

4-19b

step 1) Kinematic Requirements

OXYZ is inertial with the origin at the center of the radius of the curve, and oxyz is attached to the car.

$$\vec{a} = \frac{d^2 \vec{R}_o}{dt^2} + \vec{a}_{rel} + 2\vec{\omega} \times \vec{v}_{rel} + \dot{\vec{\omega}} \times \vec{r} + \vec{\omega} \times (\vec{\omega} \times \vec{r})$$

where  $\vec{a} = -\frac{v}{R} \vec{i}$

Step 2) Force Dynamic Requirements

$$\vec{T} + \vec{f}_g = \frac{d\vec{p}}{dt}$$

Step 3) Constitutive Relations

$$\vec{f}_g = m\vec{g}$$

$$\vec{p} = m\vec{v}$$

or combining equations

$$\vec{T} + m\vec{g} = -m \frac{v^2}{R} \vec{i}$$

and using the fbd

$$T \cos \theta - mg = 0$$

