FEATURE ARTICLES

Traffic Safety and the Highway Engineer

ROBERT W. SWEET, Chief Engineer, New York State Department of Public Works

EDITOR'S NOTE: This article, prepared by Mr. Sweet for the Highway Research News, is based on a letter he recently wrote to Mr. A. E. Johnson, Executive Secretary of the American Association of State Highway Officials. Mr. Johnson had asked members of AASHO to give him their views on traffic safety and design standards to be used in the next generation's highway program.

For a long time I have felt that the highway engineer's approach to safer highways is archaic, outdated and unreasoned. We are using methods of approach that defy logic and good engineering practice. An engineer used to be trained to reach his conclusion by reasoning from the best engineering information available. Our present method seems to be to extrapolate (by computer) from information we know to be unreliable with an eager eye over our shoulder on our press releases.

Let's look into the anatomy of an accident first so that we can discard the things we cannot control. An accident always is the juxtaposition of a series of events and conditions.

Many unpredictable factors may make a contribution—the mental or emotional condition of one of the drivers, the weather, the mechanical condition of the vehicle, the proximity of roadside obstacles, sudden illness, the action of other vehicles and, of course, the road itself.

Obviously the only thing we, as highway engineers, can really effectively control is the road. We can and must do our best to exercise this control in such a manner that the highway, at least, will be less of a contributing factor.

Identifying the accident-prone location has long been a bone of contention. Police reports provide but a guide. They are seldom complete or conclusive. And seldom do they accurately pinpoint the location; often they err as to cause.

A long, straight stretch of road may have a rash of accidents and subsequently be identified as an accident-prone location. It may well be that the location, itself, has nothing to do with it. Poor speed law enforcement and lack of adequate police patrolling may be the cause.

On the other hand, there are many dangerous locations where the coincidence of conditions and events necessary for an accident or accidents simply has not yet occurred. Therefore, even if no accident record exists, this does not change the hazardous nature of the location.

I cite the infamous Dansville Hill on New York's Route 36 as an example. Here is a long, steep hill terminating in the main business section of a moderate-sized village. To my personal knowledge, at least 20 large trucks have lost their brakes on that hill and roared down into the village. So far no one has been hit or killed! It took four long years to finally convince the statistics people that here was a hazardous situation. We now have a relocation under construction. There are many other potential killers of a similar nature.

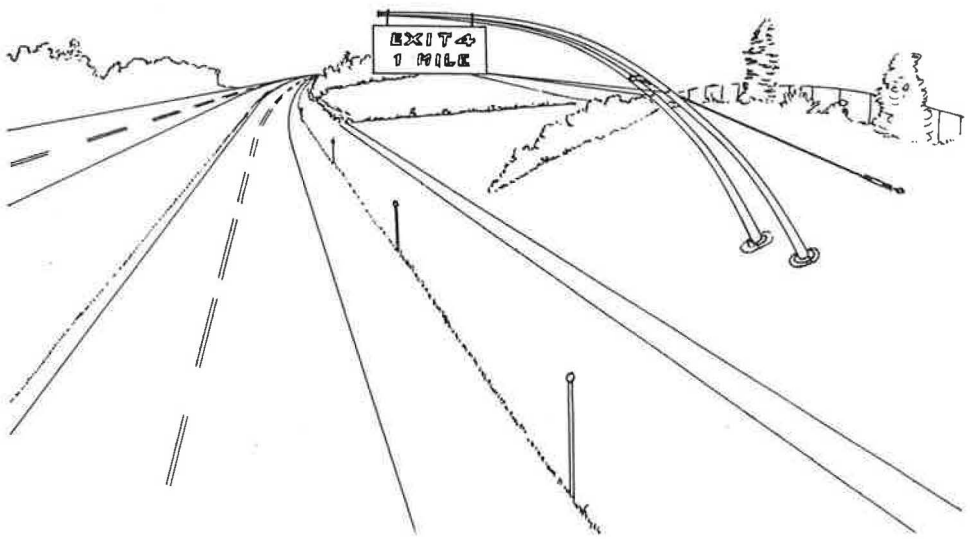
About 40 percent of all highway accidents are now of the in-line, rear-end collision type. If we stop to think a little, the cause becomes apparent. When one vehicle stops in the line of moving traffic, for whatever reason, it becomes a potential accident cause or victim.

Contributing factors are the driver's tendency to follow too closely and the fact that many motorists let their minds wander while driving. These two factors are generally beyond our control, but there is much we can do to reduce the reasons for the sudden, in-line stop.

In New York we have, as a policy, adopted the practice of providing a speed change lane on the right side of surface intersections to give a right turning driver the chance to slow down out of the line of traffic. We are providing protected left turn slots wherever possible, not as a capacity feature, but as a safety provision. Much more careful analysis is needed for the design of direction and guidance devices so that motorists will not be surprised when they come upon an intersection unexpectedly, thus causing them to stop suddenly.

We cannot altogether do away with rear-end, multiple accidents, but we can greatly reduce their incidence by these and similar measures. My plea for a "sanitary zone" around our ramp intersections has been motivated by this cause. There are many other devices such as better driveway control, bus turn-outs and the use of the New Jersey "J Ramps" for left turns that would help cut down rear-end collisions.

There are also a large number of accidents of the "car leaves the road, hits fixed object" type. The obvious thing for the highway engineer to do is to move such fixed objects as far from the traveled way as possible. As a guide, New York has arbitrarily chosen 30 feet as the distance that trees and poles should be kept from the edge of the traveled way.



Wide paved shoulders and flat slopes are important safety features, too. They give a momentarily out-of-control driver a chance to recover. We are, however, on uneasy ground as long as we place solid objects of our own making inside that distance.

Sign posts and light standards must have some new, imaginative designs. (See Figure.) I do not believe that break-away mounts are the whole answer. Telephone and power lines might well be put underground. This would enhance both beauty and safety. I am exploring the practicality of this idea with a prominent power engineer of my acquaintance in Los Angeles. The changeover would be costly, but it would be money well spent.

I am also investigating the use of low, airport runway type lighting mounts for highway illumination. Such lights would fan their beams out at right angles to the road, thus reducing the blinding effect the high mounted lights have on approaching drivers. In New York we have experimented with bridge lights mounted in the railings. These have been highly effective and permitted much reduced wattage. The same result could be obtained by the low mounts designed as break-aways that are easily and quickly replaceable.

I fully understand that this idea is not universally applicable. In urban areas where neighborhood illumination is a secondary objective, the high lights would probably be better. However, for interchange illumination and rural highway lighting, low mounted lights might well be best and most effective.

Center piers on overhead structures should be eliminated. Abutments should be moved to a point high on the back slopes. These are already a feature of some of our newer designs. The elimination of headwalls and solid guard rails through slope design is not new, but also deserves mention.

To return to statistics for a moment, two-thirds of all accidents occur at night when only one-third of the driving is being done. If we highway engineers just recognized wherein our road fails at night, we could do some big things.

For example, we know that most night-time accidents happen to local people who are usually familiar with the road. (Strangers and tourists seldom travel at night.) Thus, it's often a case of familiarity breeding contempt and overconfidence.

Excepting the drunks and drag-racing teen-agers, the apparent problem involves overdriving the range of the headlights. Under ordinary conditions only about 10 percent of the light produced is reflected back to the driver's eyes to enable him to distinguish objects and alignment. Under adverse weather conditions the percentage is much smaller. We badly need research to produce a surface that will help keep that percentage up.

The use of white or light-reflecting aggregate on paved shoulders is a tremendously helpful step in that direction. This we're doing in New York. (See Highway Research News, Autumn 1966 issue.) A different and coarser texture on the shoulders is also very helpful, because the increased noise from the tires alerts a driver that he is off the traveled way.

Much greater use can be made of fluorescent paint and other reflectorized materials that will enable drivers to see roadside objects or detect a change in direction at a greater distance. The drawback here is that these materials lose their reflective quality during rain or snow storms when they are most needed. It is possible that illuminated delineators powered by low wattage batteries—perhaps solar batteries—could be installed at points of particular hazard.

Naturally, highway design should eliminate car-hiding dips in the profile. Greater use of cattle passes would mitigate the early morning accidents that occur during fogs and rainstorms when a car plows into a herd of cattle crossing the road.

Practically all my comments above have dealt with our primary and secondary system rural roads. There is less to say about the Interstate System and the expressways. All our engineering talent has concentrated on them, and their accident record per million vehicle-miles is excellent.

I do suggest, though, a careful look at the considerable pressure to increase design speeds. Since 1920 allowable speeds have constantly increased until average travel speed has picked up from about 30 mph to over 70 mph. In some midwestern and western states there is no top limit. Unfortunately, human reaction time, and human judgment and depth perception have remained constant.

The time has come to take this human limitation into account. I have already mentioned isolating ramp terminals to that they can be easily identified. Many states are working on improved designs for ramps and gores at exits. The elimination of marginal friction is even more important on freeways.

Finally, I'd like to touch on highway and street safety in the densely populated central city. The most effective safety program New York State ever undertook was the elimination of railroad crossings at grade. By vertically separating the two modes, car-train collisions were materially reduced.

In many major cities that I have visited, a serious obstruction to traffic flow is the delivery van which double parks and blocks one or more travel lanes. All sorts of desperate maneuvers result from frustrated drivers trying to get by. Something obviously should be done about this as well as about the problem of pedestrian impatience and lack of judgment which result in all sorts of trouble and delay. The "Barnes Dance" system helps from the standpoint of pedestrian safety, but does not do much toward moving traffic.

For many years I have favored moving business establishments to the second floor of the existing buildings and devoting the lower or ground level to off-street loading and unloading and parking. The extra width needed for traffic movement could be provided by rigid frame supports that double as pedestrian overpasses and as needle beams supporting the existing buildings.

Architecture is already trending toward the open lower floor for various reasons. The problem was created by vertical development, and it follows that the solution lies in the same direction. This idea is not new or original. The Romans utilized it when they built what is now Chester, England.

This article might better have been called "Random Thoughts of a Highway Engineer." The point is that I think all of us in the field of highway transportation must think ahead and think creatively if we're to effectively meet the challenges tomorrow will surely bring.