Bending of a Cyclist.

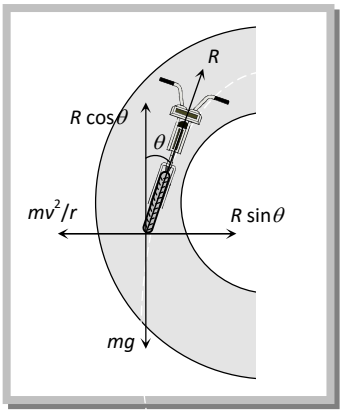
A cyclist provides himself the necessary centripetal force by leaning inward on a horizontal track, while going round a curve. Consider a cyclist of weight *mg* taking a turn of radius *r* with velocity *v*. In order to provide the necessary centripetal force, the cyclist leans through angle θ inwards as shown in figure.

The cyclist is under the action of the following forces:

The weight *mg* acting vertically downward at the center of gravity of cycle and the cyclist.

The reaction *R* of the ground on cyclist. It will act along a line-making angle θ with the vertical.

The vertical component $R\cos\theta$ of the normal reaction *R* will balance the weight of the cyclist, while the horizontal component $R\sin\theta$ will provide the necessary centripetal force to the cyclist.



$$R\sin\theta = \frac{mv^2}{r} \qquad \text{.....(i)}$$

and $$R\cos\theta = mg \qquad \text{.....(ii)}$$

Dividing equation (i) by (ii), we have

$$\frac{R\sin\theta}{R\cos\theta} = \frac{mv^2/r}{mg}$$

or $$\tan\theta = \frac{v^2}{rg} \qquad \text{.....(iii)}$$

Therefore, the cyclist should bend through an angle $\theta = \tan^{-1}\left(\frac{v^2}{rg}\right)$

It follows that the angle through which cyclist should bend will be greater, if

(i) The radius of the curve is small *i.e.* the curve is sharper

(ii) The velocity of the cyclist is large.

Note: For the same reasons, an ice skater or an airplane has to bend inwards, while taking a turn.