Roller Coaster Event

The roller coaster event has been developed to provide students with opportunity to design a car that can coast down a ramp without falling off or loosing its passenger (plastic Easter egg with candy inside). Participants will test their ideas about momentum, velocity and necessary restraints for the passenger, and they are able to make improvements in design after a test is performed. A few restrictions in design of their restraints are to be considered so that they simply do not just ‘attach’ their passenger to the car.

The basic car is made of a flat piece of pine (1/2 inch thick, 5 ¼ inches long and 3 5/8 inches wide) with four plastic 1¼ inch plastic wheels. The pine is beveled at each end and has 10 1/8th inch holes, 5 on each side, drilled ½ inch from the side and evenly separated 1 inch apart (See Figure 1). The holes are provided so participants can incorporate short pieces of 1/8th inch dowelling into their restraint designs.

The dowelling is approximately 2 ½ inches long and students can select to use it in all 10 holes for their restraint designs (See Figure 2).

Figure 1. Basic wooden roller coaster car.

Figure 2. 1/8 inch X 2 ½ inch dowelling

Other resource materials will be available (rubber bands, string, tape, etc), but here is where some restrictions apply. While the rubber bands can be used to form a restraint, along with the dowelling for instance, around the passenger egg, they cannot be used to wrap around the car so as to pass underneath. Likewise, they cannot tape the egg to the car. The tape might be used to attach additional pieces of dowelling to form a ‘cage’, for instance, but not used to attach the egg to the car. The intent is for students to design a restraint system that would still allow the passenger easy exit of the car so they cannot attach it.
The cars, after their design and development, will be rolled down a track made of a double layer of plastic-based signboard. This board is the probably familiar to you as it is used to make political signs that are posted along roads during election periods. It has been cut into widths of approximately 6 inches and fastened lengthwise to form the track (See Figure 2).

Figure 3. Roller coaster track

Figure 4. Roller coaster car as it rolls down the track. Note the center strip in place to guide the car down the track.
An additional layer of the board, which is just under the distance between the wheels, in width, is applied to the middle of the track (See Figure 4). This center strip will keep the car on the track as long as weight of the car—a factor in the design—is not too great. Cars that are too heavy tend to gain speeds that cause them to fly off the track so students will need to make sure they do not overload the passenger-egg with too many pieces of candy.

Another aspect of this challenge is for the roller coaster cars to reach, and stop at, the end point—a flat space preceded by a slight incline (See Figure 5). Thus the car must restrain the passenger, without attaching it to the car, and arrive safely at the terminus. Few students will achieve both goals in their first attempt and to have them attempt different designs, based upon the results of their tests, is a major goal for the staging of this event. They learn that failure does not enter into this activity. Rather, they test and improve upon their designs in an effort to succeed with both goals.

![Figure 5. Terminus of the roller coaster track.](image)

Note to the teacher: Please consider that the basic roller coaster cars are hand made by a member of our staff and thus we ask that students do not remove them from the room where the event takes place. Upon completion of your class' involvement, kindly have students return the cars, eggs and other materials used to the location indicated. The can keep the candy if they wish. We thank you for this consideration.
What did your students learn about velocity, momentum, and safety from this activity?
Questions to consider for your students when you return to class:

1) What happened when you added weight to your car?
2) How did you decide how many candy pieces (weight) should be added?
3) Why was it important to design your car so that the passenger-egg was restrained from falling out but still could be removed easily once you got to the end of the track?
4) What did you do in the design to keep your passenger-egg from falling out?
5) What were you able to do after you tested your car?
6) How would you describe the best speed for your roller coaster car?
7) How would you describe the best speed for a car when it approaches a freeway on the on-ramp? Leaves a freeway on the off-ramp? Goes around curves on a mountain road?