CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Richard Martinez; Kaitlyn Wakefield

Project Number

S0218

Project Title

Barrier Beat Down: A Study of the Efficiency of Six Barrier Configurations

Abstract

Objectives/Goals

To measure the force of impact of a simulated vehicle on a set of barriers arranged in various configurations to determine the configuration that most safely and successfully slows the vehicle (i.e. provides the largest change in velocity over the longest time interval).

Methods/Materials

Six barrier formations were tested at three different velocities to determine what formation yielded the safest and most successful stop of the simulated vehicle. The six different configurations used in this project closely resemble the following shapes: a straight line, a rectangle, a horizontal wedge, a pyramid, an ellipse, and a pentagram.

Each configuration was tested at three velocities (the vehicle was raised to either the 30°, 60°, or 90° mark on a pendulum setup) and the deceleration of the vehicle after impact was determined. In order to find the deceleration of the vehicle (and therefore the effectiveness of each configuration), the velocity and time interval of the vehicle's travel were measured. To find the velocity, the vehicle travel distance was divided by the time interval over which the vehicle traveled. The travel time was determined by reviewing a frame-by-frame replay (at 26 frames per second) and measuring the number of frames of travel.

Results

At all three travel speeds (30°, 60°, 90°) configuration three (the "wedge") most safely and effectively decelerated the vehicle over the longest time interval (with average acceleration measurements of -63.0 cm/s2, -94.6 cm/s2, and -92.6 cm/s2, respectively). The least effective overall was the fourth configuration (the "pyramid"), which received the highest measurements for all three velocities (with acceleration measurements of -583.3 cm/s2, -1342 cm/s2, and 1608 cm/s2).

Conclusions/Discussion

The data do show that a horizontal "wedge" with spacing between the individual barricades is the most effective way to safely (largest change in velocity over longest time interval) slow a moving vehicle. These data could easily be adapted to real-world crash barricades as the simulated objects in use are in a specific ratio to their real-world counterparts.

Summary Statement

To measure the force of impact of a simulated vehicle on a set of barriers arranged in various configurations to determine the configuration that most safely and successfully slows the vehicle.

Help Received

none