CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J0106

Project Title
High Winds and Low Roofs

Abstract

Objectives/Goals

Introduction

In a hurricane or in high winds, a roof of a house is prone to detaching from its walls. The problem of roof disengagement from homes is often approached with large metal bolts and special attachments that fasten the roof to the walls. However, this is both expensive and wasteful. It would be very useful if there was a way for roofs to not part with the rest of the house as easily. We want to find out how variables such as the shape and angle of a roof affect the house's lift in high winds.

Lift is the force that raises an object if air is flowing over the object faster than the air flowing under it. Because of the higher pressure below it and the lower pressure above it, the object rises toward the more desirable low pressure air. It will be interesting to find out what shapes and angles of roofs have the most and the least lift. To test our procedure, we will build a wind tunnel and model houses and roofs.

Because airplane wings, which are designed for lift, are curved, we believe that if a roof is curved, its lift is higher than that of a gable roof. We think the lift on a shed roof is higher than the lift on a gable roof of the same angle because the wind will not have a smooth or symmetrical surface to flow over.

Methods/Materials

tape,box fan, cardboard,box with dividers, thin plastic, foam core, glue gun, removable tape, electric scale that measures in grams, protractor, knife, Yardstick, Ruler

Testing Procedure

We built a wind tunnel with cardboard, placed a house with different shaped roofs inside. We messured with a scale the lift created by the wind. A fan blew wind in the tunnel.

Results

The steeper the pitch, the lower the lift. A 15° gable roof has the same lift as a 15° shed roof with the vertical side facing wind. The curved roof has a little lower lift, and the 15° shed sloped side has a small down force.

Conclusions/Discussion

It was observed after a hurricane that most of the steep roofs were still attached to the rest of the house, and the shallower roofs were detached. The lifts on the roofs shown in that graph support this idea because the shallower roofs have much more lift than the steep roofs.

This experiment indicates that the safest roof angle on a house that avoids both lift and downward force where tornadoes or hurricanes are common is around 30 or 35°. If an avoidance of lift alone is the primary concern, then the data indicates that steeper is better.

Summary Statement

How the angle and shape of a roof affects its lift in high winds

Help Received

Nathalie's mother helped to make the wind tunnel and solved problems with the graphs.