there is the largest number, is not less than thirty tons. But even this does not tell the whole story, for in the eight years, from 1908 to 1915, there was an increase of 555 per cent. in the number of 40-ton cars and an increase of 150 per cent. in the number of 50-ton cars; in other words, the railways were increasing the numbers of their 40-ton cars by about 70 per cent. per year and of their 50-ton cars by about 20 per cent. per year. The greater and greater cost of this heavier equipment and the heavier engines to go along with it, together with the larger capital outlay rendered necessary along other lines, such as heavier rails, improvements in ties and ballasting, stronger bridges, etc., made serious inroads upon revenues which were, in the case of most companies, wholly inadequate to the maintenance of equipment at the highest point of efficiency. The use of these larger cars intended for heavy loading required their construction to be of steel rather than of iron or of wood; for by the employment of steel for construction the strength and the carrying capacity of the cars were increased more than in proportion to the increase of the tare. With the greater purchases of these cars, in the building of which higher priced materials and higher-wage labor entered, it is evident that the railways were incurring very heavy capital charges in order to keep up with the increased demands upon them. A peculiar situation will be noted in this table—namely, that above 40,000-pound cars the large purchases are concentrated on the even numbers, 60,000, 80,000 and 100,000, while relatively few purchases of the odd numbers are given. This seems to have been due to the fact that the amount of freight to be carried has increased enormously, and in order to provide the increased facilities there has not been a gradual increase by stages of 10,000 pounds each, but a series of abrupt increases of 20,000 pounds each. Statistics regarding the larger size of locomotives would be illuminating, but they are not yet available; having never been collected by the department.

Traffic is Becoming Denser

Another element to be considered in determining the economies of operation is the volume and density of the traffic. It would be natural in this country of such wide extent and diffused population that the density of the traffic should be low by comparison with that which would prevail in a country which was well settled and abundantly provided with ample traffic of all kinds. Yet the relation of the volume of business done by the railways to the revenues of the companies is direct and immediate. Very few people ever stop to think of the vital relation of these physical factors to the earning power of the properties, and yet even the best management cannot secure results apart from favorable conditions of traffic. But it is not the number of ton-miles alone (that is, the number of tons carried one mile), which is the expression of the total amount of business done, that tells the entire story of the extent to which the property is utilized. The important fact in railroad operation, the significant and vital question back of the earning power of a railway, and therefore back of its securities, is the intensive development of its operating capacity. In order to know this we shall have to find the traffic density, that is, the number of ton-miles per mile of line. It is the density figures which bring out very strongly the condition of this development; and when the figures for traffic density are examined in connection with those for gross revenue, for maintenance expenditures and for net revenue, they assume great importance. The more work (that is, ton-miles per mile of road) that can be obtained from a given mile of railway operated, as computed on the average, the more satisfactory is the income account likely to be.

In the United States, during the past decade or more, the great majority of the railroads show a steady increase in traffic density, which reflects concisely the greater and greater degree of utilization of the properties. The same situation is shown in the case of the Canadian railways. Of course, there has been wide diversity in this general trend, some properties showing density increases far in excess of others. But, if we would get a knowledge of this for all the lines of railway, in order to ascertain the progress for the country as a whole, we must take the average for those which are most advanced in this particular and those which are less advanced. By so doing, we may set down the traffic density, along with other features, of the Canadian railways in the following table:—

Year.	Train load.	Traffic density (tons hauled one mile per mile of line).	Average No. of loaded cars per freight train.	Average No. of tons per loaded car.	Average capacity of box cars in tons.	Percentage of utilization.
1907	260	518,486	16.92	15.37	28	55%
1908	278	564,378	16.04	17.33		
1909	278	545,991	16.37	16.98		
1910	311	635,321	18.15	17.13	29.1	58%
1911	305	631,829	18.03	16.91		
1912	325	731,776	18.19	17.87		
1913	342	785,820	18.00	19.01		
1914	353	716,359	18.40	19.18		
1915	344	496,355	18.06	18.43	33.2	55%
1916	411	753,202	19.65	20.91		
1917	436	807,948	19.59	22.24		
1918	457	798,093	19.77	23.09	34.1	67%

It will be seen that the traffic density in the last twelve years has increased by 54 per cent., or an average of 4½ per cent. per year. This clearly indicates that there has been a rapid increase in the intensity of employment of the railway facilities of the country. In this respect our railways stand about on a par with those lines in the United States, like the Atchison, Rock Island and Northern Pacific, which pass through the great farming section west of the Mississippi.

Average Train Load

Another factor in economical operation must be considered with reference to the train load, or the average number of tons per train. Under ordinary conditions of operation about one-third of all the expenditures are for fixed charges (returns on capital, rentals, taxes, etc.); and of the operating expenses about one-half are fairly constant and do not vary much with changes in the volume of business done. It would be natural, therefore, for the railways not only to endeavor to distribute its expenses over a larger and larger volume of traffic, thus making the unitary expense progressively lower, but also to reduce the entire burden of expenses by concentrating the work in larger and larger train loads.

The economies from the increasing of the train loads come from several sources which we need not stop to consider, but chiefly from the fact that the wages of the crews may be spread out over a larger amount of paying traffic, since the same number of men who can handle a train of sixteen cars can handle a train of thirty cars or more by the aid of the modern air brakes. It is inevitable, then, that the railways should seek ever larger loads of freight, so long as the weight of rail, the ballasted roadway, the strength of bridges, etc., will permit it. From our figures as to train load in the preceding table, we can calculate that, in the twelve-year period here considered, the average number of tons per train load increased by about 80 per cent., or about 7 per cent. per year. When we compare this with the increase in traffic density already shown the change in loading is all the more remarkable. In this respect the Canadian roads compare very favorably with those in the United States which are similarly situated with regard to traffic. Of course, in the case of the great wheat-carrying roads of the western provinces, the train load is much greater than that indicated by the average in this table, for it is not uncommon to have trains each carrying 1,500 to 2,000 and more tons of wheat. The extent to which this may go must be determined by the character of the roadway, the tractive power of locomotives, the terminal facilities and other similar factors. In the case of the Canadian Pacific Railway, for example, it has been found that after a certain point has been reached in augmenting the train load, it is better to increase the number rather than the loading of trains. It is for this reason that on this line we sometimes find a wheat train leaving Winnipeg for the elevators at Port Arthur and Fort William every fourteen minutes during some of the exceptionally busy days of the crop-moving season. The contrast between the average Canadian train load of 457 tons in 1918 and the best train loads of 78 to 80 tons on the Lon-

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