CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Sara Broyles; Sophia Mao; Lindsay Runnels

Project Number

J1801

Project Title

Earthquake Resistant Architectural Design

Abstract

Objectives/Goals

The purpose of our project was to find out what shaped structure resisted earthquakes most successfully.

Methods/Materials

First we built a shake table using plywood, springs, a small motor, and batteries. Next we built structures in the shapes of L, T, U, and square out of sugar cubes and peanut butter. We then tested the structures on our shake table. We graphed the data and prepared our backboard and report.

Results

The square-shaped structure withstood the simulated earthquake most successfully. The t-shaped structure performed the worst. The L-shaped collapsed from top to bottom, leaving a pyramid-type ruin standing. The U-shaped building failed at the bend, falling outward. The T-shaped building interestingly was the only structure to collapse inward.

The square structure seemed to take the shaking force and distribute it equally throughout the building, making the structure more resilient to the shaking.

Conclusions/Discussion

Our hypothesis was that the square shaped structure would perform the best in a simulated earthquake. The results indicate that this hypothesis was correct.

Summary Statement

By using a shake table, we determined which shaped structure could withstand an earthquake most successfully.

Help Received

Mother helped type report; Father supervised building of the shake table.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Evelyn Chang

Project Number
J1802

Project Title
Earthquake: Building Destroyer

Abstract

Objectives/Goals
The objective of my project was to see how the different modes of earthquake effect the damage suffered by the building. I predicted that the combination movement will cause the most damage because the building is suffering from two movements at the same time.

Methods/Materials
*Materials:clay,thin cardboard,toothpicks,foam board,6 springs,2 hold-downs,block of wood,2 large cardboard,marbles,100cm wire,6 nails;2 thin,2 thick

*Procedures:For the building,I used the clay as the columns the thin cardboard as the roof and the toothpicks as reinforcement against collapsing. I build the building on a foam board and connected the board to the springs which are then connected to the block of wood.The whole contraption would then be placed on a large cardboard with marbles to prevent friction. During the experiment, I traced the building before I shook it.Then, I pull the board 7 cm back and let go. Finally, I trace the shaken building and record the distance in mm between the original position and the shaken position. For the combination movement, I would remove the building contraption from the large cardboard and place it on 4 springs attached vertically to another cardboard. During this experiment, I would pull the building back 7 cm and push the building down by4 cm and record my results the results as I did for the horizontal movement. For the vertical, I would simply cut off the horizontal springs and press the board down by 4 cm and record my results the way I did for the previous experiments.

Results
In the horizontal movement, I noticed that the building tilted to the side every time. In the vertical movement, the building did not tilt to the side as much as the horizontal movement, but I noticed a 0.5 mm to 2 mm large gap between the column of the building and the roof. In the combination movement, I did not see as much lateral damage as I did in the horizontal movement, but I noticed a 5 - 27 degrees large twist in the building.

Conclusions/Discussion
The data supported as well as opposed my prediction. It supported my prediction by showing a twist in the building, which could cause more damage than a regular horizontal movement earthquake in reality. However, it opposed my prediction because it did not show the most lateral damage. For my data, I was recording and measuring the lateral damage. I conclude that each movement causes their own damage and therefore could not exactly be compared.

Summary Statement
My project is about the different seismic waves and how they effect a building shaken by it.

Help Received
father helped set-up the shake table, mother helped me with my backboard

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Kelly A. Dudek

Project Number
J1803

Project Title
The Change in Diameters and Its Effect on the Stability of a Dome

Abstract

Objectives/Goals
In my project I started by asking if the diameter of a dome changed, would it affect the stability of that dome. For my testing I used balsa wood and bent it into an arch with a height of ten centimeters. (I tested arches because I did not know a way to built and measure the deflection of a dome and because a dome is an arch rotated on all its axis, I could use the information for domes as well as arches.) I did not have a formula for how much board to cut to have x diameter, so I just measured different board lengths, but if the board length was different and the height remained the same, then the diameter would be different. I tested three 60, 50, and 40cm arches.

Methods/Materials
For my testing I put sack weights on each arch and measured the deflection at each increment of weight. When weight is put on top of an arch or domes the top, where the weight is applied. Sinks down and the sides bulge out, this is called deflection, and this is what I measured to see how stable the dome/arch was. I used the information gathered for three separate tests, the first test being #Weight at which arch broke#, the second test being #Weight of first deflection# and the third test being #Deflection at 1.4 Kg#. I found that overall the arch with the board length of 50cm performed the best, so I concluded that there must be a ratio between the perimeter and height of the arch. The materials I used was balsa wood, an exacto knife, hot glue, and sack weights.

Results
I then continued to find that ratio. To do that I tested a 70cm arch with the same height just to make sure that the 50cm arch was the most stable for a 10cm height; and it was. I then used that ratio of 1:5 for height to perimeter and applied it to others arches with different board lengths. Once I had the arches with the applied ratio I had to prove that that ratio was the correct ratio so I tested the arches with the applied ratio, and arches with the same board length but a different height as the original, and arches with the same height but different board lengths. I then did the same tests as the original arches. Out of the nine extra tests only in two tests the arch with the applied ratio not perform the best.

Conclusions/Discussion
I conclude that the ratio of height to perimeter for the strongest dome/arch possible is 1:5.

Summary Statement
My project is about finding a way to built the most stable dome possible.

Help Received
My math teacher, who is a former civil engineer, helped me brainstorm on ho to built my test.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Paige E. Farrell

Project Number
J1804

Project Title
Which Truss Do You Trust?

Abstract

Objectives/Goals
Objective: The objective of this project is to evaluate which truss bridge design will hold more weight, the Pratt or the Warren design. My hypothesis is that if I put weight on two model bridges, one constructed as a Warren truss bridge and the other built as a Pratt truss bridge, then the Pratt truss will hold the most weight. I think the Pratt truss will hold more weight based on research I did which said it was stronger and because the Pratt model has more trusses on it.

Methods/Materials
Materials and Methods: The first step I did for this project was to research truss bridges and collect materials including popsicle sticks, balsa wood, glue and clamps. Using these materials I constructed trusses 24 inches long based on two different designs. Next I connected two of the same trusses one popsicle stick apart and glued a two foot piece of balsa wood in the middle of the trusses making the bridge platform. Then I piled two stacks of books the same height, put a bridge on top of the two stacks so that there was one inch of each end of the bridge on each of the two stacks. Finally I put weights on the middle of the span for each bridge. Using a digital camera, I took pictures of every addition of weight and collected my data.

Results
Result: The results of my experiment support my hypothesis that the Pratt design would be stronger then the Warren design. The Pratt design held sixteen more pounds before it collapsed then the Warren did. The Pratt held forty-two pounds compared to the Warren which held twenty-six before collapsing.

Conclusions/Discussion
Conclusion: My conclusion is that the Pratt truss held more weight then the Warren truss because the Pratt design has more trusses. This makes it better able to withstand additional stress.

Summary Statement
Two model truss bridges, one built as a Pratt truss the other built as a Warren truss, were compared to see which one could withstand the most weight.

Help Received
Dad helped purchase materials and supervised construction; Mom proofed my final content.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Sean B. Fennell

Project Number
J1805

Project Title
Kitchen Surfaces: Which Is Most Durable, Granite or Marble?

Abstract

Objectives/Goals
The objective is to determine which rock granite or marble will be most durable for kitchen surfaces.

Methods/Materials
Having obtained samples of granite and marble their durability was tested and measured at Testing Services and Inspection (T.S.I.) Company. Using the Tinus Olsen Test Machine, sixteen tests were performed. By comparing and measuring equal amounts of granite and marble it was determined which rock would width stand the most pressure.

Results
At a thickness of .813 inches marble and granite slabs were tested for resistance. Weight used from 600 lbs., to 80,000 lbs of pressure on a Tinus Olsen Testing Machine.

On the #point load# test granite and marble proved to be of equal resistance. However, on the #full support# test and the #cantilever test# granite proved the more resistant in 100% of trials.

Conclusions/Discussion
My conclusion is that granite is more durable for kitchen surfaces rather than marble from tests performed on the Tinus Olsen Testing Machine.

Summary Statement
Granite or Marble - Which is Most Durable for Kitchen Surfaces?

Help Received
Gino Russo gave samples; Juan Diaz owner of testing laboratory; Mother, Father, and Teacher.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Omar K. Habbal

Project Number
J1806

Project Title
Which Earthquake-Resistant Building Technique Works the Best?

Abstract

Objectives/Goals
The purpose for this project was to find the best way to keep buildings safest during an earthquake. Since a major earthquake is expected in Southern California, we have to prepare for the worst. Building designers already use techniques to help buildings withstand an earthquake,however, they do not know which one will perform the best during an earthquake. This experiment will test three techniques in an earthquake simulator. The first is the rubber foundation technique. The second is the Damper technique, and the third was my own invention, the Ball Bearing technique.

Methods/Materials
I first constructed the earthquake simulator. To do this, I built a peg board with 4 pegs, each 15 inches apart. I then constructed the three model buildings and applied a technique and weights on each of them. Then, I conducted the experiment. I placed the building inside the earthquake simulator and pulled the rubber band to the 5 cm. line. I pulled the rubber band 1 cm. farther every 5 seconds. I recorded the times they stood standing and how far the rubber band was able to go before the building fell over. I conducted 5 trials.

Results
My results were very surprising. The Rubber Foundation technique stood for an average time of 37 seconds, and the rubber band was able to be pulled to the 13 cm. line. The Damper Technique only stood for an average time of only 29 seconds and the rubber band was able to be pulled to the 11cm. line. My invention, the ball bearing technique, lasted for an average time of 1 minute, 9 seconds and the rubber band was able to be pulled all the way to the 21 cm. line!

Conclusions/Discussion
I have concluded that the Ball Bearing technique was able to withstand an earthquake almost twice as powerful than the Rubber Foundation, or the Damper technique could withstand. Some day in the future, building designers might use my invention to ensure that everyone will remian safe during a major earthquake.

Summary Statement
This project was conducted to find out the best way to make buildings earthquake resistant

Help Received
My dad helped to make the earthquake simulator and purchased the needed materials

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Chase D. Hagen

Project Number
J1807

Project Title
Optitum Foundation Design for Model Houses Undergoing an Earthquake

Abstract

Objectives/Goals
Find what type of house foundation:rubber, coil, or cement will absorbe the shock givin off by an earthquake and survive in the best strucutural condition.

Methods/Materials
Earthquake Simulator from company Pitsco that follows the Rictor scale . 4 model houses,4 foundations, power tools, nails, ect.

Results
Rubber foundation absorbed earthquake shock and remained in perfect structural condition.

Conclusions/Discussion
Earthquake simulator has flaws at the higher settings.

Summary Statement
Testing model houses with different foundations on an earthquake simulator

Help Received
Dad helped use power tools and edit video.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Clinton L. Hatayama

Project Number
J1808

Project Title
The Effects of Nonbiodegradable Plastic on Concrete Cracking

Abstract

Objectives/Goals
The goal of my project was to see if nonbiodegradable plastic had an effect on the cracking of concrete.

Methods/Materials
I had 54 concrete bricks made and tested. The plastics I tested were plastic #4 and plastic #6. I had 18 trials for each variable. Nine blocks of each variable went in the oven to reach an internal temperature of 125 degrees and the other nine went into the freezer to reach an internal temperature of 32 degrees. The 27 blocks that went into the oven were immediately pulled out and 32, 60, and 80 degrees water was poured on the blocks. For each temperature there were three blocks from each variable. The 27 that went into the freezer were taken out and 60, 80, and boiling water were poured over three blocks from each variable. Then I recorded my results.

Results
After all my results were recorded I found no results. None of the concrete cracked during the extreme temperature change. So I decided to go further and do another experiment. I decided to drop the bricks from seven feet and see how many broken pieces there were and I also recorded the biggest piece out of each variable. The results of my second test were: the control had an average of 1.7 cracks per block, the concrete with Plastic # 4 was 4.6 per block, and the concrete with the Plastic #6 was 2.5 cracks per block.

Conclusions/Discussion
In conclusion the control did the best with a low number of cracks. This states that even though the plastic was being put to good use the concrete still cracked more. This suggests that the plastic could be added to the concrete in small unimportant areas, like a sidewalk, so the plastic wouldn't have to go to any of the landfills.

Summary Statement
My project is about the effect of nonbiodegradable plastic on the cracking of concrete.

Help Received
Mother helped type report; Parents bought materials.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Robert A. Hays

Project Number
J1809

Project Title
Structures Put to the Test: The Effects of Seismic Activity on Different Types of Buildings

Abstract

Objectives/Goals
The goal of my project is to determine which structure; a dome, 3-Sided pyramid, 4-Sided pyramid, or standard square structure; is strongest in an earthquake simulation.

Methods/Materials
Specially Cut Toothpicks,Oil-Based Clay,Electric Drill, Piece of Thin Plywood,Large Piece of Wood,Wire Coat Hanger,Threaded Metal Rod for Motor Shaft,2 blocks of wood taller than the height of the motor shaft above the base once attached to drill,4 blocks of wood to support rails,Thin wooden disk with holes drilled in it,Washers to space wooden disk from second block of wood and to space coat hanger wire from wooden disk,Screw to put in wooden disk,Nuts to hold screw to wooden disk and to hold wooden disk to motor shaft,2 plastic tubes,Two metal rails that fit through the plastic tubes and allow the tubes to slide back and forth,Small block of wood with screw in it,Hot-Glue Gun, Wrench, Something to lubricate the rails with,Digital Camera,Stop Watch,Pen,Composition Book,Duct Tape,Wood Glue

Results
I built three of each structure and so conducted three trials of each structure. The 4-Sided Pyramid ended up being the strongest, the square structure came closely behind it, the 3-Sided pyramid was third strongest, and the dome's strength was separated from the other three structures by a good distance, making it the weakest.

Conclusions/Discussion
My results do not support my hypothesis because I thought the dome would be the strongest structure, and it ended up being the weakest. One pattern I noticed was that the structures with bases that had four sides were the strongest structures. Also, almost all the structures broke around stages 9 and 10. I learned that the structure that most houses are made of (square) is a good choice because it is very strong, and is a practical shape for construction. Two possible sources of error are that each of the 3 constructions of each structure could have been built differently, and the dome might not have been built well, resulting in it not being very strong.

Summary Statement
My project determines which structure; 3-Sided Pyramid, 4-Sided pyramid, dome, or standard square structure; is strongest.

Help Received
My dad helped me build the shake table, which I used to test the structures' strengths.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Hitomi N. Heap-Baldwin

Project Number
J1810

Project Title
Which Truss?

Abstract

Objectives/Goals
For my science fair project, I decided to test different roof trusses and come to a conclusion of which one can hold the most weight. I chose five roof trusses (kingpost, queen truss, fink truss, raised heel truss, gable truss) to test. They are all made out of spruce wood, using balsa wood to make the gussets. When I had finished making all the trusses, I created what I called the #gweight-tester#h. It is a device made out of pine wood, that holds the truss up. I would put the weight-tester over two sturdy objects that were about a foot apart, and then place a truss into it. I would tie twine string in the appropriate places so that bricks were able to hang from the bottom. I started by adding 6 lb. 10 oz. bricks because I figured that they were all capable of holding that amount of weight. I would then add up to 2 lb. increments. Once the truss broke, I would record the amount of weight it held and I would continue with another truss.

Methods/Materials
1. spruce wood 2. balsa wood 3. pine wood 4. wood glue 5. twine string 6.bricks of different weights 7. scotch tape 8. two sturdy objects of equal height

Results
When my testing was done, I discovered that the queen truss held the most. This was different than my hypotheses which said that I thought the gable truss would hold the most because it was made with the most materials. The order of strength from most strength to least strength is as follows: 1. queen truss, 2. gable truss, 3. raised heel truss, 4. fink truss, 5. kingpost. After the queen truss, everything gets weaker as fewer materials were used in creating it. I found this odd because the queen truss uses the least amount of materials after the kinpost, yet it was the strongest.

Conclusions/Discussion
I think my results are the way they are because of the way the weight is distributed throughout the truss. There was a vertical post as well as two angular posts which could help with the arrangement of stress on certain points. The amount of tension and compression in a truss have a lot to do with the arrangement of posts. Although my hypotheses was incorrect, I was amazed by my results and I think it would be interesting to try different types of roof trusses.

Summary Statement
Which roof truss design will support the most weight?

Help Received
Father taught me how to use power tools

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Stefan E. Karlsson

Project Number
J1811

Project Title
Earthquakes: Lifting, Shifting, and Retrofitting. Strengthening Structures for Seismic Activity

Abstract

Objectives/Goals
My objective was to subject buildings to a simulated earthquake on a shake table to understand three important factors which determine the amount of earthquake damage: (1) The strength and durability of the construction material used; (2) retrofitting of the building; and (3) the composition of the foundation soil and how liquefaction determines the amount of earthquake damage.

Methods/Materials
I conducted six experiments. The first three were pre-experiments and included tests as to: (1) - (3) Understanding seismic waves including Tsunami waves; testing the strength of different construction materials; and , Liquefaction in soil. The three main experiments included : (1) Testing towers made of three different materials on a shake table, (2) Testing retrofitted towers, and (3) Testing towers in different soils to study soil liquefaction. The tests used a point system to measure simulated injury and loss of life and earthquake damage.

Results
With my main experiments I observed that the metal tower had the best result with the least amount of earthquake damage. The wood had the second best result followed by the plastic tower. Second, when I added retrofitting to the towers all of the results improved with less damage and injury. Finally, the towers tested in loose soil had the most damage with the liquefaction test and damage increased as water content increased.

Conclusions/Discussion
The metal tower had the best result with the least amount of damage and injury because metal is a strong building material. Retrofitting can help save lives and minimize earthquake damage. I observed that when the soil is loose and wet it can cause more damage to buildings. Buildings should be built on stable soil with metal and wood and retrofitted in earthquake prone areas.

Summary Statement
An examination of the devastation of earthquakes and how to minimize damage, injury and loss of life as to three main factors: (1) the type of construction material, (2) retrofitting and strengthening of buildings, (3) and liquefaction of

Help Received
Mother and father provided some help in the layout. Father typed some portions of the report and helped build the shake table and towers.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Elizabeth H. Koo

Project Number
J1812

Project Title
Best Balancing Beam

Abstract

Objectives/Goals
I am trying to find out what shape has the least deflection using three pieces of lumber each 12 ft. long.

Methods/Materials
The materials are 3 pieces of lumber each 12 ft. long, measuring tape, Two concrete blocks, and screws.
METHOD
1. First, I screw the lumber together to make a shape.
2.I will measure what are the inches before my dad stands on the beam. This number will stand for "A".
3. Then, my dad would get on the beam.
4. I will measure how much it deflects ten times on each shape. That number will stand for "B".
5. I will do the same with the other shapes.
6. I will take the average for "B" and minus it from "A".
7. That number will be the deflection for the shape.
8. The most stable and rigid balancing beam will be the one with the least deflection.

Results
I found out that the I shape deflected the less; only 1/16 of and inch. THe worst shape were the three flat pieces. It deflected 4 6/16 of an inch.

Conclusions/Discussion
Screw helps the beam to deflect less because it makes the beam work as a single component. The point is, it is not what the material is but how i use it makes the difference.

Summary Statement
It is about using three pieces of lumber each 12 ft. long to makes a shape to see which one has the least deflection.

Help Received
My dad took me to Lowe's to buy the materials and helped me screw the shapes together. My mom helped me with my board.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Rebecca S. Lim

Project Number
J1813

Project Title
Glue Mania: Adhesive Bonding Efficiency Testing

Abstract

Objectives/Goals
Objective-to find the components that lead to a successful bond,and from the data be able to find out the strongest and most effective adhesive.Purpose-to find the most efficient way to bond substrates, the components that lead to a successful bond, and find the best adhesive product.
Hypothesis-Epoxy will be the strongest and longest lasting glue because it is known to be one of the most strongest household glues,can also cure all types of substrate surfaces in 90 seconds-1 hr.,and is very effective and quick.

Methods/Materials
I have 40 Substrates(8 each):glass,paper/cardboard,aluminum,wood,plastic,4 different types of adhesives or glues: Epoxy, KrazyGlue, Carpenter Wood Glue, and Rubber Cement,8+weights-water cans, 1 Bucket1lb,20Clothespins,wooden-frame post;1+metal hooks,1lb scale
Procedures: A.Produce a frame out of long wooden beams and form a rectangular post;B.Screw in metal hooks to the top of post;C.Get two substrates and create a simple lap joint by bonding two same substrates with each adhesive.(clean the surface);D.Label substrates,and clothespin the area bonded-wait for 4 hours.;E.Make two holes on ends of substrate and hang it from the metal wire on the post;F.On the other end hang a bucket of 1lb.and place weights on carefully;G.Wait until the bond breaks by tallying the results

Results
Testing at home proved unsuccessful because only 7 specimens were able to break their bond.I have about over 200-300lbs of weights but the bond in all the substrates will not break.Due to danger I sent the remaining 13 substrates to a company that I have connection with.Home test results in, epoxy, carpenter wood, and krazy glue (¼inchlap shear)reached over 35 lbs of weights. Highest RESULTS-single overlap shear joint for Krazy Glue Aluminum weighed 675.70 lbs.

Conclusions/Discussion
Depending on the substrate surface and strength of adhesive, the bond will hold the most and never fall apart. Although my hypothesis failed, this testing proved that even the most commonly used craft glues(Krazy Glue)is stronger than Epoxy. How do I find the components that lead to a successful bond and be capable of making it secure while under a large amount of pressure?the adhesive, substrate, and surface pretreatment factors greatly impact the length of a bond's service time and using the right amount of glue and applying the right glue to the proper surface was the key to a secure bond.

Summary Statement
To find the most efficient way to bond substrates, the components or factors that lead to a successful bond, find the best adhesive product, and find how this project will benefit others and our current society.

Help Received
Jimmy Quevedo helped provide information and suggestions; Martin Silva helped send pictures of machines; Inocencio Narez helped provide pamphlets; Used lab equipment or machines at Huntsman Advanced Materials Inc. in Los Angeles; Dad helped build framelike testing device.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Priscilla Y. Lok

Project Number
J1814

Project Title
A Matter of Glues

Abstract

Objectives/Goals
The purpose of my experiment was to find out if Super Glue, Tacky Glue, Krazy Glue, Elmer's White Glue, or Wood Glue worked best on wood, and if sanding the wood surface before gluing would help the glue stick better.

Methods/Materials
First, I obtained commonly used commercial brand glues including Super Glue, Elmer's White Glue, Wood Glue, Tacky Glue, and Krazy Glue. With five pairs of chopsticks for each type of glue, I glued the end parts overlapping each other at three centimeters length and let them dry for a week. Before I glued the other five pairs of chopsticks, I sanded off a layer of wood on each chopstick and then glued them in the same following manner. After a week, I attached the glued pairs of chopsticks on a bench so that the end of one chopstick was against the edge of the bench and a helper holding down the chopsticks to insure that the chopsticks did not move. I attached a bucket to the chopstick against the edge of the bench at eight centimeters length and gradually started pouring sand into the bucket until the bonding of the glue breaks. I repeated the same process with remaining chopsticks.

Results
Two types of Statistical Analysis were used to determine if there was a significant difference between each type of glue. Analysis of Variance was used to determine if there was a significant difference between each type of glues. There was a significant difference between every type of glues except Wood and Krazy glue in the sanded and non-sanded results. The t-test was used to compare the sanded and non-sanded results for each type of glue. There was a significant difference in Super and Elmer Glue results but no significant difference in the Wood and Krazy glue. Tacky glue was hard to determine because almost all the chopsticks broke in the non-bonded area.

Conclusions/Discussion
In conclusion, my hypothesis that Super Glue would be the strongest glue whereas Elmer's Glue would be the weakest glue was not supported. Although Elmer's Glue was the weakest glue in the sanded results, Super Glue was the weakest Glue in the non-sanded results and Tacky Glue was the strongest glue overall. My project expands the knowledge of chemistry because it demonstrates some factors that can affect how well a glue sticks to a surface such as the roughness of the surface of the wood.

Summary Statement
My project is about trying to find out which of the commercial brand glues works best on wood and if sanding the wood would help the glue stick better than just instantly sticking the wood together.

Help Received
Friend helped to fasten chopsticks onto bench; Instructor helped me learn mathematical formulas of statisical analysis

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Stephen T. Michal

Project Number
J1815

Project Title
Don't Be Blown Away: The Effect of Wind Pressure on Different Building Shapes

Abstract

Objectives/Goals
The objective is to determine which building shape is least affected by wind

Methods/Materials
Three buildings were built with K#nex containing the same volume but with different shapes (triangular, square, and circular) and covered with paper. Using a blow dryer as a wind source, wind pressure measurements were taken at 10 cm intervals beginning at 100 cm and ending at 0 cm. The pressure was measured with a 100 sq cm sail pressing against an electronic scale. Each building was then tested at the same 10 cm intervals measured before. If the building fell over from the wind force, the distance from the blow dryer was noted. If the building didn#t fall over, the distance of zero was recorded. The square and triangular shaped buildings were tested on both a flat side and an edge.

Results
The triangular building never fell in any test. The square building fell when the blow dryer was at 20 cm while blowing against an edge and at 40 cm when blowing against a flat side. The circular building fell 20 cm from the blow dryer.

Conclusions/Discussion
The triangular building can stand up to the most wind pressure. Perhaps people in hurricane-prone areas, such as Florida, should build triangular buildings.

Summary Statement
My project is about comparing building shapes and how they are affected by wind pressure.

Help Received
Interviewed local civil engineer for wind load research and formula; father operated blow dryer during tests; used electronic scale from father#s company

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Maxwell M. Mileck

Project Number
J1816

Project Title
Over or Under

Abstract

Objectives/Goals
The goal is to determine whether an overhead Warren truss bridge or an underhead Warren truss bridge is capable of holding more weight.

Methods/Materials
Aircraft grade western spruce and three-ply plywood were used to construct four identical Warren trusses. Two of the trusses were tested upright and two were tested upside down. Bricks were applied evenly on the bridges until they collapsed.

Results
The overhead truss bridges held more weight than the underhead truss bridges. The first overhead truss held 225.5 pounds and the second held 258.5 pounds. The first underhead truss held 181.5 pounds and the second held 214.5 pounds.

Conclusions/Discussion
The research conducted on this subject showed that the underhead Warren truss bridge should have held more weight, but the tests results showed that the overhead truss bridge consistently held 44 pounds more than the underhead truss. The results were suprising but gave an obvious answer to the question: the overhead Warren truss bridge can hold more weight than the underhead Warren truss bridge.

Summary Statement
I set out to discover whether an overhead Warren truss bridge or an underhead Warren truss bridge could hold more weight.

Help Received
Father supplied construction materials and gave advise on contruction of bridges.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Nick L. Okita

Project Number
J1817

Project Title
The Effects of Length on the Strength of a Beam

Abstract

Objectives/Goals
To determine whether length has an effect on the weight a beam can support when tested in the form of a simple, free-ended beam bridge.

Methods/Materials
Bamboo skewers were weighted down by pre-measured rocks until the load broke the skewer. Twenty skewers were tested at each span length of six inches, four inches, and two inches. A bucket hung from the center of the skewer and held the weights. Increments of weights were added based on sample tests and deflection observations. At prescribed increments, the deflection was recorded. A total of seventy tests were conducted.

Results
The maximum weight of the two inch beam was four times stronger than the six inch beam and two times as strong as the four inch beam. As the length of the span decreases the weight increases at a constant rate. Furthermore, the deflection at each length was proportional to that of all of the other lengths. This means that the same amount of deflection was achieved prior to breaking, but at a much greater weight as the beam became shorter.

Conclusions/Discussion
The length of the beam had a large effect on the maximum weight supported by a beam. This experimental data illustrates that the length of the span on a bridge is stronger when it is shorter.

Summary Statement
This project determines the effects of length on a beam bridge's strength.

Help Received
Help was received by both my dad and my mom. My dad helped in construction of my apparatus (i.e. working the table saw) and with the designing of graphs on excel. My mom helped minimally with the tests.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Stephen A. Richardson

Project Number
J1818

Project Title
Soils and Earthquakes

Abstract

Objectives/Goals
The experiment will explore seismic resistive effects of different soils applied beneath a building#s foundation. The procedure will apply simulated earthquake test waves to various soils and materials and record the results and building movement during the shaking. This project will attempt to answer the question: Which soils isolate a building from an earthquake the best?

Methods/Materials
I plan to record measurable results from an experiment that I will design and build. I will test different types of soils in a wooden box with each soil shaken by a speaker so I can record resulting shaking in the model building. I will record the results using an oscilloscope connected to an instrumented model building.

Results
The data shows rock pebbles isolates simmulated earthquake test waves the best. I also discovered that the farther away the model building and sensor was from the wave source the less the movement. Deeper and denser soils isolated the waves the best. Sand was actually one of the soils that did not dampen the waves as effectively I originally thought. The readings were taken on eight different soils and over 400 data points were collected during this experiment procedure.

Conclusions/Discussion
Before I started the experiment I thought sand would isolate the earthquake waves the best. But I found out that a better earthquake isolation soil is rock pebbles! I liked doing this science fair project and it was harder that I thought it would be. I would like to thank True Value Store for providing the soils and my dad for the tools to help me with this science fair project. With my experiment I wanted to show a unique way to demonstrate which soil isolated earthquake test waves most effectively and I proved it.

Summary Statement
My project tests seismic resistive effects of different soils when exposed to earthquake test waves.

Help Received
Dad helped with test equipment setup

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Jared A. Ruekberg

Project Number
J1819

Project Title
What Is the Effect of Cement Ratio on Concrete Strength?

Abstract

Objectives/Goals
Concrete can be made from different mixtures of cement, sand, gravel, and water, which can determine its attributes, including strength. The hypothesis states that the most common mixture of materials does not produce the strongest concrete. My goal was to test the flexural strength of the most common mixture and compare it to the results of the two other mixtures.

Methods/Materials
To test this, three batches of concrete were mixed using different ratios of cement to set amounts of sand, gravel, and water. The concrete was poured into homemade molds to make three sets of 17 individual bricks, 25.4cm x 5.08cm x 5.08cm in size. These were then allowed to cure and harden for 28 days. Then the bricks were tested using a Flexural test consisting of a homemade tester and weights.

Results
During the first testing, Batch #1, the most common mixture, averaged 64.7 Kg to break the brick. Batch #2, the batch the experimenter thought would be the strongest, averaged 108.3 Kg. Batch #3 was the strongest requiring an average 108.5 Kg to break. During the second trial, Batch #1 averaged 65.3 Kg., Batch #2 averaged 108.4 Kg., and Batch #3 averaged 108.7 Kg.

Conclusions/Discussion
The Hypothesis was correct because both Batch #2 and Batch #3 were stronger than Batch #1. Further testing using mixtures of even greater ratios of cement to other materials would provide further information on the mixture needed to create the strongest concrete.

Summary Statement
I am testing to see if the flexural strength of the most common mixture of concrete will be stronger than other mixtures.

Help Received
Mother hepled with the board; Dad took pictures and helped with testing; Neighbor helped build monds and tester and supplied tools.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Christopher Ruh; Brandon Taylor

Project Number
J1820

Project Title
Investigating Glass Behavior under Extreme Temperatures

Abstract

Objectives/Goals
To determine at what temperature glass is strongest and weakest.

Methods/Materials
We are using 12X12 double strength (DS) glass sheets, heating glass with heat lamp, cooling glass in snow and control at room temperature. We inserted the glass into a wooden frame to simulate a framed window. We dropped a 5oz lead weight from a 40 degree angle into the framed glass. We are investigating at what time of year glass is strongest and weakest.

Results
We found that the heated glass shattered easier than the cooled glass. The cooled glass broke in a more uniformed manner.

Conclusions/Discussion
After completing our investigation, we found that our hypothesis was incorrect.
The hot glass cracked and shattered easier and did not have any uniform pattern to it, the cooled glass had more uniformed cracks, they were larger, straighter and cleaner looking.

Summary Statement
How glass reacts to extreme temperatures

Help Received
Friend who works for a glass company, Mr. Matt Imfeld from Anlin Industries

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Whittney L. Russell

Project Number
J1821

Project Title
Determining Glue Strength: Your Best Bet Might Not Be Perfect or Super

Abstract

Objectives/Goals
The objective of my project is to test five diverse types of glue to see which one works the best on bonding oak wood and is also the most economical.

Methods/Materials
I started my project out by selecting five different types of glue and bonding 2 inch oak boards together, using each of the different types of glue. Once I bonded the wood together I then used clamps to keep the seam tight while the glue bonded. I used a jack to apply pressure to the glued wood. My jack was set on 4 balanced scales to even out the pressure points. I would then continue to apply the pressure until the wood would break at the seam. By reading all four scales when the wood would snap I was able to tell how much pressure the glue could withstand before breaking. The five glues that helped me receive data for my project was Super, Titebond II, Gorilla, Perfect, and Epoxy Glue.

Results
As a result of my project I found that Epoxy Glue was the glue that could withstand the most pressure at 913.8 pounds & economically it was the third cheapest glue at $3.69 an ounce. Super glue was the second glue to handle pressure at 808.3 pounds, but was the most expensive glue, costing $11.42 an ounce. Third was Titebond II it could handle 676.6 pounds of pressure and was the cheapest out of all of the glues costing only $0.57. Fourth was Gorilla glue at 642.2 pounds of pressure and the cost of $1.87. And the worst glue was Perfect glue it could only withstand 152.2 pounds of pressure and the cost was $5.25 an ounce.

Conclusions/Discussion
In my hypothesis I believed that Epoxy Glue would be the number one bonding glue, and my data supported this. Super Glue surprised me by being the second best bonding glue. Titebond II Glue was the third best working glue which I thought it would be based on my hypothesis. Gorilla Glue didn#t do as well as I had thought it would & Perfect glue which came in last just did not perform well at all. It is important to have knowledge of what you are using when building a structurally sound project.

Summary Statement
My project was about bonding different glues to wood to see which one could withstand the most pressure.

Help Received
My father helped me in preparing the jack and scales, he also helped watch the scales as I applied the pressure to break the wood. I also had assistance from my mentor Mr, Piercy in getting information and about using the data.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Mark R. Tobias

Project Number
J1822

Project Title
Truss Me!

Abstract

Objectives/Goals
The purpose of this project is to determine different strengths in truss designs and which truss design is the strongest.

Methods/Materials
Nine model trusses (3 models each of 3 designs) were constructed of the same size and type of wood but with different internal supports. One design had just a single central support, another design had a central support with two diagonal supports (Pratt design) and the third design had internal supports looking like a W (Warren design). The trusses were tested with an Arbor press to determine the pounds of pressure needed to break each truss.

Results
The truss that had the W design on the inside was the strongest. It held about 10 more pounds than the Pratt truss design, not breaking until 45 pounds of pressure were applied. The truss that held the least weight was the design with just a single support in the middle. It could only hold 15 pounds of pressure.

Conclusions/Discussion
The three different types of trusses held weight the way I predicted. I found that the more internal support beams used, the stronger the truss design. The Warren truss was the strongest because, by having the W shaped supports, it transferred the weight to all areas of the truss and not to just one central point.

Summary Statement
I wanted to determine whether additional supports in truss designs added building strength.

Help Received
My dad helped me build all the models and crush them. My mom helped me write up my project and proof read it.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Cody Vick

Project Number
J1823

Project Title
Comparing the Strength of Laminated Wood to Solid Wood

Abstract

Objectives/Goals
I am want to compare laminated wood with solid wood. This will give me a better understanding of what type of wood to use in contruction. I will be comparing the strengths of the wood.

Methods/Materials
I will use douglas fir, oak, and pine.
I will have a sample of laminated wood for each type of wood. I cut wood into strips and glued them together. Let the wood sit for a day.
After laminating is complete for types of wood I will test strength.
I placed laminated wood into a 20 pound press and record results.
I then placed solid wood into press and compared results. Recorded for resistance in inches.

Results
Solid douglas fir proved to be the strongest wood.
Weakest was pine.
Oak showed no diference between laminated and solid. Same strengths.
Solid and laminated oak broke in strips.
Other woods broke in half.

Conclusions/Discussion
People who are building houses should use solid douglas fir. Oak is also a good wood to use. Using these woods would make homes and cabinets stronger.

Summary Statement
Comparing solid and laminated wood to determine strength for use in construction.

Help Received
dad helped with press and display of board