Ex 5-21
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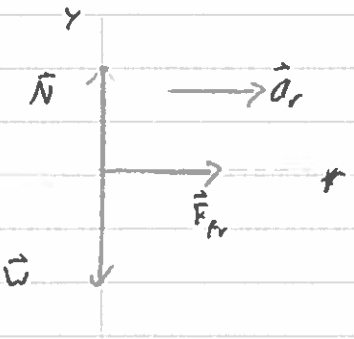
FBD for car:




Static friction provides the radial force keeping car in circular motion. ($F_{fr_s}$)

- NII along radial direction:

$$\sum F_r = ma_r = \frac{mv^2_{max}}{r} = F_{fr_{max}} = \mu_s N$$

$$\rightarrow \frac{mv^2_{max}}{r} = \mu_s N \qquad (1)$$

- NI along y:

$$\sum F_y = 0 = N - W \rightarrow N = W = mg.$$

$$\therefore (1) \rightarrow \frac{mv^2_{max}}{r} = \mu_s mg$$

$$\therefore v_{max} = \sqrt{\mu_s g r}$$