# CALIFORNIA STATE SCIENCE FAIR
# 2013 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**J0323**

**Project Title**
## Effects of Roller Coaster Configurations on the Car's Final Velocity

**Abstract**

**Objectives/Goals**
The purpose of my project is to determine the factors that make a roller coaster ride enjoyable and long-lasting. Based on my research and using the law of conservation of energy, my hypothesis is that for roller coaster configurations with a fixed starting height and fixed track length, the final velocity of the car will not be influenced by the track's configuration.

**Methods/Materials**
In order to simulate a roller coaster, a skyrail marble coaster was used where the marble represented the car. The plastic tracks were twisted into different shapes to mimic roller coaster tracks of twelve different configurations. A marble was gently placed at the same starting height and a video camera was used to record the movement of the marble on the last 59 cm segment of the track where the average final velocity of the marble was measured. By slowing down the video to one-eighth of the real-time speed, accurate measurement of the time was possible, and final velocity was calculated by dividing the segment length by time. To eliminate friction as a variable in the experiments, the track was set to a fixed length for all track configurations, since the track length was assumed to be the only source of friction in the experiments.

**Results**
The final velocities of the marbles varied with configuration. Configurations in which the marble travelled nearly horizontally, at low speeds, for a major portion of the track before quickly dropping near the end of the track had the highest final velocities. However, configurations which included early big drops and vertical loops resulted in lower final velocities. The results showed that, in addition to the track length, the speed at which the marble travelled was also responsible for the frictional effects experienced by the marble.

**Conclusions/Discussion**
Based on these experimental observations that the car's final velocity depended on the coaster configuration, I came up with a design for building roller coasters. By placing the thrill portions of the ride that involve big drops and loops towards the end of the tracks, the rides will last longer and be more thrilling. Some future research that I could do is to identify what forces other than friction cause loops to have lower final velocities and how they can be designed in a better way.

**Summary Statement**
The goal of my project is to determine factors that will maximize the thrill and duration of a roller coaster ride by studying the effects of various roller coaster configurations on the car's final velocity.

**Help Received**
My father and mother supervised my research and reviewed my presentation and poster.