

# Expert Interview: Barrier Design

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*Expert:* A barrier offers the ability to deform and absorb part of the impact if possible. But you want the barrier not to allow the vehicle to dig into it so to speak. In other words you don't want the vehicle -- upon contact with the barrier -- to suddenly have a reduction in speed along the barrier. So ideally you would make the outer surface of the barrier somewhat slippery but it should also have a spring quality to it.

*Interviewer:* Let's talk a little bit about guardrails. Please describe some features and also what happens when the guardrail permanently deforms.

*Expert:* The tax payers pay for it with highway and road maintenance. However, it's a lot cheaper to replace a deformed barrier than to repair a badly injured person. It's a small price to pay to save the human life or serious bodily harm. The barriers have to be replaced when they are deformed. But again that's part of their design.

*Expert:* At one time breakaway guardrails with energy-absorbing terminals involved the use of wood posts as opposed to steel. Wood posts were used many years ago to allow absorption and deflection -- and then would ultimately break away. The ends of the posts have been modified so that they will not protrude or are not as likely to protrude into the passenger compartment. The barrier can still "give" regardless of whether you hit on the end or you hit along the side.

*Interviewer:* What are the properties of good and bad barriers on race tracks and public roads?

*Expert:* Race tracks and public roads share one thing in common about the barrier. The barrier should do its part to both retain the vehicle in the area where the vehicle is supposed to remain, such as on the road surface or on the track surface. And thus keep it from harming others. It should also lessen the chance that it will harm the occupants of the vehicle. Barriers should absorb energy from the hit to lessen the severity of the impact.

*Interviewer:* Are there any difference between barriers of public roads and race tracks?

*Expert:* Yes. Race track barriers are much more sophisticated. The cost factors involved in trying to make these barriers for public roads are prohibitive. Race track barriers are

designed for much higher speeds. The speeds on a race track are two to three times the speed of passenger vehicles on the public road. Race track barriers are designed with the idea that the vehicles are going to be traveling around the track in a known direction. Highway barriers have a much more complicated problem because vehicles in the course of an accident may approach the barrier at a very unusual angle. They may approach the barrier nearly perpendicular. After a collision a vehicle may even be knocked backwards in some cases. So the barriers that are used along public highways are design for more complicated accidents.

*Interviewer:* How does vehicle speed impact the design of the barriers?

*Expert:* In recent years, cable barriers have been used on highways. These cables have been used as an economical means of providing an energy-absorbing barrier that still keeps the vehicles from approach oncoming vehicle lane. The vehicles on a race track travel at higher speed. The barriers do need to be ultimately stronger because of the greater energy that's involved in retaining the cars on the track. However the barriers are doing different jobs. So that accounts for the difference in construction. As far effectiveness, the race track barriers are better at maintaining a high speed vehicle on the track. And they cost a lot more.

*Interviewer:* Other considerations include motorcycles, which need a different kind of barrier and drag races where guardrails can be more dangerous because the car can get under the guardrail.

*Expert:* Two other barriers at the race track are water barrels and Styrofoam blocks.

The use of water barrels is really more of a low speed application. The use of the concrete and steel and some other absorbing materials are intended to withstand higher impacts. The big difference here is that the race track has to constrain all of the parts of the vehicle to the track surface. The highway barriers primarily just keep the vehicle on the surface as best they can. But if a wheel comes off and goes down a grassy hill it just doesn't matter as much. There are no spectators sitting close-by on the highway – hopefully!

The Indy Racing League developed softer walls and a majority of the oval tracks used that system. At certain tracks I saw NASCAR and other racing leagues use Styrofoam blocks. But every time somebody hit the Styrofoam blocks they exploded. The Styrofoam barrier worked but led to long caution flags.

And some tracks use tires on road courses.

*Interviewer:* Why don't they put air bags in race cars or in barriers around the track?

*Expert:* Airbags surrounding the track in problem areas may be difficult to maintain and employ properly in an accident. There are some technological issues at this time. Airbags in race cars, I would not be surprised to see them at a future point. But they already have

many safety systems and restraint systems that are excellent. So airbags would have to make a new and different contribution.

*Interviewer:* You say though that one of the big differences between a race car and a private car would be seatbelt use?

*Expert:* Seatbelt usage among professional drivers is 100 percent. They know from both experience and from their training that the seatbelt will save their life more often than not. The seatbelt is the one device that is most likely to help them out during an accident. An airbag is a device that can offer some improvement for certain types of accidents. But the seatbelt is the most efficient general-use device for safety.

*Interviewer:* What are the most common mistakes/faults in designing barriers for tracks and public roads?

*Expert:* If I had one big criticism I would say that they're not tall enough. At a lot of places along the roads, there's an increased potential for the cars to leave the road, which enhances the severity of the accident.

The other problem I see with the barriers -- and this is a very unusual problem -- is that some cars with sloped contours on their hoods and front ends allow them to actually slide over the top of the barrier.

*Expert:* I think that while race cars are designed to survive a severe accident, they're ultimately designed for better protection of the driver. They have rigid interiors that tend not to deform. This provides a rigid passenger zone that is less likely to crush the driver. Passenger cars don't often don't have this design. Passenger cars are more susceptible to compromising passenger space in a severe accident. However, in minor accidents, the passenger cars do offer some crumple zone protection.