SOME THEORIES UPON RAILWAY LOCATION.*

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Railway location is becoming one of the most important branches of civil engineering, partly because Canada is entering an era of railway construction unequalled in magnitude by any that she has passed through since the completion of the C.P.R. main line in 1885, and partly because the critical study of railway transportation, commenced, in engineering departments at least, after the publication of the revised edition of Wellington's Economic Theory of Railway Location in 1891, has established principles which call for the almost complete reconstruction of the more important of the older lines.

The great factors in any railway location, in order of importance, are— (1) The aims and ideas of the promoters; (2) the position of present and future traffic centres; (3) the topography of the country; (4) the economic advantage of adjusting roadbed and rolling stock to one another; (5) the requirements of modern operating practice; (6) Difficulties of construction.

The general route of a railway is rarely determined by engineering considerations. The promoters of the line—be they politicians, railway men, or speculators—have some political or financial end to attain, and to that end all other considerations will be subordinated. . . . It has frequently happened that the route has been determined before an engineer has even been called in for consultation, and in easy country such a practice cannot be considered altogether objectionable. An engineer's training does not fit him in particular, as distinguished from other classes of railway officials, to foresee the great economic and commercial changes that will be sure to follow the opening up of railway communication, and at times he would be almost at a loss to choose between competitive routes, had they to be judged from an engineering standpoint only. The four lines that now connect Montreal and Ottawa furnish a good example. They connect termini that are about 100 miles apart and yet are as much as 50 miles distant from each other, and their lengths vary from 112 to 125 miles; it can, however, hardly be said that the proportions of the traffic they carry are materially affected by this variation or by any other difference in the engineering detail of the lines; that proportion is determined by terminal facilities and by the support of connections. Instances, on the other hand, are not unknown where the promoters have undertaken to locate a line through what is by no means easy country, and the history of such attempts is the most forcible argument that an engineer can bring forward when opposing any repetition of the same policy. The writer conceives it to be the duty of a chief engineer to form and express an independent opinion upon the merits of any route that he is instructed to examine, the adoption of the route being a question for his employers to decide. . . .

Making an exception of those numerous lines which have been built in Canada for the set purpose of opening up new regions for settlement, and whose very existence is due to public liberality, it may be said that all railways are built as business concerns to transport passengers and freight, and that the share of the business offering that they secure is a fair measure of their success. It has been pointed out in the most recent economic discussion, that the possibility of any producing district shipping into a given market is largely controlled by its transportation facilities, and that therefore every improvement made by the railway will increase the business opportunities in the district, and consequently the traffic of the line. There have been many bankrupt lines in Canada on account of lack of traffic; there can be none that will succeed without it, and every effort should be made to secure it where it exists and to create it where it is lacking. The control of through traffic is hardly affected by the details of location. It is a question of terminals and alliances, and lies within the special province of the general manager or president. It may be advisable to modify the general route to secure such traffic, it certainly will be worth while to reduce the grade line in order to handle it, but it is wise to recognize that it may be entirely cut off from even a powerful system. . . .

Much of the railway line now projected will run through practically unsettled districts, and it may be safely predicted that the situation of the future centres of population that will control local trade will be determined by the presence of natural resources, and by the location of the railway. It follows that the more nearly these two causes can be brought together the better it will be for the future of both country and railway. It is not easy in preliminary survey to recognize the existence of the natural resources, nor to realize how great their future development may be. The location engineer, indeed, gets but few opportunities to observe the growth of traffic on the lines that he has planned; but he should certainly know what staples constitute the bulk of the traffic in adjoining districts, and why they are produced there. Statistics are published annually by the Department of Railways and Canals giving the tonnages of different articles of freight handled upon various railway lines. The location of the Great Northern Railway is a recent example of a line avowedly laid out to approach as nearly as possible to the great Laurentian water powers, which were considered to have the greatest traffic producing possibilities of all the resources in the district. In Eastern Canada the commercial centres are well established and practically all traffic originates near them. Any effort to ignore these existing centres will result in the material disadvantage of both town and railway; the town will be handicapped in its commercial growth and the railway will lose the business that would have been created. The locations of fifty years ago are full of efforts of this kind, made, it is said, largely in the hope of inducing the town to move on to land in the immediate vicinity of the railway station, and owned by the railway promoters. The series of towns along the north shore of Lake Ontario, between Toronto and Kingston, are proof of the inability of a railway company to compel an eastern town to move; they still stand where they stood 50 years ago when the railway was built past them. Brantford has furnished the most remarkable example of the power of an established town to hold its own against a railway company. The Great Western passed it by about 1850, when it had a population of 3,877, and located through its rival, Paris, which had a population of 1,890, the final choice having been influenced, it is said, by a subsidy. To-day, after over fifty years of struggle, Brantford has at last succeeded in getting the main line traffic of the old Great Western diverted into it, and in spite of transportation difficulties, has grown into a city of over 16,000 inhabitants, one of the most active manufacturing centres in Canada. It may therefore be taken as good practice in Eastern Canada to carry the location directly into the existing towns, no matter how great may be the cost of right of way or the sacrifice of engineering niceties, for the return will in nearly every case give ample profit on the expenditure. In exceptional cases it may be necessary to construct a freight loop around the town if too serious a sacrifice of grade would otherwise be required, but by the use of momentum freight can be carried directly through a town situated in a hollow. The C.P.R. line into the town of Lachute has 1.00 per 100 falling grades on each side of the town, and runs its traffic straight through without stopping, unless there is local business to be attended to.

That any man who can handle surveying instruments is popularly regarded as entirely competent to make a railway location is but a most general proof of the important influence exercised upon the details of location by topography. The engineer must know his country thoroughly, and it may be said that any man who is sent out on location without having opportunity to study all the information that has been accumulated in the past about his district is improperly equipped. The various Canadian governments have for years been sending out exploring and surveying parties to gather information about unsettled areas, and when it is remembered that these parties are generally in charge of trained observers and surveyors, the value of their reports and of their maps cannot be overestimated. The very fact that these reports

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