

LOCOMOTIVE TRACTION AND TRAIN RESISTANCE.

To find the maximum traction of any well designed locomotive, weight on drivers being known,

Maximum traction = $\frac{1}{4}$ weight on drivers.

This result can only be obtained on very dry rail, when engine is working at slow speeds, and train resistance accordingly high. Engine must also be carefully throttled or wheels will slip, reducing co-efficient of friction between wheel and rail.

For *Ordinary Traction* over ruling grades, a speed of about ten miles per hour should be allowed. At this speed, the cylinder power is the limiting factor of the locomotive, and traction should be figured accordingly.

To find *Tractive Power at Drivers*, boiler pressure (P), diameter of cylinders in inches (d), stroke in inches (S), and diameter of drivers in inches (D) being known,
Tractive Power in pounds for Simple Engine =

$$\frac{.8 P d^2 S}{D}$$

For Compound Locomotive d_h = diameter high pressure, d_l = diameter low pressure cylinder, and R = ratio of cylinder areas.

Tractive Power in Pounds for 2-Cylinder Compounds =

$$\frac{5}{6} \frac{P d_l^2 S}{(R + 1) D}$$

Tractive Power in Pounds for 4-Cylinder Compound =

$$\frac{5 P S}{6 D} \left\{ \left(1 - \frac{1}{R + 1} d h^2 \right) + \left(\frac{d_l^2}{R + 1} \right) \right\}$$

In any well designed locomotive, the results obtained from above formulæ should be about $\frac{1}{5}$ weight on drivers, and which may be taken as the tractive power at drivers if other data is not at hand.

To find the weight of train in tons that any locomotive can take up a given grade at ordinary slow speeds,

$$W = \frac{T}{20 g + 5 \text{ (or } 9 \text{)}} - w$$

W = being weight of train, w = weight of engine and tender, T = tractive force of locomotive, g = rate of grade.

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