

Locomotive - Coal Cars - 2.2' in 100' old Fort - ~~Saluda~~ ^{Ridgecrest}

M Locomotive = $485,000^{\#} \sim 220 \times 10^3 \text{ kg}$. 3.5' Santa Fe Grade

m coal car = $263,000^{\#} \text{ gross} \sim 120 \times 10^3 \text{ kg}$. 4.7' Saluda Grade.

μ = coeff of friction - steel to steel wheel for drivers

= 0.05 to ~~0.18~~ 0.28 assume 0.50

Rolling Resistance Coeff. RRC for new auto tires 0.007 to 0.014

RRC for coal cars assume 0.0005

Level $\mu Mg = \text{Force pulling} = (RRC)mg$

$$(0.5)(M) = (0.0005)(nm)$$

$$\frac{nm}{M} = 100, nm = 100M, nm = (100)(220 \times 10^3)$$

$$nm = 220 \times 10^5, \boxed{n = 183 \text{ cars}} \text{ flat, level}$$

Saluda Grade

4.7' in 100', $\sin \theta = 0.047$, $\cos \theta = 0.99889 \approx 1$ ^{assume}

$$\mu Mg \cos \theta = (RRC)nm \cos \theta + nm \sin \theta$$

$$(220 \times 10^3)(0.5) = (0.0005)nm + nm(0.047)$$

$$= nm(0.052)(120 \times 10^3)$$

$$\boxed{n = 19.6 \text{ cars}}$$

Saluda

$$\boxed{n = 33.9 \text{ cars}}$$

Old Fort - Ridgecrest

