California Science Center

CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.)
Matthew R. Pies

Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9)
How Does Arch Curvature Affect Strength?

Science Fair Use Only

J0125

Division
X **Junior (6-8)** _ **Senior (9-12)**

Preferred Category (See page 5 for descriptions.)
1 - Applied Mechanics/ Structures & Mechanisms/ Manufacturing

Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.)
Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.

Objective: The objective of my project was to determine how an arch's curvature affects its strength.

Materials and Methods: Nine balsa wood sheets (1/16" x 3" x 36") were cut to four different lengths (10", 12.5", 15", 17"), producing five sheets per length. These sheets were then bent into an arch shape while placing them into the test stand (which had a fixed width of 10"). A hardwood stick, with a rope that attached it to a bucket hanging below, was then placed and centered on the balsa wood arch. Sand was poured into the bucket until the arch failed. The bucket (along with the stick and rope) was weighed on a scale. Each of the balsa sheets was tested resulting in five tests per length.

Results: The mid-length arches (12.5" and 15") consistantly supported the most weight. The 15" arch only supported 3% more weight than the 12.5" arch (on average). The 10" arch supported 38% of the weight and the 17.5" arch supported 77% of the weight that the 15" arch supported.

Conclusions: The 17.5" arch tended to hold up less weight than the 15" arch because of a buckling tendency when weight was put on the arch. The arch would begin to bend to one side more and more until the balsa reached a point in which it could no longer be bent any further. This was much less noticable as the arch length decreased. An arch like the 12.5" arch is the best overall (if no support is provided to the arch) due to its stability and consistant results.

Summary Statement (In one sentence, state what your project is about.)
How does an arch's curvature affect how much weight it can support?

Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4.
My mother poured the sand during testing and helped glue papers to the board.