THE CHALLENGE
Understand how design of a road affects the ability of vehicles to maneuver (horizontal and vertical features, obstacles, lane width, etc.). This is an exercise in design and presentation skills (for older students).

Note: The activity is intended to take place in a natural outdoor setting.

GRADE LEVEL
Grades 4-6, 7-9, 10-12 with varying levels of challenges

ACTIVITY DURATION
Total 60 minutes for Grades 4-6, 90 minutes for Grades 7-9, and 120 minutes for Grades 10-12.

30 Min (Grades 4-6)
About 10 minutes to gather materials, 15 min to build course, 10 min to test and adjust course, and 15 min to drive cars through each course. Additional 5-10 minutes, depending on the length of the discussion, to review and compare results.

90 Min (Grades 7-9)
About 10 minutes to gather materials, 20 min to build course, 15 min to test and adjust course, and 20 min to drive cars through each course. Additional 25 minutes to review, compare results, and discuss pros/cos of design features.

120 Min (Grades 10-12)
About 10 minutes to gather materials, 20 min to build course, 15 min to test and adjust course, and 20 min to drive cars through each course. Then 25 minutes for teams to present their course design features to the entire group, and 30 min to review, compare results, and discuss pros/cos of design features. Teams can be evaluated (if desired) in terms of course design (could all cars make it through the course?) and the team presentation of their design (key materials, design features, challenges that were incorporated, what worked well and what did not, and what did they learn).

MATERIALS PER GROUP
- Instructions on goals, materials, and time limits
- Only natural items found in the area (e.g., sticks, rocks, leaves, dirt, grass, etc.)
- 1 RC Car per team (these are the only expense items, and it helps to have different types of RC cars (different sizes and power so some will perform better on the ground than others)

SET UP
Divide students into teams of ~5 children per group. Give each team an RC car and a distinct area to build their roadway (10’x10’ to 15’ x 15’ for each area). Teams can be smaller or larger depending on total number of participants.

ACTIVITY

Part I – Gather Materials
Have teams gather natural materials to build their course. Encourage them to be creative and use as many things as they can find in 10 minutes. (see Figure 1). Materials might include rocks, leaves, sticks, pinecones, fallen branches, dirt/mud.

Figure 1 – Course Materials
**Part II – Build Roadway**
Have teams build a roadway using the ground as a base and materials gathered in Part 1. Encourage them to be creative and put in curves, hills, bumps, obstacles, and whatever they think is interesting and challenging. They need to consider how to design and build their course so their car can get through the course without getting stuck. And they need to stick to the time limit (see Figures 2 and 3 for examples).

![Figure 2 – Simple Course](image1.png)

![Figure 3 – Medium Complexity Course](image2.png)

**Part III - Test Roadway**
Each team should now test and adjust their course in the allotted time to make sure an RC Car can navigate completely through the course without getting stuck (see Figure 4).

![Figure 4 – Testing the Course](image3.png)

**Part IV – Each Team Drives on Each Course**
Each team should now bring their RC Car to each course and drive it. Can they make it through each course? Watch the clock so the time limit for this task is followed.

**Part V – Presentation of Design Concept (Grades 10-12 only)**
Bring all teams together and ask each team to make a brief presentation of their design.

**FOR DISCUSSION**
Potential questions for discussion.

Review Results and Discuss with Entire Group

1) Bring all teams together and ask participants what they learned about roadway design.
2) Did every car complete every course? If not, why not? (e.g., car was too big, car was too weak, hill was too steep, curve was too tight, lane was too narrow, ground was muddy, obstacle in the road was too big, etc.)
3) Ask participants what they learned about different materials (hard, soft, big, small, dry, wet, etc.) and how that affected their course and/or the cars.
4) Ask participants what they learned about curves, hills, obstacles in the road, and how road features affect the ability of cars to travel.
5) Ask participants to discuss why some cars did better than others.
6) Be sure to note that in the real world, roads have to accommodate all types of vehicles (big, small, cars, buses, trucks, etc.), and also consider bicyclists and pedestrians!
7) Discuss presentations (Grades 10-12) and who made a persuasive argument.