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WELCOME

Mark Ortiz Automotive is a chassis consulting service primarily serving oval track and road racers. This newsletter is a free service intended to benefit racers and enthusiasts by offering answers to chassis questions. Readers may submit questions by mail to: 155 Wankel Dr., Kannapolis, NC 28083; by phone at 704-933-8876; by e-mail to: markortiz@vnet.net. Topics are also drawn from my posts on the tech forums at www.racecartech.com and www.rpmnet.com. Readers are invited to check out these sites, and to subscribe to this newsletter by e-mail.

Mark Ortiz

SAFETY ISSUES

With the deaths of Dale Earnhardt and three other national-level NASCAR drivers in the last 12 months, all from basal skull fractures in frontal impacts with walls, much attention is suddenly being paid to this type of injury, and this type of impact. I would like to offer my own thoughts on the matter.

THE HANS DEVICE

The HANS (head and neck support) device has been around for some 20 years in various forms. It has had trouble gaining acceptance for reasons of bulk, mobility restriction, and appearance. There is little doubt that it will prevent basal skull fractures in frontal impacts, and NASCAR drivers are suddenly ordering the device in much larger numbers.

I do not doubt the device's effectiveness. However, it should be pointed out that there is only a certain range of impact severity where it really helps. (Impact severity depends on magnitude, duration, and number of accelerations.) Below a certain threshold of impact severity, the driver will survive without the HANS. Above a higher threshold, the HANS will save the skull and neck, but the driver will be killed anyway by other internal injuries. Therefore, the HANS may be part of the answer, but there is also a need to reduce impact severity in frontal contact with the wall.

SOFT WALLS

The need to reduce impact severity in frontal collisions with walls has led to various ideas for cushions for concrete retaining walls. Some tracks in the northeastern US are using blocks of styrofoam (styrene foam). NASCAR has done a few experiments with encapsulated styrofoam, as used for marine dock bumpers. I do not claim to be an expert on impact absorption devices, but I would like to make some general observations on what is required of such a system.

First, the cushioning system must preserve the good points of a simple concrete wall as much as possible. The uncushioned wall performs very well in glancing impacts, which are in fact the vast majority. The car slides along the wall, loses speed gently, and either comes to rest or continues around the track. It is vital that any cushion present a hard, smooth, continuous surface in a glancing impact, and not snag the car.

Second, on frontal impact the cushion must yield in a controlled manner, and not spring back immediately.

These two objectives are absolutely crucial. Additionally, it is helpful if the cushion can recover its shape and absorb more than one impact. It should be replaceable quickly, in sections, when it cannot recover. It should do its job without making a mess. It should be as compact as possible, though there is an inevitable tradeoff here between compactness and impact absorption. It is desirable that the cushion be non-flammable, though this is a secondary consideration. Cost is inevitably a factor. Finally, it is a good thing if the cushion can be made of reused or recycled materials.

I have no patents on wall cushions, and I am not promoting anybody else's system, but there are some particular design features that can help accomplish the objectives described above.

The cushion needs to have a metal, plastic, or composite facing. This should probably be part of the individual segment of the cushion, for easy replacement of both the facing and whatever is behind it. To avoid the problem of a car deforming one segment and being snagged by the next segment, the facing of each segment should overlap the facing of the next segment, in the direction of vehicle travel.

Behind the facing, there must be some kind of deformable structure to absorb impact. Possibilities here include cellular or foam structures, telescoping hydraulic units, and bladders containing air or water, with blowoff valves.

One approach might be to mold cushion segments in one piece, with a relatively thick facing and a thinner-walled honeycomb crush structure behind that. A possible material would be polyethylene, sourced from recycled milk jugs. This would gently recover its shape after impact, if the damage is not too severe. When the segment is too severely crushed for that, it would be replaced, and recycled.

Bladders, made of reinforced rubber as in fuel cells, could be refilled with air or water after an impact and be ready for another. Water exiting through blowoffs absorbs impacts very nicely. The principle has been used for vehicle bumpers. The water would wet down the track, but absorbent compounds used for other spills, or simple evaporation, might cope with that. Alternatively, air-filled bladders could be restored to shape with a pressure hose. Foams such as those used for earplugs and cockpit padding can also be used in bladders.

To fasten segments to the wall, one solution is cables through the wall, with fork clips.