CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Adrienne R. Carlson

Project Number
S0201

Project Title
Golf Balls in Motion

Abstract

Objectives/Goals
To determine the mechanical design and performance characteristics of six different golf balls after they have been applied to uniform wear or use.

Methods/Materials
All balls were dropped at a set height (100 inches) using a release tube (to guarantee uniform release). The height of the bounce off of a concrete floor was recorded for each ball, and then repeated five times to get an average height for each ball. All balls were then hit with a 3 wood, fifty times in a golf practice cage. The performance/bounce of each ball was then recorded again. All balls were hit twenty-five more times each. The performance/bounce of each ball was recorded again to see if there was a difference.

Results
Each ball had performance degradation after use. The Top-Flite ball performed the best throughout the entire experiment. Maxfli also performed very well and showed the lowest percentage change in performance after use. The Scott ball was the worst ball overall; it performed the worst at the beginning and had the greatest percentage change after use.

Conclusions/Discussion
"Use" definitely affects the performance of a golf ball. Top-Flite and Maxfli were the best performing golf balls overall. Even though Maxfli performed lower than Top-Flite initially, after extended "use", I believe that Maxfli would be the best ball to use. Therefore, Maxfli has the best overall design.

Summary Statement
My project analyzes the effect on the mechanical and design characteristics of six different brands of golf balls after being subjected to uniform "wear" or "use".

Help Received
My father helped drop the golf balls form the release tube while I measured the performance height. He also helped me hit each golf ball 75 times.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Courtney Carrell; Krystina Meier

Project Number
S0202

Project Title
Cleats: The Traction Action

Abstract

Objectives/Goals
Which number and length of cleats provide the ideal amount of friction to maximize athletic performance?

Methods/Materials
Materials:
Wooden block (25cmx8cmx5cm), 5 wooden dowels (1m long x .5cm diameter), drill and .5 cm drill bit, safety goggles and aprons, spring scale, ruler, grass-dirt surfaces

Methods:
1. On underside of block, drill as many holes as the block can fit.
2. Cut as many 1 cm pieces of dowel as holes on the block.
3. Place one dowel piece in one hole.
4. Drag at constant velocity at measured distance while attached to spring scale.
5. Record spring scale reading; repeat two more times; average.
6. Repeat steps 3-5 adding one more dowel piece each time.
7. Graph results and conclude ideal number of cleats.
8. Cut the ideal number of dowel pieces at .5, .75, 1, 1.25, and 1.5 cm lengths.
9. Place the dowel pieces of one length in the block.
10. Drag block at constant velocity for measured distance while attached to spring scale.
11. Record scale reading, repeat two more times, average.
12. Repeat steps 9-11 for each dowel length.
13. Graph and conclude the ideal lenght of cleats.

Results
# of cleats/coefficient of friction
1/.745
2/.864
3/.852
4/.852
5/.913
6/1.017
7/.962

Summary Statement
We determined the ideal cleat number and length of an athletic cleat through a series of friction measurements.

Help Received
Courtney's father cut the wood, Courtney's grandfather drilled the holes, Mrs. Dimas (physics teacher and project advisor) mentored us, monitored our progress, and gave us the guidlines of a good, winning project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Jason R. Castillo

Project Number
S0203

Project Title
Sphygmomanometers: Are the Home Units as Accurate as the Gold Standard of a BP Reading from a Mercury Sphygmomanometer?

Abstract

Objectives/Goals
My project was to determine the accuracy of home blood pressure monitors when compared against the 'Gold Standard' of a blood pressure reading from a Mercury Sphygmomanometer taken by a physician. In addition, I wanted to determine which of the units was most and least accurate.

Methods/Materials
Informed consent was obtained from 30 randomly selected adults. Each test subject was put through the same testing environment and positioning, three minutes rest between tests, and would be redone if any reading was +/-20 from the Mercury Sphygmomanometer reading. The blood pressure readings taken (in order) was the Mercury Sphygmomanometer reading done on the right arm at the same time the left arm test was done by the Automatic Oscillometric unit and then reversed. The test subject was then tested with the Manual Aneroid, Wrist, and Finger units. All readings were compared against the 'Gold Standard' blood pressure readings and evaluated.

Results
The average percent error of the Automatic, oscillometric device was 4.55%systolic and 2.64% diastolic (right arm, same time), in the left arm/same time was 3.36% systolic and 5.13% diastolic, and same arm/different times was 4.27% systolic and 2.97% diastolic. The Manual Aneroid unit had an average percent error of .540% systolic and 1.19% diastolic. The average percent error for the Wrist Oscillometric unit was 1.45% systolic and 7.64% diastolic while the Finger Oscillometric unit was 11.2% systolic and 7.53% diastolic. Reviewing all readings, the number of readings that were +/-2 from the 'Gold Standard' for both systolic and diastolic were 2 for right arm/same time; 0 for left arm/same time; 3 for right arm/different time; 3 for Manual Aneroid; 2 for Wrist; and 0 for the Finger unit.

Conclusions/Discussion
The Manual Aneroid unit was the most accurate. The Finger Oscillometric unit was most inaccurate. All units had very few readings within +/-2 on both systolic and diastolic from the 'Gold Standard'. These data suggest that manual units must be calibrated and blood pressure readings must be supported by Mercury Sphygmomanometer readings.

Summary Statement
My project is to determine if home blood pressure units are accurate and which of the tested units are the most accurate when compared against the BP reading from a Mercury Sphygmomanometer.

Help Received
Physician took the blood pressure readings with the Mercury Sphygmomanometer to become the 'Gold Standard' for my project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Michael R. Davis

Project Number
S0204

Project Title
The Gauss Rifle: A Magnetic Linear Accelerator

Abstract

Objectives/Goals
My project was to test the effect, on velocities produced, of different magnet spacing on a Gauss Rifle magnetic linear accelerator.

Methods/Materials
I built a magnetic linear accelerator out of a series of magnets and ball bearings. The magnets were secured to a channeled piece of wood, with two ball bearings following each magnet. Using 5 photogates I measured the velocities of the ball bearings after each magnet. After a minimum of eight trials I changed the spacing by two centimeters and repeated the experiment.

Results
By testing spacings between 5 and 13 centimeters I found that the velocities increased as the spacing decreased. As expected the velocity was greater after each magnet, except in the smaller spacings where the velocities after the fourth and fifth magnets were sporadic and significantly slower than the velocity after the third magnet.

Conclusions/Discussion
My experiment was fairly conclusive. However, because of the variations shown after the fourth and fifth magnets, I am going to build another model of the Gauss Rifle. This model would use magnets that are not secured to the wood, instead the magnets would hang above the track from springs. This may allow for better transfer of momentum, and therefore higher velocities.

Summary Statement
Comparing spacings on a Gauss Rifle magnetic linear accelerator.

Help Received
Used lab equipment at Willits High School under the supervision of Mr. Kirkpatrick.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Christine Dempster; Elizabeth Leire

Project Number
S0205

Project Title
Saddle Sore: The Pressure War

Abstract

Objectives/Goals
This project was designed to prove whether a certain types of English saddles are better for a horses back by distributing the riders weight most evenly, and if so, which ones are best.

Methods/Materials
Methods
1.Cut pressure sensitive paper to size and shape of saddle panles
2.Tape pressure paper to saddle panels to prevent paper from slipping
3.Place saddle on horses back and sit for ten seconds.
4.Remove carbon paper layer from pressure paper so as to reveal results
5.Repeat these steps with all twelve saddles reccord and compare results.

Materials
1.Three dressage saddles
2.Three multi-purpose saddles
3.Three close-contact saddles
4.Three air filled saddlees
5.Pressure gauge
6. One square inch metal disc
7.Transparent graphing paper
8.Sharpies
9. Rubbing alcohol
10.Fifteen sheets of 28cmx48cm pressurex sensor film
11.One horse
12.One rider

Results
Air sadles created the least amount of pressure points, followed by the close-contact saddles, then the multi-purpose saddles and finally the dressage saddles, which actually created the most pressure points.

Conclusions/Discussion
The air in the panels of the air saddles moved away from pressure creating an even contact over the horses back. The close contact saddles are light weight and designed to allow the horse to jump (move in vertical direction) as well as doing lateral work (move in horizontal movement). The designer of this saddle

Summary Statement
This project explores the weight distribution and pressure points created on a horse's back by different saddles.

Help Received
Neighbor helped find the most effective way to construct our graphs. Iron Horse Saddlery and Calabasas Saddlery supplied saddles we tested. A friend supplied the pressure gauge.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Carrie M. Garibotti

Project Number
S0206

Project Title
Value Engineering Your Motor Oil

Abstract

Objectives/Goals
To determine if there is a significant difference in the lubricity and longevity of single viscosity motor oils from different manufacturers, and if there is, is improved performance related to increased price.

Methods/Materials
A steel shaft was spun at a constant rpm with a steel friction bar applying a constant pressure. A new shaft and friction bar were used for each test. For each motor oil, a drop of that oil was used to lubricate the shaft, and for each test, the elapsed time until failure was recorded.

Results
There were significant differences in performance ranging from 8 minutes to 23 minutes. The more expensive oils provided longer run times before failure. The longest run time was with "Valvoline Racing" while the shortest was with "Parts Plus". Pennzoil, Valvoline, and Quaker State performed twice as well as "Parts Plus".

Conclusions/Discussion
There is a definite relationship between the cost of an oil and the protection that if will provide your engine. The cheapest oil should be avoided while the most expensive oils are probably not cost effective. The best return on investment is probably received by using moderately priced national brand oils. Definately avoid proprietary oils.

Summary Statement
Does an increase in cost provide and increase in protection?

Help Received
A. David Garibotti (dad)-helped construct the test apparatus.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Craig Harter; Devin Head

Project Number
S0207

Project Title
Can We Recognize Patterns in Steam by Cross Sectioning?

Abstract

Objectives/Goals
The objective of our project is to determine if we can recognize patterns in steam by cross sectioning.

Methods/Materials
The materials and methods used are, aquiring a laser, attatching 2"x2" mirrors around the circumfrance of a fan motor with approximatley a 5" diameter. Display a propane stove on a platform even with the motor. Heat a pot of water until it steams and reflect the laser off the motor/mirrors back through the steam to create plains.

Results
We found that the steam expanded similar to a mushroom cloud with layers swirling outward. The laser projected plains making the steam visible.

Conclusions/Discussion
In conclusion, the differentiating angles of the mirrors as the motor/mirros rotated projected plains in the steam by cross sectioning.

Summary Statement
In our project we took a laser and reflectedit off of rotaing mirrors to record if we could create plains in steam by cross sectioning.

Help Received
We would like to acknowledge our parents for driving us to department stores and helping us to assemble the project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Lynn A. Hiel

Project Number
S0208

Project Title
Thermal/Fire Protection Basics and Applications

Abstract

Objectives/Goals
My project determines if one or more insulating layers will protect a steel rod when heat is present.

Methods/Materials
I did this experiment using 12 straight, pre-measured, steel rods cut to the same length and 18 thin strips of fiberglass dipped in fire protection. I prepared 3 uncoated rods, 3 rods with 1 layer, 3 rods with 2 layers, and 3 rods with 3 layers. Using the testing device, I hung 2000g on each end of the rod and heated the middle using a Bunsen Burner. When the rod yielded 1/8", I stopped my stopwatch and recorded the time. I repeated the entire procedure for the rods covered with 1, 2, and 3 layers of protection.

Results
I found that when heat is present, the steel rod covered by an insulating layer, supported the load for a longer period of time than the uncoated metal rod. Additional layers on the rod increased the amount of time the rod resisted the heat. All these results were graphed and showed the interaction between the rod, layer of fire protection, and time the steel rod could support the load. It was noteworthy that the greatest time gain occurred between the uncoated rod and the rod with 1 layer of protection (430% gain). A second layer showed a relatively small gain (100%). This is interesting from the cost-effectiveness point of view.

Conclusions/Discussion
Since the layer of fire protection prolonged the time the rod could support the load, the results supported my hypothesis. The work in my project has direct applications in space shuttles, skyscrapers, utility poles, and houses, which are all structures that require insulation to protect them from the destruction of a fire.

Summary Statement
My project studies the effect of one, two, or three layers of fire protection on the load carrying capacity of a steel rod.

Help Received
Neighbor helped supply steel, teacher helped formatting report, mother helped taking pictures, father helped during the experiment with the Bunsen Burner.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Cori D. Holmes

Project Number
S0209

Project Title
Perilous Playgrounds: The Physics of Distinguishing Which Playground Surface Material Reduces Force on a Head on Impact

Abstract

Objectives/Goals
The purpose of this experiment was to see which of five playground surfacing materials resulted in the lowest impact force put on a head-form. I wanted the material with the least acceleration because the acceleration varies directly with the force according to Newton's law; so if acceleration is reduced, force will also be reduced.

Methods/Materials
I had six different materials: coarse rubber mulch, fine rubber mulch, wood mulch, sand, gravel, and concrete. I made a head out of twelve layers of pine wood with an accelerometer installed in the middle. Inside the head were lead and steel weights to simulate real head mass. The accelerometer was attached to a computer oscilloscope. From the computer, I read off the acceleration and the time it took to stop.

Results
Impact with the six inches of fine rubber resulted in the lowest acceleration, with an average peak acceleration of about 56g ±4 during testing. The second lowest was the wood mulch with the average peak acceleration of about 77g ±7. Next was the sand at 85g ±15. In fourth was the gravel with an average peak acceleration of about 93 ±30. The coarse rubber was the fifth lowest and had an average peak acceleration of 102g ±12. The material with the highest average peak acceleration was the concrete with 400g ±50.

Conclusions/Discussion
My conclusion is that the six inches of fine rubber would be the safest material to use as a playground safety surfacing. My hypothesis was right. The coarse rubber, sand, gravel,and wood would also be acceptable but concrete would not.

Summary Statement
The purpose of this project is to determine which of six different playground surface materials most reduces the force on a head upon impact.

Help Received
Father owns oscilloscope; Borrowed accelerometer from the Air Force Research Laboratory at Edwards Air Force Base.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Niraj K. Inamdar

Project Number
S0210

Project Title
Conductive Polymers as an Environmentally Safe Commercial and Space Applicable Material

Abstract

Objectives/Goals
Do intrinsically conductive polymers offer a more cost- efficient replacement material in comparison to traditional space and commercial materials, while at the same time performing the same functions, or even a combination of a functions performed by several traditional space applied materials and corrosion preventing materials used currently.

Methods/Materials
The following tests, for this experiment were the following: salt spray testing to determine the anti-corrosive properties of polyaniline (which would both determine its durability on Earth prior to launch, as well as whether polyaniline can be used as a replacement for the harmful hexavalent chrome paint used in modern aircraft to protect corrosion), thermal cycling to determine polyaniline's durability in temperature extremes, and surface resistance testing to verify that this conductive polymer can prevent electrostatic discharge from potentially damaging circuitry and instrumentation within a spacecraft.

Results
The results were as follows: in the salt spray testing, which was performed for one week, polyaniline successfully protected steel and aluminum coupons from oxidization (a finding that was further established this chemical analyzation); in the heat cycling, which alternated for approximately ten hours the temperatures of #100°F and 257°F, the coupons covered with polyaniline were intact (though scanning electron microscope pictures showed minute amounts of the polyaniline had worn off); and surface resistivity testing produced results of a resistance of 10^6 to 10^8 ohms, which fit precisely within the guidelines of commercial satellite specifications.

Conclusions/Discussion
The results of corrosion testing were very promising and as of now, the results point in the right direction for a possible space use of polyaniline, in the future I hope to perform more tests to determine is acceptability as a space applied material: outgassing, more electron microscope analyzations, and solar radiation testing.

Summary Statement
Whether or not conductive polymers are a good substitute for materials used commercially to prevent corrosion as well as in space.

Help Received
Father contacted people to help in testing.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Zachary M. Kirkman

Project Number
S0211

Project Title
Which Two-Stroke Cycle Engine Oil Allows for the Most Power to be Produced?

Abstract

Objectives/Goals
There are three major types of oils; synthetic, castor, and castor-synthetic blend. Each different type of oil has its unique properties; lubrication, power outputs, corrosion protection, cleaning properties, and many more. The goal of this study is to see which type of oil produces the most power.

Methods/Materials
An ATV with a two-stroke engine, will be placed on a dynamometer. The three different variables will then be added, separately, to the gas tank. Each variable will be tested at a different time. After each is tested, the results will be analyzed, and a very precise graph will be printed.

Results
The Maxima Castor 927, a castor-synthetic blend oil produced a maximum of 18.18 rear wheel horsepower. The Bel-Ray MC-1, a fully synthetic produced 20.08 rear wheel horsepower. The Blendzall 460 Green Label Racing Castor, a fully castor oil, produced 22.06 rear wheel horsepower.

Conclusions/Discussion
I hypothesized that the castor-synthetic blend, Maxima 927, would produce the most power. I was wrong. The most power-producing oil was Blendzall 420, the fully castor oil. I believe that this testing solves the heated debate over different oils. People can now have solid information about how different oils perform.

Summary Statement
I am trying to determine which type of two-stroke engine oil allows the engine to produce the maximum amount of power to be produced.

Help Received
Mr. Scott Lampkin, employee at DynaPack USA, operated the dynamometer to test for power

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Amanda M. Marshall

Project Number
S0212

Project Title
How Does Arch Shape Affect Load Carrying Capacity?

Abstract

Objectives/Goals
This project's purpose was to determine how an arch's span/rise ratio affects the maximum load it supports before it fails.

Methods/Materials
To give all arches equal spans (a control), a test stand 30.5 cm wide was built. To create arches with different heights (the independent variable), balsa pieces were cut into ten different lengths. During each test, a balsa piece was bent into an arch and positioned in the stand. A bucket was suspended from the arch, and gravel was added until the arch failed. To calculate the arch's load capacity, the gravel's mass was measured and added to the bucket's mass. After each of the ten arch shapes was tested ten times, load capacities were averaged and compared. Also, written descriptions of arches' failures were compared.

Results
The semicircular arch supported the highest average load. The shallowest and steepest arches became unstable and failed under the lightest loads.

Conclusions/Discussion
The shallower or steeper an arch is, the lighter will be the load it supports before it fails. When extremely shallow arches become unstable, they invert their shape and fail by snapthrough buckling. When steep arches become unstable, their sides behave as pillars do; they collapse to the side and fail by Euler buckling. Semicircular arches support the highest loads because they are least prone to either type of buckling.

Summary Statement
This project studied how an arch's shape affects the maximum load it supports before it fails.

Help Received
Father and family friend helped build test stand.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Rachel N. McKinnon

Project Number
S0213

Project Title
The Effect of Environmental Factors on the Tensile Strength of Kevlar

Abstract

Objectives/Goals
The purpose was to determine what effect (if any) different variables had on Kevlar, the thread used in bulletproof vests. The bulletproof vest is the most importamt article of clothing a police officer wears, and it is vital to know how strong the threads in the vest are. I selected the variables based on how likely it would be that a police officer would experience them.

Methods/Materials
I began my research in December by emailing companies for information and samples of Kevlar. I simulated environmental conditions comparable to those that vests would be exposed to in real life situations. I tested a total of fifty strands of thread, ten per variable. After a twenty-hour period I tested the tensile strength to measure the deviation.

Results
The variable that had the strongest effect on Kevlar was UV exposure. The second most potent variable was freezing temperatures (approximately 30 degrees Fahrenheit). I found this very interesting, because bulletproof vests come into contact with both of these conditions often.

Conclusions/Discussion
A bulletproof vest is not truly bulletproof, only bullet resistant. Kevlar has revolutionized the body armor industry, but it still carries many flaws. If a thread is going to suffer a notable loss in its tensile strength from common conditions like sunlight and freezing temperatures, how reliable is the vest? Yes, the new vests do provide an amazing second chance for life, but police departments cannot always afford to replace vests as frequently as needed. This raises the question, if a vest is not stored in the recommended conditions, can it lsat the 10 years it is meant to? Until future technology develops a thread better resistant to conditions such as sunlight and freezing temperatures, making police departments more aware of the risk their vests are at is the only alternative.

Summary Statement
To determine what effect environmental variables had on Kevlar.

Help Received
Borrowed Equipment from science teacher

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kurt A. Miller

Project Number
S0214

Project Title
Surf Wax Friction

Abstract

Objectives/Goals

A problem that most surfers have is what surf wax they should use and which wax performs the best. In acknowledging this problem, I decided to test multiple waxes to determine which one performs the best under different conditions. I decided that I should test Sex Wax, Terra Wax, and Sticky Bumps as these surf waxes are the most popular in San Diego. The wax that performs the best should enable the surfer to perform sharp maneuvers on the board's side without allowing any slippage or loss of grip. Understanding this, I decided to test the height at which the foot could remain suspended without slipping down the face of the waxed board.

Methods/Materials

I defined the best performing wax by the condition that yielded the greatest height at which the "foot" was able to stay suspended without slipping. During each trial, there were some variables that might have effected the performance. The temperature of the air was 62 degrees Fahrenheit and the humidity was around 80%. The weather conditions may have effected the performance of each wax. After testing the waxes multiple times, each wax showed smoothing of the surface of the wax from repeated use. The only reason that the wax performance may have been different under wet and dry conditions was the wax gradually began to get smoother.

Results

Based on the product test, if I were to choose a surf wax, it would be Terra Wax. I would choose Terra Wax for multiple reasons. Terra Wax has treeless paper for its wrapper, which biodegrades quickly, is non-toxic and doesn't hurt the environment. Terra Wax performed best in my test as well.

Conclusions/Discussion

After collecting and analyzing the data, I conclude that wax B-Terra Wax, out performed wax A-Sex Wax and wax C-Sticky Bumps. Terra Wax out performed the two other waxes by achieving the highest average height of the board before slippage occurred. In the actual surfing environment, this result would correlate to better adherence of the surfer's foot to the board in conditions of steeper angles.

After testing, I have determined that my hypothesis was incorrect. I found that Terra Wax achieved the highest average height before the weight began to slip compared to Sex Wax and Sticky Bumps. Terra Wax also is the most versatile wax because it performs well in all types of water conditions.

Summary Statement

Project is about comparing surf wax friction

Help Received

Advice from Vic Miller

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Brian J. Mills

Project Number
S0215

Project Title
Practicality of Linear Magnetic Acceleration

Abstract

Objectives/Goals
How fast, using my own design, can I accelerate a steel ball bearing using only permanent magnets?

Methods/Materials
For this experiment I used Neodymium-core magnets of equal strength, steel ball bearings, and a length of PVC pipe.
To measure the strength of the magnets, a steel ball bearing was glued to the top of a wooden dowel and ballast was attached to the bottom of the dowel. This was placed atop a weight scale and the magnet was slowly lowered to the ball, and the difference in weight due to the magnet's pull was recorded

Results
The most effective design was the Internet standard of one magnet in the barrel. The runner-up was my original "Quad" design, followed by my "Alternating Quad" design.

Conclusions/Discussion
Surprisingly, the single magnet in the direct path of the ball bearing was more effective than four magnets closely spaced around the periphery of the barrel. Presumably this is due to interference from the closely spaced magnets' magnetic fields.

Summary Statement
I am comparing the efficiency of my Gauss accelerator to a design discovered on the Internet.

Help Received
My father helped me to measure the strengths of the different design configurations.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Rachel G. Robertson

Project Number
S0216

Project Title
Can Recyclable Plastics Make Asphalt Stronger?

Abstract

Objectives/Goals
The purpose of this experiment was to study whether combining household Recyclable Plastics #1-7 as an additive in asphalt would improve the strength of asphalt.

Methods/Materials
Two experiments were performed to test this: a tension test to determine its plasticity and strength and a torsion test to determine its ability to withstand rotational strain.

Results
The tension test showed that the addition of plastic to asphalt usually results in a significant reduction in its plasticity. At the same time, there is a significant increase in the overall strength or resistance to deformation of the plastic- asphalt mix when compared to plain asphalt. The torsion test revealed that while the addition of most plastics results in reduced ability to withstand rotational strain, plastic #1 showed a significant increase in the that ability.

Conclusions/Discussion
According to my findings in the tension test, I conclude that asphalt is stronger by mixing Plastic #4 or Plastic #5 with it. Mixing Plastics # 1,2,4, and #6 with asphalt does not make the asphalt stronger.I can however conclude that a that the above asphalt plastic mixture cited will make a stronger, more flexible road. The benefits of a stronger asphalt would be most useful in a hot region.The addition of Plastic #1 (Polyethylene terephthalate) actually results in a significant increase in that ability

Summary Statement
The purpose of this experiment was to study whether combining household Recyclable Plastics #1-7 as an additive in asphalt would improve the strength of asphalt.

Help Received
Professor Carl Monismith helped by providing asphalt materials and equipment. Chinese Christian Schools provided both the facilities and the equipment for some experimental work. My Dad and Mom, Don and Krista Robertson helped with their ideas, stimulating discussions, and time devoted to the

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kenny Sharma

Project Number
S0217

Project Title
Artificially Replicated Movement (ARM)

Abstract

Objectives/Goals
The purpose of ARM was to create an effective system that could handle materials without a direct user interface. The user would be free to be in a remote location during use.

Methods/Materials
The equipment used in this project is divided into several parts. The actual arm consists of dc motors, plastic gears, plastic rods and beams, several screw mounts for the motors, and electrical wire. The base of the project consists of two plastic sheets, plastic cubes, an on/off button, and several terminals for the motor power connections. The driving system consists of a solder-less breadboard, a power supply, a db-25 cable, a db-25 connector, and the power posts. The board has an octal buffer and several alternating PNP and NPN transistors.

The procedures of this experiment were simply to construct the components of the experiment. The breadboard had to be built from the various transistors and jumpers. The base was constructed out of plastic cement and the pieces of plastic. The power terminals were drilled into the frame and led out. The leads from the power supply were lead to the motors resting on the limb. The limb itself was made by using plastic rods to act as axels. The axels allowed from the shoulder and elbow rotation. The hand was constructed by simple mounting a plastic rod onto a rotating gear. The power leads were connected to the power switch and all of the other wiring was completed.

Results
The results of this experiment show the system was effective at a distance. The system was able to respond quickly at a distance. The data shows there was only a slight delay between command file transfer.

Conclusions/Discussion
The results of this experiment sucessfully completed what the project was intended to do. It also taught me the basics of robotics and some fundamental techniques. It was a learning experience and a success.

Summary Statement
ARM is a system designed to handle materials without a direct user interface.

Help Received
Father helped to drill holes

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Andrew D. Thompson

Project Number
S0218

Project Title
Robotics

Abstract

Objectives/Goals

I. Purpose: Can a rover simulator consistently climb over objects that are as big as it self.

II. Hypothesis: I predict that 75% of the time, the rover simulator can climb an object equivalent to its own size. (Rover)

Methods/Materials

III. Methods and Materials: Light weight wheels, three motors (8 AA batteries), and a variety of K#nex pieces.

Methods: Design 1: The body was too long and when it tried to climb it got stuck on the top of an object.

Design 2: I took a shorter piece of K'nex and it would climb very well but it would sometimes have a hard time.

Design 3: I attached two more motors to the rover but it could not climb because the design of two motors on one set of wheels was not working together.

Design 4: I tried moving the motors from being one in the front to one in the middle and one in the back. This is the design that worked best.

Design 5: I tried the first motor in low gear so all three motors were in the same gear.

Design 6: I tried to move the wheels into different positions on the rover. It did not work.

In the end I decided to work with design 4.

Results

I have come to the conclusion that my rover can successfully climb rocks that are as tall as its own size (6in) 80% of the time. As the rock size increases the success rate decreases slightly with the exception of

Summary Statement

Robotics is similar to Mars Exploration Rover (MER) that is launching this summer, and I created and tested an original rover on my own.

Help Received

My mom helped me with my board and edited my spelling.