# The Effects of Speeding

## *Initial Conditions*

I'm driving through town at the legal speed limit of 30 mph and as I approach a school I slow down to a new speed restriction of 20 mph. 40 feet ahead of me a child suddenly steps out into the road and I immediately brake, stopping just short of the child who is shaken but unharmed.

## *Assumptions*

Assume the stopping distance is made up of thinking distance and braking distance which is by constant deceleration. The thinking distance is 1 foot per mph.

## *Determining Braking Factor*

At 20 mph thinking distance is 20 feet so 20 feet left for braking

$v^2 = u^2 + 2as$ where $u = 20$ mph and

$v = 0$ because I just manage to stop.

$u^2 = {}^{-}2as$

$20^2 = {}^{-}2a\,(20)$

$a = {}^{-}(10 \text{ mph})^2 / \text{foot}$

negative because this is a deceleration.

## *Speeding at 30 mph ?*

In an alternative reality I fail to slow down to 20 mph and the child steps out as before. At what speed do I hit him?

At 30 mph thinking distance is 30 feet so 10 feet left for braking

$v^2 = u^2 + 2as$

where $u = 30$ mph and $v$ to be found.

$v = 30^2 - 2\,(10)\,(10)$

$v = 26.5$ mph which may be thought surprisingly high.

## *Speeding at 40 mph*

What speed would I hit him if I'd been travelling at 40 mph when he stepped out?

At 40 mph the thinking distance is 40 feet so there is no space for braking so

$v = 40$ mph

## *General Solution*

$v^2 = u^2 + 2\,({}^{-}10)\,(40 - u)$

$v = \sqrt{\{(u + 40)\,(u - 20)\}}$

for $20 \leq v \leq 40$

Descriptively the kinetic energy of the car which has to be dissipated by the brakes is a function of speed **squared**. In increasing from 20 mph to 30 mph the available braking distance reduces by 50% and the kinetic energy increases by a factor of $30^2 / 20^2$ ie 125%.

So a small increase over the speed limit has a devastating effect on the ability to stop in an emergency.

ꝏ *rg*