the increased cost of terminal facilities, and the increased demand for grade separation in towns, cities, and even on country highways. Least of all does he realize how essential it is for the modern road to reduce grades and curvature. So long as the rails are not rusty, one bit of track looks to him very much like another. Yet nothing is more axiomatic than that the cost of transportation depends not only upon the length, but also upon the elevation of haul.

While from the earliest days of railway construction reduction of distance had always been sought for, sufficient provision has not until recent years been made for lessening operating costs through grade reduction. The rising cost of labour, of fuel, and of materials, have emphasized the necessity of reduction in other matters more within the control of the railways; and the increasing weight to be hauled, bringing with it heavier locomotives and heavier cars, has pointed to grade reduction as a means of securing greater economy in operation. The railway which can haul the greatest unit train load naturally works to the best advantage, and given a stated amount of traffic this advantage can be accurately determined. The older railways in Canada and the United States have been attempting, in recent years, to correct their heavy grades and sharp curvatures, and not infrequently have abandoned track impossible of line rectification. Millions have been expended for this purpose which could have been saved if sufficient care had been exercised, and sufficient money spent in the original construction.

Quite recently public attention was directed to some replacement work on the Lackawanna. The reduction in distance was only three miles, but the reduction in grade and curvature was so considerable as to amply justify an expenditure of twelve million dollars.

The extent to which operating costs are reduced and the carrying efficiency of railways increased by grade reduction, are shown in the following, supplied by S. J. Hungerford, Superintendent of Motive Power, Canadian Northern Railway:

From the standpoint of train haulage, the relative values of two lines, one having controlling grades of four-tenths of one per cent. and the other of one per cent., are as follows:

Resistance per ton on Controlling Grades.

	1.0%	.04%
Due to gradient only	20 lbs.	8 lbs.
Due to friction	4 "	4 "
Total resistance	24 "	12 "
Ratio	2 "	1 "

It is assumed that curvature is fully compensated for in such cases. The allowance for frictional resistance of 4 lbs. per ton, is substantially correct for fully loaded forty-ton cars which are now standard on most railways in Canada and the United States. If trains were composed of thirty-ton cars, the allowance would have to be slightly greater.

The actual tonnage that could be hauled by a large locomotive having a tractive effort of 50,000 lbs. at the driving wheels would be as follows:

Four-Tenth Grade.

Tractive Power of Locomotive	50,000 lbs.
Deduct 5 per cent. for Internal Friction	2,500 "
Net Power Available	47,500 "
Net power divided by resistance per ton=47,500 divided by 12	3,958 tons.
Deduct weight of engine	190 "
Net train tonnage	3,768 "
	or 62 2-3 loaded 40-ton cars.

One Per Cent. Grades.

(Same Locomotive.)

Net power divided by resistance per ton, 47,500 divided by 24=	1,979 tons.
Deduct weight of engine	190 "
Net train tonnage	1,789 "
	or 29 5-6 loaded 40-ton cars.

It should be noted that as the grade resistance rises the weight of the locomotive assumes a larger proportion of the total weight of train. In the case of the four-tenths grade, it represents 4.8 per cent. of the gross weight of train; whereas in the case of the one per cent. grade it represents 9.6 per cent. of the gross weight of train, a large increase in non-revenue load.

In 1906, when contracts were let by the National Transcontinental Commission for the construction of the Eastern Division of the National Transcontinental Railway, between Moncton and Winnipeg, it was definitely determined as a matter of public policy that the roads should have a maximum grade of four-tenths of one per cent. against eastbound, and six-tenths of one per cent. against westbound traffic. The Grand Trunk Pacific Railway Company, which, about the same time, began the construction of its Western Division between Winnipeg and Prince Rupert, has nowhere a maximum grade in excess of one per cent.

The Canadian Northern, coming even later into the construction field as a transcontinental line, was keenly alive to the question of up-to-date construction. The Montreal-Port Arthur section has maximum opposing grades westbound of five-tenths of one per cent., and eastbound of four-tenths of one per cent., with the exception of ten miles affected by a grade of five-tenths of one per cent. A revision of the Port Arthur-Winnipeg section, completed in 1914, replaced a part of the original construction of trestles across Rainy Lake with permanent work, and at the same time reduced the grade to a maximum of four-tenths of one per cent. On this section of the line the maximum grade against eastbound traffic is one-half of one per cent. Between Edmonton and Winnipeg the maximum grade is five-tenths of one per cent., while from Vancouver to Edmonton (except for 60 miles affected by a seven-tenths of one per cent. grade) the maximum grade against eastbound traffic is four-tenths of one per cent.

The Canadian railway situation is, therefore, in this respect, very much better than the situation in the United States. The Canadian Pacific has already spent large sums in revising its line and more will have to be expended, but it has the financial ability to carry on the work. The junior transcontinentals are not faced with the problem of steep grades and excessive curvature. They are finished propositions in this regard, and beyond doubt economy has been effected by up-to-date construction. Everyone knows how costly and unsatisfactory an undertaking it is to remodel an old house and make it new, but even more costly and unsatisfactory may be the effort to bring a railway built a great many years ago up to the high standard required for the most efficient and economical operation. The Baltimore and Ohio, constructed more than half a century ago across the Alleghany Mountains, is a warning and an example.

Let us re-state our position in a paragraph. A company building a railway between two points desires ultimately, of course, to have the road as free as possible from grade and curvature so as to lessen operating expenses. But it has at the same time to consider the item of fixed charges. If the cost of money be unusually high the company may be justified in building the road as cheaply as possible in the hope of later bringing it up to standard. But when money is cheap it is good business to build the road right in the first place. Our junior transcontinentals it will be remembered were built during a period of cheap money, and the added burden of interest charges was more than compensated by the decrease in operating expenses. Had the roads been built more cheaply but less efficiently they would to-day be burdened with heavier operation charges. They would require more motive power and would have nothing like the ability they now possess for handling the big business of the war and the bigger business of the reconstruction period yet to come.

We cannot credit the Government and the railways with foreseeing the present war, but they could not have acted more wisely had the future been revealed to them by the flash of undoubted revelation. They borrowed money when money was cheap and the fixed charges of our railways are therefore not oppressive. If the roads had been cheaply built in the first place they would be burdened with greater operating costs and less efficiency for years to come. It would be out of the question to attempt to bring them up to the proper standard. Money costs our Finance Minister to-day six per cent., which, not many years ago, he could have borrowed for 2¾%. Railway securities bearing 4%, that brought par a few years ago, could scarcely now be marketed at less than 7% or 8%.

The cost of a railway plant is not to be measured by the actual capital investment, but rather by the fixed charges and operating expenses which must be earned before it becomes profitable. A seventy-five million dollar road built with the proceeds of four per cent. bonds has really cost no more than a fifty million dollar road built with the proceeds of six per cent. bonds. It has cost a good deal less if it can be more cheaply and efficiently operated.

Nor can the charge of extravagance be brought against our Canadian railways in the matter of terminal facilities, for freight and passenger traffic. Their expenditures in this behalf have indeed kept within quite moderate bounds. No transcontinental line has been projected for years in the United States, notwithstanding the great increase in traffic, partly because the cost of terminals for such a line has been considered prohibitory. But in Canada our latest transcontinentals have secured the necessary terminals in all our cities without unduly burdening their resources, while the Canadian Pacific and the Grand Trunk acquired terminals of great value in many places years ago at comparatively low prices.

In Montreal a difficult problem was solved by the C.N.R. tunnelling Mt. Royal. In Toronto, the Canadian Pacific and the Canadian Northern have extensive terminals in what will one day be the centre of the city, quite apart from the immensely valuable water front holdings acquired many years ago by the Grand Trunk and C. P. R. In Winnipeg valuable and well-located terminals were acquired by the Canadian Northern with the acquisition of the Manitoba and Northern Pacific lines. These have been enlarged, and to-day furnish ample accommodation for the National Transcontinental, the Grand Trunk Pacific, the Northern Pacific and the Great Northern, as well as for the Canadian Northern Railway system. The Grand Trunk Pacific may eventually have to acquire terminals at Vancouver, and much work remains to be done on the Courtenay Bay development at St. John, N.B., in connection with the National Transcontinental, but, generally speaking, all our roads are well provided with terminal facilities which do not represent anything like the enormous investment of many of the big American roads in the principal cities of the United States.

Recent railway construction in Canada and the United States, as well, has been very expensive when compared with the cost of railway construction twenty or thirty years ago, but it has not on that account been extravagant. The favourable grades of the Canadian Northern and the National Transcontinental between Winnipeg, the Head of the Lakes, and the Atlantic seaboard, permit grain to be shipped from west to east the year round. The old grain embargoes and blockades at the head of the lakes are now a thing of the past, and the western grain grower is no longer compelled to take whatever he can get for his grain after the close of navigation. The economic benefit this change will work cannot be overestimated. Moreover, as we have already pointed out, a considerable portion of the western grain crop can find its way to Europe via the Panama Canal now that the mountains have been made as level as the plains by up-to-date railway construction.

First of Ad Brokers

ANSON A. McKIM'S death in Montreal last week removed the founder of one of the important but seldom heard-of businesses in the country—advertising agencies. The public that reads the advertisements in newspapers and periodicals seldom realizes the machinery that had to be put in motion before any one of those advertisements could appear. Between the man who has goods to sell and the reader who has money to buy those goods, there stand several experts. Anson A. McKim, besides the high esteem in which his name is held by those who knew him either personally or in a business way, has to his credit the founding of the first organization of such experts in Canada.

A number of capitalists and practical manufacturers may start a factory to manufacture red woollen mitts. They may have the best of machinery, the best of stock and the best of management and labour. Yet in the face of modern conditions they cannot succeed unless they make known the good qualities of those red woollen mitts. At first such a factory may decided to write and place its own advertisements. Probably the most fluent salesman in the place is asked to "dope out" the copy. The general manager, having no knowledge of the various periodicals in which the advertisement might do the most good, probably selects his own favourite newspaper—because it suit him (who never, never wears red woollen mitts) he thinks it is the best paper for the advertisement.

Yet there are innumerable concerns that do not need or cannot afford an exclusive advertising manager. Back in 1889 Anson A. McKim realized this fact, and set about providing an advertising service for any and all comers. At this time he was working for the Toronto Mail. He had served as a local advertising canvasser, but had been sent to Montreal as Montreal representative shortly before his plans for the new venture were made. Shortly after opening his office for The Mail in Montreal (the sign "Toronto Mail and Empire" still greets the stranger from the office door), he decided to adapt and enlarge the advertising "agency" idea which was then known in England—though England has failed to keep up with the development of the idea on this continent.

The "agency" business has been changed since then. The country contains a great number of them and they no longer act as "retailers." The credit for inaugurating such service in Canada belongs unmistakeably to the late Anson A. McKim.