CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Nicholas H. Anicetti

Project Number

J1801

Project Title

Under Pressure: The Effect of Bridge Design on Bridge Weight Bearing Capacity

Abstract

Objectives/Goals

For my 2004 Science Fair Project I did a project on the weight capacity of 4 types of bridges, The Plank Board, The King Post, The Truss and The Arch. The Control was the Plank Board. I did five repeated trials. My Hypothesis was that the Arch would hold the most.

Methods/Materials

I built the bridges using wooden coffee stir sticks and index cards. To test them, I placed weights in a bucket suspended from the bridge one at a time until the bridge collapsed.

Results

I found after doing the experiment that The Truss held the most weight, The King Post the second, the Arch the Third and the Plank Board the least. My Hypothesis was not supported in this test.

Conclusions/Discussion

In my results, I discovered that the truss was the strongest bridge. My research showed the arch bridge should be the best based on other tests, projects and information found in books and posted on the internet.

I think my science fair project results were affected by some problems in the construction and testing of the bridges. I used wood to build my bridges, and some of the bridges warped before drying, causing me to redo some of the bridges. The materials I used for the arch were not ideal; the design restricted horizontal support, and the wood splintered in some cases when bent into the arch shape. Also, the tables I used for the experiment would become unleveled (they budged just a little bit) after I leveled them. Also, one of my bridges fell of my shelf into my brother's fish tank, and this probably affected my results.

To improve my experiment, I would have had a machine build the bridges so they would all be exactly the same. I could research other materials that would be better for the project. Also I would have a lab that kept all outside variables constant such as light, heat, and wind. Furthermore, two exactly level tables would help.

Summary Statement

A project on how much weight different small scale model bridges can hold before collapsing over a wide trench.

Help Received

Funding, shopping for materials and time alone (without my curious brothers) and some editing generously donated by my mom and dad..

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Cheryl Anne P. Carolino

Project Number
J1802

Project Title
Compressing: Revealing the Concrete Truth

Abstract

Objectives/Goals
My objective was to determine which mixture proportion, with the dominating ingredient either gravel or sand, will give the most strength when compressed.

Methods/Materials
Four different mixture proportion groups were mixed with ten tubes in each group. Two groups contained more gravel than sand. The other two groups contained more sand than gravel. All tubes had the constant water content, Portland Cement, and types of aggregates. From intervals of seven days, about two tubes were taken from each group and were cracked every week using a hydraulic jack. The strength was measured using a pressure gage. From there,data were used to determine weakest to strongest groups.

Results
The group with significant amount of gravel over sand in the mixture proportion proved to be the strongest. The second strongest group, despite having more sand than gravel, was strong due to the fact that it was workable for manual mixing. The other two groups were not as strong because of either more sand than gravel ratio or bad mixing.

Conclusions/Discussion
More gravel than sand in a concrete mixture can only be effective in terms of strength when there is significant amount in comparison to the two different sized aggregates. Proper mixing, clean ingredients, and right amount of moisture for aggregates will produce strong, durable,workable, and good looking concrete.

Summary Statement
My project is about concrete mixture proportions and how the gravel-sand ratio can affect the concrete's strength when compressed.

Help Received
Mother helped take pictures and buy materials. Father helped with understanding concrete concept and fieldwork. Brother helped set up hydraulic jack.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Robert A. Carstens

Project Number

J1803

Project Title

Concrete Breakers

Abstract

Objectives/Goals

The objective of my project was to find out if the ratio of sand to cement changes the strength of concrete. My hypothesis states that the ratios between 60% sand / 40% cement to 60% sand / 40% cement would be the strongest ratios.

Methods/Materials

I tested 11 different ratios of sand to cement. I tested 100% sand / 0% cement, 90% sand / 10% cement etc. I made a form by taking two pieces of angle iron and put the bottoms together so that I had a small box. I taped a piece of expansive joint every eight inches to make nine sections. I then calculated the amount of sand and the amount of cement I needed for each ratio. I mixed up the first ratio and poured it into each section of the form. I took the bricks out of the form after twenty-four hours. After I took the bricks out I had nine 2x2x8 bricks of concrete. I then let the bricks cure for another two weeks. I did this for every ratio. To break the bricks, I supported the brick over two tables. I then centered the brick over the two tables and slid a metal bar, that had a half hook on the other side, over the brick. Then I centered that on the brick and between the two tables. After that I attached an 's' hook to the half hook on the bottom of the metal bar and attached a bucket to the other end.

Results

After I broke all of the bricks I found that my hypothesis was wrong. I found that the strongest ratio was 30% sand / 70% cement, holding an average of 25.46 kilograms. I found that the more cement you add the stronger the concrete gets until it is over 70% cement, then the concrete gets cracks in it. As the amount of sand decreases, the concrete is stronger.

Conclusions/Discussion

In conclusion people should not use any ratio other than the ratio 30% sand / 70% cement if they want the strongest and the safest results. If you use a weak ratio in bridges or buildings, they could fall because the concrete is not strong enough to handle the weight.

Summary Statement

In my project, I determined if the ratio of sand to cement changes the strength of concrete.

Help Received

I received help from my science teacher on deciding how to break the concrete.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Martin R. Geier

Project Number

J1804

Project Title

The Ultimate Underground Structure: The Effect of Pillars Added to Structural Designs of Earth-Sheltered Buildings

Abstract

Objectives/Goals

My objective is to determine if pillars added to the structural design of an earth-sheltered structure will keep it from collapsing under the weight of dirt. I believe that all of the models with pillars will hold 1800g or more of sand applied to the roof of each model and all the models without pillars will hold less than 1800g.

Methods/Materials

After interviewing two geologists, a civil engineer, and a college senior in environmental engineering, I designed and constructed 20 individual models of earth-sheltered structures out of toothpicks and marshmallows. Each design for the model was built and tested six times. The designs for the models were divided into two groups: with pillars (three with only pillars; seven with pillars and braces) and without pillars (two with no braces; eight with braces). Each model was placed in a 37.85L fish tank partially filled with sand; and tested by placing 360g sand-filled plastic bags, one at a time, on top of each individual model until the model collapsed.

Results

The results were as follows: 100% of the models with only pillars and no braces, 57% of the models with both pillars and braces, not one of the models without pillars or braces, and 63% of the models with only braces and no pillars held 1800g or more of sand.

Conclusions/Discussion

My hypothesis was correct because every model with only pillars and no braces held 1800g or more. Unfortunately, my hypothesis was also incorrect because not every one of the models with pillars and braces held 1800g or more. This data is applicable to architects and structural engineers in designing earth-sheltered structures able to withstand larger amounts of dirt applied to the roof.

Summary Statement

My project determines whether pillars added to the structural design of an earth-sheltered structure will ensure the structure's capability to support more weight of dirt applied to the roof of the structure.

Help Received

Uncle helped connect two boards to make one large display board; Aunt proofread printed material.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Sarah A. Geisse

Project Number

J1805

Project Title

How Do Different Liquids Other Than Water Affect the Strength of Cement?

Abstract

Objectives/Goals

My project's goal was to see how different liquids other than water affect the strength of cement. I did this project because I wanted to find out how to make stronger cement which might help buildings better survive earthquakes.

Methods/Materials

The liquids I used were water (the control), carbonated water, orange juice, ammonia, and bleach. I made uniform cement blocks out of equal parts of dry cement and each liquid. I tested each block for flexural strength and impact energy. Flexural strength is the ability of the block to withstand a heavy load. I suspended increasing amounts of weight on the center of each block until it broke. Impact energy measures the toughness of something; I measured this in foot-pounds. I did three measurements of impact energy for each type of cement by dropping a one-pound weight on a fragment starting at one-foot heights and then increased the height until the fragment fractured.

Results

By doing my experiment I found that orange juice made cement weaker, while ammonia and bleach made cement stronger. To explain these surprising results I researched the chemistry of cement and tested the pHs of all the liquids I used. I found that the hydration of cement is an alkaline reaction and that the acidic liquid (orange juice) made the weakest cement while the basic liquids (ammonia and bleach) made the strongest cement. By adding basic liquids I must have made the chemical reaction of hydration stronger thus making stronger cement.

Conclusions/Discussion

My experiment proves that basic liquids make cement stronger and acidic liquids make it weaker. In construction, concrete is used, which is cement mixed with gravel and metal which makes it stronger. Maybe if basic liquids were used in cement, concrete would be even stronger which would make buildings and bridges more earthquake resistant.

Perhaps construction sites should check the pH of their water before using it in their cement to make sure that it is not acidic which might affect its strength.

Summary Statement

Testing the strength of cement with liquids other than water shows that basic liquids make cement stronger while acidic liquids make it weaker.

Help Received

My father bought the cement and helped me mix it with the ammonia and bleach. He also helped me with the heavy weights used to measure the flexural strenght of the different blocks.

Name(s)

Lauren I. Grazier

Project Number

J1806

Project Title

Is There a Better Place for Used Plastic? Testing the Strength of Concrete When Various Amounts of Plastic Are Added

Abstract

Objectives/Goals

The goal of my science project is to find an alternative use for plastics number 4-7. I want these plastics to be recyclable so we can discover more resources and so that our landfills don't over flow with trash. We can just keep reusing these plastics just like we already do with plastics 1-3.

Methods/Materials

What I did first for my project was build all the forms. Then I had to cut all different types of plastic 4-7 into confetti-shaped pieces. After that I poured the concrete and plastic in the forms and let them dry for 5 1/2 days. Then I put them in a kiln for 2 days. To test the bricks, I layed one on a fulcrum and put 90lbs on one side and added weight to the other until it broke in two. Then I did the same thing with the other bricks.

Results

From doing my project I found out that plastic number six is the strongest when added to concrete. Plastics four and five came very close. Seven was the weakest plastic/concrete combination of all. None of the tests got a better test than the control.

Conclusions/Discussion

The plastic and the concrete bonded together except in plastic number 7 which was weak. In conclusion, since adding plastic to concrete had little or no effect on its strength in most cases this could become an alternative use for plastics number 4-6, which would in turn make them a renewable resource.

Summary Statement

In my project I tried to find an alternative use for plastics that are difficult to recycle, so I added them to concrete.

Help Received

Mom helped test concrete; dad helped build forms; Art teacher loaned kiln; recyling coordinator took me on landfill tour;

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Clinton L. Hatayama

Project Number

J1807

Project Title

The Effects of Different Amounts of Styrofoam on the Strength of Concrete

Abstract

Objectives/Goals

The objective is to determine if using styrofoam as an admixture in concrete will make the concrete stronger while making it lighter in weight.

Methods/Materials

Eighty concrete bricks were constructed and divided into twenties. The first group of twenty bricks had 18gms of styrofoam beads added, the second had 12gms styrofoam beads, the third had 6gms styrofoam beads, and the fourth group of twenty bricks was control. The concrete ingredients and ratio of ingredients was the same for all. The bricks were cured, weighed and tested for strength. The weight required to break each brick was recorded. A ratio of weight to strength was used to see if the styrofoam bricks were lighter but stronger than the control.

Results

Comparing the strength of the brick in proportion to its weight, the control brick was the strongest. It took an average of 20.6 times its weight to break the control brick. The group of bricks with 18gms styrofoam added took an average of 14.83 times its own weight to break. It was lighter, but still not stronger than the control. The 12gms styrofoam added took 12.45 times its weight and the 6gms styrofoam added brick took 12.0 times its own weight to break the brick.

Conclusions/Discussion

In these proportions, and using the concrete ingredients in the ratio I did, styrofoam added to the concrete did make the brick lighter, but did not make it stronger in any of my trials. The data suggests that styrofoam could be used to lighten concrete, but more testing would have to be performed to determine a better ratio of both concrete ingredients and styrofoam to make it stronger than regular concrete.

Summary Statement

My project is to determine if adding styrofoam to concrete will make it stronger while making it lighter.

Help Received

Used scales from school to weigh ingredients, mother helped type final project papers, Mr. G. helped with graphs.

Name(s)

Hartlyn T. Haynes

Project Number

J1808

Project Title

Can Your Hair Hold You Up?

Abstract

Objectives/Goals

This experiment was performed to decide which type of hair was the strongest between curly, wavy, and straight hair.

Methods/Materials

I tested the hair by measuring how many drops of water each strand of hair could hold. Then I converted the drops of water to a measurement of grams using a triple beam balance.

Results

In conclusion, curly hair proved to be the strongest type of hair tested. Wavy was the second strongest, and straight was the least strong.

Conclusions/Discussion

In doing further research, one should consider the following:
1. Getting hair from many different age groups would expand the experiment, since the weakest hair came from the oldest people.
2. Get hair from many different races. When interviewing the expert, she told us that she believed the type of hasir didn't necessarily mastter, it was more the person's racial background.
3. Get many different lengths and colors of hair. This may also be a determining factor of strength.

Summary Statement

My project was performed to discover which type of hair was the strongest between curly, wavy, and straight hair.

Help Received

Mother helped a little with board; many people contributed their hair; Patsy Hodges was the expert I interviewed.

Name(s)

Leslie J. Koyama

Project Number

J1809

Project Title

Factors that Affect the Strength of Concrete

Abstract

Objectives/Goals

Based on my literature research, I believe that the more water added relative to the amount of cement will decrease the compressive strength of the concrete. I also believe that larger aggregate will result in stronger concrete. Lastly, I believe that commercial grade bag mixes will be stronger than my own mixes.

Methods/Materials

Materials used include: cement, sand, two sizes of rock, water, and two commercially available concrete bag mixes. The concrete mixtures were made with water/cement ratios from 0.6 to 1.1 all with 1/2" rock. To investigate the effect of aggragate size, I also made two different 0.8 water/cement ratio mixtures with 3/4" rock and all sand. Lastly, two mixtures were made with the commercial bag mixes for comparison. For each of the concrete mixtures, strength test samples and slump test samples were made. The strength test samples were allowed to cure for twenty-eight days, then they were taken to a materials testing lab for compressive strength testing.

Results

In the water/cement ratio range of 0.6 to 1.1, compressive strength decreased as the water/cement ratio increased. The size of the aggregate did not appear to affect the compressive strength of the concrete. For the commercially available concrete bag mixes, one mixture was considerably stronger than my comparable 0.8 water/cement ratio mix, and the other bag mixture was about the same strength as my mixture. One of my two 0.6 water/cement ratio samples had voids, which resulted in the compressive strength being about half of the sample without voids.

Conclusions/Discussion

The results of my experiment comfirm that the more water added relative to the amount of cement decreases the compressive strength of the concrete. The size of the aggregate did not seem to affect the strength of the concrete. Voids in the concrete dramatically reduce its compressive strength. Bag mixes can be stronger or about the same as mixtures made from scratch.

Summary Statement

In this experiment I determined how the water/cement ratio and the size of aggregate affect the compressive strength of concrete.

Help Received

Father helped secure materials and with Excel plotting, Mr. Gary Phones, Senior Civil Engineer City of San Jose Materials Tesing Lab, provided compressive strength testing facilities, Mrs. Broadbent encouraged me to enter the science fair.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Nitish Lakhanpal

Project Number

J1810

Project Title

Strength in Numbers? A Study of Change in Cable Tensile Strength Due to the Number of Wires and Their Arrangement

Abstract

Objectives/Goals

My objective is to examine whether the ultimate tensile strength (UTS) of a cable is affected by the number of wires in the cable and the manner in which they are arranged. I explored two questions: When a wire is added to a cable, will the change in its UTS be greater than the UTS of a single wire, i.e., will there be a synergy effect? Will the manner in which the wires are arranged, e.g. through braiding, increase the cable's UTS? Correspondingly, the two hypotheses for this experiment are:
Hypothesis 1: The UTS of an n-wire unbraided cable will be more than n times the UTS of a single wire.
Hypothesis 2: For the same number of wires, braiding will result in higher UTS.

Methods/Materials

Materials: Ring Stand with single-burette clamp; Calibrated gram weights; 16" lengths of 32-gauge wire cut from the same spool; S hook; String; Cookie tin; Nail.
Procedure:
For hypothesis 1, a container to hold weights was first prepared using a cookie tin and string. One end of a 16" length of 32 gauge wire was then tied to the burette clamp attached to the ring stand; the other end was tied to a S hook. The container was attached to the hook and weights were gradually added to the container, waiting a few minutes between each addition. Weights were added till the wire snapped and this weight was recorded. 9 more trials were conducted in the same manner. Measurements from these 10 trials were then averaged. These steps were repeated for 2, 3, and 4 wires.
For hypothesis 2, the above procedure was repeated for 2 wires braided together and the weight at which the cable snapped was recorded for 10 trials and averaged. These steps were repeated with 3 and 4 wire braided cables.

Results

For the unbraided case, the increase in cable UTS due to each additional wire was equal to the UTS of a single wire. Further, the UTS of braided cables was greater than the UTS of corresponding unbraided cables with the same number of wires. Error bars of one standard deviation were used for analysis.

Conclusions/Discussion

The observations did not support hypothesis 1. As more wires were added, the UTS of the unbraided cable increased in proportion to the number wires; no synergy effect was found. Hypothesis 2, however, was supported. The UTS of a 2 wire braided cable was greater than the UTS of a 2 wire unbraided cable - with similar results for 3 wire and 4 wire cables as well.

Summary Statement

This project examined the change in the ultimate tensile strength of a cable due to the number of wires in the cable and the manner in which they are arranged.

Help Received

Parents provided transportation and help with buying materials.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Casey J. Mansfield

Project Number

J1811

Project Title

Does the Degree of Curvature Affect the Strength of Wooden Arches?

Abstract

Objectives/Goals

My objective was to determine how a wooden arch's curvature affects its strength. My hypothesis was that the greater the curvature of an arch, the stronger it would be because of the greater effect of tension on the underside of the arch.

Methods/Materials

I cut 1/8" X 15/16" strips ripped from two 2x8 basswood boards into five different lengths: 42", 48", 54", 60", and 66", then bent each strip into arch supports (abutments) placed 38" apart. I attached a 5 gallon plastic bucket with a carabiner to the middle of each arch and filled the bucket with sand until the arch broke. I repeated the experiment for a total of 5 trials. I calculated the arc angle for each arch with a construction caculator, using each arch's dimensions from tracings.

Results

On average, the middle length arch, 99 degrees, supported slightly more weight than either the two steeper or the two shallower arches. However, all five arches were fairly close in their ability to hold weight.
On average, the 99 degree arch supported 9% more weight than the 51 degree arch, 11% more weight than the 73 degree arch, 19% more weight than the 112 degree arch, and 7% more weight than the 118 degree arch.

Conclusions/Discussion

I originally thought that the steeper arch would create the strongest arch. My results indicated that while all my arches effectively dissipated the weight from the center of the arch to the abutments, a medium arch of about 100 degrees created a slightly stronger arch than ones either substantially shallower or steeper.
The steeper arches tended to buckle with increased weight, the result of compression overcoming the wood's ability to handle compression. Their breaks were usually off center, at a buckle. I feel this buckling negatively affected the arch's strength. The shallower arches tended to snap in the middle.
My results were more varied than I expected, which caused my average results to be closer than I expected, possibly due to the inconsistent nature of my wooden strips, despite my efforts to make them as consistent as possible.
I would like to repeat this experiment using different materials, such as thin strips of plastic, and possibly add stabilizing structures to the steeper arches to help prevent buckling.

Summary Statement

My project tested how the degree of curvature affected the stength of wooden arches.

Help Received

My dad helped me with the power saws, and my mom drove me to the lumberyards and helped me edit.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Maxwell M. Mileck

Project Number
J1812

Project Title
Truss Bridge's Arch Enemy

Abstract

Objectives/Goals
To discover which bridge has the structural strength to withstand more weight, the arch or the truss.

Methods/Materials
I constructed the two bridges using paper and glue. I made two bridges of equal length. I applied sand as a weight in 150-gram increments. I added weight until the bridges collapsed. I then repaired the bridges and retested them.

Results
The truss bridge held much more weight than the arch bridge.

Conclusions/Discussion
To span gaps I would use the truss bridge, not the arch bridge, because it is stronger.

Summary Statement
Testing the strength of arch and truss bridges.

Help Received
Parents helped organize project.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Colin Potter

Project Number
J1813

Project Title
Wood Stiffness

Abstract

Objectives/Goals
The purpose of the study was to compare vertical grain versus horizontal grain stiffness within and between three species of North Coast softwoods.

Methods/Materials
Wood samples from Douglas Fir, Coastal Redwood, and Sitka Spruce were carefully selected, split along the grain and dried and planed to the same dimensions and then tested by placing a load at the same postion in each. Measurements were taken to the nearest 0.001 inches to record the deflection with the grain oriented both vertically and horizontally.

Results
All species showed variation within the same sample (board) and between samples. Redwood consistenly was less stiff than the other species. Both Redwood and Douglas Fir were stiffer with the grain oriented vertically.

Conclusions/Discussion
No consistent conclusion can be made from the results about grain orientation and stiffness for all species tested. Stiffness varied even in samples taken from the same board.

Summary Statement
The project compares the stiffness of three wood species orienting the grain vertically and horizontally.

Help Received
Mother helped type/edit report. Father helped with the preparation of the wood samples.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jacob T. Roulston

Project Number
J1814

Project Title
Bending Bridges

Abstract

Objectives/Goals
To find which bridge, the arc bridge, the span bridge, or the cable-stayed bridge supports the most weight.

Methods/Materials
1. Gather materials
2. Make span bridge
3. Put weights on it until it collapses and take pictures
4. Record the amount of weight it holds in scientific notepad
5. Make arc bridge
6. Repeat steps 3 and 4
7. Make cable-stayed bridge
8. Repeat steps 3 and 4
9. Repeat steps 2-8 one more time

Balsa wood, wood glue, exacto-knife, ruler, builders square, drill, plastic lid, pruning scissors, coping saw, picture frame vise, rasp, awl, picture hanging wire, weights (various sizes), scientific note pad, pencil, and digital camera.

Results
The results of my experiment were: The arc bridge held an average 120 ounces, the span bridge held an average of 54 ounces, and the cable-stayed bridge held an average of 52 ounces.

Conclusions/Discussion
My hypothesis was supported. To make my experiment better I could have used different materials on my cable-stayed bridge.

Summary Statement
I was trying to determine which bridge type supports the most weight.

Help Received
Dad helped construct bridges; Mom bought materials and helped with research.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Christopher Ruh; Brandon Taylor

Project Number
J1815

Project Title
Investigating Glass Behavior Under Various Environmental Stress Conditions

Abstract

Objectives/Goals
To Determine how different tempertures will affect glass.

Methods/Materials
We are using 12 X 12 double strength (DS) glass sheets, inserted into a wooden frame to simulate a framed window. We will be dropping a 4, 5 and 6 oz. lead weight from a 40 degree angle into the framed glass. We are investigating if temperature will effect the way the glass breaks.

Results
We found that the hot glass cracked, and shattered easier than the cold glass, it even cracked while being put in the wooden frame. We also found that the heated glass cracked in a less uniformed manner.

Conclusions/Discussion
After completing our investigation, we discovered our hypothesis was incorrect. the hot glass cracked, and shattered easier and did not have much of a uniformed pattern, while the cooled glass had more uniform cracks, and the cracks were much straighter and clean looking. The cold glass did not have a lot of little pieces like the hot glass.

Summary Statement
How glass reacts to different temperatures

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

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Todd M. Schenk

Project Number

J1816

Project Title

Mystery of the Nicoleño Fishhooks

Abstract

Objectives/Goals

The purpose of this experiment was to answer an actual archaeological question that still remains unsolved: Did the Nicoleño Indians understand that abalone was the best possible shell to use for fishhooks, or did they use abalone simply because it was readily available?

Methods/Materials

Various types of shells were collected from the beaches of San Nicolas Island. After researching fishhook-carving techniques used by the Nicoleño Indians, several shells of each type were properly carved. Each shell was measured for weight, thickness, and eye-to-shank/eye-to-curve distances. A breaker device was constructed to measure the breaking strength of each shell. The resulting data was analyzed to determine which shell type makes a better fishhook.

Materials included seashells, a breaker device (constructed,) Digital Scientific Calipers, a digital fish scale, and hardware to connect the shells to the breaker device.

Results

My results showed that abalone is the strongest shell for making fishhooks, among the most commonly available shells on San Nicolas Island. Clearly the strongest in strength-to-weight ratio, abalone is also the strongest shell when comparing hook shank strengths.

Other data showed abalone to be the third strongest shell based on thickness ratios of the hook, and second strongest for hook-to-eye curve strength. While these secondary data comparisons do not place abalone in first place, when combined with the strength of shank and overall strength-to-weight comparisons, they show abalone as clearly the best possible choice for making a durable fishhook.

Conclusions/Discussion

This experiment has demonstrated that my hypothesis is correct, and supported by strong data. It is very likely that the Nicoleño Indians of San Nicolas Island knew that abalone was the best material from which to make their fishhooks.

Now that we believe the Nicoleño understood the value of abalone, more research should be conducted to further investigate their abalone fishhooks, as well as all of the fishing technologies they developed on San Nicolas Island.

Summary Statement

My project was to determine if the Nicoleño Indians knew that abalone was the best seashell for making fishhooks.

Help Received

I borrowed digital calipers from the curation facility of San Nicolas Island.