CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

S1715

Project Title

Designing the Perfect Coaster

Abstract

Objectives

The goal of this project was to determine how engineers design the "most perfect roller coaster"; that is, one that is safe, efficient, and thrilling, all while having minimal effects on the human body. Through a model coaster, I wanted to determine the physics-related concepts engineers consider upon designing such rides because not only do they need to operate successfully, they also need to be tolerable for the human being.

Methods

A model coaster was first constructed from KNEX coaster pieces, which includes tracks, chains, and small bars and clips to connect the pieces together. In addition, a KNEX motor was included, which includes 2 AA batteries that are secured within the motor. Upon conducting research, several modifications were made to the design of the roller coaster for the purpose of understanding how the physics-concepts worked.

Results

Upon designing the most perfect roller coaster, it is absolutely critical that engineers apply the overall concept of physics into the development of such a ride. It is necessary that they consider the heights of the slopes, the steepness of the hills, and the radius of the loops, because all of these factors can actually determine the acceleration of the coaster car, the G-forces along the track, and the minimum speed in which the coaster car must travel at, in order to successfully complete the course. For example, if my model coaster were built proportionally to a larger scale, a human being would most likely remain conscious during the descent of the first hill because the 2.40 g's experienced, does not exceed the maximum 3 g's the human body can typically handle at this given point.

Conclusions

Through this project I discovered that there are not only certain speeds, but also maximum forces that the human body can handle at different periods of time. Upon descending a steep hill, engineers design more of a curved path leading into the next section of the track, ensuring the safety of the riders. I also discovered that there is a certain number of amps the motor needs to have in order to operate successfully. Engineers have to consider factors as these because coaster cars do hold the life of anyone who steps inside. Coasters are not made for everyone, given that not everyone can tolerate and handle the adrenaline rush, the motion sickness, and the dizziness that they bring. Despite these effects on the human body, today roller coasters are not only more thrilling than ever before, they are much more safer, given the safety mechanisms, the restraints, and the simulation software that is utilized. Roller coasters are designed to meet the demands of the people s interests, all while taking into account safety precautions and what the human body can handle.

Summary Statement

I designed a model coaster for the purpose of determining how engineers incorporate physics-related concepts into the design of a coaster, ensuring that it's safe, thrilling, and most importantly, one that has minimal effects on the body.

Help Received

I received no outside help, other than lectures from my physics teacher during class periods. I did conduct research on the internet, but no mentors, professional scientists, or engineers were contacted. The entire coaster was built myself, and the calculations were that of my own as well.