the pull exerted by the brakes on the wheels = pressure of the brakeshoes, multiplied by the coefficient of brakeshoe friction. When this latter force becomes equal to the pull of the rail, the wheel will slide on the rail.

In nearly all of the existing specifications the traction force is taken as 20 per cent. of the total live load on the span considered. This condition assumes that enough pressure is applied by the brakes to skid all the wheels of a loaded train, with a coefficient of friction between wheel and rail of .20.

The standard American practice is to make the efficiencies of the brakes on the various classes of equipment as follows:

Passenger Cars.. .. .. .. .. .. .. ..90 per cent. of light weight.
Freight Cars .. .. .. .. .. .. .. ..70 per cent. of light weight.
Tenders.. .. .. .. .. .. .. .. .. ..100 per cent. of light weight.
Locomotive Driving Wheels.. .. ..75 per cent. of the loaded weight.
Locomotive Truck Wheels .. .. ..75 per cent. of the loaded weight.

By efficiency of the brakes is meant the ratio of the total maximum pressure exerted by the brake shoes on the wheels to the vertical pressure of the wheels on the rails.

These percentages have been determined and adopted by the American Air Brake Association as best suited to actual service conditions, and are designed to prevent skidding and consequent flattening of wheels when the brakes are applied.

The comparatively high ratio of 90 per cent. of the light weight is used on passenger cars because there is small variation between the light and loaded weights, and it has been found that at the comparatively high speeds at which these cars run, the coefficient of brakeshoe friction is lower than that of freight cars which run at lower speeds.

The experiments of Captain Douglas Galton and Mr. George Westinghouse, Jr., made in 1878, show that the coefficient of friction between the cast-iron brakeshoes and steel-tired wheels varies from 5 per cent., at a speed of 60 miles per hour, to 25 per cent., at zero speed.

The coefficients for locomotive driving wheels and trucks are based on the loaded weights, since for these the loaded weight is the working weight, which does not vary much.

Assuming the value of 25 per cent. and Cooper's E/50 loading, a formula giving the coefficient of traction on spans of various lengths may be obtained.