# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**J1809**

**Project Title**
## Truss Analysis: A Study in Engineering Practices

**Abstract**

**Objectives/Goals**
"Can you combine member strength analysis and static analysis to form a predictive model for craft stick truss bridge failure?" My project applies engineering practices to a craft stick truss bridge by examining materials and loads. My predictions are based on data I collect through my own member tension, compression, and buckling tests and which then is combined with my static analysis of a particular truss. Then I will build the truss and apply a mid-span point load until the truss fails. My Variable: Truss Type, will have three study values to be sure that my predictive model works with more than one truss type and I will build three of each type.

**Methods/Materials**
My trusses were constructed out of craft sticks, wire pins, and joint plates. I prototyped the joint plates, to asuure stability, without providing structural support. Using my tension, compression, and buckling fixtures, I tested the craft stick member's strengths, for both long and short sticks. Combining the data collected from these member tests with the static analysis of each truss type, I made predictions on the failures of the three trusses. I set Variable: Truss Type, with three study values: #1: Warren Through-Truss; #2: Howe Through-Truss; #3: Pratt Through-Truss. Building and testing conditions for all trusses were the same. On each truss, I applied a mid-span point load using a bucket of weights. When the truss failed, the weight was recorded with the member name where the truss failed. I compared the actual failure weight and member location with my predictions.

**Results**
The Howe Truss was the most accurate prediction, breaking within 2 lbs. of my prediction. The Pratt Truss also had good results. I estimated a small range (71.7 lbs +/- 6.3 lbs) of failure. The prediction was 104% of the average. The Warren Truss prediction was incorrect. I attribute this to using only the compression test. Since I performed a buckling test later, the Warren truss prediction would be somewhere between the buckling and compression averages, which would have been correct. In every case, I successfully predicted which member would fail.

**Conclusions/Discussion**
My hypothesis was correct; combining static analysis and member strength testing, I was able to accurately predict when the truss would fail and which member would fail. The member strength test results for compression and tension were very accurate.

**Summary Statement**
Combining member strength tests and static analysis, I found that I could make a predictive model of truss bridge failure by testing three truss types.

**Help Received**
My father taught static analysis, aided with experimentation, & building apparatuses.