influenced by the proposal to utilize these sags and momentum grades?—A. Exactly, yes.

Q. So that it would not be possible for us to arrive at a definite figure as to the saving that might have been effected?—A. No.

Q. So that momentum grade information or instructions should have been given to the locating engineers in order to have taken advantage of this economy?—A. Yes.

Q. Were the original instructions such as would have permitted the use of momentum grades and sags?—A. They were not.

Q. You were given hard and fast instructions to build actual grades?—A. Yes.

Q. Reverting to timber trestles, is it possible for us to-day to figure the economies that might have been effected had timber trestles been constructed originally?—A. I think it is.

Q. I understand you are working on such information for this commission now?—A. Yes.

Q. In the matter of curvature, I understand your instructions were (Reading from general instructions to Civil Engineers, signed by Mr. Lumsden)—"The maximum curve on a level shall not exceed six degrees. This curve should be used sparingly, and only when the topographical conditions prohibit an easier radius. At depots or stopping places curves exceeding three degrees should not be used. Curves less than 300 feet long are objectionable and should not be used. Reversed curves must not be used under any circumstances. At least 600 feet between transition curves must be had. Broken back curves must not be used. The minimum tangent between curves in the same direction shall be 600 feet clear of transition curves"?—A. Yes, that is so.

Q. How do these instructions compare with those under which you worked on other railways?—A. Rather more rigid, or confined the locating engineers more than on other railroads.

Q. Were you given a maximum degree of curve without any latitude on any other railway that you have ever worked on?—A. Yes.

Q. What was your maximum?—A. Four degree curves. It was departed from in one case.

Q. So that there are six degree curves on the Toronto Sudbury?—A. One.

Q. Was there any limitation as to the length of curve on the Toronto Sudbury?—A. No.

Q. Were the curves on the Toronto Sudbury spiral?—A. Yes.

Q. Was there any objection to reversing spiral curves?—A. I do not think so.

Q. Was there any instruction against compounding curves?—A. By no means. There were numerous compound curves used on the Toronto Sudbury.

Q. In your experience as an engineer, do you see any advantage in limiting the length of tangents between curves that are spiral?—A. I do not.

Q. So that you would feel that any additional money expended for tangents between spiral curves would be wasted?—A. I would.

Q. From your knowledge of your division, could any large saving have been effected if the limit in degree of curves had been extended to eight degrees?—A. Yes, it could have been.

Q. Would it be good railroading to introduce eight degree curves where large saving could be effected, even though it would be expected that, under heavy traffic, that curvature might, at some later date, be reduced?—A. I think it would be practical railroading to do so.

Q. What is a pusher grade for a four-tenths, assuming that the pusher locomotive is of the same power as the locomotive pulling the train?—A. It is 1.12 per cent.

Q. What is the rate for a pusher grade in a six-tenths line, using the same size of engine for pusher as that hauling the train?—A. 1.47.

Q. If a lesser gradient was used, such as I understand is the fact west of the St. Francis River, and it cost more money where the rate of gradient was 1.1 than a 1.47 grade would have cost, that additional expenditure was unnecessary?—A. It was.

(N. T. R. INVESTIGATING COMMISSION, EVIDENCE TAKEN AT OTTAWA, IN THE COMMISSION OFFICE, OCT. 17th, 1912.)

CHILION LONGLEY HERVEY, sworn:

By the Chairman:

Q. You are an engineer by profession?—A. Yes.

Q. And are now a contractor on the National Transcontinental?—A. Yes.

Q. Where?—A. I have a small section of work away up above La Tuque, up beyond where the end of steel is at present, and I have some work in New Brunswick, not on the Transcontinental though.

Q. Were you in the employ of the Transcontinental at one time?—A. Yes.

Q. When did you enter their employment?—A. I think it was 1905; I won't be exact about that.

Q. In what capacity?—A. As assistant to chief of party.

Q. On an exploration party?—A. Or a survey location. They had assistant chiefs of party then, as they called them.

Q. After you finished on that job what did you go to next?—A. They transferred me from New Brunswick up to Lake Abitibi, on the surveys there, and then into District C, and then into District B, and then on the Quebec Bridge Terminals, and then back up on to District A, down where Mr. Foss was, and then back again up to District B.

Q. You were finally at District B?—A. Yes, that is where I was when I left the road.

Q. What were you at District B when you left the road?—A. Assistant district engineer.

Q. To Mr. Doucet?—A. Yes.

Q. I want to ask you about this Ludger Noel arch?—A. Yes.

Q. The Ludger Noel arch is situated where?—A. If I remember right, it was about mile 141 west of Quebec.

Q. And it spans a stream?—A. Yes.

Q. It runs through on the north ride?—A. It is on the west side of the St. Maurice River.

Q. It runs north?—A. Yes.

Q. Is the stream called the Ludger Noel?—A. Yes.

Q. This stream empties into the St. Maurice River?—A. Yes.

Q. And the arch is quite close to the mouth of the stream? A. Yes.

Q. It is a floatable stream used for logs?—A. I have been told they drive it continually.

Q. Did you see any driving down on it?—A. No, sir.

Q. Did you know what the high water mark was returned by Mr. Ferguson?—A. Well, may be I can help out by just making a little explanation. Before I was assistant district engineer there, I was a divisional engineer some distance below that, and consequently I was dependent for my water levels on my predecessors in that country. We had several water levels on that area and several on the St. Maurice River at different places, and that is all the information we had to go on, and when I got there it was the time this arch was about to start to build, when I came in charge of it, and there were several sets of levels given by Ferguson and Bourgois, and a number of other engineers that had been there before me. That opening was originally designed for a steel viaduct, and I think it was on a reverse curve—I am not quite sure about that—and finally we came to the conclusion, on account of having the pedestals on steep gravel side hills, and the undesirability of a viaduct at that point was on account of the curves, and that it would be better to put in an arch, and we decided on a forty-foot arch; that is how the decision was arrived at.

Q. Before that it was first decided that a steel viaduct was not desirable?—A. Yes.

Q. By whom was that decided?—A. Well, I think I am correct in saying that we had correspondence between Quebec and Ottawa, with Mr. Uniacke, upon that subject for certain weeks and possibly months.

Q. Eventually the chief engineer, or whoever was the proper officer—A. I think the bridge engineer Mr. Uniacke.

Q. He consented to doing away with the arch?—A. Yes, that is what I understand.

Q. A design was prepared, was it not?—A. Yes.

Q. For the culvert?—A. Yes.

Q. And is that not the design? (Showing blue print).—A. I think that is just about the design, as I remember it: it is about four years ago.

Q. Was there a plan sent to you to work under?—A. We had a standard plan for a forty-foot arch.

Q. What is the size of the arch as built?—A. Forty foot.

Q. Did you get a plan for a forty-foot arch?—A. We had what we call a standard plan.

Q. Did you get anything from the office in Ottawa for the building of that arch?—A. No, sir.

Q. Nothing whatever?—A. No more than the standard plan we had on fyle for any forty-foot arch: I think I am correct in saying that: I do not remember of any.

Q. By a forty-foot arch, you mean an arch with a span of forty feet?—A. Yes, sir, and in this case the ring is a twenty-foot radius.

Q. Are the bench walls shown on that at a certain height?—A. Yes, they are.
Q. The bench walls are the walls that support the arch?—A. Yes, exactly.
Q. And they are shown to be how high on the standard plan?—A. On this standard plan they are shown to be ten feet.
Q. And that is the general instruction, is it, on which the engineers act when a forty-foot arch is to be built?—A. Yes, general instruction.
Q. Who authorized you to put in an arch at all?—A. Why, it was agreed upon in the correspondence we had with Uniacke, the bridge engineer, if we assured him ourselves down there that a forty-foot arch would hold that strain.
Q. Have you any letter authorizing it? (Letters produced and referred to).
Q. It was apparently on your suggestion that this forty-foot arch was put in: at least, it originated with you, so far as the correspondence shows?—A. Well, I certainly was one that originated it: I think I said in my letter that there were three or four of us there.
Q. Did you not do the correspondence from the office?—A. I did the correspondence from the Quebec office. My office was in Quebec, then, you know.
Q. Did you examine it on the ground?—A. I did.
Q. And you concluded that a forty-foot arch was right?—A. Yes.
Q. You stated in your letter that a forty-foot arch was sufficient. You said in your letter December 21st, "They agreed with me, without one dissent, that a single forty-foot or a double twenty-five would carry this stream any time"?—A. Yes.
Q. You knew all the time you were corresponding that a forty-foot arch bridge was the standard forty-foot bridge?—A. Yes.
Q. Did you ever get any authority to raise the bench walls of that culvert?—A. We have that authority any time.
Q. I did not ask you that: did you ever get any written authority to raise them?—A. Not that I recall, from anybody.
Q. Did you consult your superior officers about raising the bench walls of that culvert?—A. Not that I recall, sir.
Q. The bench walls of that culvert were raised?—A. Yes.
Q. And they were raised so as to make the culvert how much higher?—A. Eight feet higher: I think it is eight feet.
Q. At a cost, I am told, to the government of $22,000?—A. That may be accurate, but I do not think it is that. I did cause the raising of that wall.
Q. But it was a large amount of money?—A. Yes.
Q. What right had you to take it on yourself to do that?—A. I produce a standard plan of a forty-foot arch (Exhibit A) and I draw your attention to figures on the side 3070, with a circle round them.
Q. These figures mean what?—A. Those are the height of the bench wall.
Q. And in this case show the height to be ten feet?—A. Yes.
Q. And you add the three and the seven together?—A. Yes.
Q. And opposite there are encircled in the same way the figure 30 and 50 and 25 four inches. What do those indicate?—A. The entire height of the arch.
Q. That is to the centre, from the floor?—A. From the top of the completed arch to the floor, and this is the height of the wall at its extremity, and I point out that on this plan are written the following words "Dimensions marked thus (with a circle) may be varied if necessary."
Q. And you say that under that authority you raised these bench walls?—A. Yes.
Q. What was the necessity for raising them?—A. As I told you, we were going on the data of water marks left us by our predecessors.
Q. What were the data that you had before you?—A. The high water marks given by all the locating and constructing engineers that had preceded me on the works.

Q. So far as the records go, I am instructed the high water mark is shown on this profile?—A. This is as far as Ferguson's high water mark is concerned, but we have several.

Q. Do you say that you had any other profile showing any other high water mark?—A. I cannot say that it varied from that; we had several others.

Q. Did you ever make any record, or can you refer to anything which showed the high water mark was higher than that?—A. No, I cannot state that positively.

Q. Don't you know as a fact it was not higher than that?—A. No, I do not. That gives the depth of that water on this plan ten feet on the profile, and it is practically 75 or 80 feet wide. Now we are congesting that into forty feet.

Q. That is on the lower side?—A. No, it is right in the centre line.

Q. Of the stream?—A. Crossing the stream, on the centre line of the railway crossing the stream, and if you congest that to forty feet, you would naturally expect it higher, and if you were going to have a log drive, and did not want it against the ring of the arch—

Q. You know the stream suddenly breaks out at the railway, and is not on the south side anything like 80 feet wide?—A. It certainly was at this time, because they have taken the elevations.

Q. It spreads out on the railway?—A. When it backs up it is high.

Q. But I am speaking of the stream: it is not fair to say that that is an eighty-foot stream coming down there and crossing?—A. In high water it is.

Q. Do you say that the stream was of that breadth on the south side of the railway?—A. Right on the exact centre line of the railway, and we congest that into forty.

By Mr. Gutelius:

Q. What plan is this we are looking at?—A. That is a plan of Alexander Ferguson, in charge of a location party to locate the railway, dated September 7th, 1907.

Q. And on this plan high water mark is shown at what elevation?—A. 645.

Q. And low water?—A. 636.8.

Q. What is the width of the stream at high water on the plan?—A. 85 feet.

Q. And what is the width of the stream at low water?—A. 50 feet.

Q. What is the elevation of the spring line on the arch as constructed?—A. 656.

Q. And the height of low water is what?—A. 636.

Q. What is the elevation of the bottom of the invert of the arch in the centre?—A. 637.

Q. So that it would require nineteen feet of water to make the surface of a flood equal to the height of the spring line?—A. Yes, to the level of the spring line.

By the Chairman:

Q. Then you ordered the walls to be increased under these circumstances without consultation with anybody?—A. Yes: I do not remember consulting anybody about it. I cannot say that I did, positively.

Q. Then were there other engineers on the ground?—A. If I remember right, the time that I decided to raise those walls was just after we had completed the piers in the St. Maurice River. This has a bearing on this: and I had completed them on the previous day in high water levels: and after we had completed those—we built them in winter before the steel had been put on—I stood there myself and saw the St. Maurice River and the ice going over the top of the piers five feet: that is practically the first opening on the St. Maurice below this; it is about 13 or 14 miles down.

Q. A flood in the St. Maurice would not be any more guide to you for the construction of this than a flood in the St. Lawrence?—A. No, I do not mean to intimate it would be a positive guide.

Q. It would not be any guide?—A. Well, it did not lead me to believe these men that were preceding me were underestimating the flood of the river.

Q. That they were not underestimating?—A. Or rather, it led me to believe they were underestimating.

Q. You came to that conclusion when?—A. When the freshet took place in the St. Maurice.

Q. When was it you began the arch?—A. The same year.

Q. You observed the freshet in the St. Maurice River months before you began the construction of the arch?—A. Not many; it was the same year.

Q. You made up your mind then that the figures of the engineers as to observations were not reliable?—A. I wanted to be on the safe side, because I had taken the responsibility.

Q. You saw Mr. Doucet?—A. Lots of times.

Q. You saw him many times before you commenced the construction of the Ludger Noel arch?—A. Yes.

Q. And you saw the Inspecting Engineer?—A. I think I saw him too.

Q. And you were in constant communication with the Head Office?—A. Yes.

Q. And yet you never drew it to their attention?—A. I cannot recall that I did; I may as well say I did not.

Q. If you did that, was it not undertaking something that you had no authority whatever to do?—A. Well, I think my authority is on that plan.

Q. I cannot see how it is, because it does not say you may vary those measurements?—A. What does it say?

Q. It says they may be varied where necessary?—A. It says they may be varied if necessary; that means by the engineer on the ground.

Q. I should think it means by the engineers. You were only assistant engineer; you never even spoke to Mr. Doucet about it?—A. No, I do not think I did.

Q. Did you pursue that policy of spending large sums of money off your own bat, without consulting any person else?—A. No, I cannot say that I did, sir. In the case of the St. Maurice we raised that fifteen feet.

Q. Did you consult Mr. Doucet in that?—A. Yes, I will tell you why; that was a vastly different point—

Q. Never mind that. Here you had present to your mind that this culvert should be raised, and it cost a large sum of money to raise it. Before you had adopted that culvert you consulted the engineers on the ground, you consulted Mr. Doucet, you consulted the Head Offices, and although you had the matter in your own mind for months, you deliberately put in those side arches without consulting anybody—increased the side walls without consulting anybody?—A. I never considered those side walls to be an absolute fixture.

Q. W. do you mean by that?—A. I would consider myself—I may be wrong—that if I were putting in an arch for a certain purpose, and there was going to be hardly any water, I would consider myself justified in cutting that down five or six feet, or raising it, if necessary, on the ground; and we referred the bridge plans to the bridge engineer, because it was eliminating a structure.

Q. Broadly speaking, where increased expenditure was necessary over that contemplated and contained in the direct instructions, did you not always consult your superior?—A. No, sir.

Q. You did not?—A. No.

Q. Did anybody else do that, to your knowledge, on the road?—A. I am speaking, of course, of ordinary minor expenditure; I am not talking about change of location.

Q. Of course this was a large expenditure; it was increasing the cost of the whole fill and arch a fifth?—A. I cannot quite figure that out.

Q. Would you not think that improper deductions might be made by people, from your doing that?—A. I should say not; I do not see why they should.

Q. You have not, so far as we can see, given any data to show the necessity for it; you never consulted your superior, or a single engineer, and never wrote a letter, and involved the commission in an expenditure through a whim, so far as I can see?—A. Would not this plan you show me be considered a data?

Q. I want to know what the data is?—A. The water is ten feet deep in an eighty foot opening.

Q. And you knew that when you made that recommendation, and your recommendation said that a forty foot arch would carry it under any conditions?—A. But I did not say the arch would have eight or ten foot walls.

Q. You knew you were misleading the Head Office?—A. No.

Q. You knew what the standard arch was?—A. We had several standards.

Q. Had you a standard forty foot arch that differed from that?—A. I do not know whether we had or not.

Q. It is quite plain from your letter, December 21st, that you wished to, if possible, avoid a steel viaduct, and that you were trying to persuade them to built this culvert, as you use these words: "I have been on the ground with Timbrell and Grant"—that is the present chief engineer, is it not?—A. Yes.

Q. "And have enquired from Bourgeois and others that have been familiar with the Ludger Noel in freshet season, and they agree with me, without one dissent, that a single forty or a double twenty-five will carry the stream any time". There is your judgment formed after consultation with most capable engineers who are familiar with the conditions, and you, without any additional information, excepting, according to yourself, that you saw the St. Maurice in flood; you knew, according to yourself, the width of this stream, because you said you were on the ground—you deliberately increased that without any consultation with anybody, to the advantage of the contractor?—A. I do not know about the advantage to the contractor. I spoke to some of them up there, I do not remember whether it was resident or divisional engineers, in the matter, at the time of the St. Maurice flood that I refer to, and they told me that there had been a big flood here in this river.

Q. Who told you?—A. I have been trying to think ever since I have been in there, whether it was Timbrell or somebody else. I cannot state positively, because it is too serious a matter to say, unless I am sure of it, but some of the men on the ground did tell me, and I was on the St. Maurice River at the time.

Q. But you did not undertake to increase the length on the St. Maurice River without authority?—A. That was the bridge engineer's direct affair, because it was a bridge structure.

Q. But this was Mr. Doucet's direct affair: he was responsible for this expenditure, and you were in his office, in the same building with him?—A. I have changed culverts on that railway.

Q. I cannot conceive why you should do this without even telling the man in the same office?—A. I certainly do not recall telling him anything about it.

Q. And you can give no more explanation than you have given?—A. No more explanation than that I considered it advisable to raise it.

Q. No person agrees with you that we know of, and subsequent experience shows, as far as we know, that it was a waste of money, and you have not given any concrete evidence of why you did it?—A. If you take the thing theoretically, there is a plan——

Q. But you had that plan before you when you wrote this letter to Mr. Doucet?—A. Yes.

Q. Then you did not draw that conclusion at that time?—A. I did not state in the letter that the walls had to be ten feet high or fifty.

Q. You said two twenty-five or a forty would take care of it, under all conditions?—A. Yes.

Q. Do you mean to tell me that if any man wrote that letter to you, that you would not understand that the standard was what he was referring to?—A. Those dimensions are all variable.

Q. But you were referring to the standard arch; you were showing them by that letter that the price would not be any more than the standard arch, because this is an argumentative letter. You say in effect "I am sure that a standard arch, or two twenty-fives or one forty, will carry us under all conditions"?—A. Yes, this is made deeper on account of excavations for foundation, understand.

Q. I am speaking of the length above the water?—A. That makes a wall higher.

Q. You said a few moments ago that you did make changes in other work under your charge?—A. Yes.

Q. Without consultation with anybody else?—A. Yes, I did.

Q. Will you tell me one of them that is of any importance?—A. Offhanded, I should say that I had changed several culverts; it is a little hard for me to remember those exactly.

Q. Mr. MacPherson wrote to Mr. Lumsden, January, 1909, drawing his attention to the fact that the quantities being returned for standard culverts were largely in excess, not in accordance with the plans, and cited seven locations in District B where the total yardage called for by the standard plan amounted to 1471, while the total yardage returned by the resident engineers was 2,230 yards. Those are on Residencies 22 and 23: are those yours?—A. They were all under me.

Q. Can you give any reason why you increased the yardage in those?—A. I did not increase them. It was due to the foundation, or the particular structures.

Q. No, it was the thickness of the walls?—A. When we started the road, Residency 22 was where the work was started, and they were constantly changing the plans. If they had one set they had four, and the work was going on all the time, and we had to get along the best we could.

Q. Do you say you were not supplied with a plan which showed a fixed thickness for those walls?—A. I mean to say they were changing them monthly or weekly; that is a guess as to time.

Q. Do you repudiate the responsibility, so far as you are responsible, for the changing of the thickness of the walls of these culverts in these residencies?—A. I mean to say when we were building the plans kept coming in, in different ways, and we had to keep on building. We went on the best we could with what we thought was right. We had a set of standard plans sent to us that we never built one culvert on: that is the egg-shaped culvert, such as the C.P.R. used.

Q. In February, 1909, Mr. MacPherson wrote a letter and said:—"Assistant district engineer Hervey's statement that the culverts referred to were built before a standard plan furnished from this office is absolutely incorrect, as none of them were even standard when the final standard plans for these sizes of culverts were sent out. On August 15th, 1906, final standards were sent out and acknowledged by the district engineer, 17th August, 1906. The earliest start on one of the five culverts referred to on Residency 23 was September 5th, 1906, and the latest October 28th, 1906. This latest one is the worst of the lot in its departure from standard plans. The thickness of the arch at crown is 18 inches instead of nine inches on standard, and depth of concrete under culvert three feet three inches instead of six inches". Is that right? You cannot tell us anything about the foundation part of it?—A. No.

Q. "With the result that the total concrete in the structure is 2.6 times that called for by the standard plan. Most if not all of the plans of small arch culverts received from District B to date have thickness of crown and other features different from the standard, proving that the men on the ground have taken

it upon themselves to alter or ignore the standards, the result being always increased quantities". What do you say to that?—A. That was from August to September, I understand?

Q. Yes?—A. I think that we had been building culverts on the plans that those culverts are built on prior to receiving—possibly not those particular culverts but other ones in the same residence prior to receiving those final standard plans, and that they went on with them; that is my impression about that, because we had three different sets of standard plans sent us in one summer right at the time you speak of, and we went on the best we could and designed our own culverts, because we did not know what we were going to do.

Q. Did you make any protest or send in any letters about it, or put yourself on record?—A. I think there was a certain amount of correspondence about culverts and standard plans and criticisms of them. I supposed the thing had been done away with long ago.

Q. If Mr. MacPherson's statement is correct, is there any excuse for having departed from the standard plans?—A. Any more than we were probably building on those very plans the culverts were built upon before.

Q. He says they were not commenced till after?—A. But there were other culverts there, and the resident engineers were working on those plans at the time, and they might have received them at that date, or might not have received them till afterwards.

Q. You mean to say that, although the plans might have got to the district engineer's office, they might not have got to the resident engineer's office in time, before the commencement?—A. That is very possible, but I do not state that it did happen, because they sent out a negative, and they all had to be reprinted and sent out.

By Mr. Gutelius:

Q. Did you knowingly permit an eighteen inch ring on a six foot arch?—A. I cannot state positively whether I did or not.

Q. Do you think you did? If you came to a six-foot arch and found them putting an eighteen-inch ring on, what would you do?—A. I think I would consider it about right. I have forgotten. I was never much on culvert design. I am not clear on the point. I could not tell you whether I permitted that or instructed it or not.

Q. Referring to that three-foot thick invert, if you found it was necessary to go three feet below the depth of the stream, would you consider it good economical construction to fill the hole from the bottom up entirely across the bed of the arch with concrete as deep as three feet or more?—A. We would put in inverts wherever we thought there was danger of scouring.

Q. What depth of invert concrete do you think should be a maximum for an eight-foot arch?—A. I should think about 12 or 18 inches.

Q. Then if you had a hole deeper than that you would have filled it with what?—A. Rock, I suppose, or other material.

Q. So that it would not be good engineering to fill up a three-foot hole with solid expensive concrete?—A. No.

Q. That was done on that work. Did you know of it?—A. I cannot say that I did.

Q. Referring to standard plan of forty-foot arch, these variable dimensions are intended to enable the engineer in the field to fit the arch to the ground as he finds it?—A. That is what I understand it, yes.

Q. If this standard plan showed high water mark at the line where the terms "springing line" are printed, what effect would that have had on you in locating the height of the side walls of the Ludger Noel arch?—A. I should think that the area ordinarily below the springing line, the cross-section area below the springing line should be sufficient in that arch or any other to take care of it—or equal to the water at high water level.

Q. And the area on Mr. Ferguson's plan would be fifty feet on the bottom, eighty feet on top, ten feet high, which would equal 650 square feet?—A. Yes.

Q. The area of waterway in the Ludger Noel arch as constructed is what?—A. 760 feet.

Q. You provide a margin above your own formula of 110 square feet?—A. Yes.

Q. Or three feet as least?—A. Three feet in height.

Q. As an engineer, you figure that that extra height was necessary for a safe structure?—A. Considering it was a log driving stream I do, with the information I had at hand.

Q. The amount of money, as brought out heretofore, is large?—A. Yes.

Q. And the fact that you did not take this up with your superior officers is the one thing which we are rather putting up to your door. If you had known that this was going to involve anything like that additional expenditure, would you not have taken it up with your superiors?—A. I did not realize the large expenditure.

Q. If you had realized it, you would?—A. Yes.

Q. Now, that it is all over, you are willing to say that unfortunately you overlooked discussing this matter with your superior officers, although, as an engineer, you felt that that extra height was necessary?—A. With the information I had, I do.

(N. T. R. INVESTIGATING COMMISSION, EVIDENCE TAKEN ON THE TRAIN BETWEEN GRANT AND COCHRANE, JUNE 9th, 1912.)—

H. M. BALKAM, sworn:

Examined by the Chairman:

Q. You are an engineer by profession?—A. Yes, sir.

Q. How many years' experience have you had as an engineer?—A. About thirty odd.

Q. Have you had experience in classification in Canada before you came on this road?—A. Yes.

Q. On what roads?—A. The last one I was on was the New Brunswick Coal and Railway.

Q. How long were you there?—A. About three years.

Q. And before that where were you?—A. On the Bangor, Aroostock and Maine Railway.

Q. When did you come on the Transcontinental?—A. In September, 1904.

Q. Where was your first experience on that line?—A. In New Brunswick.

Q. How long were you there?—A. I was there until the winter of 1905 and 1906.

Q. What was your position there?—A. In charge of surveying party.

Q. You came up to this country when?—A. I stayed in New Brunswick until the winter of 1905-6.

Q. Then to this country?—A. No, then in the Nipigon country.

Q. How long did you remain there?—A. Stayed there until September, 1906.

Q. When did you come here?—A. I came here about the 1st of September last year.

Q. In the meantime where were you?—A. On the Transcontinental N.B.
Q. In 1906?—A. Yes.
Q. You went back to New Brunswick?—A. Yes.
Q. What were you engaged at down there?—A. I was on location, divisional engineer, assistant district engineer until 1908, I think, and then I was inspecting engineer.
Q. On what?—A. On the whole road.
Q. From Winnipeg to Moncton?—A. Moncton to Winnipeg.
Q. Then after that?—A. I came here in September as district engineer.
Q. You are now district engineer where?—A. Headquarters at Cochrane, district C.D.
Q. About how many miles in your district?—A. About 400.
Q. Have you the control of the classification over that whole district?—A. No.
Q. Have you control over any part of it?—A. No.
Q. Have you any concern with the classification?—A. Certainly.
Q. What is your position?—A. I control the classification until I am overruled by my superiors.
Q. Then you control all the classification on that 400 miles until you are overruled by your superiors?—A. Yes.
Q. Who are your superiors?—A. Gordon Grant, chief engineer.
Q. Anybody else?—A. Not that I know of.
Q. Then you are next to Mr. Grant?—A. On this piece of ground.
Q. Does your district extend through what is called the clay belt?—A. It is virtually all in the clay belt.
Q. Is the country about the same as from Peter Brown to Grant?—A. No; the surface of the country down there is very near the same. Down there we have that underlying soft blue clay and that does not occur up on the western end.
Q. Have you given any instructions to the resident engineers, the divisional engineers, or the assistant district engineers with regard to classification since you came on the road?—A. Yes.
Q. Were those instructions in writing?—A. No; there might be some in the form of a circular letter.
Q. Have you kept a fyle of written instructions which you gave to your engineers?—A. Yes.
Q. And among those are there circular letters concerning this classification?—A. Yes.
Q. Where is that fyle?—A. In my office at Cochrane.
Q. Is the classification in your district governed by your instructions?—A. Yes.
Q. And you are, therefore, responsible to your superior for the classification in this district?—A. Well, not what was done previous to my connection with the district.
Q. But since you came here?—A. Yes.
Q. Have you given any different instructions for classification apparently different from those which were in force when you came here?—A. Only in one instance that I can remember.
Q. What was that?—A. That was to classify no clay other than common.
Q. As what?—A. To classify all clay as common excavation, pending a plough test.
Q. In consequence of what did you give those instructions?—A. Because I was so instructed by the Chief Engineer.
Q. When was that instruction given?—A. Some time this spring.
Q. Before that had you given any such instructions?—A. I had given instructions to cut out a certain classification that had been returned as loose rock for clay that was too soft to plough.

Q. Will you tell me where that was?—A. I think that was only on two contracts.

Q. What contracts were they?—A. 15 and 14.

Q. Whose were they?—A. 14 is the G.T.P. and 15 is Fauquier Brothers.

Q. The G.T.P., or Foley, Welch & Stewart?—A. Yes.

Q. Why did you do that?—A. Because I was so instructed.

Q. To cut out the soft clay?—A. Yes.

Q. And to classify the soft clay as what?—A. Common excavation.

Q. Who instructed you?—A. I think the instructions came through the chief.

Q. Do you recollect?—A. I cannot say positively whether these instructions came from Mr. Leonard or the chief.

Q. That was after Mr. Leonard came in?—A. Yes.

Q. Did you change it before Mr. Leonard came in?—A. Yes, I changed the classification in that pit we saw this morning.

Q. Tell me the number of it?—A. That was at Missinabie, about mile 211.

Q. What classification did you change there?—A. I changed it from train fill to classified train fill.

Q. What is the number of the pit?—A. Number one.

Q. You changed it from train fill to what?—A. Classified train fill.

Q. What is train fill classification?—A. That is something that is not allowed in the book.

Q. Was train fill more expensive classification or less expensive?—A. My classification was more expensive.

Q. How was it being classified before you made the change?—A. Train fill; no classification.

Q. What was the commission paying for it then?—A. 55 cents.

Q. Did that include overhaul?—A. No.

Q. 55 cents a cubic yard and overhaul, whatever that amounted to; is that right?—A. Yes, if there was any.

Q. Was there any overhaul?—A. Not in that case.

Q. So that it was costing them 55 cents?—A. Yes.

Q. What did your classification make it cost them?—A. 97 I think.

Q. Had there been any complaint made about it?—A. I could not say as to that.

Q. How long had it been classified as train fill?—A. Well, during that season.

Q. During what season.—A. Last year, 1911.

Q. When did you change it?—A. I think it was in November or December.

Q. What made you change it?—A. Because I thought it was right.

Q. Was there no other reason? Nobody was making any complaint?—A. No.

Q. You just of your own motion, without any instructions or complaint, raised it to 97 cents?—A. That is my remembrance of it now.

Q. Was that not rather an extraordinary thing to do?—A. I do not think so.

Q. You were there in the interests of the Transcontinental, were you not?—A. Certainly.

Q. It was not in its interest to pay any more money than people were asking?—A. It was my interest to pay what was right; it was my business to pay what was right.

Q. What was this material?—A. It was clay.

Q. How has it been taken out?—A. Pick and shovel.

Q. And it was just scooped out with a steam shovel, was it?—A. Handled with a steam shovel, as far as I know.

Q. Is there very much of it?—A. Yes, there was a good deal of it.

Q. How much did you classify of it?—A. I would have to look it up. I should say something like 50,000 yards.

Q. Did you communicate with the chief engineer before you changed this classification?—A. I do not remember that I did.

Q. Did you advise him by letter that you had changed it?—A. It showed on the form.

Q. What entry on the form did you make that would draw any person's attention to it?—A. It showed a minus quantity in train fill and a plus quantity in classified train fill.

Q. I do not follow you; you have certain forms on which you enter the classification. Did the classification say?—A. We change it from one item to another.

Q. Did the classification say, before your time, that material taken from pit number one, for instance, is paid for as train fill?—A. That shows on the form.

Q. When you came along did you change the figures?—A. I took so much out of the train fill column and put it into another column.

Q. If the chief engineer had the two documents before him would he know that the material that the commission had been paying as train fill was raised now to 97 cents?—A. Certainly.

Q. How could he tell it?—A. It was self evident on the form.

Q. You did not draw his attention to it more than that?—A. I do not know: we generally sent in a letter as to any change; I could not say whether we actually sent in a letter of that kind.

Q. Had you any discussion with anybody before that?—A. Yes, I discussed it with the divisional engineer, Mr. Pardee.

Q. Anybody else?—A. I do not remember.

Q. Had you any discussion with any of the commissioners or any of the higher officials before you did that?—A. I do not remember of any.

Q. You would remember, would you not?—A. I do not think I did.

Q. Did you see any of the commissioners before you did it?—A. I do not think I mentioned it to them.

Q. Do you remember the month you made that change in?—A. I think it was November, but I would not be sure.

Q. Were any of the commissioners up here in November?—A. I could not just say when they were up; they were not on that part of the work. They were up here one time and went to Grant in the night, but I could not fix the date.

Q. Did you see them up here before you made the change?—A. No, I do not think it.

Q. Can you say whether or not you discussed it with any of the commissioners?—A. I am almost positive that I did not.

Q. You do not discuss things with the commissioners every day, and I should think you would have a recollection whether you did or not. You should be able to say definitely?—A. Well, to the best of my recollection, I did not.

Q. Was Mr. Grant with them?—A. I think he was.

Q. Did you discuss it with him?—A. Not previous to making it.

Q. Did you ever discuss it with him?—A. Yes, sir.

Q. When?—A. Since.

Q. When?—A. In his office at Ottawa.

Q. When?—A. I could not fix the date.

Q. Was it since November 1911?—A. It was since I made the difference in the classification.

Q. You cannot come any nearer than that to it?—A. No.

Q. How did you come to discuss it with Mr. Grant?—A. Because the classification that I made was cut out in the Ottawa office.

Q. Was there ever any of it paid for under that classification?—A. No.
Q. And whose contract is it in?—A. O'Brien, Macdougall and O'Gorman.
Q. Did you discuss it with any members of that contracting firm before you made it?—A. Yes, I talked with Mr. O'Brien about it.
Q. Before you made it?—A. I do not remember whether it was before I made it.
Q. How long had the pit been opened?—A. Some time that spring.
Q. Is there any correspondence bearing upon the classification?—A. Yes.
Q. In your possession—before you came in?—A. No, not that I know of.
Q. None at all?—A. No.
Q. Do I understand you to say that, without being moved to do so by any person, either in authority or not, that you, of your own volition, and on your own responsibility, changed that classification?—A. I did, off my own bat.
Q. Did you change any other classification?—A. Yes.
Q. What did you change?—A. I adjusted the classification west of the Kikamenogany River.
Q. What was that adjustment?—A. I lowered it.
Q. What did you lower?—A. The cuts and the borrows.
Q. The cuts and the borrows?—A. Yes.
Q. What was it before you lowered it?—A. It was a little different.
Q. I would like to know something definite about it?—A. I went over that work, and the classification which struck me as too high I reduced.
Q. Then you did find some classification in that place too high?—A. Yes.
Q. For example?—A. I do not think I could mention any special case.
Q. Did you find any material being classified out of its class?—A. In my judgment, yes.
Q. What material did you find so classified?—A. Clay.
Q. What kind of clay?—A. Indurated clay.
Q. Was it classed too high or low?—A. The most of my changes were lower.
Q. You lowered some indurated clay from loose rock to common excavation?—A. Yes.
Q. Was there a large or small quantity of this?—A. There was about forty miles of it.
Q. About what quantity would there be, very roughly speaking?—A. In a rough guess it was going on 15,000 yards to the mile.
Q. That was done when?—A. That was in September.
Q. Who was classifying in that way?—A. The engineer on the ground.
Q. Do you know who it was?—A. The different resident engineers and divisional engineers.
Q. Can you give me where that occurred, between what points?—A. It was from the Kikamenogany River, from about mile 5 or 6, up to 60. I said forty miles; it was more than 40 miles.
Q. This clay you considered common excavation, and you changed it, to make it common excavation?—A. Yes.
Q. About what per cent of it?—A. According to the different material.
Q. What I understood from your answer was that you reduced about 15,000 yards a mile?—A. The work averaged about 15,000 yards a mile.
Q. Your action affected about 15,000 yards a mile?—A. More or less.
Q. Approximately 15,000 a mile?—A. Yes.
Q. So that it was a very serious and important reduction in classification?—A. Yes.

By Mr. Gutelius:

Q. 15,000 per mile, or 15,000 all told?—A. I am taking the average of 15,000 a mile for the grading of the road.

By the Chairman:

Q. You found what you estimate as 15,000 cubic yards per mile of clay in the locality which you have last named had been classified as loose rock, and you classified it as common excavation?—A. No, sir.

Q. What did you say?—A. I said I estimated the yardage would run 15,000 yards to the mile, and I reduced that in places. It was not all clay. There was a lot of muskeg.

Q. I am talking about clay?—A. I could not say what proportion of that would be clay.

Q. How much would you estimate the clay would be?—A. I could not say.

Q. How much would you estimate your deduction affected—A. I could not say that.

Q. Did it affect 500 yards?—A. Oh, yes.

Q. All told?—A. Yes, more.

Q. What would it affect?—A. I could not give you any idea.

Q. Can you tell me within 10,000 yards?—A. No.

Q. Can you tell me within 50,000 yards?—A. No. I could not.

Q. Could not tell me at all? It had been classified? It was on the books?—A. Yes.

Q. And you had the classification changed?—A. Yes, I gave instructions to classify differently.

Q. And the changes would show on the sheets?—A. No, it would not all show until the work was completed. Supposing they were given fifty per cent in a cut, and they had only worked a little bit in it, I would say to the engineer "If that cut holds as it is, it should not be more than thirty per cent." That would not show on the returns until the cut was finished.

Q. You cannot give me any definite information as to the saving this reduction effected?—A. No.

Q. You cannot swear whether it effected any material saving at all or not?—A. No.

Q. It may have been so small as not to have amounted to anything, for all you know?—A. Yes; I never worked it out.

Q. Did you raise the classification in that district at all?—A. There may have been places where I raised it.

Q. Do you remember raising it?—A. I do not remember any place it was raised.

Q. So far as you are at present able to say, you cannot tell me whether you changed the classification to the advantage of the commission in any place before you got the instructions that came after Mr. Leonard came in?—A. This change I just told you about was a reduction.

Q. You have told me you did not know it amounted to anything?—A. I never estimated what it amounted to.

Q. What material have you approved of being classified as solid rock excavation over your whole district?—A. Nothing but solid rock and boulders more than a yard.

Q. I suppose you approved of all large stones and boulders measuring more than one cubic foot and less than one cubic yard, and all loose rock, whether in situ or otherwise, that may be removed by hand, pick or bar, being classified as loose rock; that is right?—A. Yes.

Q. Had you any cemented gravel along your district?—A. I do not think it.

Q. Then we come to clay: did you approve of or instruct any clay to be classified as loose rock?—A. Yes.

Q. What clay did you approve of or instruct to be classified as loose rock?—A. Indurated clay.

Q. All indurated clay?—A. Indurated clay that, in my judgment, was sufficiently indurated.

Q. Do you consider that an intelligent answer?—A. Yes.

Q. I would like you to try and put it to me in less technical language. What clay did you instruct or approve of being classified as loose rock?—A. Clay that I thought was sufficiently indurated.

Q. To be what?—A. To be entitled to be called loose rock.

Q. What clay did you consider to be sufficiently indurated to be entitled to be called loose rock? Now, supposing I am the engineer and going out on the job, and you are going to tell me what clay I will testify as loose rock, what will you tell me?—A. I will tell you I want to see the clay, and when I see it I will say, "This is loose rock" or "This is not".

Q. But if you were going to send me out, what would you tell me?—A. If I were going to send you out I would give you that specification.

Q. You would wash your hands of any instructions and hand me the specification?—A. Then I would go out and see what you were doing.

Q. You would hand me the specification and tell me to go out and pick out of the specification what it should be myself?—A. I never ask an engineer to return anything outside of the specification.

Q. If you were sending an engineer out over this work, you being familiar with the specification as you are, what instructions would you give him about clay?—A. I would tell him to classify clay in strict accordance with the specification.

Q. Then would you tell him to classify any clay which could be ploughed with a ten-inch grading plough behind a team of six good horses, properly handled, as loose rock?—A. That would depend upon who does the ploughing.

Q. Would you tell him that any clay which, in his judgment, could be ploughed behind a team of six good horses, properly handled, should be classified as loose rock?—A. No, if it could be ploughed, in his judgment, he had to classify it as common.

Q. Is there any clay here which could be ploughed by such a team and such a plough being classified as loose rock, to your knowledge?—A. No.

Q. There is not?—A. No.

Q. Then you consider that it is the duty of the engineer not to classify clay which could be so ploughed as loose rock under this specification?—A. Certainly.

Q. And if it has been so classified, it has been wrongly done?—A. Certainly.

Q. Is there any excuse for a person under this specification classifying clay which can be so ploughed as loose rock?—A. Yes, it is a question of judgment.

Q. But if he thinks it can be ploughed?—A. He certainly would not return it if he thought it could be ploughed.

Q. Have you made any tests to see whether any clay which has been so classified could be ploughed?—A. No.

Q. Do you think the clay along this district can be ploughed with such a team and such a plough?—A. Very little of it.

Q. What portion of it could be ploughed?—A. Oh, I could not say that.

Q. Where will you find that which can be ploughed?—A. Well, each case, as you come to it, you decide on each case on the ground.

Q. Is there some of it can be ploughed down two or three or four feet?—A. Yes.

Q. Five or six feet?—A. No, I do not think there is any can be ploughed that depth.

Q. Down as far as four feet?—A. No, I am very doubtful about that.
Q. You say it is only the surface can be ploughed?—A. Not always that.
Q. But only the surface in any case?—A. But not always the surface.
Q. But in any case it is only the surface; it never goes below the surface?—A. No, it might be the other way. I have seen streaks underneath that could be ploughed.
Q. What do you mean by ploughing?—A. I mean practical ploughing.
Q. Do you think a team of horses could not pull a plough through most of the clay in this district?—A. I would not consider that ploughing.
Q. But a team of horses could pull a plough through it?—A. I have no doubt they could, through most of it.
Q. And turn it over?—A. Some places would turn over and others would fall back.
Q. Are there any large quantities you could turn over?—A. Yes.
Q. And that has been classified as loose rock; is that right?—A. Yes.
Q. What justification is there in the specification for classifying as loose rock any such clay that could be turned over by such a plough?—A. Because you have not accomplished the purpose for which you plough; it is not practical ploughing.
Q. Explain, please; you are doing the explaining?—A. Well, the fact that you can pull a team through it is no use. You plough for a certain purpose, the same as you blast a rock for a certain purpose, to break it and handle it. If ploughing made this clay readily handable, I would consider it ploughing; otherwise, I would not.
Q. You thought it could be turned over, but you classified without seeing it done?—A. There was never any plough work on this to my knowledge.
Q. You concluded that you would never accomplish your purpose by ploughing?—A. You had not accomplished your purpose.
Q. You concluded you had not accomplished your purpose?—A. Yes.
Q. What reason had you for concluding that?—A. My judgment.
Q. How did you arrive at that? Because a man is supposed to exercise his reason. How did you arrive at that?—A. From the nature of the material.
Q. Had you ever tried it in your life on that kind of material?—A. Not just exactly on this kind of material.
Q. So that you had no experience in it; you could do more than guess, could you?—A. Oh, yes.
Q. How can a man form a judgment without experience?—A. You know it is a tough, hard material. You can form some idea by the way a pick or shovel works on it how a plough would work it.
Q. How was it taken out?—A. A great deal of it was blasted.
Q. Was there any continuous blasting in the whole district?—A. Yes, there has been continuous blasting in my time.
Q. Where?—A. Up on 29.
Q. Mr. McBey's?—A. No, beyond his—it is his division now.
Q. Was there any other place where continuous blasting was used to get out clay?—A. No. Those cuts were nearly all out before I came here.
Q. Was there any used in your time?—A. I do not know of any.
Q. Do you know if any was used before your time?—A. That would be only hearsay.
Q. Well, from hearsay?—A. I could not swear to that.
Q. You could not enlighten me on that?—A. No.
Q. You could not tell me of any?—A. No.
Q. So far as you know, there was not any?—A. I really do not know anything about it.
Q. Is there anywhere where I can find reliable information in any records showing where continuous blasting was used?—A. There should be a record of how much explosive is used in each and every cut on the road.

Q. In whose possession should that be?—A. It should be in the Ottawa office.

Q. Had you any written instructions, excepting what are contained in the specifications, as to how you should classify material?—A. Well, there has been the Lumsden circular that I recall now.

Q. Did you ever remeasure any of this work at all?—A. No.

Q. So that from actual measurement you cannot say whether it has been properly measured or not?—A. No.

By Mr. Gutelius:

Q. With reference to your interpretation of the specification, I notice that you are reading into the specification the same idea, under loose rock, that is presented under solid rock, where it says, "May best be removed by blasting". You read the loose rock specification to mean, "May best be removed by ploughing"?—A. To a certain extent. Where it would be practicable to plough it, and you would accomplish the purpose you ploughed for.

Q. You observe the reading of it, "In the judgment of the engineer can be ploughed"?—A. Yes.

Q. It does not say, "In the judgment of the engineer can be blasted"?—A. No.

Q. It says, "May be best removed by blasting"?—A. Yes.

Q. Would it surprise you to learn that the proper interpretation of this ploughing clause is that it is simply a test? Had you considered that it might simply be a test?—A. Well, whose interpretation would that be?

Q. Have you ever looked at it from that point of view?—A. Yes.

Q. And, after looking at it from that viewpoint, concluded that was the wrong view to take?—A. Yes.

Q. Was that based on the language of the specifications?—A. No, I supposed it was not a catch question; it was actual conditions as they would be on the work.

Q. A test in cement is how many pounds it takes to pull apart, where the cross-section is a square inch?—A. Yes.

Q. A test for softness at a foundation is driving a pipe?—A. Yes.

Q. Suppose, instead of the specification reading as it does, it read, "Cannot be penetrated by a two-inch pipe driven by one man, with a sixteen-pound hammer, without the necessity of blasting", and so on?—A. I understand you.

Q. Did you have that feature in mind in connection with ploughing?—A. Well, I understood that that feature was possible—that that construction of that language was possible, but I did not put that construction on it. I put it practical ploughing.

Q. But there is no language that gives you the idea of practical ploughing for the removal of the material, is there?—A. Yes, I think there is.

Q. You have had this specification before you for three or four years and studied it more times than once?—A. Yes.

Q. If the price for loose rock and common excavation had been the same, and you would read this specification literally, would you classify any clay that could be ploughed as common excavation?—A. You would not give it a thought; you would not be bothered with keeping any different check on it, measuring or anything.

Q. But as an engineer, you would be expected to place these things where they belonged, in accordance with the specification?—A. You would be very careless about it.

Q. Because there would be no money involved?—A. There would be no object in spending any time in keeping them different, under the circumstances you state.

Q. Is it not a fact that the money, the cost of moving, and the price that is being paid, influences classification by you?—A. It should not.

Q. Does it not?—A. Well, we are all human; it might, but it should not.

Q. When you talk to a resident engineer about the hardness of stuff in a cut, does he not give you information which is either reduced to dollars, or which you can reduce to dollars very quickly?—A. As soon as we know the difference we can reduce it to dollars. What I understand you to ask me is if I would classify by cost?

Q. Does the cost influence you in your classification?—A. I should strive not to allow it to influence me at all. I should certainly say it was wrong. It is the material only that is to be judged.

Q. You have ignored the plough test?—A. There has never been a plough test made.

Q. You classified loose clay on this contract knowingly that could have a plough dragged through, that could be broken up by a plough; you classified and signed the estimates for that character of material as loose rock?—A. No, sir, I will not admit that.

Q. You admit that there is clay that has been classified as loose rock, which could have been ploughed?—A. The plough could have been dragged through it.

Q. You have allowed to be classified as loose rock clay that a plough could have been dragged through?—A. Yes.

Q. In the matter of general construction of this division, I see fills along for miles that look to me as if they could have answered every purpose in the matter of gradient and curve, and be lowered from one to three feet. Does your observation concur in that statement?—A. I have asked on several occasions to be allowed to increase the gradients in places, but I was never allowed to.

Q. If you had been allowed a free hand, you would have changed the gradients, both for rate of grade and for elevation of grade, and saved money on your district?—A. I have been allowed to change the gradient, the elevation of the grade, but not allowed to change the rate of grade. I certainly would change the rate of grade.

Q. Are there not many locations in which you could change the gradients to the economical advantage of the Commission?—A. That is what I have wanted to do.

Q. I mean these banks that are run along the river three or four feet high?—A. I understand you mean making a sag, departing from the four-tenths grade and making a sag and coming up again?

Q. Here is a level piece of muskeg which has a bank three feet high on which you propose to put 18 inches more on ballast and track. That three feet could be reduced to a foot and a half to advantage?—A. No, not in a wet country, or in a country where snow would drift. That additional elevation is worth its price.

Q. Is it?—A. In my opinion.

Q. How deep does the snow get?—A. It is not the depth of it; it is the wind.

Q. How deep does it get?—A. I suppose three feet would be as much as I have seen.

Q. If the rails were three feet above the surface of the ground out of the right-of-way, it would be swept clear by the wind, would it?—A. Not always.

Q. When would it not be?—A. If there was a heavy snow with no wind, and the plough went through and threw that up, the snow would fall up to that top.

Q. It would not throw it up; it would throw it out?—A. No, they could not throw it all out.

Q. On a fill of that kind, the snow would not make an embankment?—A. I would not advocate a ten-foot fill, but I do think it should be three or four feet above the surrounding country.

Q. You have never operated much with a snow plough?—A. I have been on a snow plough.

Q. Much?—A. Not very much.

Q. Many winters?—A. No.

Q. Never undertook to keep your mileage open during winter?—A. No, only keeping a piece of construction work open during the winter.

Q. You would make a sub-grade three feet above the surrounding country through this level muskeg?—A. If it is very wet, so that we would have that much of dry material.

Q. On which to lay your track?—A. Yes.

Q. Why do you say three feet instead of 18 inches?—A. Because that 18 inches is not sufficient height to keep dry, and it saturates with water, and the roa heaves.

Q. And the saturation comes from the water that runs below?—A. Yes, it is the capillary attraction; there is more or less moisture in it.

Q. If you constructed ditches, as you have, along here, is not that standing water removed, and there is nothing for capillary attraction, except the rain fall? —A. To ensure the road being sufficiently dry, so that it will not heave, is all that is necessary.

Q. Are you spending money to prevent heaving on this road?—A. We certainly should.

Q. Are you?—A. We should have the banks high enough so that they are dry.

Q. Is that the reason that the many miles that I see here appear to be elevated too high to prevent heaving and possibility of snow?—A. You are asking me something I do not know anything about, but we are simply working to the grades we are given.

Q. You are defending the grades?—A. No, I am against them.

Q. You are not defending the grades, either for height or gradient?—A. I am defending them when they go less than three feet.

Q. Less than three feet of finished track?—A. Yes.

Q. If momentum grades within the limits of four-tenths eastbound and six-tenths westbound had been introduced, you would have saved a lot of money? —A. Yes.

Q. It would have given you a maximum of one per cent to work on?—A. Yes.

Q. Have you any idea what you would have saved?—A. Never made any estimate.

Q. It would be a large amount of money?—A. It would be a large amount of money, certainly.

Q. Were you ever connected with a railway in which all the structures were made permanent while the railway was being built, before this one?—A. No, I do not think I was.

Q. If you had been permitted to use wooden trestles at all of these points that you are filling now, would you have saved a large amount of money in original investment?—A. In some places, not all of them, by any means.

Q. In the net result over the whole division?—A. You could make an immediate saving by putting in wood in place of fill in places.

Q. And a large expenditure might have been deferred for from six to ten years?—A. I would not recommend wooden trestles, if that is what you mean.

Q. You would have saved a large amount of money?—A. By using wooden trestles you could build the road and not pay out so much money at the time.

Q. And your division probably would be finished by now?—A. No, it would not.

Q. It would have shortened the time very much to have constructed wooden bridges rather than waiting for steel and fills and arches; it would have expedited the work?—A. Yes, you could have expedited the work.

Q. And saved a large amount of money at present?—A. Yes.

Q. Take that fill at 1040 that has slid out so, do you think that if a pile foundation trestle had been built there originally, without touching the water way at all, that there would have been any slide?—A. Excuse me, that is before my time.

Q. This is professional. Do you think there would have been, as an engineer? —A. I have very little faith in a wooden trestle on that kind of material.

Q. Would the pounding of the piles in there loosen it?—A. No, but I do not know whether you could have held piles there.

Q. I thought you would have answered without scrapping?—A. I do not know anything about that. You ask my opinion, whether I would have advocated—

Q. I ask your opinion whether, if a pile foundation wooden structure had been built there originally, you believe there would have been any sliding of that material —no fill at all?—A. I could not answer that.

Q. You are dodging?—A. No.

Q. Suppose the railroad had never been built up there, would there have been any slide there, where that 150,000 went?—A. No, it is not likely it would.

Q. Suppose the engineers walked across there, would there have been any slide?—A. No.

Q. Supposing you drove a string of piles across there, would there have been a slide?—A. We have one case where there was a slide with a string of piles along.

Q. Had you any reason to expect such a thing to happen in this place?—A. That is the trouble; we do not know when to expect these things in this country.

Q. Have you any reason to think so in that case?—A. There was nothing on the surface to indicate that as far as I know.

Q. Would it probably not have slid?—A. I could not say that.

By the Chairman:

Q. How would the piles make it slide?—A. The mere running through might make it slide.

By Mr. Gutelius:

Q. There is no catch in this. All I want you to say is what any engineer will say, that virgin country such as that ought not to slide in your opinion, and you would not expect it to slide if you built a trestle across it?—A. I certainly would not have expected it to slide, from the indications on the surface.

Q. With all your dodging, it would look as if you were not working with me? —A. Oh, no, I am not dodging. I did not understand the fact; I will certainly admit that right off.

Q. There are other permanent structures which have slid out and require a large amount of filling, on your division, in which the cost of the extra filling might have been saved for a long time, if they had built wooden trestles over it on pile foundations?—A. Correct.

Q. And if that system had been followed, a large amount of money could have been saved?—A. Present expenditure, yes.

Q. You know from your experience on other railways that your division has cost a large amount of money?—A. Sure.

Q. Besides the permanency of structures and the low gradients and the light curvature, do you know of any other places where money in considerable quantities might have been saved in this construction?—A. You mean in location?

Q. Well, take location if you like; if you have a point where you think, in location, a certain amount of money might have been saved, either by dodging a muskeg, or reduction in material—A. No, I think the location is good.

Q. This is the point I want to make; your division has cost a large amount of money. You are practically chief engineer so far as the division goes. I want to give you an opportunity to tell this commission why your division cost such a large amount of money. Take your own way to do it?—A. Well, the principal thing is the unreliable bottom that we have struck in the east, and the prices at which the work was let on account of the difficulty, that the work was removed from civilization, and the scarcity and high rate of labor in the country.

Q. Do those prices for labor and men generally run 25 to 35 per cent more than they would down in civilization?—A. They run something; I would not put any certain value on it.

Q. So that in the evidence, so far as labor is concerned, 33 per cent, or something like that—we would have to expect that item would increase that much for this construction?—A. Whatever the value is, I would not put any value on it.

Q. The extra cost of cement is simply the transportation?—A. Yes.

Q. Is it not the fact that the price paid to the general contractors, as compared with the prices paid to the subs, represents a larger amount of money than the difference between prices of labor and material here, as compared with such prices down in civilization?—A. I do not know. You are talking about something now I do not know much about.

Q. Do you know anything about the prices the subs are getting?—A. No.

Q. You do know that this line of railway has cost, or is going to cost, more than double any railway you were never connected with before?—A. I know it is a very expensive railway.

Q. You know it is a cheap country to build in; you never built through as cheap a country for the inequalities in the surface—A. You mean the yardage per mile would be low?

Q. Yes; you never built one any lower, except some branch line. The cuttings were usually greater than on this railway?—A. Yes.

Q. And yet your prices are nearly double. I should think you would be glad to tell the Commission where that extra cost comes in?—A. Well, the number of yards have gone into the road; they used a great many more yards than necessary.

Q. Where did they go?—A. They have gone into the road.

Q. Why do you say they were unnecessary?—A. Because if we increase the grades we get the same result.

Q. You were divisional engineer in New Brunswick?—A. Yes.

Q. Who was your district engineer?—A. C. O. Foss.

Q. Did the classification you adopted over there coincide with that which you have adopted here?—A. Very similar. They had not any material like this down there.

Q. You could take the plough test into consideration, could you not?—A. I took it into consideration everywhere.

Q. You only gave them earth there where they removed it by ploughing—where they used ploughs in the process of its excavation?—A. No, I could not say that.

Q. You just used your judgment?—A. Yes.

Q. And ignored the plough test, the same as you did here?—A. I never saw a plough test.

By the Chairman:

Q. Did they give you as high classification as they did here?—A. I think it is pretty uniform.

Q. Uniformity appears to be the governing principle?—A. If it is not, it is no good. If it is not uniform, something must be wrong.

By Mr. Gutelius:

Q. Uniformity in work of this character depends on what the first fellow classifies, does it not?—A. No, I do not think so.

(TRANSCONTINENTAL RAILWAY ENQUIRY COMMISSION: OTTAWA, FRIDAY, OCT. 25TH, 1912.)

Present: G. LYNCH-STAUNTON, Esq., K.C., *Chairman.*

H. S. BALKAM, District Engineer of District D of the Transcontinental Railway, sworn:

Examined by the Chairman:

Q. You are the district engineer in District D?—A. Yes.
Q. How long is your district?—A. About 400 miles.
Q. You have been district engineer ever since when?—A. September, 1911.
Q. Before that, you were where?—A. On different parts of the road.
Q. Do you know Mr. E. P. Goodwin, inspecting engineer?—A. Yes, sir.
Q. Did he visit your district lately?—A. Yes.
Q. Did you and Mr. Mattice and he go over a part or the whole of your district?—A. We went over all of it.
Q. You made an inspection of the line both east and west of Cochrane?—A. Yes, sir.
Q. And did you and he classify any portion of the line?—A. We changed the classification in one cutting.
Q. That is the cut at station 835-839?—A. Yes, on Contract No. 13.
Q. You were present when Mr. Mattice was examined and you heard his evidence and you made the inspection with him and Mr. Goodwin and do you agree with him in what he has said?—A. Yes, sir.
Q. Mr. Goodwin had two plough tests made?—A. Yes.
Q. The first was at Station 428, Mile 103, Contract 14, at Cochrane?—A. Yes.
Q Will you tell me what he did and what you saw?—A. I was there at the plough test two or three different times. I saw them plough and scrape.
Q. Did it plough easily?—A. It ploughed fairly well.
Q. Did it plough with two horses?—A. Yes.
Q. And taken out with a scraper?—A. Yes.
Q. There was no outside assistance in the way of powder or anything else?—A. No.
Q. Have you examined the cross-section?—A. Yes.
Q. It is correct is it?—A. I assume it is, our own engineer did it.
Q. And you have no reason to doubt its accuracy?—A. No sir.
Q. Then he made the other plough test at Station 500, Mile 104, Contract No. 15, did you see that made?—A. I was there at least once.
Q. Did it plough as easily as the first one?—A. No, I do not think it did.

Q. They ploughed it all right and took it out with a scraper?—A. Yes.

Q. To the depth shown on the cross-section?—A. It was down about three feet when I saw it.

Q. Mr. Goodwin says: the first foot of this test was muckeg and clay, the next eighteen inches was a stiff clay, and the balance of that portion ploughed consisted of mixed clay and gravel, is that right?—A. Yes.

Q. He says: the whole was easily ploughed with two horses and the cut itself consisted of clay, mixed clay and gravel, mixed clay and boulders, and some mixed clay and sand; do you agree with that?—A. I do not know what the cut was; the cut was taken out long before my day.

Q. Is his description of the plough test correct?—A. Yes.

Q. He described the result of his inspection and knowledge of the country, the material, in four classes and he says that the clay which can be ploughed with two or four horses and which, when ploughed, breaks up into such a way as to make a good shovelling or scraping, do you agree with that?—A. Well, I would not agree with the word "good."

Q. There is some that can be done that way?—A. I say it can be shovelled or scraped, but I would omit the word "good."

Q. Then he says: 2, clay which can be ploughed but is either too tough or too soft for the plough to be of any use as a means of handling; in some cases the clay is too soft and sticky to allow horses to be used on it, and in other cases, it is so tough that although it could be ploughed it would still have to be cut with shovels before being removed; do you agree with that?—A. Yes.

Q. Then he says: 3, a quicksand clay which can be ploughed, but which runs together again almost immediately; this clay runs together so that it invariably has to be shovelled out of the cars or carts; do you agree with that?—A. Yes, there is that material there.

Q. Then he says: 4, mixed clay and gravel, some of this clay can be included under class 1, which as it can be easily ploughed and scraped or ploughed and shovelled, when a proportion would contain too much stone to allow it to be ploughed, do you agree with that?—A. Yes, with the exception of the word "easily."

Q. Now, Mr. Balkam, were those tests made by Mr. Goodwin fair tests, under the conditions which exist there now?—A. Yes.

Q. If you were sent to make the tests, would you make them in the same way?—A. For now?

Q. Yes, if I sent you up to-morrow?—A. Yes, they were tests in the conditions as they are now.

Q. What condition do you say the material was in where he made these plough tests and when he made them?—A. They are in the same condition as now?

Q. Can you describe it, was the stuff wet or dry, or hard or soft?—A. The one at 103 was dry.

Q. The other one?—A. The other was this wet clay that he mentions.

Q. Do I infer from what you have said, that in the cut at Station 428, Mile 103, the ground had been drained and was drier by reason of the building of the road, than it was at the time when the grading was done?—A. I was not there when the grading was done.

Q. Would you judge it was?—A. Naturally you would expect it would be.

Q. Am I right in inferring from what you say that at Station 500, Contract No. 13, the ground had not drained out there?—A. It has not drained out entirely dry.

Q. You say it was wet and sticky at that place?—A. A portion of it, along the line itself, at that place.

Q. Along the line itself was there any place where he could have better made the tests than where he did, or did he choose them fairly?—A. I suppose he did because it was much more convenient, the only place he could get seeing.

Q. Were they fair under the present conditions along the line?—A. Yes, they are fair tests of the conditions there to-day.

The witness was not further examined.

(NATIONAL TRANSCONTINENTAL INVESTIGATING COMMISSION, OTTAWA, JUNE 14TH, 1912.)

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

ARTHUR MOLESWORTH, sworn:

By Mr. Gutelius:

Q. You are an engineer of many years' experience?—A. About forty.

Q. You were employed on District C, of the N.T.R. from the time of the construction until when?—A. Until 20th August last.

Q. While you were in charge of District C, as district engineer the greater portion of the grading was performed?—A. Yes.

Q. And during that time you passed upon and arranged for the classification?—A. Yes, sir.

Q. So that it is fair to say that you were the responsible officer in connection with classification?—A. Yes.

Q. Under the chief engineer?—A. Yes.

Q. Were you responsible for the location and gradients?—A. Location; not for all of C., because part of it was given to me afterwards, but I was for all the old district C, which was first turned over to me. I went with them in 1904, before there was any location done at all.

Q. But it was all subject to revision, if you choose to revise?—A. Yes.

Q. What officer superior to you, if any, approved of your location and grades?—A. Well, the chief engineer.

Q. Did you get the chief engineer's approval to profiles and locations?—A. I think we always did.

Q. Make sure about this, because there is some question in my mind as to whether the chief engineer did actually approve of the grades and locations. So you remember of him signing your profiles?—A. Yes, I do.

Q. You think that signed copies are in your old office?—A. I do, or else they are in my office here. We turned the originals all over to MacPherson to be fyled here, and they gave us prints of them.

Q. And you think the originals that are fyled away here were approved by the Chief Engineer or MacPherson?—A. I think they were. MacPherson always went over them, and changed the grades in a great many instances—ordered us to change them. Sometimes we disagreed with him and fought it off, but he always did that.

Q. So that your profiles were criticized by the chief engineer's office?—A. Yes.

Q. I notice that the grade on portions of district C. is raised two or three feet higher than would be necessary to secure a uniform grade?—A. Yes.

Q. What was your object in raising the grades?—A. The chief engineer sent out what he calls his inspecting engineer, Macfarlane, and made him go over all my cuts, and he raised those grades. He got instructions from the chief engineer to go out and go over the grades.

Q. Macfarlane did raise these grades over these low places?—A. All the places that were raised was his doing. In lots of places I put the grades on carefully in my office, and he was sent down, and he came down to Mattawa when I was there, and went over every one of the profiles, and raised the grades in a great many instances.

Q. Did the G.T.P. engineer have anything to do with raising those grades as well as Macfarlane?—A. Not that I know of. Well, let me see—yes, he did; he was there too, Tomlinson.

Q. And those two between them agreed that many of the grades along those flat places should come up three or four feet, instead of being down 18 inches?—A. Yes, instead of where we had them. We had them where I thought they were right, but Mr. Grant sent him out to go over them with him; whatever he recommended I was to do.

Q. If those people had not revised your grade lines, would you have kept that roadbed as you had it?—A. I would have kept it as I had the grades on.

Q. Would it have saved very much money, compared with the work that was actually done?—A. Well, I think it would have saved a good deal.

Q. There are places there a mile long that might have been kept down two feet?—A. Oh, yes, it might be more; I do not know how much, but it might be more than two feet some places.

Q. I had our assistant engineer go over one residency, and he found that he could lower those grades, and keep above the muskeg at least a foot, and save $22,000 in ten miles. Does that look as though it might be possible? That is $2,000 a mile?—A. Well, I would have to figure a little.

Q. 5,000 yards to the mile?—A. Yes. How many miles did he say he could save $22,000?

Q. Ten miles?—A. That would be 50,000 yards.

Q. At 50 cents a yard it would be $2,500?—A. Yes.

Q. That looks reasonable to you as an engineer?—A. Yes.

Q. In the matter of wooden trestles, why did you not build some wooden permanent trestles?—A. I did. I built more, I guess, than anybody. I put them in several places towards White Fish, where I found the ground would not hold the bank, and 90 feet of muskeg or soft stuff, and I could not find any bottom, and I put in permanent trestles there. I put one in two or three miles west of White Fish, at Moberly Creek, and another little creek was 90 feet, and we could not get any bottom, and I made a floor of cordurov: and it had not sunk an inch till the day I left, but the ground had gone down on each side of it.

Q. Did you intend to leave that when the road was finished?—A. Yes, and the other one too. I found the bank began to open out, as if it was going to be a big sinkhole, and I stopped grading right off, and put in a trestle 600 feet long, drove piles, and made a permanent trestle. I thought it would last eight or ten years, and I thought the country would dry out to a certain extent, and we would know better what to put in.

Q. Where is that?—A. Three miles west of White Fish-Moberly Creek.

Q. Where is that?—A. About 80 miles east of Cochrane. The ground had sunk down there to a great extent, and they had piled in any amount of gravel there.

Q. Those were two special cases?—A. Yes.

Q. I want to ask you about the construction of wooden trestles generally on a railroad of that kind in that character of country?—A. Well, we built another one at another place. When I took charge of that work from Cochrane to White

Fish it was pretty near all graded under the supervision of D. and D. was turned over to me; but the grading was all done and the piers and abutments for the bridges in, but there was one there that was a very bad one——

Q. 1040?—A. No, that is not the one, but that is an awful bad one too; there was another one further east than that, quite a distance further east.

Q. If you had been building this railway on your own responsibility, would you have built many more wooden trestles to begin with?—A. I would, a great many.

Q. Why?—A. Simply because near the top of the ground there was a crust, and it appeared solid, and, going over that, you would think it was nice and solid, but as soon as you drove anything down 30 or 40 feet, the material down there was just like grey paint, and the further you got down the worse it got, and it pushes out just like paint, and if you build a short bridge over the little waterway, and then fill that in, it is going to push the crust down into that little mixture like paint, and it will bulge up and scatter all over the country.

Q. If you would build a trestle all over those places, and not attempt to fill them until the sun had an opportunity to dry it out, and the drainage got its work in, and then probably fill in six to ten years—what do you say to that?—A. I think so; that was my idea. That was my idea. That is the reason I put them in. That is the objection they made. "You will have to fill some time"; and I said "That is all right. I have had experience of that kind before". If you put ditches in and have it draining for some years, the country will dry out, and you will have an opportunity, and experience and time to judge what to do.

Q. Besides that, you would have saved a large amount of money on the total cost of that division?—A. Oh, enormous. Take the one place near Moberly Creek, and the place near the other little creek nearer White Fish than Moberly, Calamity Creek—that is the place I put that little short trestle and corduroy underneath. Well, the whole country went away down for 100 feet on each side of it; they kept pouring in gravel pits there before I left, and if a trestle had been put across that 1,000, or 1,500 or 2,000 feet, it is hard to say how much could be saved.

Q. But a large amount?—A. Yes.

Q. You are familiar with trestle 1040?—A. Yes.

Q. What position was that in when you took charge of the work?—A. It just looked like it does now. That pile of earth was away off on the side there. They had first put in a big arch culvert, and it had broken out and disappeared, and then they put in a square box 8 or 10 feet square to carry the water, and when I went there the bank was in there, and the water had raised up in the lake, and they had a syphon carrying it over the track.

Q. And they cut out a channel?—A. Yes; we cut out a channel and put in a big pipe there to carry the water.

Q. That is the way you left it?—A. Yes; it had only got that far when I left it.

Q. About how much money did you spend on it?—A. Very little; I do not know how much; just that corrugated pipe.

Q. What district engineer was in charge of that special structure prior to your taking hold of it?—A. Mattice was in charge for a while. Macfarlane had been in charge for a while, and he was made inspecting engineer, and then Mattice took charge.

Q. Who could tell us most about that structure?—A. Mattice ought to be able to. He was there all the time, either as assistant or district engineer.

Q. In the matter of classification, you instructed the divisional engineers in the matter of classification fairly early in the work?—A. Yes.

Q Were your instructions based upon a literal interpretation of the specifications—I mean to the letter?—A. No, they were not.

Q. Why did you not follow the specifications literally?—A. Well, there did not seem to be any specification to cover that material up there.

By the Chairman:

Q. The classification is covered by sections 33, 34, 35, 36 and 36a of the general specifications; you find that at page 39?—A. Yes, I know all about it.

Q. You had no trouble, of course, in classing solid rock excavation, had you?—A. Yes, they did have in some parts of the road, I think.

Q. Did you?—A. I did not, no.

Q. You did not, I suggest, classify anything as solid rock excavation which was not rock?—A. I did not.

Q. Did anybody else?—A. I understand they did on other parts of the road.

Q. Did you classify any clay as loose rock?—A. I did, yes.

Q. What clay did you classify as loose rock?—A. When I took charge of D. it had been nearly all graded, and they had been out and gone over it two or three times and classified it and when my work commenced the Grand Trunk engineer went over with me——

Q. Who was that?—A. Tomlinson, and we had quite a quarrel over the classification over the whole district. He thought I was not giving enough.

Q. When did you and Tomlinson go over it?—A. Two or three years ago.

Q. Can you fix the date?—A. I cannot remember right now.

By Mr. Gutelius:

Q. Who else was in the party?—A. The representative of Foley.

By the Chairman:

Q. Swanson?—A. Yes.

Q. Swanson and Tomlinson went over the line?—A. Yes.

Q. There was only one trip of that kind?—A. Yes, we went over the whole of my work. At that time I did not have charge of D, you know.

Q. Over what portion did you go?—A. I went from the Quebec line east about as far as the work was graded, about the Harricanaw river, with Tomlinson and Swanson.

Q. At that time was the grading all done?—A. No, but there was a good deal of it done, and there was a great deal of dissatisfaction, and the men would not stay; they could not possibly do the work. When I first commenced I was giving them pretty small estimates in their estimation.

Q. Where did you first commence to classify?—A. How do you mean?

Q. What district and what part?—A. On C. from Quebec east.

Q. To the Harricanaw River?—A. Yes.

Q. How did you classify the clay at that time?—A. When I first commenced I just classified it as earth.

Q. You classified all the earth between those two points in the beginning, so far as you classified it at all, as earth?—A. Yes; in some instances there was a layer on the bottom, it was like gumbo; I gave them about twenty per cent, or something like that, of loose rock. There was no other classification. There should have been another classification.

Q. How long did you continue to classify this clay as common excavation?—A. I do not remember; two or three months; and then we took this trip over the line.

Q. Did anybody raise objection to your classification?—A. Yes.

Q. Who?—A. Tomlinson, for one.

Q. And anybody else?—A. The contractors—Swanson.

Q. Then, as a result of that, did the three of you go over the district?—A. Yes.

Q. When you went over the district, what occurred on that trip?—A. We looked at each cut and dug into it with shovels and examined it, and we decided on the percentage that we should give of loose rock.

Q. What percentage did you decide on?—A. We did not decide on any special percentage. We would give one thirty per cent and another one fifty, and so on, according to how bad the material was. I took the shovel and dug into it myself, and I had a very heated dispute over every cut with them. They wanted a great deal more. They said they got a gr at deal more on D, and I said I could not help that, that I was giving more than they were really entitled to, that on a literal translation of the specification I doubted whether they would be entitled to that.

Q. You thought in the first place they were classifying it correctly as common excavation?—A. Yes.

Q. Had you seen it then?—A. No, I walked over the ground before it was graded. It just looked like any common earth. A person making a survey and running the line there would put that down in his mind as ordinary common excavation, but after you see the work you see the difference; in fact some of it is more costly to do than any loose rock.

Q. Did you take into consideration the cost of excavating in revising your classification? You have said just now that they could not make pay out of it?—A. Yes.

Q. Did you take into consideration the cost of excavating when you revised it?—A. Well, yes, I suppose we did; that was the general expression that everybody made, that they cannot possibly do that work for the price.

Q. Who was doing the work? Station men?—A. Contractors—yes, station men.

Q. Did you know what they were getting?—A. No, I did not, but we used to keep force account of all the work done by the contractors.

Q. Why did you keep a force account?—A. To know what the work was costing us.

Q. What was that work costing the contractors to get it out—that clay?—A. Well, it was costing over 60 cents in some places.

Q. Not if they were letting it to station men, was it?—A. Oh, yes. Some of those station men did not come out with anything.

Q. But the stationmen were only getting 23 cents for common?—A. Yes.

MR. GUTELIUS. 23, 36 and $1.30.

By the Chairman:

Q. The station men were getting 36 for loose rock?—A. Well, of course I did not know what they were getting.

By Mr. Gutelius:

Q. But if they were receiving wages, the amount of labor that they put on the taking out of this clay would raise it to what you say, as much as 60 cents?—A. Yes. In some cuts it was that much and over, and when they came to be settled up with they had not anything coming to them, and Swanson, in many instances, would give them a dollar a day apiece for their time.

Q. Because their prices were too low?—A. Because their prices were too low for that kind of work. The work was more expensive to do than loose rock in a great many cases, and when they came to settle there was nothing coming to them, and he would give them a dollar a day. Of course it came from the company. I know of two or three cases where he gave the Russians a dollar a day for every day they worked in the cut.

Q. Even though they were in arrears on their contract?—A. Yes, and there was not a cent coming to them.

Q. Was that not the reason, when he told you these things, that you were inclined to raise this classification?—A. Well, I raised it more because it had been done on all the other districts before. At first I would not do it, because I did not believe that that clay was as bad as it was, until it was opened up. When I found it had been done on the other work, and accepted by the chief engineer, I supposed it was right to do it. There was no specification to cover that material. Common earth does not cover it. It should have been gumbo, or something like that. There was no specification to cover it, and I thought we were supposed in that case to use our own judgment as district engineer.

Q. Who told you what other districts were classifying?—A. The divisional engineers on the other work. I never estimated as high as the rest of them did in some places.

By the Chairman:

Q. What made that clay difficult to remove? Was it too hard, or soft, or what? Was it because it was too hard or because it was too soft?—A. It is the most awful stuff to take out I ever saw. It gets sticky. It is very hard and it is like rubber, and the mud is awful, and it slides. It gets into a nasty puddle like paint.

By Mr. Gutelius:

Q. Like mortar?—A. Yes, and sometimes, when you put it in the bank it would run away across the railway right of way. Some of it we could not use in the bank; we had to just waste it.

By the Chairman:

Q. You classified it as loose rock, whether it was soft, or whether it was hard, did you not?—A. Oh, no.

Q. Was it the hard stuff you classified as loose rock, or the soft stuff?—A. It is the hard stuff.

Q. Did you classify any soft clay as loose rock?—A. Well, this hard stuff, when they dig it and begin removing it out in rainy weather, it would get nasty and sticky, and soft, like mortar. We only gave a certain percentage in each cut.

Q. How deep did you consider the common excavation went, averaging it?—A. We would come along to each cut, and spend quite a time looking at it, and take a shovel and dig into the sides of it, and find where the hard material came up to, and measure from the top, and give them a percentage.

Q. Did you cross-section any of those cuts, or were they cross-sectioned?—A. They were cross-sectioned before the work was done.

Q. They were cross-sectioned for the purpose of finding the contents?—A. Well, we just measured down.

Q. They were cross-sectioned to find how much material was to come out of the cut?—A. Yes.

Q. Were they cross-sectioned to find how much common excavation was in it and how much loose rock was in it?—A. No.

Q. Was that ever done anywhere?—A. No, that would be very hard to do.

Q. It was never done?—A. No, I tried to do it on the start. I gave instructions to all the engineers to do it on the start, because I thought something like that would come up and we should have those figures, but it seemed almost impossible to do it, and we gave a percentage.

Q. It never was done?—A. We would go out and look at a cut and give a percentage.

Q. The way you arrived at the amount you should allow as loose rock was by estimating a percentage?—A. Yes.

Q. Not by cross-sectioning the cut?—A. No.

Q. So that on the whole district that was the practice followed, to estimate what percentage should be common excavation and what percentage should be loose rock?—A. Yes. At first I sent them a circular, and I insisted on having a clearly-defined line between the two, if possible. But they all declared it was impossible.

Q. It would have been giving them some more money, would it not?—A. Well, it would not be so much work.

Q. When they came to solid rock excavation, did they cross-section the solid rock?—A. Yes.

Q. If you found in a cut common excavation, loose rock and solid rock, do I understand you that the solid rock was really cross-sectioned?—A. Yes. It is more clearly defined than the difference between the two clays. It is highly perceptible.

Q. Was there any solid rock estimated?—A. In what way?

Q. Estimated instead of measured and cross-sectioned?—A. Repeat that.

Q. Was there any solid rock excavation estimated, or was it all cross-sectioned and ascertained in that way?—A. Oh, all cross-sectioned in that way.

By Mr. Gutelius:

Q. By actual measurement?—A. Yes.

Q. But you were unable to find a line of demarcation between common excavation and loose rock and for that reason you made a guess at it?—A. Yes.

Q. And called it a percentage?—A. Yes.

By the Chairman:

Q. Did you allow any muskeg as loose rock?—A. No, indeed.

Q. Do I understand you that you did not allow as loose rock excavation any material which, before it was exposed to the atmosphere or to the rain, was soft?—A. No, any stuff, what we considered common excavation—

Q. No, but there is a lot of that clay, plastic and soft; did you allow any of that?—A. It got soft after it got wet sometimes.

Q. You mean you only allowed indurated clay as loose rock?—A. That is it exactly. I went over every cut with a shovel myself.

Q. I was told you had allowed a quantity of soft clay, not indurated, as loose rock?—A. Well, I did not, that I know of.

By Mr. Gutelius:

Q. Robertson told us that you advised him in the beginning to keep the classification away down; is that right?—A. Yes; that is what I told you a little while ago.

Q. Robertson also advised us that he classified soft clay in the bottom of those cuts, which is like gumbo, as loose rock; did you know that he did that?—A. I do not call clay that is like gumbo as being very soft.

Q. Those are his very words, "The very soft, this blue clay we get in the bottom of those cuts, some of them, is like gumbo; I classify that as loose rock also"?—A. He was always telling me how hard this rock was that he classified, and on any cuts I went over with him he never classified any soft clay; it was all very hard to excavate. In the Canadian Pacific years ago we used to have a classification for gumbo—in the Northwest on the C.P.R. in the old days.

By the Chairman:

Q. You did not classify any material which you considered soft material as loose rock?—A. No, sir, not to my knowledge.

Q. Give me, if you can, what percentage of the clay you considered generally throughout that district, should be classified as loose rock?—A. Well, it was different in different cuts. We did not classify any two cuts the same.

Q. Could you give me any idea what percentage you think it would run?—A. I do not remember. Robertson would have those figures.

Q. Is it not all the same class of material?—A. Very much the same—no, the cuts are very different; some of them would be hard up from the bottom for two or three feet, and some would be hard nearly up to the top—just a couple of feet on the top.

Q. Would it not be quite easy to remove the soft and cross-section the hard?—A. It would be a hard job.

Q. Why should it be any harder than to cross-section in solid rock excavation?—A. Well, it has never been done anywhere, and all D was done when I commenced my classifying that material, and I followed the same system they had, after I found we could not very well do it.

Q. My impression is, from the evidence which has been given—and my impression may be wrong, because I have not reviewed the evidence yet—that they gave nearly 90 per cent of that clay as loose rock excavation?—A. They did in some cuts.

Q. But nearly all over?—A. Oh, no, not on my district. They gave 100 per cent in some of the others—at least, I heard they did—but they did not on mine.

Q. Do you think from what you saw that they could fairly give 100 per cent anywhere?—A. I did not see any on my district.

Q. Did it not seem to you, roughly speaking, that the clay which could be affected by the frost—in other words, down to the frost line—should be common excavation?—A. How do you mean?

Q. The frost goes down into the earth in that country some three or four feet?—A. Yes.

Q. Would not the frost break up the clay as far as it went down?—A. No, it did not seem to.

Q. You do not think so?—A. No.

Q. Because as soon as it is exposed it crumbles all to pieces. How did they take out that clay?—A. They would blow a good deal of it, with powder.

Q. Is there any cut in your division they used powder continuously?—A. In the big cuts they did.

Q. Was it continuously?—A. I have seen it along there.

Q. Do you think you are right about that, or are you only speaking from recollection?—A. I may not be right, but I think I am.

Q. The records will show?—A. They ought to. Then of course we do not always give people loose rock where they use powder. I have seen them use powder in lots of cuts to shake them out, so that they could dig them easily. With a forty-foot cut they would put in black powder, and shake it up.

Q. In that country could that clay be ploughed?—A. No, it could not.

Q. Did you ever see it tried?—A. My gracious me, you could not put anything in there to plough it.

Q. Why?—A. Because they would stick in the mud and could not move.

Q. They would get mired?—A. Well, they would get mired, and I do not know whether they could plough it. I do not think they could. It is tough like gumbo.

Q. The top never was tough; they could plough the top?—A. I do not think they could plough it.

Q. You did not approach it from that point of view, whether it could be ploughed or not?—A. Oh, yes, I had many arguments with them about it. I thought it could at first myself, and I had many an argument with contractors and engineers about it, and we came to the conclusion it could not.

By Mr. Gutelius:

Q. Do you think now all of the loose rock classification in those clay cuts that was given under your charge was too hard to be ploughed?—A. I do not know whether it was too hard to be ploughed. I think it was impossible to plough it, or to get the horses in there to plough it.

Q. But supposing that the horses were taken care of on a corduroy, and they were just ploughing a single furrow, would all the material that was classified as loose rock be too hard for them to break up?—A. Well, I do not know.

Q. Did you try to get the difference between common excavation and loose rock such that this test would prove out?—A. Well, they never could get in there to plough it. Now, take on the top, there was about a foot on the top, a different line of earth altogether, and a foot down it was different; some parts we just gave them two or three feet at the bottom; in others it went up nearly to the top. I was very particular in digging into the cuts in every instance where I decided what we should do, and Tomlinson. the district engineer for the Grand Trunk. representing them, wanted a great deal more than that allowed. but I would not give it to them.

Q. Tomlinson really advocated increasing it?—A. Oh, my—why once or twice he said, "Why if you don't do better than that I am going right home, I won't go over the line any more"; and I said, "I cannot help that; I cannot give you any more; I think that is plenty."

Q. It has been said that one cubic yard of muskeg put in a fill originally is worth about half a cubic yard when traffic gets on it?—A. I have no doubt. I had experience of the worst muskeg that was ever on the C.P.R. I had charge of that. They thought they would have to pile that first, and I proposed that big ditch 90 feet from the centre.

Q. But the muskeg does settle?—A. The bottom of the big ditch kept coming up, and we kept putting that in, and it kept coming up.

Q. What do you think of muskeg material for making fills, where the ground under the embankment is reasonably solid?—A. Well, you would have a nice back; it makes a nice roadbed.

Q. But it is more expensive?—A. Yes. I believe some of those muskegs you can squeeze up to less than a third.

Q. To a third of the original amount?—A. Yes.

Q. Are you familiar with momentum grades?—A. Well, we had a lot of them down south.

Q. What saving could have been effected on your division if you had used momentum grades in a general way?—A. Do you mean for a permanent thing?

Q. No, in original construction, could you have saved as much as ten per cent. on the grading of your division if you had used momentum grades?—A. Yes, I believe we could and do better work. You see in getting the line on a four-tenths grade, a continuous long grade as they insisted on you had to have such high banks, a bank nine or ten or twelve feet high for a mile. You put that in there, and it kept going down—

Q. Which would not have gone down if you had introduced the sag within the limits of a momentum grade?—A. Yes. We would have saved a lot of trouble and expenses.

Q. Why did you not introduce momentum grades?—A. Well, I wanted to introduce them in one or two places, but they said they would rather have—

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 altogther.

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 Desmoines Osceolla and Southern, from Desmoines, 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.