Investigating the braking distance of a wooden crate.

In this experiment I looked at the braking distance of a wooden crate. The purpose of the experiment was to determine whether there was a relationship between the breaking distance of the crate and its initial velocity. I came to the conclusion that the breaking distance was proportional to the velocity squared.

My research question is to investigate the relationship between the velocity and the braking distance of a crate.

Because kinetic energy becomes heat energy when braking, I can write $\frac{1}{2}mv_0^2 = Fd$ or simply that the distance is proportional to the square of the speed, $d \propto v_0^2$.

The dependent variable is the braking distance while the independent variable is the initial velocity. The fixed variables are the frictional forces of the table surface and the mass of the crate.

I used a track, crate with a flag, photocells, electronic clock, and rulers. My method used two photocells and the electronic clock to find the time the crate uses to pass between two points with the flag distance Δd. I use this to calculate the initial velocity using the formulae $v_0 = \frac{\Delta d}{\Delta t}$. The initial velocity is v_0 for the experiment. We use the two rulers to find the distance the crate has traveled. I used a rubber band to give the crate an initial velocity, and tried the best I could to control the initial velocity.

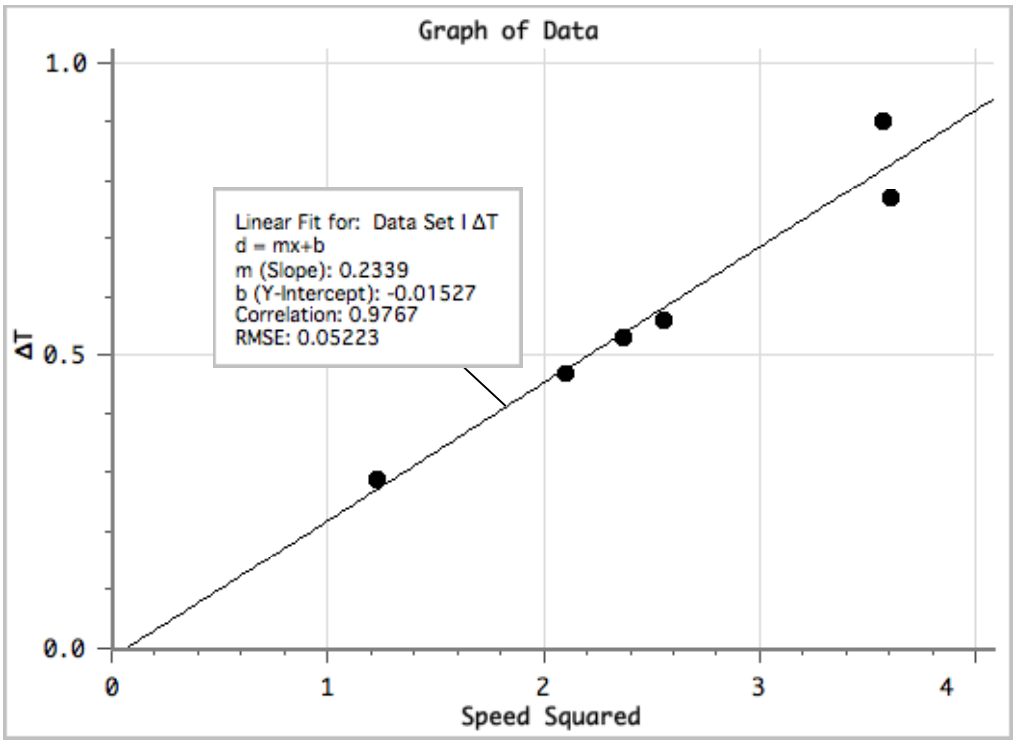
My data are as follows.

Trial	Δt ±0,0005 s	Braking Distance ±0,04 m
1	0,0186	0,90
2	0,0241	0,47
3	0,2193	0,56
4	0,0315	0,29
5	0, 0228	0,53
6	0,0184	0,77

The flag $\Delta d = 3,4\,\text{cm}$.

Calculating the initial velocity of the crate I used distance of flag divided by time the flag takes to pass the photocells. For example: $v = \frac{0.90\,\text{m}}{0.0186\,\text{s}} = 1.89\ \text{m/s}$.

$v_0 = \frac{\Delta s}{\Delta t}$ $\pm$ 0,4 m / s	v^2 $\pm$ 0,4 m / s
1,89	3,57
1,45	2,10
1,60	2,56
1,1	1,23
1,54	2,37
1,90	3,61



Plotted on the graph above is the time vs. velocity squared. As evident from the graph, the derivative function of distance vs. time will be a straight line, and so the breaking distance is proportional to the velocity squared. My expectation was true. We had trouble controlling the launch speed, so that is one problem. Often the crate would move off at an angle. To fix this we would make sure it always moves straight along the track. I enjoyed this experiment and I was successful in proving my idea.