



# Colorado Science and Engineering Fair

## 2024 Team Project Abstract Form

**Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.**

Title of Project: Shake Rattle And Roll - Washboard Phenomenon: The Effect of Wheel Velocity On A Road Bed

Team Leader's Name: Carson Stone

Team Member 1: Connor Stone

Team Member 2:

School and City: Brush Middle School, Brush

Sponsor's Name: Erik Stone

Category: Physics & Astronomy (PHYS)

Division: Junior (6th - 8th grades)

Abstract (250 words or less):

We live on a gravel road where the washboard effect commonly occurs. We wanted to understand the physics behind the formation of washboard ripples. Our hypothesis was that when cars drive faster on dirt roads the bumps will be more severe.

We tested our hypothesis by using a record player and an apparatus to simulate a car wheel traveling down a dirt road at different speeds. We spread the dirt in a modified pan uniformly with a notecard. Test 1: We placed the wheel into the dirt and ran the record player for 1 minute at 78 rpm, 2 minutes at 45 rpm and 4 minutes at 33 rpm. We ran 3 trails at each speed measuring and averaging 3 crest heights and 3 wavelengths for each trail. Test 2: We ran another set of trials for 4 min at each speed, 78rpm, 45rpm and 33rpm using the same procedure.

Test 1: The crests of washboard ripples were higher and wavelengths longer as speed increased. Test 2: When the run time was the same for each speed (4min.), the crest height at mid speed (45rpm) and high speed (78rpm) were very similar.

Our experiment results proved our hypothesis incorrect. Washboard ripples formed at mid speed had similar crests to high speed but had shorter wavelengths causing the most severe bumps for a driver.

*We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. We also attest that the above properly reflects our own work.*

Team Leader's Signature: Carson Stone

Date: 3/3/24

Team Member 1's Signature: Connor Stone

Date: 3/3/24

Team Member 2's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with your Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.