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CANADIAN PACIFIC RAILWAY.

Exploratory Survey of 1871.

GENERAL INSTRUCTIONS

TO

ENGINEERS IN CHARGE OF PARTIES, TRANSIT-MEN AND LEVELLERS.

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EXPLORATORY SURVEY OF 1871.

General Instructions to Engineers in charge of Parties.

OFFICE OF THE ENGINEER IN CHIEF,
OTTAWA, MAY 24th, 1871

1. The gentleman placed at the head of a party will be required to take general charge of it, and the Chief Engineer will look to him for the proper and faithful execution of all instructions, whether general or special, which may be given from time to time, as well as for the maintenance of proper discipline in the party.

2. Every member of the party will be under the Engineer in charge, and must obey his orders. The Commissariat Officer in charge of the transport of provisions will consult with and be advised by the Engineer in charge, and in the absence of the former, the packman will obey the orders of the latter.

3. When the Engineer in charge finds it necessary to leave the party, or in the event of illness, he shall nominate the person to act in his place for the time being; in the event of his failing to do so, the Transit-man shall take charge.

4. Arrangements will be made for forwarding supplies to a general depot at or near the point of commencement of each Division of the Survey, and when practicable, to certain intermediate points; this will be done by the Commissariat Department, but the Engineer in charge must, before starting for his field of operation, obtain a complete list of all supplies intended to be forwarded, and if any article appears to him to be wanting or superfluous, or if any change in the proposed arrangement respecting the mode of supply appears advisable, he shall at once confer with the Commissariat Officer, and before leaving for the survey he shall arrive at a perfect understanding with respect thereto.

5. The Commissariat Officer is instructed to procure and forward the very best of each article required, and to use every means in his power to maintain a sufficient supply of provisions and stores. The Engineer in charge must, however, look sufficiently far ahead with reference to the movements of his party, to be able to advise that officer as to the nature and quantity of stores required, and the place where they must be delivered, and there must be a clear and distinct understanding between them that they will be delivered at the time and place required. The Engineer will also see that proper care is taken of the plies, and that there is no waste.

6. As the season for field operations is limited, the Engineer in charge is expected to see that every member of his party performs his duty with diligence, and that every effort is made to carry out the whole of the work in a satisfactory manner.

7. Each exploring party shall be designated by a letter of the alphabet, and all articles of equipment, supplies, books, papers and records, belonging to the party shall be marked with and known by that letter.

8. In conducting the survey the Engineer of a party is expected to be at its head every day, exploring in

front, and to the right and left of the line, in order to see what obstructions may be in the way of the same, and if serious, deciding as to the best manner of avoiding them.

9. It is not expected that the first survey through wooded districts will, as a rule, be the best position for the railway; it will, however, be the aim of the Engineer in charge to have the "Transit Line" not very far distant from a practicable railway line. The "Transit Line" on which the measurements are taken will form a base on which to project an approximate section, and the Engineer in charge, by noting the features of the country on both sides of the line, will be able to make an approximate section as the survey proceeds.

10. In many cases it will be desirable for the Engineer in charge, while making his daily explorations, to take barometric elevations of the ground, noting by estimation the approximate position of the points of observation in relation to the "Transit line." These elevations should be reduced afterwards to the datum of the survey, and marked upon the plan in their proper position. This, as well as the general features of the country, should be marked upon the plan every day, while the whole is fresh in the memory. The barometric elevation will answer for rough cross sections, and be useful in determining on the plan the position of the approximate location line, and also in compiling an approximate section of the same.

11. The engineer in charge must have two barometers, one to be carried by himself, the other to hang in camp; the cook, if moderately intelligent can, in a short time, be instructed to observe and record its readings, and he should do so regularly at every hour of the day. By this means the Engineer in charge, (who will note the time when his own observations are taken) will be able to correct roughly all his observations, ascertain by comparison the height of each point above the camp (this being known), and thus be enabled to reduce all to the

level above the datum of the survey. Barometers will be furnished by the Government.

12. The Engineer in charge will find it of great service while exploring, to carry with him light steel climbers, made to enable him to climb a tree with facility. By this means he will frequently be enabled to obtain a good knowledge of the topography of the surrounding country, and take such general observation and bearings as may be useful in directing the survey. A pair of climbers will be furnished with the stores for each party.

13. It may frequently be necessary to move camp when circumstances will render the available force of packmen inadequate for this duty, at such times it will be proper and expedient for all, or as many members of the Staff as the Engineer in charge may direct, to assist in this work. The Engineer in charge will, however, be governed by circumstances, and use his best judgment in having this done in such a manner as will least delay the survey.

14. Instructions for the Instrumentalists are printed on the first page of each of the "Field Books," (copies accompanying this), and the undersigned will look to the Engineer in charge to see these general instructions carried out.

15. It is important that observations of the pole or some other star should occasionally be made (say once in every ten miles) when the weather will admit of its being done, in order to check the traverse of the line. The latitude of certain points should also be determined approximately, whenever a favourable opportunity occurs, by means of an observation of either the upper or lower transit of the pole-star, or otherwise; the Engineer in charge taking care, however, that both these objects are effected in such a manner and at such times as not in any way to delay the progress of the surveying party.

16. At the starting point and termination of each Division of the Survey, the Engineer in charge will see that conspicuous "Reference Stakes" and "Bench Marks" are established with all necessary information respecting the Survey and adopted Datum, distinctly written thereon. When two Divisions of the Survey form a junction, the two Engineers in charge will see that the two traverses are properly connected, and the angle formed by the two lines, measured and entered in each of the "Field Books." The levels must also be connected, and a common "Bench Mark" established, with the elevation of the same above the two respective datums clearly marked thereon, thus :—

B. M.
460.07 above
Datum C.
371.40 above
Datum D.
1871.

In the event of one party arriving at the generally defined termination of a Division before the party on the next Division has reached that point, it will be the duty of the former to push on until a connection is made.

17. Whenever an opportunity occurs, once a fortnight if practicable, the Engineer in charge shall forward to the Head Office a traced copy of the plan and section, shewing, with full details, the amount of work done to date.

18. As it is probable that there will be occasions when each member of a party will have to carry his personal baggage, this should be reduced to the smallest weight possible. Keeping this in view, the following is all that is considered necessary to form an outfit, viz. :—2 pair of pants, 2 coats, 3 flannel shirts, 3 pair of drawers, 6 pair of socks, 1 pair of mitts, 2 pair of strong boots or shoepacks, 1 towel, 1 brush and comb, and a few other small articles ; the whole personal outfit need not exceed 30 pounds. The Engineer in charge will, upon his party arriving at the end of steamboat navigation, see that the personal baggage belonging to members of his party is reduced to the above. Strong canvas bags, sufficiently large to contain the outfit and one pair of blankets (to be

supplied by the Government), will be provided for each member of the party.

19. Except in special cases, which will be determined by the undersigned, it is desirable to limit the number of fire arms in each party to one rifle and one double barrelled gun.

20. It may be necessary, during the progress of the Survey, to forward special instructions to the Engineer in charge of a party; for this and other reasons, that officer will take special care that whenever he changes his camping ground, a notice is distinctly written (upon a tree or elsewhere, in such a conspicious position that it can be readily seen by anyone passing along the line) containing the following information, viz. :—

1st. The distinguishing letter of the Division of the Survey.

2nd. The number of the camp.

Each camp should be numbered consecutively from the begining of the division.

3rd. The date of the removal of the camp.

4th. The probable direction and distance to the next camping ground.

5th. The name of the Engineer in charge of party.

21. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced levels entered in ink.

22. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of

local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic, at the right hand.

23. Horizontal scales must be 400 feet to an inch; Vertical scales 30 feet to an inch.

24. Without in the least desiring to dictate on the subject, attention is requested to the suggestions regarding service on Sundays, which have been placed in the hands of the Engineers in charge of parties.

25. The Engineer in charge will be furnished with a diary and note book, in which he will enter daily, a record of the progress of survey and every thing relating thereto.

SANDFORD FLEMING,

Engineer-in-Chief.

INSTRUCTIONS TO TRANSIT-MEN.

The object of the survey about to be undertaken is to secure a continuous chain of instrumental measurements through the country, as near as possible to the shortest and most practicable route for railway construction. The information obtained by means of the survey, should be fully and carefully put on record in such a way, that no difficulty will be experienced hereafter by any one in understanding it perfectly. It is important therefore, that uniformity of system in making measurements and preserving records should be adopted throughout, and with that object in view, the undersigned requests attention to the following :—

1. The first entry in the "Field Book" each morning should be the date, and the name of the person acting as "Transit Man."

2. The Transit Man is requested to make full notes as he proceeds, of the character of the country, lakes, timber, &c., on both sides of the line.

3. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced levels entered in ink.

4. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic at the right hand.

5. Horizontal scales must be 400 feet to an inch; Vertical scales 30 feet to an inch.

6. The Transit is to be used, because no reliance can be placed on the compass in passing through a mineral region.

7. In certain cases, however, where local magnetic attraction does not exist, the Compass may be substituted for the Transit.

8. When a change in the direction of the line is made the angle to the right or left must be carefully noted.

9. The chaining must be as correct as possible, a stake being driven at the end of every hundred feet, and the nnmber of chains from the starting point of the Division marked thereon.

10. At every change in the direction of the line a larger stake should be driven, having the distance marked thereon.

11. The line must be cleared sufficiently to admit of levels being taken.

12. At the commencement of the survey it is desirable that observations should be taken to establish the latitude and determine the angle which the line to be surveyed makes with the true meridian; the latter should be done once in every ten miles or once a week if possible, (in order to check the traverse) and the former when practicable; these observations should be taken at such times as will not interfere with the progress of the survey.

13. The chaining will be noted regularly from the bottom of the page upwards, each hundred feet stake driven being noted on a separate line, the space on each side of the column for distances being used for such notes

and sketches to the right and left of the line as may be necessary in order to give a general idea of the country.

14. Note every stream and river crossed, its size, direction, probable maximum volume, and any peculiarities which it may seem to possess.

15. Every member of the party will be under the Engineer in charge and must obey his orders. The Commissariat Officer in charge of the transport of provisions will consult with and be advised by the Engineer in charge, and in the absence of the former the packmen will obey the orders of the latter.

16. In the event of the absence or illness of the Engineer in charge, and unless he shall otherwise determine, it will be the duty of the Transit-man to take charge of the party and direct its movements.

SANDFORD FLEMING,

Engineer-in-Chief.

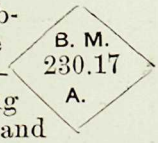
OTTAWA, 24th May, 1871.

INSTRUCTIONS TO LEVELLERS.

The object of the survey about to be undertaken is to secure a continuous chain of instrumental measurements through the country, as near as possible to the shortest and most practicable route for railway construction. The information obtained by means of the survey, should be fully and carefully put on record in such a way, that no difficulty will be experienced hereafter by any one in understanding it perfectly. Is is important therefore, that uniformity of system in making measurements and preserving records should be adopted throughout, and with that object in view, the undersigned requests attention to the following :—

1. In keeping field notes the first duty every morning will be to enter the date and the name of the Leveller, whose notes are to be recorded.

2. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced levels entered in ink.

3. Bench marks should be regularly established about every 1,500 feet apart, and the elevation above datum written thereon thus :— 

the letter underneath being the distingishing mark of the particular division of the survey and of the party. Each Bench-mark must be described in the column of remarks.

4. Note every stream and river crossed, its size, direction, level of surface, difference of level between high and low water if practicable, and any peculiarities which it may seem to possess.

5. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic, at the right hand.

6. Horizontal scales must be 400 feet to an inch. Vertical scales 30 feet to an inch.

7. Every member of the party will be under the Engineer in charge, and must obey his orders. The Commissariat Officer in charge of the transport of provisions will consult with, and be advised by the Engineer in charge, and in the absence of the former the packman will obey the orders of the latter.

8. The Engineer in charge will name the person who is to take charge of the party during his temporary absence or illness, in the event of his failing to do so the Transit-man shall take charge.

SANDFORD FLEMING,

Engineer-in-Chief.

Ottawa, 24th May, 1871.