

Expert Interview: Egg Transport Vehicle

Expert information in this interview has been provided by:

Rolin E. Barrett, Jr., Ph.D., P.E.
Consulting Engineer and Accident Reconstruction Specialist
Barrett Engineering

Eric Klang, Ph.D.
Director, Undergraduate Program
Mechanical & Aerospace Engineering
Faculty Advisory, Wolfpack Motorsports

Interviewer: If you were teaching this lesson what guidance would you give to 8th grade students as they get ready to design their egg transport vehicle?

Expert: The best thing to do with an egg transport vehicle is to realize that you've got to limit the forces of acceleration on the egg to a certain maximum value. Design a compartment to prevent the egg from contacting a hard feature of the interior. I would make a crumple zone on the outside of the exterior surface of the vehicle to permit the vehicle to absorb some of the blow for the egg prior to the egg transport compartment medium having to do its job.

Interviewer: Well, how could you do some of those things?

Expert: If the transport vehicle has a rigid interior and you have a delicate egg, the best thing to do is to place some kind of energy absorbing medium in there, such as foam or some kind of soft material which will deform and crumple. It does not have to restore after the accident to its original value. It can be something that is a one-time-use item and just simply deforms and crumples and absorbs the impact. The idea is to spread out the duration of the impact for the egg and to prevent it from contacting a hard feature.

Interviewer: I guess it's safe to say that adding vehicle crumple zones would be another methodology.

Expert: Yes, you can then look at the possibility of adding crumple zones or crush zones on the exterior of the vehicle, outside of the egg compartment itself. That area can be modified to allow the same extending of the accident duration as well as the ability to limit the shock and acceleration felt by the egg. And the same thing's true in passenger vehicles.

Interviewer: So what variables make a difference in the success of design? Height? Wheelbase? Track? Distribution of weight?

Expert: For an egg transport vehicle the length is the first thing I would consider. The longer the distance in which the egg has to slow down the better. Because for a given speed at which the vehicle impacts a barrier, the longer the time you can spread it out the softer you can make the accident for the egg. You need a longer distance in which the

vehicle can softly crumple up and absorb the impact. The height of the vehicle will make some difference. Also its stability to stay on a track as opposed to rolling over and falling off is important.

The wheelbase is primarily going to impact the size of the egg compartment and the room you have to put in cushioning medium. The track of the egg transport vehicle is similar to the height in the sense that it's going to affect the stability and the distribution of weight. I would think that you would want the heavier part forward so the egg doesn't have a weight behind it forcing it further into the barrier upon impact.

Interviewer: How about the track?

Expert: You want the egg transport vehicle to remain on the test track throughout the duration of the experiment. If the vehicle is not stable or if the test track is not designed to prevent the vehicle to remain on it then it will fall off the track. And unfortunately the egg will suffer a complicated type of accident.

Interviewer: Name three design features for the egg transport vehicle and or its safety compartment you would incorporate if you were doing the lab.

Expert: If I had to pick three design features for the egg transport vehicle, I would say padding the egg transport compartment to prevent the egg from contacting a hard feature of the interior. I would make a crumple zone on the outside of the exterior surface of the vehicle to permit the vehicle to absorb some of the blow for the egg prior to the egg transport compartment medium having to do its job. And then I would design the vehicle to safely remain on the test track and to hit in a predictable manner.

Interviewer: What are the elements of design for any car? And what is its purpose

Expert: When you design a passenger car you're designing it to fill a certain role. Maybe that passenger car is supposed to haul a family. Maybe it's supposed to haul a given product. Or perhaps it's just for general family use, general transportation by an individual. And so you're constrained by motor vehicle regulations about the design. You're also constrained by the size of lanes and other traffic devices. So the design of a passenger car begins with regulations and with the common design or roadway.

Interviewer: What is more important for young kids to understand about accidents?

Expert: The best thing that kids can learn about accidents is that most accidents are the result of driver error. Most accidents are the result of either being in too much of a hurry or taking a chance when it's just not necessary. The actual vehicle safety comes after those factors.

Interviewer: What are important safety rules about driving a car?

Expert: One of the biggest causes of accidents that I experience at my work has been noticing that people drive too closely. Or they drive too fast for existing conditions. For example if there's a heavy fog or a driving rainstorm you want to slow down. And if you have any doubt about the driving conditions allow for more space between you and any vehicles that may be ahead of you.

Interviewer: When do accidents happen? Who has the most accidents and why do most occur?

Expert: There are different causes of accidents. There are more accidents when there are more vehicles on the road simply because there is a greater chance. The other issue is times of day when drivers may be tired or otherwise distracted.

Statistically most accidents are caused by younger drivers. That's due to inexperience. Although, some accidents when drivers are no longer physically able to operate the vehicle safely. But the younger drivers still dominate most accidents just because of a lack of opportunity to learn about the vehicle and about driving safety.

Interviewer: What can people do to reduce accidents?

Expert: Again, one of the most important things to reduce an accident is to simply allow for greater distance between you and other vehicles. And reduce speed when driving conditions worsen.

Interviewer: Ok. How do these two differ from the optimum system?

Expert: We would like to have people packaged in cars like we package eggs for transport. But it's not practical to do that. So we have to find something that blends in with every day needs. And the current system of seatbelts and airbags do an excellent job. For the near future we'll see an expansion of the airbag concept to cover other types of accidents than have previously been covered. We've seen them go from a simple head on type of protection to side protection and now rollover protection. I think we'll see some small extensions of that. And we'll also see the electronics, which activate the airbag systems to be more precisely controlled for each specific accident scenario.

Interviewer: Will there be air bags eventually around the driver's legs in NASCAR?

Expert: Not very likely. There's a combination of the cost efficiency. What does it deliver for the amount of extra cost? Also it may impair control of the vehicle by the pedals. It may knock the feet free of the pedals. However, an advancement we can expect to see is multiple-use airbags. So that if you're hit in a collision and then another vehicle comes along seconds or minutes later and collides with you, you're protected from that as well.