**Summary**

In this activity, teams of students in grades 3 to  12 learn how engineers design tire treads to increase safety and reliability, then follow the design process to construct, test, and evaluate treads sculpted from clay that will be safe when driving in heavy rain.

**Grade level:** 3-8

**Time:** Two or three 45-minute sessions

**Engineering connection**

Engineers design tire tread patterns to achieve safety in a range of driving conditions. Different grooves can reduce slippage in heavy rain by forcing water to flow out to the side of the road, away from the tire.

**Learning objectives**

After doing this activity, students should have a better understanding of:

* The engineering design process.
* The role of planning and construction in engineering.
* Teamwork and working in group

**Standards**

**Next Generation Science Standards**

Engineering Design

Students who demonstrate understanding can:

* 3-5-ETS1.1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
* 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
* 3-5-ETS1.3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
* MS-ETS1.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
* MS-ETS1.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

**National Science Education Standards**

As a result of activities, all students should develop:

CONTENT STANDARD A: Science as Inquiry

* Understanding(s) about scientific inquiry [Grades K-8]
* Abilities necessary to do scientific inquiry [Grades 9-12]

CONTENT STANDARD B: Physical Science

* Understanding of properties of objects and materials [Grades K-4]
* Properties and changes of properties in matter [Grades 5-8]
* Motions and forces [Grades 5-12]
* Interactions of energy and matter [Grades 9-12]

CONTENT STANDARD E: Science and Technology

* Abilities of technological design [Grades [K-12]
* Understandings about science and technology [Grades 5-12]

CONTENT STANDARD F: Science in Personal and Social Perspectives

* Understanding of science and technology in local challenges [Grades K-4]
* Natural hazards [Grades 5-8]
* Risks and benefits [Grades 5-8]
* Science and technology in society [Grades 5-8]
* Science and technology in local, national, and global challenges [Grades 9-12]

CONTENT STANDARD G: History and Nature of Science

* Understanding of science as a human endeavor [Grades K-4]

**ITEEA Standards for Technological Literacy**

Nature of Technology

Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

Standard 7: Students will develop an understanding of the influence of technology on history

Standard 9: Students will develop an understanding of engineering design.

Design

Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World

Standard 11: Students will develop abilities to apply the design process.

Standard 13: Students will develop abilities to assess the impact of products and systems.

The Designed World

Standard 18: Students will develop an understanding of and be able to select and use transportation technologies.

**Common Core State Mathematics Standards**

Measurement and data

Solve problems involving measurement and estimation.

*Math.Content.3.MD.A.2* Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).1 Add, subtract, multiply, or divide to solve one-step word problems

involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. Understand ratio concepts and use ratio reasoning to solve problems.

*Math.Content.6.RP.A.3c* Find a percent of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percent.