CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Juan M. Alvarado

Project Number
J0301

Project Title
Soil Mechanics Engineering: The Effects of Moisture Content on Soil Strength

Abstract

Objectives/Goals
The objective of this experiment is to determine the optimum moisture content at which a soil becomes most stable and be used for structural foundations.

Methods/Materials
In order to create different soil mixes with different moisture contents, I combined 500 mL of soil with different amounts of water. The moisture contents ranged from 5% to 50%. Then, I used a cylindrical mold made of PVC pipe to make the soil specimens. To keep the soil particles together, I compacted the soil in the mold with a wooden dowel. After that, I put a 4 7/8 in by 4 7/8 in base on top of the soil cylinder and gradually added coins until the soil failed. I recorded the maximum pressure and repeated this for each mix. I used coins because the weights of coins are known. Finally, I used the soil with the optimum moisture content for my model house experiment. I placed 16 cylinders with 15% moisture content under a wooden model house and recorded how much pressure it could hold.

Results
The minimum percentage of water by volume that the soil specimen could hold without collapsing under its own weight was 5%. This specimen held 113.125 grams. The maximum percentage of water by volume that the soil could hold without collapsing was 40%. This specimen held 1271.25 grams. Initially, increasing the moisture content increased the strength of the specimen. However, this was only true up to 15% moisture content. After 15% moisture content, the soil strength decreased. The graph of strength vs. moisture content shows that ther is an increase up to the optimum moisture content, where it reaches the maximum, then falls following a parabolic shape. Finally, I found that the model house held up to 19.79 lbs/ft^2. The failure angle of the house was 32 degrees.

Conclusions/Discussion
Since the optimum moisture content of this soil was 15%, my hypothesis was incorrect. I thought that a soil with a moisture content between 20 # 30% would be the strongest and hold the most pressure. I believe that any amount of water above the optimum moisture content makes the soils particles slide and prevents compaction. At this point, the water acts like a lubricant instead of like a glue. Therefore, 15% moisture content should be for building and structural foundations in order to make them more stiff and stable.

Summary Statement
My project analyzes how moisture content affects the strengths of soils used in structural foundations.

Help Received
No help.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Daniel P. Arnold

Project Number

J0302

Project Title

How Did We Get Off Track? Functional Comparison of Railroad Switch Design and Derailments

Abstract

Objectives/Goals

The objective was to compare a new modified spring design to a currently used spring switch and a control fixed switch for preventing the derailment of trains that run over it the wrong way, #fouling# the switch

Methods/Materials

A Lehmann Gross-Bahn G scale track, switches and locomotive with a flatcar were used to simulate a train fouling a switch. A modified spring switch was engineered by inserting a second spring in between the rail and the point of an existing L.G.B. spring switch. The locomotive and flatcar were tested at three speeds and with three loads for derailment when run over each of three switches that were purposely set in the wrong position. The control group was a locked position switch, and the test groups were a spring switch and the modified spring switch described above. Each condition was tested five times. The most variable results of the spring switch at the top speed were retested for 10 trials each. The results of all trials were photographed and the train#s performance was documented as either a success or a derailment. The percentage of derailments were determined and compared by Chi square test.

Results

The fixed switch had a 100% derailment rate, the spring switch had and overall derailment rate of 44% and the modified spring switch had a 0% derailment rate. The differences between the spring switch and the modified switch were statistically significant by Chi square test for all of the lightest load trials, but the medium load was only different at the fastest speed.

Conclusions/Discussion

Train derailments at fouled switches occur most commonly on fixed switches at lower speeds and with unloaded cars. The modified switch to spring switch to fixed switch derailment ratio was 0:44:100. These data suggest that an enhanced switch design might reduce the number of annual derailments and financial losses especially in switchyards.

Summary Statement

A modified railroad spring switch design was compared to two other switches for its effectiveness in preventing derailments.

Help Received

Mentoring on the process from Mrs. Gillum. Discussion on the research topic with David Boyle Inteviews with Doug Williams and parental support, proof reading, and statistical advice.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Parisa K. Baher

Project Number

J0303

Project Title

What's Shakin'? A Study on Finding the Most Earthquake-Resistant Design of Base Isolation During Seismic Activity

Abstract

Objectives/Goals

Goal of this experiment is to find the most efficient design of base isolated building which will prevent the amount of lives lost and save money that is used for reconstruction by using different shapes of base isolation and dampers. In order to increase movement, I hypothesize that a decrease in friction between the base and the building, with adequate number of dampers and treated contact surface, will result in the least damage to the building.

Methods/Materials

.Plastic Pan, ·Wooden Boards, ·Square Blocks, .Round Blocks, ·Metal Screws, ·Gold Foam Board, ·Project Bricks, ·Tacky Glue, ·Elastic Bands, .Rubber Bands, .Knife, .Marbles, ·Electric Drill, ·Scissors, ·Straight Edge.

1)Build the shake table. 2)Build the building base using the base isolators and dampers. 3)Build the building using the foam board and foam blocks. 4)Count the number of blocks that fell, and the building displacement.

Build the various base isolation models for the rest of the trials, following similar procedures described above, using various base isolation shapes, number and type of dampers, and types of contact surfaces, and repeat the shake test experiment 15 more times.

Results

I discovered that the trials with square-on-square isolators with elastic band dampers (A-1 to A-4) had an average displacement and fallen blocks of 0.375# and 46. The same series of tests with round-on-square isolators (B-1 to B-4) produced average displacement and fallen blocks of 0.475# and 50. When I ran the same tests using rubber bands (C-1 to C-4, and D-1 to D-4) the average displacement and fallen blocks were 0.4875# and 67.

Conclusions/Discussion

My Trial A-4 performed the best among all the other 16 trials. In contrast, the worst performing trial was Trial D-1.

My experiment supported my hypothesis, that the base isolation system with adequate number of dampers and proper contact surface did have the best performance in the major seismic event. This was measured through the number of blocks that fell, and amount of building movement for each trial.

Summary Statement

This experiment is focused on discovering which design of base isolation will be most earthquake-resistant during seismic activity, to prevent stuctures from collapsing and minimize the number of injuries and deaths that impact our society.

Help Received

Father helped with measurements before building was built. Father sewed the two ends of the elastic band dampers. Father drilled holes on base isolators.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Conner R. Bennett

Project Number

J0304

Project Title

Biomimetic Water Striders, Year Two: Testing the Load-Bearing Capacity of Different Leg Coatings

Abstract

Objectives/Goals

To determine whether applying different leg coatings to a static water strider models legs could increase the load-bearing capacity in excess of 15X body weight. Based on my research, I believe the silicon dioxide solution based on Patent 3,931,428, will be the best coating for increasing the models weight-bearing capacity in excess of 15X body weight.

Methods/Materials

To mimic the insects water repellent legs, gelatin, food grade silicone, silicone dioxide, and paint brush bristles with Fumed Silicia powder were applied. The fifth model had bare metal legs. Also, the paint brush bristles and Fumed Silicia leg coating is unique. Results were recorded for each model floating on distilled water in three 3-minute trials, as additional weight was added to the model. In order to test the water strider model leg coatings, five control foreleg pieces of stainless steel wire were cut; one leg was left uncoated; and, the other four leg sections were each covered with one of the four coatings. Each control leg length completed the three, 3-minute surface tension time trial results. Also, the leg dimple shadow area and the different coatings contact angle data were gathered.

Results

The silicon dioxide solution based on Patent 3,931,428 increased the weight-bearing capacity of a static water strider model to 21X body weight. However, the self-assembled leg hair coating using paint brush bristles increased the load-bearing capacity to 24X its body weight. The model with bare metal legs carried 10X its body weight.

Conclusions/Discussion

The data did not support my hypothesis that the silicon dioxide solution would be the best coating. While this solution increased the weight-bearing capacity from 15X to 21X body weight, the homemade paint brush bristles and Fumed Silicia powder carried 24X body weight. The data shows studying innovative water repellent coatings that mimic the legs of a water strider insect may further increase the load-bearing capacity of water strider models, and have applications to water strider robots, marine vessels, and dish TV bowls.

Summary Statement

This study was concerned with increasing the load-bearing capacity of static water strider models beyond 15X its body weight by applying different coatings to the legs.

Help Received

Dr. P. J. Utz, M.D. at Stanford University School of Medicine provided access to the analytical balance. Also, Mr. Robert Dubrow and Ms. Zoe Dubrow provided the solution based on Patent 3,931,428 and advice.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Adam M. Berger

Project Number
J0305

Project Title
Science of Soccer: Optimize Your Kicking Range

Abstract

Objectives/Goals
My experiment was trying to test which contact position on a soccer ball will produce the maximum distance traveled. I will be helping all soccer players with the information they need to get the ball to fly as far as possible. My hypothesis is that the point of contact that will produce the maximum average distance will be the bottom middle portion of the ball, because it will give the ball lift for distance and reduce the amount of spin so that the ball will not slow down.

Methods/Materials
The experiment was accomplished by building a pendulum-like mechanism powered by bungee cords. The 5 ft. tall, 3 ft. wide mechanism was built out of metal conduit pipe and 2x6 wood with a 4 ft. long kicking arm. A size 3 soccer ball was placed on three different levels of wood planks that measured the vertical positions on the soccer ball. For every trial, the kicking arm was raised up and locked in place with a fence clasp attached to an adjacent conduit pipe. With the force of the two bungee cords pushing down on the kicking arm, the pendulum was released to strike the ball. The same procedure was carried out for nine contact points with ten trials for each.

Results
The independent variable in this experiment is the contact point on the ball, and the dependent variable is the distance that the ball traveled after contact. The dependent variable was measured by placing a piece of twine measured off in 5 ft. increments on the ground in front of the pendulum. For every measurement, we marked the point of first bounce to determine the distance from the pendulum. The data collected in my experiment rejected my hypothesis because the data points with the highest average distance was the soccer ball position that lies in the middle of the soccer ball, both horizontally and vertically. The average distance of the data taken at this position was 61.74 ft.

Conclusions/Discussion
Through my experiment, I learned that the best point to kick the ball is near the equator to achieve the maximum distance because this will create more force on the ball and will not have excessive amounts of lift. For players new to the sport or anyone trying to perfect their game, my experiment will show them how to get the most out of their kick.

Summary Statement
My project was trying to test the relationship between the point of contact on a soccer ball and the distance the ball travels.

Help Received
Father and grandfather helped with the design and assembly of the kicking mechanism; Parents and sister helped with collecting the data - marking and measuring the distances.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Michael C. Binon

Project Number

J0306

Project Title

Having a Hard Head Won't Save You

Abstract

Objectives/Goals

My Goal is to test different combinations of shells and energy absorbing materials to find out which combination will absorb the most energy, and protect the head the best.

Methods/Materials

1. ls anThe first step for this project was to select all the materials that I was going to use for the shells and liners. I chose carbon fiber and fiberglass for the shells, and closed-celled polystyrene and conformal foam for the energy absorbing materials.
2. My next step was to form the shells out of fiberglass and carbon fiber. I did this by making a helmet shaped mold and covered the material with a resin mixture to create a hard shell for the liners.
3. The third step was to make the liners so that they fit inside of the shells. For the polystyrene liners, I cut out rings of foam that approximately fit the measurements of the shell. I was then able to cut the straight edges of foam to make a spherical figure. To make the liner out of conformal foam, I cut out small pieces of the material and used Velcro to connect it to the shell.
4. I was then ready to take the completed helmets to be tested. I did this by taking the helmets to Snell Memorial Foundation to have them help me impact test them and to perform a penetration test. The impact test shows how much the brain accelerates and de-accelerates which tells me how severe the damage to the brain would be.
5. My next step was to analyze all the data I had gathered to see which combination of liners and shells protect the head the best.
6. Lastly, I created my backboard to show my project at the science fair.

Conclusions/Discussion

It turns out that my hypothesis was totally wrong. The carbon fiber and conformal foam had such a low density that Snell would not even test it in fear that it would break their machines. The carbon fiber and closed-celled expanded polystyrene ended up performing the best under the circumstances. We also noticed that the shells were not rigid enough to attempt a penetration test.

After performing the tests on two of my helmets, we determined that it would be redundant to test the other helmets. My final conclusion was that none of the foams that I tested were dense enough to absorb the energy and none of the shells had enough rigidity when the impact hit.

Summary Statement

My project is about finding what materials will make a helmet to protect the head the best.

Help Received

Snell memorial Foundation helped me test my helmets,and My dad helped me trim the edges of the molds

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Brent E. Cahill

Project Number

J0307

Project Title

Cars of the Future: Powered by Water?

Abstract

Objectives/Goals

Question: How will a Hydrogen PEM Fuel Cell-powered car compare to a battery powered car and a solar car, in terms of energy and efficiency?

Hypothesis: The Solar Car will be the most powerful, then the Hydrogen car, then the Battery. This still proves Hydrogen as an efficient and moderately powerful option.

The scientist wanted to find a way to eliminate the excessive emmisions of co2 from entering our atmosphere, and discovered that Hydrogen fuel cells, might just be a way to do so.

Methods/Materials

Materials

Fuel Cell Car Science Kit By Horizon Solar/ Battery Car Kit Stopwatch Ruler or Tape Measure Calculator (If Needed)

Pen/ Paper 2 Duracell AA Lithium Batteries Platinum Wire 9 Volt Battery Clip 9 Volt Battery

Distilled Water Glass of Water Volt Meter Popsicle Stick Transparent Sticky Tape

How to Test the Hydrogen, Battery and Solar Cars

1. Assemble the Cars as Directed in the Instructions placed in the kits.
2. Allow electrolysis for 15 minutes for the Hydrogen Car using the battery pack, testing the car immediately after.
3. Layout a track for the cars, testing how long it takes each car to complete that track using a stopwatch, then find out the cm/second of the cars, using a proportion.
4. To test the decrease of energy, place the Volt meter#s ends on the silver electrodes of the solar car, and the battery car, but for the Hydrogen car connect the red (positive) end of the volt meter to the Oxygen side and the black (negative) end to the Hydrogen side and turn the Volt meter setting to DC Volts.
5. This will show you the exact amount of Volts that a certain car is generating at any given time.

Results

The Solar car was the fastest, going an average of 40.763 cm/second. The Battery car was the second fastest, going an average of 35.883 cm/second. The Hydrogen Car was the third fastest, achieving an an average of 35.883 cm/second.

Conclusions/Discussion

In conclusion, the scientist learned a lot of very valuable information about Hy-drogen Fuel Cells,

Summary Statement

This Project was created to eliminate the excessive and harmful emmisions of CO2 entering the atmosphere due to cars.

Help Received

Johnny Li, Mentor, assisted in the development of the methods used to test.

Name(s)

Julia V. Cote

Project Number

J0308

Project Title

Which Will Withstand the Weight?

Abstract

Objectives/Goals

For my project, I tested the problem: What shape of pole can withstand the most weight? I predicted the circular pole would do the best (hold the most weight without collapsing), while the star shaped pole will do the worst (hold the least weight).

Methods/Materials

Four pole structures were constructed out of identical white paper (circular, square, triangular, and 5-point star). A plastic disc of nominal weight was placed atop the upright pole. Weights of 2-ounce increments were placed atop the disc until each structure collapsed (failed). Recordings of weight used were made and each pole shape underwent 2 additional trials (3 total).

Results

In all three trials, the circular structure withstood the most weight. The triangular pole withstood the second most amount of weight. The square was third and the 5-point star fared the worst.

Conclusions/Discussion

I concluded that it is better to use circular poles (or a pole with fewer corners). The more corners a pole has, the weaker the pole will be.

Summary Statement

My project is the testing of different shaped pole structures in order determine which shape withstands the most weight.

Help Received

Sister instructed on graphics; Mother helped construct board; Father advised on engineering aspects

Name(s)

Bedig D. Deirdeirian

Project Number

J0309

Project Title

Bombs Away! A Ping-Pong Catapult

Abstract

Objectives/Goals

The purpose of my project is to answer the question,"Which position would propel the ping-pong ball further?" I predict that if the catapult is pulled furhter back, then the ping-pong ball will have a better chance of landing in the bucket.

Methods/Materials

The Procedure of my project is to build a homemade catapult that launches ping-pong balls. You must hold the top arm at a certain degree that is written on the white circle. Then when you launch it, wait unntil the ball stops. Then it and record your data.

Results

As the graph shows yhe average for 20 degrees is 7'8". The average for 40 degrees is 4'8". the average for 60 degrees is 6'5". The average for 80 degrees is 8'2". The average for 100 degrees is 10'6". The average for 120 degrees is 9'2".

Conclusions/Discussion

My hypothesis was correct. My prediction was the more you tilt the catapult the further it will launch. The lowest my catapult launched was 2'4". The highest the catapult launched was 15'6".

Summary Statement

A catapult that launches and measures how far ping-pong balls can be launched into the air.

Help Received

Father helped to build the ping-pong catapult.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Danielle C. Faulkner

Project Number

J0310

Project Title

Efficacy of Seismic Retrofits in Diminishing Surface Wave Induced Swaying

Abstract

Objectives/Goals

My experiment investigated the effectiveness of the most commonly applied modifications to structures to reduce shaking, provoked by the compressing and expanding motion of P-waves, sustained during seismic activity. Base isolation, shear walls, and reinforced wall bursts were the models of retrofit I tested.

Methods/Materials

I constructed four rudimentary two-story buildings using fiberboard and wooden dowels. To one I attached base isolating feet composed of fiberboard and cotton balls, to the second shear walls of fiberboard slats, and to the third building I affixed supplementary dowels acting as reinforced wall bursts. I built an electric shake table from a box within a larger box allowed to roll freely on styrofoam balls. A wire ran from the interior box to a multi-speed kitchen Stand mixer which acted as the motor, jerking it to and fro. With velcro, the structures were fixed to the shake table and a tank of colored water lined with white paper was fastened to their tops. As the buildings were subjected to three trials with foreshocks, a mainshock, and aftershocks, waves in the tank splashed, staining the paper. The heights of the tallest stains were measured, averaged, and compared to that of the control.

Results

Compared to the control whose wave height exceeded 70mm, the base isolated structure decreased shaking by 38% with an average tallest wave height of 43 2/3mm, the reinforced wall burst decreased shaking by 53% its average tallest wave height being 33mm, and the shear wall structure reduced shaking by 56% with an average peak wave height of 33 1/3mm.

Conclusions/Discussion

Shear walls proved most effective in reducing building sway, reinforced wall bursts following narrowly behind, while base isolators were least effective. However, when subjected to the more violent shaking of the simulated mainshock, base isolators visibly buffered more of the motion than the other retrofits.

Summary Statement

Compare the effectiveness of seismic retrofits in reducing earthquake induced P-wave generated swaying.

Help Received

My father accompanied me to various stores for supplies, aided in cutting dowels, supervised trials, and provided encouragement.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Brian J. Fleming

Project Number

J0311

Project Title

Throwing a Lacrosse Ball the Right Way

Abstract

Objectives/Goals

The objectives of this project are to:

1 - Determine if changing length of a lacrosse shaft will proportionally affect the throwing distance of a lacrosse ball.
2 - Determine if changing the throwing force will proportionally affect the throwing distance of a lacrosse ball.
3 - Determine if changing the throwing angle will proportionally affect the throwing distance of a lacrosse ball.

Methods/Materials

By building a catapult from construction lumber, barbell weights, and a lacrosse stick, throwing trials with standard lacrosse balls were conducted where each variable combination was tested five times. The changing variables were:

1 - Six different throwing shaft lengths, varied by 6" increments.
2 - Four different throwing forces, varied in 5 lb increments from 5 lbs of force to 20 lbs.
3 - Four different throwing angles, varied by 10 degree increments from 90 degrees to 60 degrees.

Results

For the first hypothesis, variable shaft length, the longer shaft lengths did cause, proportionally, longer ball throws.

For the second hypothesis, variable throwing force, the heavier weights did cause longer throws, proportionally.

For the third hypothesis, variable throwing angle, the higher angles did not conclusively cause a change in throwing distance.

Conclusions/Discussion

The main purpose of this experiment was to test different release angles, shaft lengths, and weights for a more accurate and farther throw. This wasn't completely achieved because of some malfunctions in the shaft extension. However, with the data that was collected, the purpose was semi-achieved because over sixty trials were conducted and good data were collected.

Summary Statement

The focus of this project was to test throwing distance based upon the changing variables of shaft length, throwing force, and throwing angle.

Help Received

My dad help me build the catapult and conduct the trials. My dad also helped me format the graphs and data tables using Excel.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Alethia K. Halamandaris

Project Number

J0312

Project Title

The Duomo: Art and Science

Abstract

Objectives/Goals

This project tests the strength of two different building techniques.

Methods/Materials

Two domes, equal in size, were constructed, but each was created with a different building technique. One dome was built with the same technique that was used in 1420 to construct the Basilica di Santa Maria del Fiore. When the basilica was built a herringbone brick pattern was used on the dome because the architect, Filippo Brunelleschi thought that it would give the building more support. The other model was built in a traditional manner by regularly laying the bricks one on top of the other. Each dome has the same diameter and the same height. The two models were tested by putting the domes on the "squeezer" to see how much weight each model could withstand.

Results

The dome with the herringbone pattern withstood 376.2 pounds of force until there was 2.189 inches of deflection. However, the dome with the regularly laid bricks was able to keep its shape until the squeezer reached 634.1 pounds of force. After the dome with the regularly laid bricks was put on the squeezer, there was 0.98 inches of movement on the dome.

Conclusions/Discussion

There are at least two possible conclusions that can be drawn from my experiment; one of these being that buildings with regularly laid bricks might actually be stronger than building with the herringbone pattern. In the test of the two domes the dome with regularly laid bricks was able to go through two different tests and withstand a greater amount of force. The dome with the herringbone pattern was only able to endure a little more than half of what the other dome withstood.

Another presumption that can be taken from this test is that using the herringbone pattern on a building really will make it stronger. Although in my test the building with the herringbone pattern was not as strong as the building with regularly laid bricks, it is possible that it is an error on my part. There were more variables when constructing the dome with the herringbone pattern because there were certain pieces that needed to with precision and sometimes they did not. It took 35 years to build the Duomo, where I had two weeks to build my two replicas.

Summary Statement

I am testing to see if a dome with a herringbone brick pattern has more support than a building with regularly laid bricks.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Quin Lin Harrill

Project Number

J0313

Project Title

Swing and a Hit

Abstract

Objectives/Goals

The purpose of this experiment is to determine if a golf ball, softball or a baseball will go the farthest when hit by a baseball bat.

Methods/Materials

Materials: A 2x4 and 2x6 types of wood, ABS cement, 2 inch abs pipes, regular stop watch, 2 softballs, 2 baseballs, 2 golf balls, 1 wiffle golf ball, 1 wiffle softball, 1 wiffle baseball, an Aluminum bat, drills, screws, tees and duck tape.

Methods: 1. Build a batting machine by getting ABS tubes and gluing them together and put a bat in a T shape tube. 2. Hit the wiffle golf ball with the batting machine 3 times, measure the distance and record. 3. Hit the wiffle baseball with the batting machine 3 times, measure the distance and record. 4. Hit the wiffle softball with the batting machine 3 times, measure the distance and record. 5. Hit the golf ball 9 times with the batting machine, measure distance, then record. 6. Hit the baseball 9 times with the batting machine, measure distance, then record. 7. Hit the softball 9 times with the batting machine, measure distance, then record results. 8. Take the two test results and graph them.

Results

The results show that the size of the ball does not matter because in the test results it shows that the wiffle softball went the farthest, but in the regular test it went the least distance. But, weight does matter because even though the wiffle softball is hollow, it weighs more than the wiffle golf ball or the wiffle baseball. The wiffle golf ball has the lowest weight and it went the shortest distance. The wiffle baseball came second.

As I learned in the wiffle ball test, weight does matter. The inside of a golf ball is rubber and plastic. The baseball is made of hard cork, which is lighter than rubber and plastic. The softball is made of the lightest material, with is hard foam.

Conclusions/Discussion

After conducting so many tests, the results show that the golf ball goes the farthest. My hypothesis was correct that the golf ball would go the farthest. But I was wrong about size making a difference. I believed that the golf ball would go the farthest based on just its size. But I learned that weight also determines how far the ball will go.

Summary Statement

Is seeing which ball will go the farthest when hit by an aluminum baseball bat.

Help Received

Dad helped cut the balls in half with a bandsaw.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Katherine Irajpanah

Project Number

J0314

Project Title

Which Type of Bridge Can Hold the Heaviest Load?

Abstract

Objectives/Goals

The goal of this experiment was to see which of the three most common bridges (arch, deck truss, and beam) could hold the heaviest load, or weight.

Methods/Materials

In order to build these bridges, I had to first design them. My second step in conducting the experiment was gathering my materials, which consisted of balsa wood, dowels, carpenter#s glue, dominoes, a hack saw, premixed cement, boxes to hold up the bridges, and an ounce scale to measure the dominoes weight. To test each of the three types of bridges, a copy of a ruler was placed against the back wall of each box holding the bridges. This was done to allow me to see if there was any change in the lateral height of the surface of each bridge. I began the experiment by weighing the dominoes and then placing them on top of the middle of the surface of each bridge.

Results

I found that the surface of the beam on the beam bridge had the most change in its lateral height. The truss bridge had minimal change when the weight was 2.4 lbs., and the arch bridge did not have any changes in its lateral height, even after placing 5.3 lbs. on its surface.

Conclusions/Discussion

From my research and experiment, I learned that these bridges did not break or have much of a lateral dip because of their great support system. The experiment proved that the arch bridge could hold a great deal of weight without breaking or bending. The arch bridge can hold the most weight of the three, the deck truss bridge can hold an average amount of weight, and the beam bridge could hold the least amount of weight.

Summary Statement

This experiment tested the arch, deck truss, and beam bridges to see which could hold the heaviest amount of weight.

Help Received

My mother helped copy edit my essay and cut some pieces of wood during the construction process of my bridges.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Rachel L. Kanonchoff

Project Number

J0315

Project Title

For Shear Joy

Abstract

Objectives/Goals

To determine the effects of adding recyclable materials (thermoplastic strips and polyethylene terephthalate strips) to soil behind an MSE (mechanically stabilized earth) retaining wall.

Methods/Materials

Scale models of MSE walls were constructed using dry, poorly graded sand as the soil type. The thermoplastic strips and polyethylene terephthalate strips were added to the soil behind the front-facing wall (scaled to size and strength of posterboard) at various addition rates. Normal force was then added to the top of the scale model as a surcharge load. The more normal force the MSE wall held, the greater the improvement in shear strength.

Results

The scale MSE wall with the polyethylene terephthalate strips at an addition rate of 2% held the most normal force, exhibiting the greatest increase in shear strength. The scale MSE wall with the polyethylene terephthalate strips at an addition rate of 1% held the second highest normal force, showing the second greatest increase in shear strength. The scale MSE wall with the thermoplstic strips at an addition rate of 0.2% held the third highest normal force, showing the third greatest increase in shear strength. The thermoplastic strips at an addition rate of 0.1% held the least normal force (excepting the Control) showing the least improvement in shear strength.

Conclusions/Discussion

Adding plastic materials to soil can greatly improve the shear strength of the soil. The more friction generated in the soil when the soil begins to slip, the stronger in shear the soil is. When placed in the soil, the plastic strips generate friction as well as cross over many shear planes, further stabilizing the soil. The more abrasive the plastic strips are, the more friction they create when the soil tries to slip, and the more the increase in soil stability.

Summary Statement

This project explores the effects of different recyclable plastic additives on the shear strength of soil behind an MSE retaing wall.

Help Received

Gary Welling was my project mentor and advisor. Mother helped on display board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Hayato S. Kato

Project Number

J0316

Project Title

Pasta Bridge: Which Shape Is the Strongest?

Abstract

Objectives/Goals

My project was to determine if the shape of a bridge affect its ability to hold weight. I think the arch structure is stronger. I think short beams minimize the pressure and small triangles help to strengthen the structure and to keep it stable. The truss structure will do the same work as small triangles. I predict that the combination of arch and truss structure is the strongest bridge.

Methods/Materials

Six types of bridges with variation (total: 14 types + 1 special type) were constructed with pasta.

1. Place one pasta bridge on top of the two blocks
2. Hang the aluminum can on the middle bar at the base of the bridge
3. Slowly add one coin into the aluminum can and count ten seconds
4. Repeat step 3 until the pasta bridge breaks
5. Remove one coin from the aluminum can and then record how many grams the pasta bridge held
6. Repeat 5 times per type (total: 75 times)

Results

The Simple Triangle Bridge was the weakest. The Sunset Suspension Bridge with 5 beams held more weight than the one with 3 beams. The Sunrise Suspension Bridge was about the same as the Sunset Suspension Bridge and adding more beams to the bridge made the bridge stronger. The Suspension Vertical Bridge held about 2 times more than the Sunrise and Sunset Suspension. The Kobe Suspension Bridge held more weight with more structures. The 1/3 Arch Bridge held about the same weight as the 1/4 Arch Bridge.

Conclusions/Discussion

My conclusion is that the combination of arch and truss structure is the strongest bridge. I created a dream bridge that is based on the data I collected from 14 different types of bridges. Its base is the 1/3 Arch Bridge with truss structure that held most weight and I added few extra poles to it. The bridge#fs weight isn#ft different that much from the other bridges but the weight it held was about two times more than the other ones.

Summary Statement

Does the shape of a bridge affect its ability to hold weight?

Help Received

Father helped work on the aluminum can; Mother helped cut out the pasta, create the base support and print out.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Ryan D. Kmet

Project Number

J0317

Project Title

Vortex Power

Abstract

Objectives/Goals

The United States military and various law enforcement agencies are studying the use of non-lethal weapons to reduce the potential for casualties, reduce the risk of alienating people from humanitarian efforts, and prevent escalation to lethal force. Such a weapon, a vortex cannon, could be created based on Bernoulli's principle. The increased speed of a core of air fired from a vortex cannon would create increased pressure around the core, while there would be decreased pressure within the core. This principle would allow this toroid of air to remain focused and sustained instead of immediately dissipating, making an ideal non-lethal weapon.

Methods/Materials

I constructed a vortex cannon using a plastic trashcan, plastic trash bags, a bungee cord, duct tape, and a tennis ball. By placing the open end of the cannon over a charcoal smoker before each set of firings, I was able to make each toroid fired visible. I carefully measured from a determined mark on the cannon table to a determined mark on the target table at distances of 6, 8, 12, 13, and 14 feet. I then set the cannon and the targets. I repeatedly fired the cannon from increasing distances until it became ineffective, recording the time from release of the cannon to contact with the target in order to estimate feet per second the release of air traveled.

Results

Though very effective and with spectacular results at the short distances of 6 and 8 feet, the cannon was less effective at 12 feet, even less effective at 13 feet, and completely ineffective at 14 feet. This does not mean a similar vortex cannon could not be effective at a distance of 15 feet or even greater. Adjustments could be made to the cannon to increase its potential, including the construction of a sturdier cannon and the addition of a fuel source to create a more powerful expulsion of air with more significant results.

Conclusions/Discussion

Results showed positive effectiveness of a vortex cannon at short distances with the application of minimal force. In real-world situations, a properly constructed vortex cannon has the potential to allow the person or authority employing its use to temporarily stun and subdue a subject without having to employ potentially dangerous chemicals, electrodes, or force that is more lethal.

Summary Statement

An effective non-lethal weapon, a vortex cannon, can be created on Bernoulli's priniciple.

Help Received

Mother helped purchase materials and took pictures; stepfather operated charcoal starter and stopwatch

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Keshav B. Kundassery

Project Number

J0318

Project Title

The Best Pulley Combination for Reducing Workload

Abstract

Objectives/Goals

The objective was to find the best pulley combination for reducing workload.

Methods/Materials

First, a platform was built to hang and test the pulleys. A total of 11 combinations were tested. After assembly, a spring scale was used to measure the force required to lift a 320 g weight with that combination. Along with force required, the distance the string had to be pulled to lift the weight 10 cm was measured. This was accomplished with a measuring tape attached to the side of the platform. In some cases, the observation was different from my expectation. The weight was changed to confirm a finding. Friction was ignored in my numerical findings, but it was taken into consideration when concluding.

Results

I found that the double tandem pulley combination was most efficient. The force required was equivalent to 0.392 N, and the string was pulled 40 cm to lift the mass 10 centimeters. The block and tackle system with three fixed and two moveable pulleys was also quite effective. The force required was 0.588 N and the string was pulled 40 cm to lift the mass 10 centimeters.

Conclusions/Discussion

There was a slight difference between expected force and actual force. With a fixed pulley the force was 0.392 less than expected, while with a moveable pulley it was 0.245 N more. This is possibly because of the difference in direction of pull with respect to gravity. I thought that more pulleys would decrease the force required, but I found that it is not always the case. My hypothesis was not supported. It is not the amount of pulleys that matters; it is how they are arranged.

Summary Statement

This project is an attempt to find the best pulley combination for reducing workload.

Help Received

Dad helped with choosing the project and understanding physics, Mrs.Morgensen mentored the project

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Ethan D. Maahs

Project Number

J0319

Project Title

A Study of How Different Forms of Base Isolation Affect the Maximum Acceleration of a Structure during Seismic Activity

Abstract

Objectives/Goals

My objective was to determine the most effective material at reducing maximum acceleration and vibrations during an earthquake. The secondary objective was to use materials that may be applicable to residential use.

Methods/Materials

A shake table was constructed that was capable of multiple acceleration settings using a standard drill. A 1/20 building was constructed based on my own home. A 3-axis accelerometer was purchased and from Vernier and used with a Vernier LabQuest data logger with LoggerPro software borrowed from Fairmont Private Schools-Edgewood Campus. The accelerometer was attached to the shake table. A variable autotransformer was used to adjust the drill speeds to achieve accelerations equivalent to earthquakes with magnitudes of 7.0 # 9.7 on the Richter scale. Six (6) materials were tested 3 times at each drill speed setting. The peak acceleration was determined by reviewing the graphs generated by LabQuest and five (5) peak data points from each run were averaged to determine the average peak acceleration. Additional statistical tests were performed between all the materials to determine if there was a statically significant differences between the averages existed.

Results

Tennis balls and carpet sliders were the most effective because the reduced the friction between the shake table and the house. Golf balls were not as effective as tennis balls because the house bounced up and down and the momentum of the golf balls increased the acceleration of the house causing the house to be destroyed. The other base isolation methods were ineffective and sometimes increased the acceleration of the building rather than reducing it.

Conclusions/Discussion

The friction between the building and the ground causes seismic energy to travel throughout the building and damage it. Tennis ball were the most effective because they completely isolated the house from the shake table, but also prevented the building from bouncing up and down. Isolating the building from the shake table was not only factor that contributed to reducing the maximum acceleration, it was also important not to increase the momentum of the house because increased momentum increases the maximum acceleration. This was the case in with the golf balls.

Summary Statement

The project was conducted to find forms of base isolation that effectively reduce the acceleration of buildings and homes during seismic activity.

Help Received

Father helped build shake table; Mother helped construct the house; Mark Hobbs helped revise my report; Amy Hoffman gave me the necessary materials for my board

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Maya D. Miklos

Project Number

J0320

Project Title

Pump it Up! The Effect of Tire Pressure on Bicycle Efficiency

Abstract

Objectives/Goals

Gasoline for cars is becoming an expensive and valuable resource. Everyone looks to save on car fuel, but there appears to be no easy solution. One often-overlooked solution to this problem may be to keep the tires of your car properly inflated. I decided to investigate the effect of tire pressure on bicycle efficiency, since this model could be directly applied to car fuel consumption. Based on my research, I learned that tire pressure in the wheel maintains the shape of the wheel, and so the highest tire pressure is usually the most efficient. I hypothesized that if I lower the bicycle's tire pressure, then the efficiency will decrease.

Methods/Materials

To test my hypothesis, I measured the speed of bicycle down a 100-meter downhill course with tire pressures at 10, 20, 40, and 60 psi. For these experiments a rider sat passively on the bicycle, not pedaling but keeping the bicycle straight. For an additional endpoint, I measured the rolling resistance at these same pressures. Rolling resistance was defined as the force (measured by a force gauge) that is required to pull a bike at 10 miles per hour. All experiments were conducted using 2 different bicycles of wide (2.1#) and narrow (1.125#) tire width. For all experiments the statistical significance of the data were examined using a student's paired-T test.

Results

For the bicycle with the wide tires, supporting my hypothesis, the greatest speed (4.64 m/s) was obtained with highest tire pressure (60 psi). The differences in speeds at the varying tire pressures were small but reproducible and statistically significant. Rolling resistance tests further validated my hypothesis. The highest tire pressures also gave lowest rolling resistance (2.583 lbs). However, the significance of the measured rolling resistance data was less than the speed measurement, due to the limits of the experimental method. The experiments conducted using a bicycle with more narrow tires gave similar results.

Conclusions/Discussion

Supporting my hypothesis, bicycle efficiency decreased as tire pressure was lowered. My results showed that by decreasing the tire pressure by just one pound per square inch (psi) you can lose up to 0.2% of your bicycle efficiency. This data can directly be applied to car fuel consumption. Gasoline for cars is a dwindling and expensive resource, which can be preserved if drivers took the simple and direct step of properly inflating their tires.

Summary Statement

My project investigates the effect of tire pressure on bicycle efficiency as measured by both speed and rolling resistance.

Help Received

Mother helped arrange board; Father helped conduct a student's paired T-test

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Vivian N. Nedeltchev

Project Number

J0321

Project Title

What Is the Strongest Shape?

Abstract

Objectives/Goals

The objective of my project was to determine which 3-dimentional shape best withstood Static and dynamic forces.

Methods/Materials

I made four simple experiments to test the resistance to static and dynamic forces. I constructed 12 different shapes of equal area using twenty-four popsicle sticks and the same amount of glue. Each shape was tested with four experiments fifteen times. In the first two experiments I determined the resistance to static force; one testing piont force, one testing the holding force. The results were measured in Newtons. In the second two experiments I determined the dynamic force. In one of my tests I found the force it takes to break each shape, and the other test I found the lateral force. The results were measured in Joules.

Results

After I took the mean of each experiment I found the "A" shape had the most resistance to static and dynamic forces. The "A" shape is the stongest.

Conclusions/Discussion

While the results did not support my hypothesis I obtained my objective, to determine which 3-Dimentional shape best withstood static and dinamic forces. My projecthelps to find a more durable more earthquake resistant building.

Summary Statement

My project determines which shape best withstoods static and dynamic forces with four different experiments which I repeated fifteen times, with twelve different shapes each constucted of 24 popsicle sticks and the same amount of glue&area.

Help Received

I would like to thank my mom for purchasing all the materials necessary,taking pictures and inspiring my idea.I would like to thank the principals of my school and the high school for letting me use the weights.I would like to thank Dr Barbara Hoeling,Dr. Richard B Franklin, Dr. Margaret Rise, and Mr. Vince Rosse

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Forrest P. O'Connor

Project Number

J0322

Project Title

Can I Engineer a Cheap, Easy to Build Hydro-power Crane?

Abstract

Objectives/Goals

I wanted to see if there was a cheap and efficient way for farmers and workers in poor countries to lift loads utilizing water power. I observed that workers in non-industrialized countries often use manual labor to lift heavy loads. Goal: To build a scale water crane which can lift an equivalent of 200 lbs.
Criteria: The crane needed to be low cost, use common easily obtainable materials and be easy to construct.
Constraints: The crane is only operational when it has access to a continuous flow of water. It has both a limited load capacity and mobility.

Methods/Materials

Methods: I built a prototype based the Greco-Roman Trispastos, 3-pulley crane design. I used a 3-gallon bucket as a reservoir and attached a paddle wheel to the crane axil to provide twisting power for lifting.

Results

Initial trials revealed that the initial design would not work because the threaded rod I used for the axle moved to the left because of the spiral threads. So I added two bolts and a washer to keep the rod from moving. I also noticed that there was a lot of friction where the axle rubbed in the brackets so I sprayed the axle with lubricant. The starting water pressure (head pressure) was also too low so I had to move the bucket up higher. The flat paddles I used for the water wheel also seemed to be not working so I replaced them with plastic spoons. This seemed to capture more of the waters force rather than just letting it just spray to the side. After the first trial the load would drop as soon as I turned off the water valve so I had to make a ratchet device. The rope I used at first was too stiff and was causing friction so changed this to 1/16# nylon twine.
I was able to get the model to work but it did not meet the lifting criteria. I only lifted 0.18 lbs. I think the model is too fragile to lift the target load of 20 lbs.

Conclusions/Discussion

I did not meet my engineering goal but I was able to create a functional crane and learned what I can do next time to make a more function model. I would first make the model a ¼ inch scale and then I would increase the size of the water wheel to increase the leverage and I would also use a greater mechanical advantage such as 4 to 1 pulley system so that I did not have to use as high a head pressure.

Summary Statement

Can I design a low cost easy to build water powered crane for lifting loads?

Help Received

Dad helped in building prototype, troubleshooting, and constructing display board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

James A, Poirier

Project Number

J0323

Project Title

Shock Absorbers: Counteracting Physics and Force

Abstract

Objectives/Goals

The purpose of this experiment is to optimize the handling of a high-performance remote control (RC) car. This project explores the effect of using different viscosity oil inside the shocks to determine the optimal configuration for relative speed, handling and jumping capabilities of the car.

Methods/Materials

An acceleration course, jump course, cornering course, and drop fixture were set up to run the experiments. For the acceleration test the car was run down a 30m straightaway and timed. For the jump test the apex and distance traveled were measured by recording on a video camera and reviewing frame by frame. The cornering test timed how fast the car could complete four tight circles. Finally, the drop test involved dropping the car from four different heights and measuring the amount of compression on two clay blocks placed below the car. An accelerometer was also used to measure total shock.

Results

The results of the testing showed that there is a significant performance difference by changing out the oil in the shocks. In the acceleration test the 45 viscosity oil performed the best by 0.05 seconds. In the cornering test the 45 viscosity oil was best by 0.94 seconds. In the jump test the 45 viscosity oil helped the car spring off of the jump and went 0.11 meters higher and 0.81 meters farther. Finally, in the drop test the 90 viscosity oil did the best by providing the most resistance against the force on the car as it hit the ground.

Conclusions/Discussion

Whether competing in a race or driving for fun, the oil that you put in the RC shocks matters. For overall results, the 45 viscosity oil had the highest performance results for three of the four tests, followed by the 90 viscosity oil, and then the 15 viscosity oil. For racing courses with lots of jumps, choosing shock oil between 45 and 90 viscosity would be best. If racing on a track that has lots of turns choosing shock oil between 45 and 15 viscosity would be the best.

Summary Statement

This project explores the effect of using 15, 45, and 90 viscosity oils inside the shocks of an RC car to determine the optimal configuration for relative speed, handling and jumping capabilities of the car.

Help Received

Help received from Dad with testing, Mom with my display board, and my teacher Mrs. Schumacher with guidance and support in the development of the experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jacob A. Posner

Project Number

J0324

Project Title

What Is the Most Efficient Way to Power a Gyrostabilizer?

Abstract

Objectives/Goals

My objective was to see whether or not a turbine could be used to power a ship's stabilization system, because ships currently burn fossil fuels, creating pollution.

Methods/Materials

The first step of my method was to build a ship to test. This ship had a turbine connected to a gyroscope. After that, I used a spring scale to measure how much the ship resisted rolling when it was not using the gyroscope and when it was using the gyroscope. I tested the roll resistance 50 times in total: 25 using the gyroscope, and 25 times not using the gyroscope.

Results

The average roll resistance of the ship when the gyroscope was spinning was 20 percent larger than the average roll resistance of the ship when the gyroscope was not spinning.

Conclusions/Discussion

My results show that when the turbine was spinning, powering the gyroscope, the roll resistance was higher. That means that the gyrostabilizer was working. Since the gyrostabilizer system was not using any energy except that created by the turbine, it was more efficient than the current way ships create energy.

Summary Statement

My project tests whether or not there is a more efficient way to power a ship's gyrostabilizer system.

Help Received

Father helped with idea, friend lent water pump, and teacher lent spring scale.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Canyon C. Robins

Project Number
J0325

Project Title
A Long Shot: Optimizing a Projectile Launching Apparatus

Abstract

Objectives/Goals
This past summer, my dad and I invented a toy, a SLOTTER, for playing table-top coin games. The purpose of my project was to discover the optimal combination of variables that maximizes the throwing capability of a SLOTTER, allowing it to throw a projectile the greatest distance.

Methods/Materials
The variables I tested were: projectile mass, card material and size, pull-back angle, and SLOTTER angle. I tested a combination of three different projectiles (penny, nickel, quarter), four types of card material (polyethylene, PVC, PVC laminated, PVC varnished), four card widths (full, 1/2, 1/3, 1/4), four pull-back angles (31, 38, 45, 52 degrees) and six different SLOTTER angles (25, 35, 45, 55, 65, 75 degrees). I sequentially tested, optimized, and controlled each variable in a systematic order. High speed video was used to confirm that the final set of variables were the optimal combination.

Results
The results of my project were consistent with my background research on projectile trajectories, spring dynamics, and basic laws of motion. However, there was still a surprising finding. The optimal combination of variables were: the lightest projectile (penny), the card with the highest modulus of elasticity (polyethylene), the widest card (full width), the largest pull-back angle (52 degrees), and surprisingly, a SLOTTER angle of 75 degrees.

Conclusions/Discussion
From these results I can conclude that the following combination of variables will cause a projectile to travel the maximum distance:
a)A projectile with the least mass
b)A spring made of a material with the highest modulus of elasticity, while still being able to deform the maximum amount without surpassing its elastic limit
c)The largest spring possible for the launching apparatus
d)The largest amount of spring deformation possible for the launching apparatus
e)A launching apparatus angle that combines with the amount of spring deformation to cause a projectile launch angle of 45 degrees (for this experiment a SLOTTER angle of 75 degrees was optimal, not 45 degrees like my hypothesis stated).

Next, I hope to use my knowledge gained from this and previous science fair projects to improve on spring powered toy cars and airplane launchers.

Summary Statement
The goal of this project was to optimize a spring-based toy that my dad and I invented last summer.

Help Received
My dad acted as a co-inventor, mentor, and assisted me during the testing process.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Sam B. Schoonmaker

Project Number

J0326

Project Title

The Acceleration of a Skateboard

Abstract

Objectives/Goals

I set out to see what weight of a skateboard would complete and accelerate down the track the fastest. My experiment question was: How does weight affect the speed of an object down a certain slope? In starting my experiment, my hypothesis was that the skateboard with the nine-pound weight would go the fastest because it had less friction but still had some weight on it.

Methods/Materials

First, I had to build a track. I used two eight-foot long plywood boards that are four feet wide. The plywood was framed in two by fours for strength. I then cut six wedges to insure the track was flat and sloped.

To run my experiment, I used a five-pound skateboard and put different numbers of two-pound lead diving weights on it to vary the weight. In total I had four two pound weights and I ran my trials adding an additional weight each time. To measure how fast the skateboard went in between the checkpoints and the end, I videotaped it with a video camera. I would count how many frames were in between one checkpoint and another and then I would divide it by thirty because I knew there were 30 frames per second.

Results

The five-pound skateboard took 9.116 seconds to complete the track, which was the longest time of the five trials. I added one two pound weight on the skateboard and it took 8.466 seconds to complete the track. The skateboard with 4 pounds on it took 8.27 seconds to complete the track. Next, the skateboard with 6 pounds on it took 8.114 seconds to complete the track, which was a little bit less than the skateboard with 4 pounds on it. Finally, the skateboard had eight pounds on it took 7.89 seconds to complete the track, which was the shortest amount of time to complete the track of all five varying weights.

Conclusions/Discussion

Originally I hypothesized that the nine-pound skateboard would go the fastest because it had less friction and still had some gravity pushing down on it. My hypothesis was wrong because the thirteen-pound skateboard actually completed the track the fastest. The reason why the heavier skateboard went the fastest was because it weighed more so it didn#t feel the friction as much because of the gravity pushing down on it. The lighter skateboards felt the friction more because they did not weigh as much, even though they still had gravity pushing down on them.

Summary Statement

My project is about how the weight of an object affects how fast it accelerates down a hill.

Help Received

Mr. Ozeni: 8th grade Science Teacher at Correia Middle School. Jon Schoonmaker: My dad. Tracy Moore: My mom

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Aesha V. Thaker

Project Number
J0327

Project Title
Killer Backpacks on the Loose

Abstract

Objectives/Goals
The objective of this experiment was to determine if a middle school student#s percentage of backpack weight affects their angle of posture. My hypothesis was that if a person#s percentage of backpack weight is over 10% of their body weight, then the average difference will be greater because the weight of the backpack will be on the person#s shoulder and back, which will cause them to be off balance, so they lean forward to center the weight, while if the percentage of backpack weight is 10% or less, then the average difference will be less and the person will stand straighter, since the weight in already centered.

Methods/Materials
A subject#s and their backpack#s weight were found. Then, the percentage of backpack weight was found. A picture of the individual was taken with and without their backpack on, standing sideways. Based on the pictures, the posture was analyzed by placing dots at the ear and shoulder and connecting them and going straight up from the shoulder. After the angles were formed for both pictures, they were measured using a protractor. The final angle of the subject with their backpack on was subtracted from the initial angle of the subject without their backpack on for both pictures. Data was then analyzed and grouped based on percentage of backpack weight.

Results
On average, the average differences in each category were 4.5°, 3.5°, 4°, 19°, and 7°. In the 1-10% category (first category), the average difference was greater than the difference in the next two categories. Also, in the 25.1-30% category (last category), the average difference was less than the previous category. However, the majority of the results depicted that the average difference in the arch of the back increased as the percentage of backpack weight increased.

Conclusions/Discussion
My hypothesis that the if the percentage of backpack weight is over 10%, the average difference will be greater, and if the percentage of backpack weight is less than 10%, the average difference will be less was supported by the resulting data. As the percentage of backpack weight increased, the average difference in the arch of the back increased. Therefore, students should decrease the amount of items they have in their backpacks and use only what is necessary.

Summary Statement
The greater the percentage of backpack weight, the greater the average difference in the arch of the back, so students should take unnecessary items out of their backpacks.

Help Received
Mother helped glue papers on my board and took me to places to get supplies; Science teacher helped correct work and answer questions; language teacher helped correct work; librarians at the Corona Public Library helped find books.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jalahn I. Travis

Project Number

J0328

Project Title

The Physics of Roller Coaster Friction

Abstract

Objectives/Goals

I love roller coasters and I have always wanted to learn more about how they work. My goal for the experiment was to create a model of a roller coaster track and drop a car from certain heights to see if the loss of friction stayed the same. Also, I wanted to see how high I had to drop a car to determine the effects of friction on potential energy.

Methods/Materials

My co-authors and I built a roller coaster from a "K-Nex" roller coaster set. We duct-taped two sides of the track to shelves and used a stopwatch to determine the average time for the car to descend and ascend the track. We also used a meter stick to determine the height the car was dropped from. We used a calculator to check our work.

Results

I used the following formula: P.E.= M.G.H. (Potential Energy equals Mass x Gravity x Height)for my experiment. The car was dropped ten times and we recorded the results. We found out that the car went 2/3 of the distance back up the track after descending from one meter. We discovered that friction takes away from potential energy by 36 percent.

Conclusions/Discussion

We noticed that the height that the car returned to was fairly consistent during the ten times we performed the experiment. I would like to know if a 36 percent loss of friction will stay the same regardless of how high we drop the car, so we hope to continue this experiment with more trials from different heights.

Summary Statement

My project used a model roller coaster to investigate how much friction affects potential energy.

Help Received

Two classmates assisted with the project but were too young to participate in this fair. Teacher helped with grammar on display. Parent helped with design of display.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ryan C. Ziegler

Project Number
J0329

Project Title
The Effects of an Airsoft BBs Weight on Its Trajectory (Flight Path)

Abstract

Objectives/Goals
The goal of my project was to determine how the weight of an airsoft bb affects how it flies. I believe that the heavier bbs will fall more than lighter ones in equal distances, have shorter trajectories, and scatter less than the lighter ones.

Methods/Materials
A brace to hold the airsoft gun was constructed, and bbs weighing .12g, .20g, and .25g were collected. Then a multitool with a laser and level was set in place of the gun barrel and the laser dot was marked on a target at 5 meters from the gun. Then ten .12g bbs were shot at the target. I repeated the process with .20g bbs and then again with .25g bbs. The whole process was repeated at 7.5 meters and again at 10 meters. The experiment was conducted twice with the same results.

Results
The heavier bbs had fallen over twice as much as the lighter ones at 10 meters. They also had a much tighter spread on the targets than the lighter bbs. Basically, they proved my hypothesis.

Conclusions/Discussion
From my project, I conclude that for a more powerful gun, heavier bbs are definitely preferable to the lighter ones. But at close range or with a weaker gun, the lighter ones will have an advantage. For a standard bb though, a .20g bb is a good mix of both.

Summary Statement
My project was to determine how the weight of an airsoft bb affects its scatter on a target and how much it will fall from the gun at a given distance.

Help Received
Dad helped conduct experiment and chart results; Grandpa helped chart results; Mom helped take photos and worked on notebook ; Sister helped take photos; GSDSEF gave helpful advice and tips for science fair; Teacher Mrs. Hubbell helped through whole project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Mariam Iyad Hmoud

Project Number

J0399

Project Title

Safe in a Quake

Abstract

Objectives/Goals

This project tests what height and type of base is best for a building in an earthquake prone area. This project is important for the safety of people who live near a fault. Hopefully this project will be taken into notice by engineers and put into use.

Methods/Materials

Plaster of Paris, Water, Ruler, Pins, Cardboard, Measuring cup, Spoon, Wooden blocks, Bucket, Masking tape, Duct tape, Nails, Metal washers, Rubber washers, Metal wire, Smooth panel board, Sharpie, Jigsaw, Earthquick shake table, Switchblade.

Results

There are mixed results of this experiment. According to the graphs, the five story isolated buildings withstood longer than the fixed base five story buildings. The shorter buildings sway with the motion of the earthquakes and have less damage. The ten story fixed base withstood the sideways shaking better than the isolated ten story buildings. However, the isolated ten story buildings were stronger than the fixed base ten story buildings in up and down shaking. Overall, the safest building was the five story isolated building.

Conclusions/Discussion

The findings of this experiment, disagrees with the hypothesis. The hypothesis was that the taller buildings would withstand the shaking longer. Based upon the results, it was the opposite. The taller buildings were heavy and could not withstand the shaking as the shorter buildings. Shorter buildings are safer to be in during an earthquake than taller buildings. Overall, people should live in shorter, isolated buildings because it is the safest to be in all kinds of earthquakes.

Summary Statement

What is the safest height and base for a building to withstand an earthquake?

Help Received

Mother helped build building models.