

Railway (C.P.R.) has constructed its new line of railway through the busiest part of Trenton, Belleville and other towns of Ontario in order to be in a better position to obtain the local traffic from these towns than the Grand Trunk Railway, which is already established, in many cases, on the outskirts of the towns. Another important instance of this is the construction of the Mount Royal Tunnel by the Canadian Northern Railway at Montreal. This great undertaking will bring the lines of the C.N.R. right into the heart of the hotel and shopping district of the city, to a passenger terminal, and will also give access for the freight traffic to the warehouse and business districts of the city. This question of terminal facilities naturally depends on the limit of capital which may be expended on the terminals without financially wrecking the whole undertaking. The proposal to defer the time of building into the heart of a city is one which should not be considered as it invariably becomes a more and more expensive undertaking as time advances.

**Cost of Construction.**—In Canada—where there are long stretches of thinly populated country on all trans-continental lines—it was only natural that originally many miles were built of the cheapest construction possible without very much attention being paid to the future requirements, but even though the traffic from these sections is practically nil and they are non-revenue producing, they form links in the chain across the continent and the lines should be built in such a way as to ensure economy of operation for the heavy through traffic. Great sums are now being spent by the Canadian railways improving the grades and alignment on some of the non-revenue producing sections in order to reduce the cost of operation of the whole system.

The type of construction to be adopted naturally will depend entirely on the estimated volume of traffic. If the traffic expected is light, then it would not be a good policy to build the railway at great expense in order to reduce the operating expenses, thus having very high fixed charges, but if the traffic over the road is to be very heavy, then a greater expense of construction per mile would be warranted in order to give a high operating efficiency, i.e., to keep the cost of hauling trains over the road at a minimum. The interest and maintenance charges for a poorly located and constructed road may be \$2,500 per mile per annum or more, and the direct cost of hauling one ton over a mile of that road will be nearly a cent. Increasing the efficiency of the location and construction of the railway will necessarily increase the annual interest and maintenance charges, but the cost of hauling each ton will be reduced in greater proportions due to the increase in possible train loads over the better grades of track. There has been, due to these circumstances, a demand for every improvement in location and construction which would enable a railway to conduct transportation more economically.

Having made the preliminary surveys of the alternative routes between any two points, an estimate of the cost of construction of the different lines is made by collecting all the materials of a kind under one head and obtaining unit prices for all the different classifications. A form somewhat similar to the following may well be used for making these preliminary estimates of cost—spaces being left on the right hand side for filling in the actual completed cost of the work, thus serving as a better guide for future estimates.

Item.	Quantity.	Price.	Estimated cost. Subtotal.	Total.	Cost completed. Total.	Price per unit.

The road may be built entirely by contract or by day labor under charge of the engineer or superintendent. The contract method is more usual. The chief engineer will have the entire charge of the work of construction and will, with the assistance of the attorney of the company, after consultation with the officers of the company, draw up all the specifications and contracts for the work. The following table gives the approximate percentages of the different items that go to make up the total cost of building a mile of a standard single-track railway suitable for heavy traffic.

TABLE V.—Percentage of Cost.

1.	Right of way .....	5.5
2.	Proportionate expense of terminals .....	13.9
3.	Bridges and culverts .....	11.0
4.	Grading .....	33.0
5.	Track laying .....	19.4
6.	Ballasting .....	8.4
7.	Fencing .....	1.4
8.	Telegraph service .....	0.5
9.	Stations and water supply .....	3.3
10.	Engineering .....	1.9
11.	General and legal expenses .....	1.7
		<b>100.0</b>

Considering these items separately, the cost of right-of-way is one that is naturally extremely variable and will often depend on the publicity given to the whole scheme before the right-of-way agents are able to get the necessary options on the lands. Frequently right-of-way can be obtained cheaper by a carefully studied location. For instance, if the railway is so located that it cuts through farms at right angles to their length the danger is not so great as in the case where the railway locates right down the centre of a long and narrow farm, leaving two even narrower strips on either side. When possible, the best location through cultivated or pasture land is parallel and adjacent to the lot lines.

The second item is one which varies with the nature of the railway and the towns it serves. It is higher for locations where there are large cities and towns comparatively close together, requiring greater expense on terminal facilities per mile of road than in places like the Western Provinces, where the towns are far apart. But even in some of the small western towns large terminals are being built to take care of the increased traffic induced by the growth of the country.

Items three to seven are ones in which considerable economies can be made if necessitated by the financial status of the company. For example, it has already been stated that money should be expended on first-class terminal facilities, even at the expense of cheaper construction between the terminals. This can be quite satisfactorily done by using more or less temporary construction for some of the smaller bridges and culverts which can be built cheaply, without sacrificing the operating efficiency of the road, and they can easily be replaced by permanent structures when this expense is warranted by the earnings of the road. Similarly in the case of the grading, temporary wooden trestles can be built instead of heavy em-