

break in two can be considered as more directly due to his handling than to any arrangement of the grade line. The possibility of the cars crowding together should, however, be prevented when this can be done, and the grade line must be arranged so that the forces acting on the several cars in the train are nearly equal. Vertical curves are introduced for this purpose, and should be made with as small a rate of change of grade as topography and economy will permit. There is no theoretical reasoning from which a proper rate of change can be calculated, and there will always be a tendency for the cars to crowd whenever the grade falls more quickly at the rear end of the train than at the head if the engine is not under steam.

When the limits of grade and curvature have been fixed, railroad location becomes little more than the solution by survey of a series of problems, in each of which the operating economy of lowered summits, reduced curvature, and shortened distance has to be balanced against the cost, as shown by the surveys and estimates, of making these improvements. The proper figures to use in calculating operating economy are very difficult to determine, and the values given by Wellington are still generally accepted in practice in spite of the great advancement that has been made in operating methods during the last ten years. The train mileage, upon which all economic calculations are based, is itself so uncertain a quantity that there is no special advantage in having very close values determined by the saving resulting from unit improvements in grade and curvature and distance. The statistics published annually by the Department of Railways and Canals give details of the train movement on the various Canadian roads, and furnish valuable figures for the prediction of train mileage on new roads. The character, resources and population can be determined by inspection and by consulting various official publications; and the history of a road through a similar district is a fair indication of the future of the one that is to be built. It is to be regretted that the gradual absorption of the minor lines into the great systems will prevent the publication of the results of their operation, the earning power and train movement of the main line and all its branches being reported as a whole by the great systems. The striking feature of the minor Eastern Canadian lines is the very slight tendency to increase shown by their traffic returns, a feature which calls for decided caution in traffic estimates.