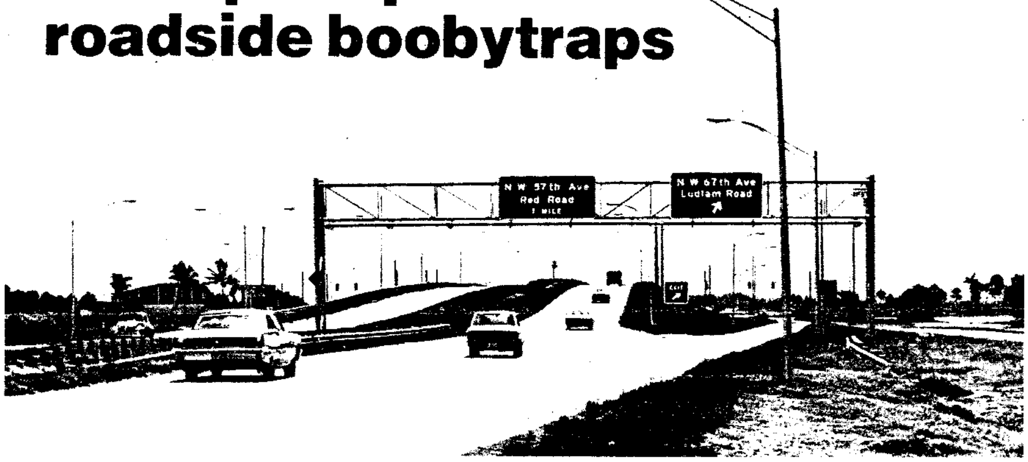
AMERICAN CITY & COUNTY, December 1979, Page 55.

Don't put up with roadside boobytraps



Roadways may never be 100 percent safe, but locating and correcting hazards can save lives.

Today, any highway official who relies on sovereign immunity as a defense against a lawsuit will find it a weak reed, indeed. Courts now require a highway jurisdictional authority to keep its roads in a reasonably safe condition for the reasonably prudent traveler. They are holding that state or local government has a duty to act where some feature might be a proximate cause of an accident, unless other proper precautions are taken or appropriate warnings given.

Last year, the Federal Highway Administration issued a report that indicted unyielding objects alongside the roadway as the proximate cause of a substantial share of fatal accidents. Pennsylvania reported that 40 percent of all the fatal crashes in that state occurred in collisions with a fixed object, such as a utility pole, a tree, or a bridge abutment. In Maryland, 31 percent of all fatal crashes were the result of collisions with fixed objects, as were 20 percent of all highway crashes.

If fixed objects alongside the roadway result in so many deaths, why are they there? E. M. Johnson, former president of the American Association of State Highway and Transportation Officials, told a Congressional subcommittee some years ago the basic reason: Early highway designers borrowed heavily from railroad practice, and could not anticipate the differing demands of high-volume, high-speed motor vehicle traffic. Subsequent highway engineers had an attitude of "I am designing a safe paved highway, but I can't be responsible for drivers who go wandering off it. That's their fault, not mine."

But drivers do leave the paved way. They may be forced off the road by another vehicle, or they may be unable to see because of fog or heavy rain or snow. They may be intoxicated, overmedicated, or out of control because of hydroplaning or skidding on ice. It is irrefutable that vehicles will leave the road for any number of reasons. Even highly trained drivers traveling the 75-mile closed course at the General Motors Proving Ground were found to leave the test strip out of control about four times in each million miles of driving.

Acting on its experience, General Motors found that it could eliminate virtally all injuries by clearing a 30-foot wide swath on each side of the paved way. The provision of this 30-foot clear zone on each side of a roadway was a key recommendation of Charles Prisk, a veteran of 38 years of experience in highway safety work before he became consultant to the Congressional subcommittee during its investigations.

But an additional 60 feet of cleared area, free of all obstructions and ditches and graded to a smooth slope of no more than six percent, is a hopeless dream for many roadways.

When you can't afford to pave all of your roads, what will those residents who have to put up with traveling on dirt and mud say about your plans to spend money on "cosmetic" improvements for those residents who already have paved roads? If you have roads that cling to the side of mountains, with a sheer drop on one side and a rock cliff bordering the other, where are you going to get the money to drill and blast and excavate all that material?

If the whole idea is utopian, must you throw up your hands and go back to filling potholes? Obviously not. You make a start by eliminating the worst hazards. People in your own department already know what traffic sign and signal standards have had to be replaced because they were hit by a vehicle.

Go out and take a look at them. Are they really necessary, or could they be removed without creating problems for motorists and pedestrians? Could they be moved to a less vulnerable location without diminishing their effectiveness? Could a single standard, located farther from the traveled way, be erected to replace a number of individual standards? The same kind of analysis can be performed for street lights and for utility poles.

Your greatest ally in locating roadside boobytraps is the police department. It has records that show the frequency of accidents at any given location. After some conversation with the proper officer, you may find that police patrolmen will supply your office with descriptions of every roadside obstacle struck in every collision, along with the patrolman's recollection of pre-

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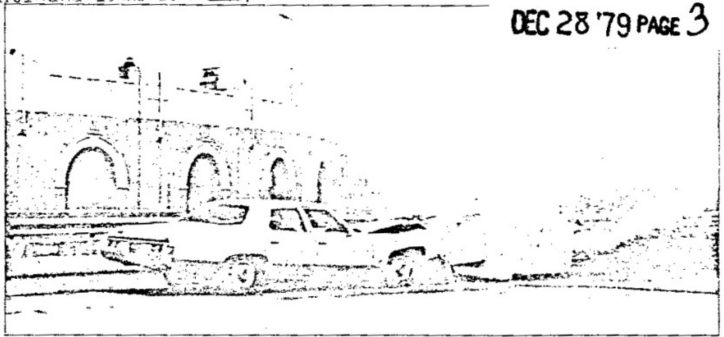
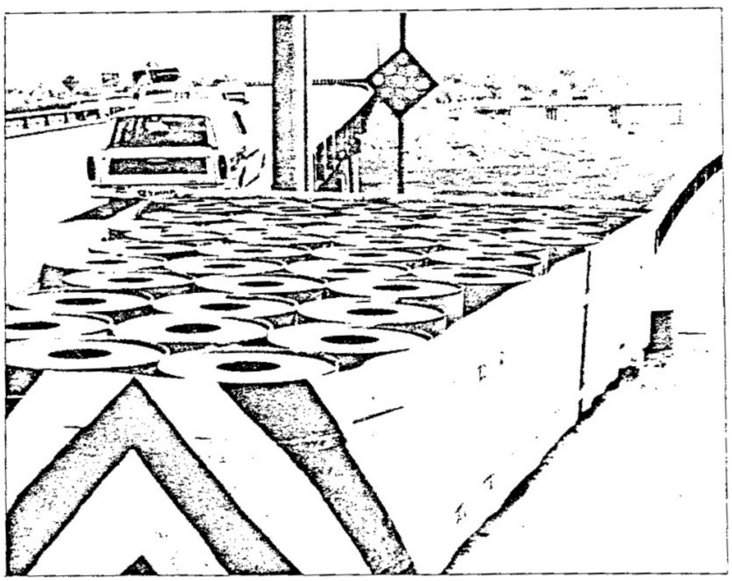


A collision with a barrier of plastic tubes filled with water is spectacular . . .

but clean-up problems are minimal. If the barrier is sand-filled plastic barrels, however, debris will be spread over a wide area of roadway.



A steel-drum barrier is only moderately expensive, but the drums must be secured together and anchored to a back-up device. Vandalism and routine maintenance are not big problems, but replacement is a major job.

vious collisions with the same object.

It only makes sense to devote your initial efforts at hazard mitigation to those objects that have already been involved in an accident. Those that were factors in fatal collisions should come first, but any object struck by a vehicle traveling at speed, even if the occupants escaped with their lives, will inevitably be struck again — and perhaps with less happy results.

Then the problem becomes one of locating and eliminating hazardous objects that have not yet been struck. Locating them is relatively easy: any substantial fixed object within 30 feet of the pavement is a potential boobytrap. Eliminating them might be equally easy, if only the highway department had unlimited funds. In view of the enormity of the task, however, some method of prioritizing the potential hazards for corrective action becomes essential.

Fortunately, major studies have been undertaken to assist highway engineers in locating those hazards that are most likely to result in a serious accident. Paul Wright, professor of civil engineering at Georgia Institute of Technology, and Leon Robertson, research associate at Yale University, reported on their project involving field studies of 300 Georgia locations where fixed-object accidents had occurred during late 1977 and early 1978, plus 300 comparison sites.

The first finding of the study was that many miles of roadway can be eliminated from consideration when the program is concerned with maximum cost effectiveness.

Arterial roadways are the problem areas. Only five percent of Georgia roads are classified as principle arterial, yet they were the scene of 14 percent of the fixed object collisions. Another 22 percent of the accidents occurred on minor arterials, which comprise only 8 percent of Georgia roads. A total of 37 percent of the collisions occurred on arterials, which comprise only 13 percent of the roadways.

Curvature proved to be an important variable in 91 percent of the accidents. Approximately, 84 percent of the accident sites were within 500 feet of a curve, while only 72 percent of the comparison sites were within the same distance of a curve. At more than 60 percent of the crash locations, the curvature was greater than six degrees, while this degree of curvature was found at fewer than 38 percent of the comparison sites. Remarkably, nearly half of the crash sites were within a curvature of nine degrees or greater, while only 27 percent of the comparison sites had a maximum curvature greater than nine degrees in the upstream section. At the crash sites, the maximum curvature tended to be located at a point about 50 feet upstream

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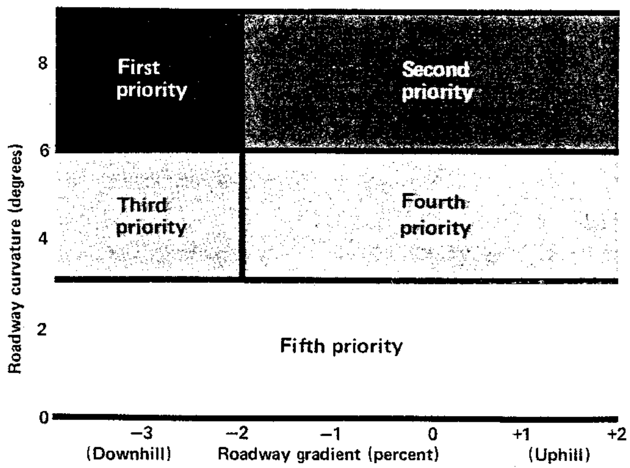
Where should you correct roadside hazards?



Source: "Amelioration of Roadside Obstacle Crashes", Paul E. Wright and Leon S. Robertson, Institution of Transportation Engineers, 1979

of the impact location.

Some two-thirds of the vehicles crashing on or near curves left the road on the outside of the curve. Roughly half of all crashes involved this type of situation. The most common scenario, occurring at least twice as often as any other, was vehicle negotiating a curve to the left and leaving the right-hand side of the road. Interestingly, the researchers reported that inadequate or adverse superelevation did not appear to be a major problem in these accidents involving horizontal curvature.

Also useful for the highway engineer is the study's findings on grades. Downhill gradient is more often characteristic of the approach to an accident location than to a comparative site. Moreover, crash sites were more often found near the points where downhill gradients end and uphill gradients begin. On the other hand, the grades were not substantially steeper leading to the crash sites than to the comparison sites.

When both maximum curvature and minimum gradient are considered simultaneously, the crash sites differ significantly from the comparison sites. One-fourth of all crash sites were at locations combining a curvature greater than nine degrees with a downhill gradient of at least three percent. Only ten percent of comparison sites exhibited this combination of characteristics.

About 90 percent of the objects struck were within 30 feet of the pavement edge, and 97 percent were within 50 feet. The number of potential hazards within this area differed little between the crash and the comparison sites. Accordingly, the degree of potential hazard seems not to relate to the number of fixed obstacles, but to the roadway geometry.

What did the crash vehicles hit?

- Utility poles — 24%
- Trees — 16%
- Ditches and banks — 13%
- Guardrails — 11%
- Bridges — 6%
- Fences — 6%
- Signs — 4%
- Other objects (culverts, mail boxes, fire hydrants, walls, curbs, parked vehicles, boulders, posts, streetlight poles, barriers, and barricades) — 20%

How many of these hazards are there? For every mile of roadway, the researchers found 275 "narrow" objects — trees, poles, and the like — and more than 6000 feet of lineal hazard — guardrail, curb, embankment, or ditch — within 30 feet of the pavement. Within the smallest of highway jurisdictions, then, are tens of thousands of potential hazards that would require millions of dollars and many years of time for correction. The only rational corrective process must follow a system of priorities that recognizes that the likelihood of an accident is a function of roadway geometry.

In the absence of data that suggests another approach would be more suitable for your own jurisdiction, start your corrective program on arterial roadways. On them, first priority should be given to segments with curvature greater than six degrees, combined with downhill gradient of two percent or steeper. Since 66 percent of the crashes occurred on the outside of the curve, give that side precedence in corrective activities, although eventually both sides of the roadway should be corrected for maximum benefit. Second priority goes to all road locations with curvature greater than six degrees; third, to those with three degrees of curvature.

How are the hazards corrected? Ideally, they are removed, leaving an open area for the driver to regain control of his errant vehicle. If removal is impossible, the next alternative is to install a guardrail that will deflect the vehicle away from the hazard. Some years ago, many guardrails were installed without careful consideration of their effects on vehicles. A guardrail on a bridge approach, for example, might deflect the vehicle on a path that led straight to the concrete abutment. A short length of guardrail might be placed in front of a sign support, and the stub ends left exposed, forming a hazard as great to an out-of-control vehicle as the support itself.

Today, most guardrails overlap bridge endposts. Guardrail ends are flared into the ground. Unnecessary guardrail installations do not block access to open recovery areas.

Some obstructions cannot be removed, nor are they located in a position that will allow oncoming vehicles to be safely deflected from them. In those cases, the only course of action is to accept the fact that collisions will occur, and to act to mitigate their effects. This may be accomplished through the installation of an energy-absorptive barrier. The purpose of the barrier, or "crash cushion", is to reduce the impact severity for the occupants of the errant vehicle.

Four energy-absorptive-barrier systems are in common use. One utilizes 55-gallon drums of 20-gauge steel. The kinetic energy of the vehicle is absorbed by the deformation of the steel. A second system uses water-filled plastic tubes. The impact forces the water through orifices in the tubes. Sand-filled plastic barrels are the third system, and the fourth employs cylindrical cells of lightweight concrete, which crushes under impact.

These systems typically are very effective in dissipating vehicular impact, but they do have some drawbacks. They extend from 18 to 40 feet in front of the fixed object, often encroaching into the desired clear areas along traveled lanes. In some cases, sufficient clearance for their installation is not available. The sand-filled barrel, perhaps the most widely used device, spreads debris over a large area after impact, requiring significant and dangerous cleanup efforts. ■■

The Washington Star, March 19, Page 1-F

On Wheels

Many 'Road Hazards' Remain Behind Wheel

By Charles Yarbrough
Special to The Washington Star

What is an "errant" vehicle?

The question leaps from an announcement of a major new study which, oversimplified, strongly suggests not only keeping the roads clear, but the roadsides as well.

It sets forth basic criteria to aid highway administrators and engineers in identifying "hazards most likely to be struck by errant vehicles" and correcting them "before motorists are killed and maimed."

As reported by the Insurance Institute for Highway Safety, the findings "suggest a clear set of priorities for removing roadside hazards or modifying them or the roadway to manage the energy of errant vehicles to protect vehicle occupants. The potential for relatively large reductions in human damage by relatively small efforts in modifying roadside hazards is clear."

"ERRANT" is defined variously as "straying outside the proper path or bounds, moving about aimlessly or irregularly, deviating from a standard" and even "quixotically adventurous."

Vehicles, generally, are not errant. Drivers are.

The phrase, "When the car left the road and —" is almost old enough to qualify as a cliche.

These observations are not intended to denigrate or minimize the importance of the study. It was prepared by Drs. Paul H. Wright of the Georgia Institute of Technology and Leon S. Robertson of the Insurance Institute for Highway Safety.

Their findings suggest that highway officials "should give top priority to roadside hazards modification on and near curves greater than six degrees, particularly those accompanied by downhill grades of two percent or steeper, on non-local roads."

Admittedly, highway authorities have been faced with roadside hazards "so numerous that immediate removal or modification of every one is unfeasible."

With all its obvious value, the study is, in essence, a proposal for tremendous outlays of money to further protect the motorist, who so frequently is inept as well as errant.

Perhaps only by coincidence, the same issue of the Insurance Institute's Status Report publication (March 3) summarizes the legal action taken against the State of Virginia over highway hazards, principally the 22-mile construction horror of widening Interstate 495, the Capital Beltway.

But despite the scores of 45-mile speed limit signs along the "destruction corridor," it is seldom that any highway user can detect any vehicle at or under that speed, which — in many places — is still too fast.

The morning after the big snow of March 8-9 left the barricade-lined pavement a veritable running stream, traffic was exceeding even the national 55-mile limit, sending up a wake of streaming spray that the best of windshield wipers couldn't cope with.

What ever happened to the emphasis — if indeed it ever existed — on the fact that the posted speed limit isn't safe under all conditions?

The potential hazards — many of them, at least — are still on the road.

The Washington Star, March 30, Page 10-A

Perils of rigid roadside objects

In your "Wheels" section on March 19, Charles Yarbrough reported on a study of roadside hazards by Dr. Paul Wright and myself. He editorialized that our emphasis on "errant vehicles" striking unyielding objects along the roadside was misplaced and that, instead, enforcement of speed limits and other measures directed at errant drivers should be emphasized.

While I have no objection to the enforcement of speed limits, substantial scientific evidence indicates that such "crackdowns" have limited effects on death rates. Consideration of the speeds at which vehicles commonly travel and of the limitations of human abilities explains why this is so.

A vehicle traveling at the moderate speed of 30 mph is moving at 44 feet per second. Since most roads have hazardous objects within a few feet — often a few inches — of the roadside, even a small deviation from the intended path in a small fraction of a second can be deadly. At best, human response time requires more than a half-second. Any mechanical difficulty or human mistake by the driver or someone else — such as swerving to avoid a dog or child — that results in even transient diversion of the vehicle from its path can have lethal results in less time than that, even at relatively low speeds.

Last year, more than 17,000 Americans were killed crashing into rigid roadside objects, even after lowering speed limits. It is time to abandon folklore about errant human behavior, along with the expectation that somehow people can and should be made perfect or risk being sentenced to death or life in a wheelchair.

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