Fire Engineering

Close

What's Causing All the Tanker Rollovers?

What's causing all the tanker ROLL-overs?" Battalion Chief Rick Fritz, an old friend and colleague from the High Point (NC) Fire Department, asked me after hearing of another fatal tanker rollover in his state. The follow-up question was, "Is the NFPA Apparatus Committee doing anything about it?"

Before all of the politically and editorially correct readers write letters to the editor, on the East Coast, tankers do not fly; they transport water to fires over streets, roads, and highways. For the purpose of this article, the words "tanker," "tender," and "mobile water supply apparatus" are interchangeable.

My answer to these questions was twofold. First, numerous measures to deal with rollover (and other) accidents are proposed in the ongoing update of NFPA 1901, *Standard for Automotive Fire Apparatus*, which currently is in the public comment period. Second, it is my opinion that the number-one cause of rollover accidents is the driver.

(1) Commercial tank vehicles that are converted for fire department use can easily become overloaded and dangerous. This unit was initially designed to haul liquid propane. (Photos by author unless otherwise noted.)

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About 25 percent of firefighter fatalities annually involve responding to and returning from calls. Lumped into this figure are volunteer firefighters who are responding in their privately owned vehicles and other transportation accidents such as forestry aircraft crashes. Of the remaining apparatus crashes, tankers have claimed more lives than all other types of apparatus combined, even though there are fewer of them in service and they respond to fewer calls.

When we review the reports about these accidents, it is usually the same scenario: The apparatus generally is traveling too fast for the road conditions encountered. Factors such as inclement weather, curves in the road, and steep downgrades increase the possibility of an accident. The driver is sometimes inexperienced, possibly distracted for a second or two by radio traffic or the sound of audible warning devices, and the right wheels drop off the pavement. In an effort to get back on track, the driver makes an overcorrection and the top-heavy truck enters the oncoming lane of traffic. He makes another correction in the opposite direction, and vehicle begins to roll over. Add to that the general lack of seat belt use, and we have the formula for disaster. Nearly three-quarters of firefighters killed in tanker crashes were not wearing seat belts, according to the U.S. Fire Administration publication *Safe Operation of Fire Tankers*.

(2) Red seat belts for better visibility and stalks to make attachment easier were required in 1999.

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So what is causing all of these accidents? Although occasionally there is a documented mechanical failure such as malfunctioning or poorly adjusted brakes or a tire blowout, the vast majority of the accidents involve, as the military puts it, "*operator error*." This could involve any of the following:

- Excessive speed.
- Lack of experience driving a heavy apparatus.
- Lack of experience handling a liquid load.
- Failure to wear seat belts.

(3) Large disc brakes run cooler, stop better, and reduce brake fade.

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(Go to http://www.cdc.gov/niosh/fire/reports/face200625.html for a recent NIOSH report of a fatal tanker accident in Alabama to get a firsthand look at the investigation of a recent accident.)

(4) The cutaway view of a hydraulic transmission retarder shows a large-fluted disc that is slowed down when the chamber fills with transmission fluid on activation.

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I worked as a truck mechanic for a sizable fleet of fuel-oil tankers for more than 15 years. The trucks were all sizes and configurations, single-axle "straight jobs," tandem rear axles, and tractor trailers, and they operated in all types of weather, day and night, year-round. The tank capacities were from 2,800 to 7,000 gallons, and most of the tanks had few baffles, if any. While we had our share of fender-benders, I cannot recall one rollover event in my entire 15 years of service. Why? The trucks traveled at normal speed (no one was in a particular hurry to rush to their next oil drop!); they were operated by experienced drivers whose livelihood depended on their skills behind the wheel; and the fleet was properly maintained.

THE GOVERNOR'S MOTORCADE

In April 2007, Governor Jon Corzine (D-NJ) was riding in the right front seat of a large sport utility vehicle driven by a state trooper who was part of the governor's security detail. The SUV was the lead vehicle in the governor's motorcade, which was made up of several units. The motorcade was traveling at a high rate of speed in the left lane of the Garden State Parkway, a limited-access toll road with a posted speed limit of 65 miles per hour.

A pickup truck entered the roadway from a right lane on-ramp just ahead of the motorcade. The driver, a 20-year-old relatively inexperienced operator, was "startled" by the fast-approaching motorcade with *red flashing lights* and abruptly pulled to the right shoulder as instructed in the driver's manual. In doing so, his right wheels dropped off of the pavement, and he reacted by pulling the steering wheel to the left to get back on the road. During this overcorrection, he entered the right traffic lane, causing another SUV to swerve into the left lane and strike the governor's vehicle. The governor's SUV left the roadway and violently struck a guardrail on the center median. As the state trooper driver fought to bring the truck under control, the governor was reportedly bounced around the interior of the vehicle and landed in the rear cargo area when the SUV came to a stop on top of the guardrail. Corzine had extensive injuries, including a large laceration on his head, a shattered collarbone, a fractured sternum, 12 broken ribs, a minor fracture of a lower vertebrae in his back, and a double compound fracture of his femur, resulting in the bone sticking out of an open wound in his thigh. He was airlifted to a trauma center, where he underwent surgery and was put on a respirator to aid in his breathing.

The trooper driving the SUV and an aide riding in the rear seat both walked away from the crash with only minor injuries. The vast difference in the outcome of this accident was that the driver and passenger were seated and belted and the governor *was not!*

You might ask, "What does this story have to do with tanker rollovers?" Actually, there are a number of shared characteristics that come into play with both types of accident:

- Excessive speed.
- Use of emergency warning lights.
- The relatively inexperienced pickup driver.
- Wandering off the pavement and overcorrecting.
- Lack of SEAT BELT USE!

EMERGENCY VEHICLE DRIVING TECHNIQUES

There are certain exemptions to the driving laws afforded to emergency vehicle operators, to expedite their response. Although these vary from state to state, generally they include exceeding the posted speed limit, traveling against the flow of traffic, passing traffic control devices, and using lights and sirens to request the right-of-way. All of these privileges are only to be taken with due regard to the safety of the driving public.

Exceeding the speed limit. The first consideration when determining a safe speed is the condition of the road. Some departments have regulations that specify the top speed at which the emergency vehicle operator can exceed the posted speed limit, but in some cases the posted limit might even be too fast for conditions; 10 mph over the limit should be the maximum allowed under the best conditions. It is reckless and irresponsible to respond at 50 mph in a 25 mph posted residential neighborhood or school zone. Curves in the road require a reduction of speed to safely negotiate the turn radius. A curve you can easily negotiate at 35 mph can be deadly when the road surface is wet or snow covered.

The "black box" in the governor's SUV indicated that the vehicle was traveling at 91 mph at the time of the accident. At that speed, there is little time to react or make a correction for another driver's error.

When approaching traffic ahead, the emergency vehicle operator must leave sufficient room to safely react and compensate for the actions of the civilian drivers. Rate of closure is the relative speed of both vehicles. For example, if the car ahead is traveling at 25 mph and the apparatus at 35 mph, the rate of closure is 10 mph. If the car ahead is stopped, the rate of closure is a full 35 mph. The apparatus operator should avoid closing this gap too rapidly and overtaking the vehicle ahead. He must allow time for the other driver to perceive his presence and take the appropriate actions. When an emergency vehicle operator "tailgates" the cars ahead, trying to push them out of the way, disaster is imminent!

In the governor's accident, the motorcade was not actually closing in on the pickup truck in the same lane, but the driver said he saw them approaching at a high rate of speed and opted to get out of the way.

Traveling against the flow of traffic. This is another dangerous practice that is sometimes necessary to expedite the response. When responding in the oncoming traffic lane, your first responsibility is to ensure that it is clear of traffic. You cannot seize the right-of-way and force drivers off the road. When it is clear, you should proceed slowly and cautiously around the stopped vehicles. Be ready to stop! If a vehicle is stopped in the left lane, preparing to make a left turn, cautiously pass on the left. If you attempt to pass on the right, the driver of the auto might suddenly comply with the motor vehicle laws when he detects your warning devices and pull to the right lane. An accident in this case would most probably be your fault.

Passing traffic control devices. Exercise caution when stopping at controlled intersections. The operator of an emergency vehicle must STOP at a red light or stop sign and proceed only when the right-of-way is clear. Often as you approach an intersection, there is a game of "cat and mouse" occurring. The civilian cars don't quite know if they should slam on the brakes and suffer a rear-end collision or rapidly pass to get out of your way. This is where the emergency vehicle driver must exercise great caution and patience. You should inch out into the intersection, making eye contact with the other drivers to determine if they are going to stop. Don't assume they see you and are willing to yield. Proceed only after the right-of-way has been given. Trying to "bully" your way through the intersection could have disastrous results. It is important to remember that when crossing a multilane roadway, you must cross *each lane* individually in the above described manner. Many responding accidents have occurred when three lanes of traffic stopped and the driver in the fourth didn't see the apparatus crossing.

Using warning devices. The method an emergency vehicle operator uses to request the right-of-way of the driving public is to use visual and audible warning devices. When the apparatus is on an emergency response, the driver should use these devices from the time the unit leaves the station until it arrives on-scene. Even at 2 a.m., you must legally request the right-of-way to avoid liability. Sometimes a late night/early morning run could be your most dangerous response. Partygoers returning home after an evening of socializing, overnight delivery people who are use to the road being clear, and fatigued drivers who might not be as alert as in the daytime are your driving companions. They all deserve to be properly warned.

Emergency vehicle operators should also avoid sounding warning devices *only* at intersections. The result of this practice will most likely be a startled motorist who will probably react poorly, stopping in your path. If you're on a response, put your lights and sirens on, and leave them on! If you are notified by radio that the emergency has been "terminated," switch off the warning devices and drive like the rest of the public. There are no special "privileges" afforded while returning from an alarm.

Some jurisdictions have established an accident-reduction program for responses to certain types of alarms that have a high probably of being accidental or false (automatic alarms from nonoccupied buildings are one type). In this case, only the first-due engine and truck respond Code 3 (with lights and sirens). Other units on the assignment "drive" to the alarm, without warning devices activated and observing all traffic regulations. If a fire is discovered, responding units are notified by radio and begin their Code 3 response. This system has reduced accidents and had no appreciable adverse effect on response time.

The governor's motorcade was indeed displaying emergency red flashing lights while traveling at a high rate of speed. You might ask, "Was the Governor responding to a natural disaster, a terrorist threat, or even a major emergency?" The answer is NO! The trooper was expediting Governor Corzine's arrival at the Governor's mansion in Princeton for a meeting between radio personality Don Imus and the Rutgers girls' basketball team.

As the operator of an emergency vehicle, your "job" is to drive the apparatus to the scene of the emergency and operate it properly. This should be your complete focus of attention. One of the first things you should do is mentally plan your route, considering impending traffic conditions and the response of other apparatus to the scene. Avoid radio communication and casual conversation with other passengers. Fully concentrate on driving.

Another dangerous practice to avoid is removing your hands from the steering wheel to operate the siren, air horn, or radio microphone. Leave these duties to the person riding in the front passenger seat.

MATCHING SPEED TO ROAD CONDITIONS

Traction between the vehicle tires and the road provides the means to steer and stop the apparatus. Drivers must be aware of several road conditions that reduce this traction and require special adjustments in speed and handling.

Slippery Surfaces

It will take longer to stop and be more difficult to steer without skidding when the road is slippery. To compensate, you must obviously drive slower to stop in the same distance as on dry pavement. A wet road will require slowing down by about one-third; on packed snow, reduce speed by one-half or more. If the road surface is icy, reduce speed to a crawl.

Sometimes the majority of the road surface will have adequate traction but certain areas will be extremely hazardous. The cautious driver will learn to identify these hazards in advance and prepare to compensate for them. Sometimes it's hard to know if the road is slippery. Potential hazards that will warrant speed reduction include the following:

Shaded areas. Shady parts of the road will remain icy and slippery long after the sun has melted the open areas.

Bridges. When temperatures drop, bridges will freeze before the general roadway. This is because of air circulating under the bridges and the earth retaining heat under the main portion of the roadway.

Melting Ice. Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.

Beginning to rain. Right after it starts to rain, the water mixes with the accumulated oil that is on the roadway from other vehicles. This causes the road surface to become very slippery. As the rain continues, the oil tends to wash away and it becomes somewhat less of a hazard.

Hydroplaning. When water collects on the road surface, hydroplaning can occur. A thin film of water forms under the tires, causing them to lose contact with the road. When the friction surface is eliminated, you may not be able to steer or brake. You can gain control by releasing the accelerator to slow the vehicle down and reestablish the friction surface. Avoid applying the brakes if the apparatus is hydroplaning. Hydroplaning is more likely to occur if tire pressure is low or the tire tread is worn. One of the functions of the grooves in the tire tread is to carry the water away from the tire surface. If the grooves are worn, they will not perform efficiently.

Reduced Visibility

Fog, rain, smoke, and dark are all conditions that reduce visibility and thus require a reduction in speed. You should always be able to stop within the distance that you can see ahead. In fog and rain, use low-beam headlights day and night. Avoid “overdriving” the headlights (requiring more stopping distance than the headlights illuminate).

Glare from driving into the bright sun or from drivers in the oncoming lane with high-beam headlights on can cause temporary blindness. Avoid looking directly into the light. Slow down and look at the right side of the road until the hazard passes. Dirty windshields add significantly to glare problems.

Curves

Apparatus drivers must adjust their speed for curves in the road. When taking a curve too fast, two things can happen. First, the tires can lose their traction with the road surface, and inertia will cause the vehicle to continue on a straight path and run off the road. Second, if the wheels retain their traction, the high center of gravity can cause the apparatus to roll over. This is especially true of water tankers and tall aerial apparatus.

Poorly designed roads might have a high crown in the center and tilt slightly toward the outside of the turn. This puts excessive weight on the tires and suspension on the outboard side, which causes the vehicle to lean toward the turn, becoming unstable and more likely to overturn from centrifugal force. This is especially true of units with a high center of gravity.

When approaching a curve, slow down to a safe speed before entering the curve, and gently accelerate out. This will help to maintain control. Avoid braking while on a curve-it is easier to lock the wheels up and cause a skid when turning.

Downgrades

On steep downgrades, gravity plays a major roll in causing the apparatus to gain speed. The driver must select the appropriate transmission gear before descending the grade, to allow the engine to provide a braking effect and work with the vehicle brakes. Continuously applying the apparatus brakes will cause heating and brake fade. If steep grades are a routine part of your response area, the proper use of an auxiliary braking device such a driveline retarder or engine brake is essential.

MAINTENANCE ISSUES

Brakes. You must properly maintain the foundation brakes on the apparatus for them to be effective and safely stop the rig. Periodic inspection for wear, lubrication leakage, heat damage to the drums and rotors, as well as the other brake mounting and linkage components should be a routine part of any shop preventive maintenance program. Drivers should also be aware of air leak problems. If you start the rig for a run and consistently encounter a low-air pressure condition or declining air gauge pressure when stopped with your foot on the brake, this should be cause for inspection and investigation.

Brakes, like most other components, wear out depending on use. Air brakes have a brake chamber with a rubber diaphragm that traps the air when the brakes are applied and exerts force on a pushrod to apply the brakes. On a typical S-cam brake system that is properly adjusted, the pushrod should not exceed one inch of travel when the brakes are applied. Between the pushrod and the brake actuation mechanism is a “slack adjuster.” This allows for the brakes to be adjusted. On older apparatus, these had to be manually adjusted by a mechanic. Slack adjusters on most modern apparatus are “automatic slack adjusters” and, as the name implies, they automatically adjust the brakes when a brake application is made. At times, these devices have been known to fail, which results in less than maximum brake application forces. Check brake adjustments by first marking the pushrod where it exits at the face of the brake canister. After being certain the apparatus has all wheels chocked so it cannot roll, have someone release the parking brake and apply the foot brake. Take the stroke measurement from the mark you originally made on the pushrod to the face of the brake chamber; it should not exceed one inch. If it does, or if the measurements are uneven between wheels, notify the shop.

Antilock brake systems (ABS). Modern apparatus are equipped with antilock brake systems that detect wheel lockup and maintain traction by applying and releasing the brakes at each individual wheel several times a second. This is an automatic system that works without the driver’s intervention. From a maintenance standpoint, the operator should be aware that the ABS is working by the illumination of the amber “ABS” light on the dash for a few seconds when the apparatus is first started. If the ABS light comes on while driving or during routine brake application, have the shop check the system. Typically, an electronic reader is plugged into a port and the faulty component or part of the system is identified for the mechanic.

Auxiliary braking systems. Since the 1996 edition of NFPA 1901 took effect, all apparatus more than 36,000 pounds have been required to have an auxiliary braking system installed. As the name implies, an auxiliary braking system works in conjunction with the foundation brakes to stop the apparatus. Currently there are four systems in use, the engine retarder (commonly referred to as a Jake Brake), hydraulic transmission retarder, electronic driveline retarder, and exhaust brake. All of these systems are required to interface with the ABS to automatically disengage when wheel lockup is detected.

Some of these systems have an “on/off” switch in the cab so the driver can disengage the unit in wet or slippery weather. The operator should understand and follow the manufacturer instructions for his particular vehicle.

Retarders can be programmed to apply either in stages at the beginning of the brake application or partially when the accelerator is released and fully when the brake pedal is depressed. A problem that arises is that some drivers don’t like the feel of the retarder slowing them down when the accelerator is released. Routinely turning an auxiliary braking device off creates an unsafe situation. Brakes stop the vehicle by the friction of the brake shoes or pads rubbing on the drum or disc. The heat created from this friction can cause the brake drum to expand, which, in turn, causes the brake shoes to travel even farther to contact the drum, reducing stopping power. This is typically called brake "fade."

Auxiliary braking devices are required on apparatus to work with the brakes to safely stop the vehicle in the shortest possible distance. The operator should not defeat the purpose of this important safety system by routinely turning it off!

Suspension. Many apparatus on the road today have overloaded axles and suspensions. This is a very dangerous condition because of reduced braking ability and poor handling characteristics. Every apparatus is required to have a sticker in the cab that shows the weight rating of each axle and the gross vehicle weight rating. The apparatus should be weighed on a truck scale annually according to NFPA 1911, *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus*, with all tanks full and all equipment on board; 200 pounds should be added to the front axle for each seating position. If the apparatus is overweight, determine why, and either take engineering steps to upgrade the axles, tires, or suspension or place the apparatus on a "diet" (remove excess hose and equipment).

The operator should occasionally get under the apparatus and look for cracked or broken springs or broken shock absorber mounts. This inspection is a must during routine scheduled preventive maintenance. A complete failure of a leaf spring set on a curve or turn could be catastrophic and cause the apparatus to roll over.

Steering. The same inspection procedure is also true of the steering components. Telltale signs of weak or broken steering components require careful inspection. In most cases, the operator is not familiar with this inspection but a qualified mechanic must have this on his list of checks during periodic maintenance. Power steering systems sometimes mask the signs of wear that the driver would ordinarily detect when driving a truck with manual steering. Loose steering, excessive play, and shimmy are all safety issues and reasons to take the truck out of service until the problem is corrected.

Tires. Inspection and maintenance of the apparatus tires are most definitely the operator's responsibility. This begins with proper inflation. You CANNOT tell if the tires are properly inflated by visual inspection! You must check them with a properly operating tire gauge. This is especially true of inside tires on dual wheels. A quick check by "bumping" the tires with a solid object can confirm your suspicion of a flat on a dual, but it is no replacement for checking for the proper inflation pressure.

Tires that are underinflated place undue stress on the sidewalls, especially on curves, which can result in a complete tire failure. In addition, underinflated tires lack the proper surface contact with the road. Overinflation results in a reduced contact area and a hard, bumpy ride. Proper cold tire inflation pressures can be found on a sticker inside the cab of the apparatus. Automatic tire pressure monitoring systems are available as an option when specifying the apparatus.

Check tread depth with a tread depth gauge. While the DOT requirement is 4/32 -inch tread depth remaining on steering axles and 2/32 -inch on nonsteer axles, you probably should replace the tires before getting to these minimum measurements.

Another safety hazard regarding tires on fire apparatus is old tires that still have plenty of tread depth remaining. Replace tires that are more than seven years old. Dry rot, cracking, and weakening of the sidewalls make older tires more dangerous. Determine tire age by checking the DOT code stamped on the sidewall of the tire. The last three or four digits at the end of the DOT code indicate the week and year the tire was manufactured. The first two digits are the week of the year and up to 1999, the last digit is the year of manufacture. After the year 2000, the last two digits indicate the year.

Physical damage is another area of tire inspection you should not overlook. First, inspect the sidewalls for cuts that penetrate to the cord. Then inspect the tire tread for nails, screws, or any foreign objects that might puncture the tire. Finally, inspect the rims for areas that are bent, broken, or cracked or evidence of loose lug nuts. Make lug nut torque part of the routine preventive maintenance program.

DESIGN ISSUES

Tankers typically have a high center of gravity, causing them to be "top heavy." Another problem is the use of tankers previously designed for transporting other commodities.

(5) The higher ground clearance on four-wheel-drive apparatus raises the center of gravity.

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According to *Safe Operation of Fire Tankers*, "Records show that a large percentage of serious crashes involving fire department tankers can be attributed to tankers that were crafted from nonfire service vehicles .... Another common practice is to develop a fire department tanker using a converted fuel oil or gasoline tanker. Even though these vehicles may be in excellent condition when the fire department acquires them, these chassis frequently are not designed for the weight of the water that will be carried on them."

(6) The pattern of a tire's tread moves water out from under the tire. Properly inflated tires are extremely important in rollover prevention.

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One gallon of water weighs 8.33 pounds, while one gallon of gasoline weighs only 5.6 pounds and fuel oil 7.12 pounds. A 2,800-gallon gasoline tanker filled with water weighs 7,644 pounds more than 2,800 gallons of gasoline that the truck was originally designed to carry. Add the additional weight of a pump and plumbing, and it is obvious why these grossly overweight vehicles handle and stop so poorly.

(7) A converted military truck being used as a brush fire unit. (Photo by Ron Jeffers.)

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Another problem with converting commercial tank trucks to fire tankers is that in many cases the liquid tanks are improperly baffled for fire department use. Some tankers that were originally designed for carrying commodities for human consumption such as milk have no baffles, as they make it more difficult to sterilize the inside of the tank after carrying a load. When the tank is partially full or the vehicle is in a "response mode," the liquid surges within the tank and can result in the truck going out of control.

ENGINEERING FIXES

A number of things can be done when specifying apparatus to counter many of the problems I have identified.

Speed limitations. Laws of nature dictate that the faster the apparatus goes, the more difficult it is going to be to stop and control the vehicle on less-than-perfect road surfaces. Limiting the top speed of the apparatus by differential ratios has the added benefit of better “low-end” performance. Some departments that operate on highways indicate that it is less safe for them to travel slower as the civilian traffic overtakes them. I would rather have cars pass me than try to accomplish a panic stop or evasive maneuver with an 82,000-pound aerial truck doing 75 mph!

Electronic stability control. This system helps stabilize the apparatus on curves and during evasive maneuvers on both wet and dry pavement. It works in conjunction with the vehicle’s electronic ABS and constantly monitors the lateral acceleration, or sideways forces, acting on the vehicle and intervenes at the critical threshold where rollover is likely to occur. When you encounter a dangerous condition, it automatically reduces engine torque, applies the retarder, and controls the brakes on the drive and steer axle so you can maintain control. Video presentations of tests of this system are very impressive to say the least! There are also stability warning devices, but these only provide an alarm and require a trained driver to take the appropriate action. The United States government just announced that electronic stability control will be required to be phased in on all SUVs in the near future. Some models are already equipped with this safety feature.

Control the center of gravity. Everyone wants to specify a rig that can do everything like a Swiss Army Knife! In reality, the width of the apparatus is relatively constant (96 to 100 inches), and if limitations on the overall length exist because of fire station configurations, the only place to go is UP! How many times have you seen a rig and thought to yourself, “How are they ever going to get the hose off the top of there?” Larger water tanks, full-depth high side compartments, full hosebeds, and ground ladder storage with an aerial device on top are a recipe for disaster when it comes to responding. These “top-heavy” rigs are more difficult to control because of the inertia of the weight leaning toward the outside of a curve. The vehicle tends to want to continue in a straight line as the driver attempts to negotiate a curve, especially at higher speeds. The result could be either the vehicle leaves the road or the tires lose traction and the apparatus begins a skid. In either case, the results could be catastrophic. Good design techniques combined with limiting the truck committee’s desire to build a “two-story-high” apparatus could be a lifesaver. The additional ground clearance required by four-wheel-drive units also raises the center of gravity.

Testing on a tilt-table where the full apparatus is chained to a flat table then tilted to the side until the rollover position is reached and the chains on the high side tighten (much like crash trucks undergo) might be a wise requirement in the specifications.

Specify axles and suspensions that are adequate for the apparatus. This is one place where you should rely on the expertise of the engineering staff at your friendly local apparatus builder. Do not simply go by what was specified on your previous apparatus. If the suspension is too light, the apparatus will lean and be difficult to control. A suspension that is too heavy for the load will ride rough and make it more difficult to stop. The best wording for your spec might be: “The manufacturer shall provide an axle and suspension capacity that is commensurate with the in-service loading of the apparatus.” Be sure to advise the bidder if you intend to exceed the NFPA equipment loading requirements in the standard or if you are adding any heavy accessories after delivery.

Seat belts that fit. Problems in the past were seat belts that did not comfortably wrap around a firefighter in gear and the attachment end buried in the seat. The last update of NFPA 1901 required red seat belts (so they could be identified) and a stalk to make the attachment easier. Some manufacturers have taken steps to provide longer seat belts to more easily secure the firefighter in the seat.

Seat belt warning devices. Seatbelt warning devices have been available for several years. Just about every car on the road has a seat sensor and an alarm if the seat is occupied and the belt is not being worn. In multiplexed electrical systems with an LCD screen, some manufacturers can display which seat is the offending party. It is up to the driver and the officer to ensure that everyone is seated and belted before the apparatus moves.

Make the driver's job easier. Consider anything that can be engineered to make the driver's job easier. Having the officer control the audible warning devices is a good start. If the driver is forced to operate a warning device, it should be controlled by the steering wheel button so he doesn't have to take his hands off the wheel. Lanyards for air horn control on the driver's side are just an invitation to take your hands off the wheel. Mirrors that can be electrically adjusted before the apparatus moves as well as convenient seat adjustments all go toward safety.

Rollover protection and air bags. Most of us wouldn't consider purchasing a family car without frontal air bags and the latest addition to the system, side curtain air bags. Why should fire apparatus be any different? Roll protection systems that tighten seat belts, pull the seats down to the lowest position, and inflate a side curtain air bag all before the vehicle is anywhere near rolling over are available; consider them.

SEAT BELT USE

My wife religiously attaches her seat belt when she gets behind the wheel to drive but for some unknown reason delays this procedure when sitting in the passenger seat! When that annoying little warning bell starts going "ding-ding-ding," I remind her that I have no intention of pushing her around in a wheelchair or visiting her in a nursing home if she is disabled in an accident because she refuses to belt in. She always complies. Cruel words? Perhaps, but when is the fire service going to get "cruel" with our own people?

We have tried numerous positive reinforcement campaigns such as "Everyone Goes Home" and the current "National Seat Belt Pledge" in honor of Firefighter Christopher Hunton of Amarillo, Texas. I am sure these programs have reached some of our members, but we are still reading about firefighters being ejected during rollovers.

Who is to blame? The driver or officer who didn't make sure that everyone had their belt on? The fire department that sets a policy but "looks the other way" at violators? The manufacturer of the apparatus or the seat because the belt wasn't "easy" to attach? Perhaps all of the above share in the blame, but I think that 95 percent of the problem is with the offending party. Some have said that SCBA mounted in the cab seats are the problem and they should be removed. That's just an excuse. Could the drivers of all those tankers blame their mortal wounds on SCBA in the cab? Removing them would be counterproductive, as it would result in firefighters placing SCBA on the floor or in unoccupied seats the way I used to do as a young firefighter and company officer. There is nothing wrong with the currently compliant seats and brackets.

If a firefighter climbs into an apparatus and makes a *conscious decision* NOT to attach his seat belt, he is not only endangering himself and his family's financial future but every other brother or sister firefighter riding in that cab with him. If he is killed or seriously injured in an accident, a court of law could consider his lack of seat belt use contributory negligence. Slow motion video footage of crash test dummies in a rollover shows the fatal damage that could be inflicted on a person safely seated and wearing a seat belt when struck by an unbelted individual flying around the inside of the cab. If you climb into the rig and attach your belt, encourage other members to do the same-if not for their safety, for your own!

I know that what I am about to say will not be popular, but perhaps if we moved more toward negative discipline, more of our own would comply. If a firefighter thought that perhaps his family would not receive a death benefit or a pension because of his *conscious decision* to place his life in jeopardy, maybe, just maybe, there would be greater compliance.

The NFPA Apparatus Committee and the manufacturers are taking every step conceivable to make seat belts more user friendly. It is now up to the fire service to drop the hollow excuses and grasp the concept.

William C. Peters retired after 28 years with the Jersey City (NJ) Fire Department, having served the past 17 years as battalion chief/supervisor of apparatus, with the responsibility of purchasing and maintaining the apparatus fleet. He served as a voting member of the NFPA 1901 apparatus committee for several years, representing apparatus users. He is the author of *Fire Apparatus Purchasing Handbook* (Fire Engineering, 1994); two chapters on apparatus in *The Fire Chief's Handbook, Fifth and Sixth Editions* (Fire Engineering, 1995); and numerous apparatus-related articles. He is a member of the *Fire Engineering* editorial advisory board and of the FDIC Executive Advisory Board. He lectures extensively on apparatus purchase and safety issues. He can be reached at fireappwp@aol.com.
