

WHAT FIRE TRUCK?

BY LAURENCE F. HATTON

Emergency vehicles by law are granted what is technically known as the "right of way" when responding to a fire or other emergency. Operators of emergency vehicles are permitted to disregard certain traffic laws, including speed limits, traffic control devices, and regulations governing turns, direction of travel, and lane markings in order to get emergency personnel and equipment to the scene in the shortest possible time.

However, this privilege places a burden of responsibility on the vehicle operator. He must exercise caution with regard to other motorists and pedestrians; and he is not relieved of the burden of responsibility for his actions in the event of an accident stemming from reckless disregard for safety.

The law also stipulates that we must make the fact that we are responding to an emergency known to the public at large by displaying warning lights and sounding an audible warning device, i.e., a siren. Upon the approach of an emergency vehicle, operators of all other vehicles are required to yield the right of way and drive to the side of the road and stop until the emergency vehicle has passed.

In analyzing hundreds of accident reports involving fire apparatus, the cause of the accident is very often reported as "Operator of the civilian vehicle failed to yield the right of way to fire apparatus. Summons issued."

A trained, thorough, objective, accident investigator would very often list the cause of many of these accidents as "Operator of fire apparatus failed to insure that all traffic had yielded right of way before entering intersection.... Operator of civilian vehicle, driving with windows closed, air control

equipment and radio on, failed to perceive the fire apparatus until beyond the point of no escape. Both drivers executed faulty evasive tactics."

In an effort to pinpoint the causes of accidents involving fire apparatus, the Safety Division of the New York City Fire Department conducted tests to determine the effectiveness of modern warning devices in making known to the driving public the approach of an emergency vehicle. Using sirens supplied by three different manufacturers and a variety of private passenger cars, it was determined that today's sirens are only marginally effective in warning traffic, and in many cases they will fail to warn drivers of an oncoming emergency vehicle until it is too late for the driver to take any evasive action at all. In several cases, the operator of the civilian car failed to hear the siren until the fire vehicle had passed him!

TESTING PROCEDURE

Several tests were conducted under various weather conditions. A total of 10 test cars representing the three major American and one foreign auto manufacturers, and six different fire vehicles equipped with various sirens were used.

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The test site selected was free of traffic and had an unobstructed straight run of over 400 feet. The civilian test vehicle was placed at one end of the roadway, and a traffic cone positioned every 50 feet to the rear of the car. With the motor at a fast idle and the car radio set at a volume to suit the operator's usual listening habits, the windows were closed and the air conditioner turned on. Both side and rear-view mirrors were covered to prevent the driver from seeing the oncoming fire vehicle. Using a digital sound level meter, the ambient noise level inside the test car was measured and recorded. The noise level averaged between 75 and 80 decibels. This level is consistent with testing done previously to determine ambient noise levels at highway speeds. (Decibels, units of measurement of sound intensity, range from 0, the average least perceptible sound, to about 130, the average pain level.)

On command, the fire vehicle started from a distance of 350 feet and approached the rear of the test vehicle at a speed between five and ten miles per hour. The operator of the test car was instructed to keep his foot on the accelerator pedal to produce a fast idle. Immediately upon detecting the siren of the oncoming fire vehicle, he was to apply the brake. The driver of the fire vehicle was instructed to stop immediately upon seeing the brake light of the test car. The distance between the front bumper of the fire vehicle and the rear bumper of the test car was then measured and recorded.

TEST RESULTS

As can be expected, the test results varied widely depending on the model of the siren, the make, model, and year of the test vehicle, the

type of music, the car radio, and the ability of the driver to hear the siren.

For all tests, the volume of the music was what the driver would hear in a light count down to a red light. In the tests, the radio volume was set at a level that was normal for the car.

In review, the test results must be kept in mind by "drivers" expecting to hear a siren. It is time to review the conditions under which we can expect to hear a siren.

Of the thousands of tests, the most common failure was that the driver did not hear the siren. In many cases, the siren was not heard until the test vehicle was within 100 feet of the test vehicle.

"Right of way" is a standing traffic rule. Response may vary by department and driver.

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type of music being received on the car radio, and the hearing acuity of the driver.

For all tests except three, music was what would be classified as light country. This was to try to strike a compromise between rock music and popular or "easy" music. In the three remaining tests, the radio was tuned to a baseball game, a news broadcast, and a classical music program. Volume was set at a level that would allow a normal conversation within the car.

In reviewing the test results, it must be kept in mind that the "drivers" of the test cars were expecting to hear the siren momentarily and therefore their reaction time was much shorter than what we can expect from the general driving public under emergency conditions.

Of the three functions found on most modern electronic sirens (i.e., wail, yelp, and high-low), the high-low function was found to be so ineffective that it is recommended that its use be discontinued immediately. On several test runs, the siren was not heard until after the fire vehicle had passed the test vehicle.

"Right of way" is never assured. Understanding traffic behavior in reaction to our response may be valuable to lessen costly department accidents like these. Photos by

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The wail and yelp functions performed about the same. However, it was noted that detection occurred at the high point of the audio frequency cycle of the warning device. This would put a siren with a long wail cycle at a disadvantage. In almost all test runs, a siren with a higher audio frequency performed markedly better than a siren with a lower audio frequency, even though both outputs in decibels were about comparable.

Other testing done over the last several years showed that detec-

tion distances varied greatest with the wail function, ranging from 446 feet down to 78 feet, using the same test car, a 1984 Ford Thunderbird, and three different siren installations. The yelp function was the most consistent, varying from 352 to 129 feet. These figures were measured with sirens set at 100-watt output and speakers mounted outside the vehicle. In tests conducted with siren speakers mounted in concealed or "undercover" positions the performance was dismal to say the least.

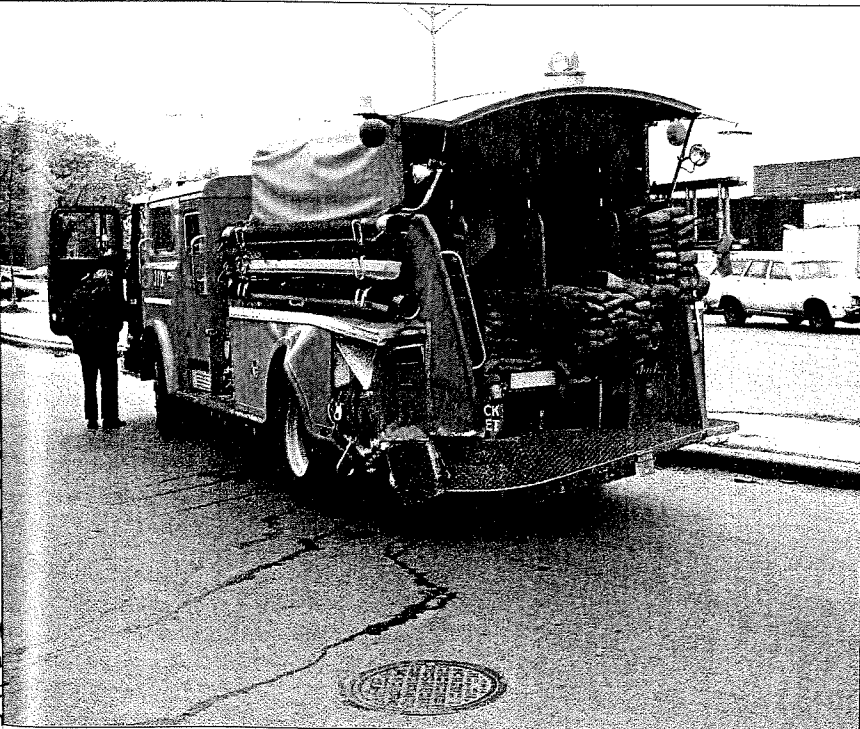
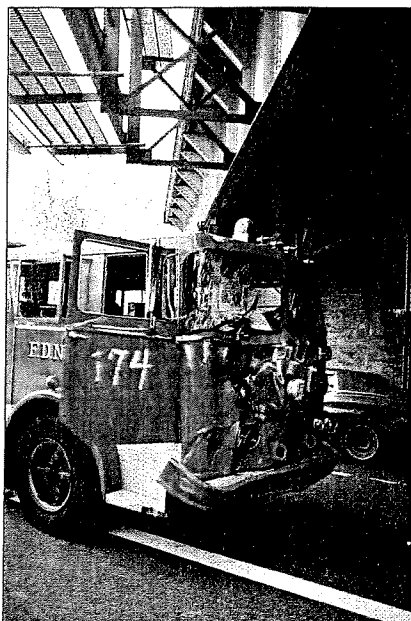
PRACTICAL APPLICATIONS

These tests were conducted to determine the ability of our modern warning devices to alert traffic to the approach of an emergency vehicle. In order to apply the results of these tests, an explanation of traffic flow is in order.

While we are most familiar with measuring the speed of a vehicle in miles per hour (mph), it is necessary to convert this speed into velocity in feet per second (fps). By multiplying the speed in mph by 1.47 we find the velocity in fps (5,280 feet in a mile ÷ 3,600 seconds in an hour = 1.466). Therefore, 30 mph equals 44.1 feet per second. If we take a normal reaction time of .75 seconds (that is, the time that elapses between the instant that a driver perceives a danger and the instant that he begins to take evasive action), we will see that the vehicle will have traveled 33 feet during the reaction time alone (44 feet per second × .75).

If for some reason the driver's reaction time is prolonged, from age, fatigue, alcohol or drug use, distraction, etc., we may find that his reaction time greatly exceeds the .75-second figure. The distance required to stop a vehicle from the time the need is perceived is influenced by three factors:

- The speed at which the vehicle is traveling.
- The reaction time of the driver.
- The braking distance required to stop a particular vehicle from a particular speed. This braking distance varies depending on the weight of the vehicle, the condition of the brakes and tires, the type of pavement, and whether



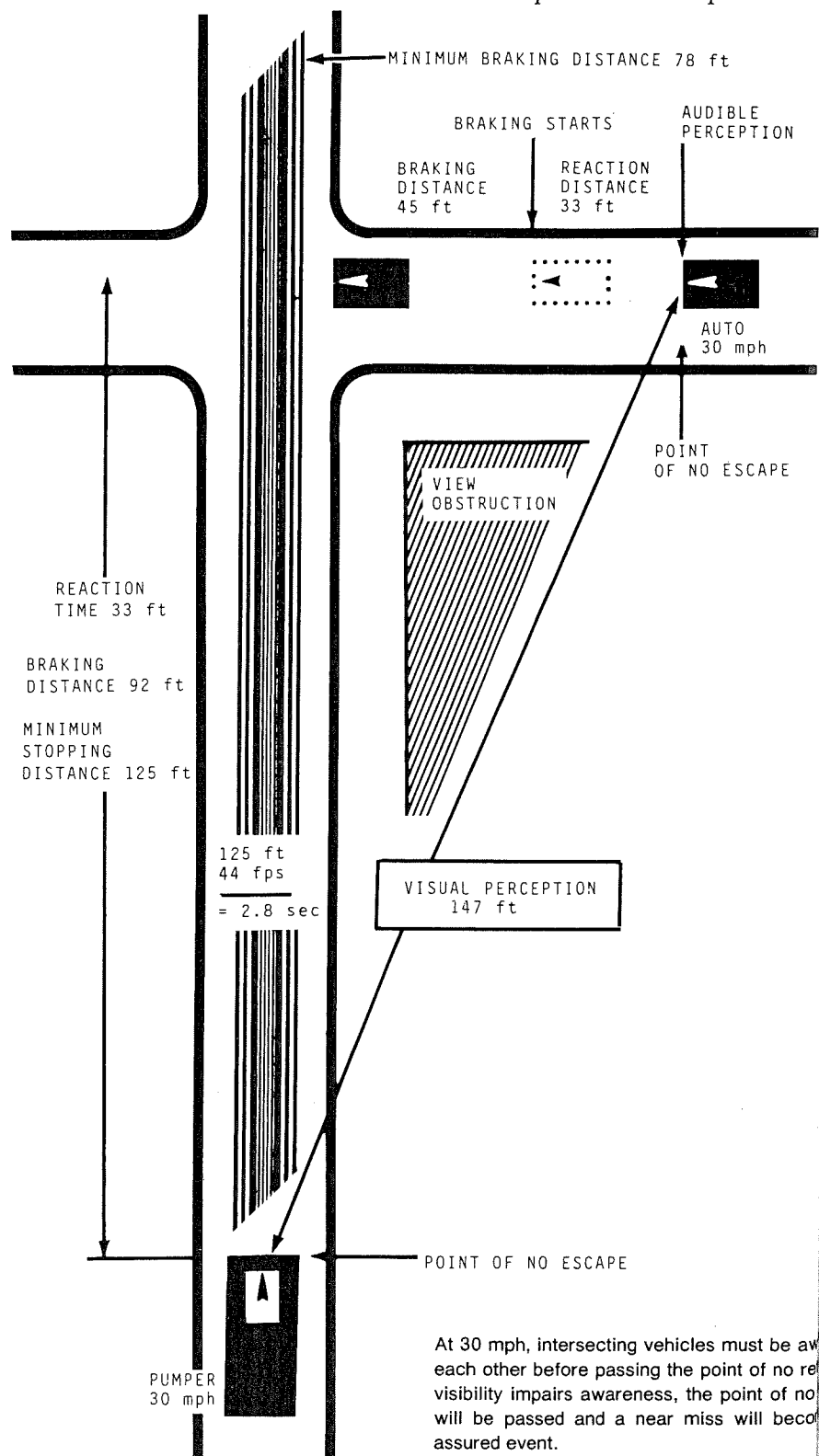
Considering the fact that the average passenger car with good tires and brakes on good dry pavement has a braking distance of about 45 feet at 30 mph and our driver has a good reaction time of .75 seconds, the total stopping distance for this car at 30 mph will be 78 feet (33 feet for reaction time + 45 feet for braking).

One thing we do know is that a driver reacts faster to visual stimuli than he would to audible stimuli. In other words, a driver seeing flashing red lights on an oncoming vehicle is more likely to react instantly (.75 seconds) than he would to first hearing a siren. His first reaction is usually to try to locate the source of the siren, looking in his rearview mirror before thinking of applying his brake. This audible stimulus greatly increases his reaction time, possibly by as much as two to four seconds. Remember, at 30 mph for each second that he delays his evasive action he is traveling another 44 feet.

These points, 78 feet and 125 feet, respectively, are known as the points of no escape. That is, if both

heard, located, and reacted to at this distance, it is of no use in such a situation.

If the civilian driver has his air conditioner on, his radio loud, and his windows up, it is *most probable* that he will *not* hear our siren in time to stop or yield the right of way to our apparatus before he enters his point of no escape.



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The stopping distance of a vehicle depends on:

- Vehicle speed,
- Reaction time,
- Braking distance.

Our test showed that under adverse conditions, the fire vehicle may approach a car to within a few feet before the driver can hear our siren. Modern automobiles are being manufactured with more comfort in mind than ever before. Most cars and some trucks are now manufactured with soundproofing insulation around the passenger compartment. Except in cars delivered in the extreme northern portion of the country, more than 75% of the new vehicles delivered today are equipped with air conditioners, and almost 95% of the cars delivered have at least an AM radio, with an increasing percentage each year being equipped with stereo systems containing four or more speakers. Many cars are either ordered new or later equipped with a tape deck and amplifiers.

The emphasis today is on driver/passenger comfort, which is accomplished in part by excluding as much outside noise from the car as possible.

Unfortunately for crews of emergency vehicles, this "creature comfort" thrust of the auto manufacturers has intensified an already hazardous environment—the highways and roadways that we must travel in answering our alarms.

WHAT CAN WE DO?

In exploring a solution to this problem, many ideas come to mind. Use of low power radio signal devices similar to radar detectors could be installed in new and existing cars and trucks to warn of approaching emergency vehicles. Some localities have installed signal light control devices that are triggered by oncoming emergency vehicles. One thing that we cannot do is make our sirens much louder, as we would probably endanger the hearing of our emergency personnel.

For the present, what we must do, at least until a possible long-term solution is "discovered" by the automotive and warning device industries, is to educate our apparatus drivers.

The drivers of our nation's emergency vehicles must be made aware that they can no longer rely on the use of sirens to warn the public of their approach. Where defensive driving tactics in the past were neglected, today they must be practiced with a religious fervor. Fire service supervisors and managers must become unwavering in enforcement of safe driving practices. Paying lip service to a driving safety program will not prevent accidents.

Remember, you do not have the right of way until *all* oncoming vehicles have granted it to you. And they cannot and will not grant you the right of way if they don't know you are coming; and they can't know that if they don't hear and see you. And you can be sure that many of them do not hear you. ■

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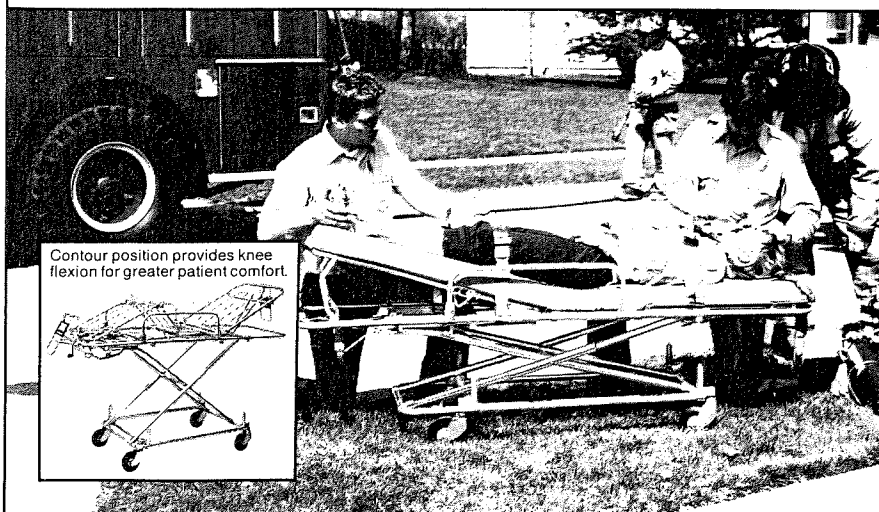
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