

## Big vs Small

The variation in size of vehicles can be great when large farm implements are sharing the same road with smaller vehicles. Many drivers do not realize the differences and the impact these differences make. Other dangers such as poor visibility, loose gravel, curves, hills, and speed variations complicate the situation and tragic results.

### ACTIVITY

Mass Force Demonstration

Targeted Age: Middle school and above

Learning Objective: The students will judge the impact of different weighing vehicles when they collide.

Concept: Vehicles on the roadways have different sizes and weights. The differences are even greater when large farm machinery is involved.

Targeted Audience: Elementary to high school, increasing the complexity of the concepts as children get older. This lesson could be adapted to be a momentum problem for high school physics.

You will need:

- ▶ Curved 36" board with groove cut down the middle of the entire length
- ▶ 4 marbles (2 small and 2 large)
- ▶ Ounce or gram measuring scales

This demonstration will show what might happen when a small vehicle collides with a large vehicle such as a tractor or combine.

Show the marbles. The bigger ones represent large farm machinery such as a combine or tractor. The smaller ones represent cars or smaller vehicle. The marbles can be painted to look like a combine or other vehicles. Have the audience compute the size relationship by weighing both marbles and dividing the larger one by the smaller one. Relate this relationship to the actual weights of vehicles. Explain that this relationship would probably be even greater in real life. Combines can weigh 30,000 to 40,000 pounds and tractors vary greatly from 1500 to 100,000 pounds. For this exercise use a combine weight of 40,000 pounds and tractor weight of 60,000 pounds so students can make weight comparisons in their head. Use 4,000 pounds for the weight of an average size car.

Explain that the momentum created by the rolling marbles on the downward curve represent moving objects. Using the two smaller marbles set one on the groove of each side. Release the marbles at the same time. They should collide in the middle and both should roll back up the groove approximately the same distance. This represents two small cars. Next, do the same thing with two bigger marbles, representing two tractors or combines. Results should be similar to using the two smaller marbles.

The third time, use one small marble (car) and one large marble (tractor/combine). The bigger marble should knock the smaller one off the board. Emphasize the direction of each marble upon impact. Try the demonstration several times to allow youth to see well and reinforce the concept.

Questions to Ponder:

- ▶ Which marble was most likely to stay in the groove? Why? Relate this to the difference in size of vehicles.
- ▶ How far did the small marble (car) fly when hit by the large marble (combine)?
- ▶ Within this demonstration we were comparing weight. Another difference between cars and farm equipment is height of the driver. What does the driver of a car see as compared to the driver of a combine? How does this influence line of sight and safety?

