CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
J0217

Project Title
Roller Coaster Fun, Falls, Forces, and Physics

Abstract

Objectives/Goals
As a roller coaster fan I questioned the safety of roller coasters and why people do not fall out of their seats on fast turns and loops. I believed that the safety bar and seat belts held the rider in place. My objective was to determine which factors which led to the fastest and most thrilling roller coaster ride while still maintaining rider safety.

Methods/Materials
The factors of speed, gravity, friction, mass, and centripetal and centrifugal force all work together to determine the acceleration of the car and how safely it moves through fast turns and loops. These factors and the aerodynamics of roller coasters is discussed in a separate report. To test these forces and which coaster design led to greater safety I developed five experiments: 1) swinging of water in a bucket to study centrifugal force and speed; 2)studying the free-fall and weightlessness of a rider with cup and water experiment; 3) a roller coaster simulator using tubing and marble to test for speed and mass; 4) a roller coaster internet simulator; and 5) a two part experiment building a roller coaster out of hot wheels track testing differences in mass and length of cars and determining which friction (a hill etc.)provided the safest ending ride.

Results
The tests showed that the car of greater mass built more momentum and greater acceleration on the track. A car of greater length had more friction and slowed the car. The best way to increase the friction is from a design change of the track, with a hill, curve or loop. A loop in the track proved best in slowing the coaster car followed by a curve and then a hill. The curve in the track proved to be the best in actually slowing the car at the end of the test and providing a safe end to the ride.

Conclusions/Discussion
Speed is important for a thrilling ride and greater mass will produce a faster ride. Enough speed is needed to make it through the loop on a track. The challenge in designing a safe ride is to slow the car throughout the ride before the car can gain too much acceleration. The loop proved to be the best at slowing the car however, a loop or hill cannot be used at the end of an actual ride. As I demonstrated, the curve proved best in slowing the coaster car at the end of the ride. Hills and loops add to the thrill of the ride however, the curve at the end is the best and most practical way in actual amusement park roller coasters to bring the car and its riders back safely.

Summary Statement
A study of the aerodynamics of roller coasters finding the fastest and most thrilling ride while maintaining rider safety.

Help Received
Mother and father provided some help in layout of the project. Father typed some portions of the reports.