CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

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Project Number

22307

Project Title

Backpack Straps: Does the Length Affect the Force Exerted on the Back?

Abstract

Objectives/Goals

The objective is to determine whether or not the length of the straps on a backpack has any effect in how much stress is exerted on the back as represented by my testing device.

Methods/Materials

I built a testing device to represent a back constructed from wood, PVC pipe and connectors, galvanized pipe and flange, a garage door spring and various levels. I filled the platform with bricks as counterbalance. I used a standard school-type backpack for my testing. I marked each strap at t intervals from 16" to 30". I tested each strap length at weights from 10pounds through 35 pounds at 1 pound intervals. I recorded the angle of the spring under each weight(at 1 pound intervals) and strap length (at 2" intervals)and measured the angle (bend) using a goniometer with an attached level.

Results

The degree of change of angle from vertical was dramatic as the strap lengths increased. Under the 35 pound weight the 16" length straps had an angle of 30 degrees. Uner the same 35 pound test weight, the 30" strap length had an angle of 91 degrees.

Conclusions/Discussion

The strap length has a definite effect on the stress exerted on a back (as represented by my testing device). The difference between the 16" strap length to the 30" strap length showed an average change of 701%. The range of difference between the minimum and maximum straps was from 227% to 1000% greater int comparison. My data clearly shows that the longer straps are critical in minimizing the stress on the back as the longer straps showed a much greater angle.

Summary Statement

My project is testing whether or not the strap length on a standard backpack matters to the amount of force exerted on a back.

Help Received

An employee from a hardware shop helped me find the spring and metal parts>

Preliminary