CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31089

Project Title

How Did We Get Off Track? Functional Comparison of Railroad Switch Design and Derailments

Abstract

Objectives/Goals

The objective was to compare a new modified spring design to a currently used spring switch and a control fixed switch for preventing the derailment of trains that run over it the wrong way, #fouling# the switch

Methods/Materials

A Lehmann Gross-Bahn G scale track, switches and locomotive with a flatcar were used to simulate a train fouling a switch. A modified spring switch was engineered by inserting a second spring in between the rail and the point of an existing L.G.B. spring switch. The locomotive and flatcar were tested at three speeds and with three loads for derailment when run over each of three switches that were purposely set in the wrong position. The control group was a locked position switch, and the test groups were a spring switch and the modified spring switch described above. Each condition was tested five times. The most variable results of the spring switch at the top speed were retested for 10 trials each. The results of all trials were photographed and the train#s performance was documented as either a success or a derailment. The percentage of derailments were determined and compared by Chi square test.

Results

The fixed switch had a 100% derailment rate, the spring switch had and overall derailment rate of 44% and the modified spring switch had a 0% derailment rate. The differences between the spring switch and the modified switch were statistically significant by Chi square test for all of the lightest load trials, but the medium load was only different at the fastest speed.

Conclusions/Discussion

Train derailments at fouled switches occur most commonly on fixed switches at lower speeds and with unloaded cars. The modified switch to spring switch to fixed switch derailment ratio was 0:44:100. These data suggest that an enhanced switch design might reduce the number of annual derailments and financial losses especially in switchyards.

Summary Statement

A modified railroad spring switch design was compared to two other switches for its effectiveness in preventing derailments.

Help Received

A modified railroad spring switch design was compared to two other switches for its effectiveness in preventing derailments.