Before any location or construction is decided upon, the commercial factors should be figured out. With a stated traffic, the Engineer must consider construction cost in connection with operating expenses (transportation and maintenance) before he can decide on the economical location of alternative lines in regard to gradients, distance, curvature, and rise and fall, the values of which are hereinafter given.

TRAFFIC AND TRANSPORTATION.

The cost of Transportation varies most directly with the number of trains required to transport a given volume of traffic, for which reason the train mile is taken as the operating unit. The commercial economy of operation is generally shown by the number of tons or passengers per train, and the ton mile and passenger mile are therefore taken as the commercial units.

Train Mile Cost may be divided into direct cost, which varies directly with train mileage; and indirect cost, which is constant under small changes in volume of traffic and varies only in a minor degree with large differences in volume. In comparing the commercial advantages of alternative lines, the Engineer will consider that excess traffic in both directions can be carried for the direct cost per train mile, and, if traffic is secured which will tend to balance trains, that it can be carried for one half direct train mile cost.

The direct train mile cost varies from 40% to 70% total cost, depending on volume of traffic, grades, locomotive power, etc.

With a given volume of traffic, train mileage will be multiplied by direct train mile cost to show the operating economy of different grades.

The value of characteristics of location, which affect cost of operation, is assumed to vary as the number of trains.

With a stated volume of traffic, a more economical location is obtained when interest and renewal charges on additional expenditures for construction are saved in decreased operating expenses, or when increased operating expenses are saved in reduced interest and renewal charges on cost of construction, the most economical location being obtained when these values balance one another.