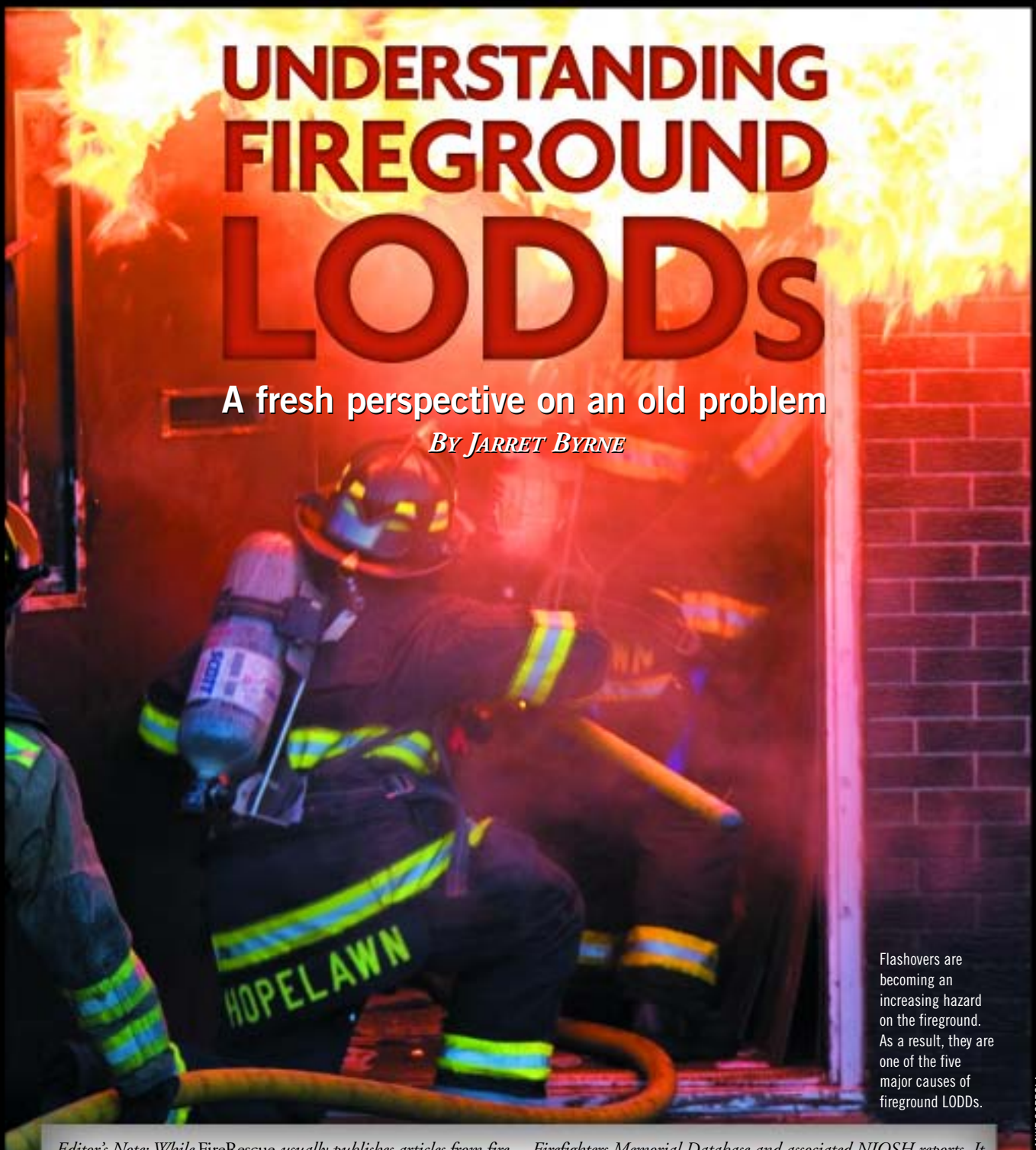
UNDERSTANDING FIREGROUND LODDs

A fresh perspective on an old problem

By Jarret Byrne



Flashovers are becoming an increasing hazard on the fireground. As a result, they are one of the five major causes of fireground LODDs.

PHOTO MIKE COPPOLA

Editor's Note: While FireRescue *usually publishes articles from fire service veterans, we felt our readers would be interested in this perspective from a young firefighter on a critical issue.*

Author's Note: This article is a shorter version of the thesis I presented to the faculty at Worcester State College. My firefighting experience includes 5 years as a call firefighter/EMT in Boylston, Mass. I joined the department when I was 17 after a family friend who was an FDNY firefighter was killed on 9/11.

Although I may not have the experience of a 20-year fire service veteran, I do possess the same dedication, and I wanted to apply the skills I had learned in college to the job I love. This article is the culmination of countless hours spent reading entries in the USFA's Firefighters Memorial Database and associated NIOSH reports. It is my belief that the best way to remember those who died in the line of duty is to make the cultural changes necessary to prevent future tragic deaths.

In 2004, fire service leaders and equipment manufacturers met in Tampa, Fla., to establish a plan to reduce firefighter line-of-duty deaths (LODDs) by 25 percent every 5 years. Deemed the Firefighter Life Safety Summit, the 200 assembled members created 16 life safety initiatives to achieve this goal. The Firefighter Life Safety Summit Initial Report states: "This is the first step along a path that will require a huge commitment of energy and resources over several years."[1]

PHOTOS COURTESY NIOSH

Above: Entanglement hazards like this one abound on the fireground; five firefighters died between 1999 and 2004 from entanglements.

Right: Structural failure and collapse contributed to 43 percent of fireground deaths between 1999 and 2004.

For firefighters operating on the fireground, however, several years is too long to wait. On average, 15 non-cardiac fireground fatalities occur each year. To prevent this trend from continuing, we must identify the factors that lead to fireground LODDs.

THE 5 FACTORS

Over the 5-year period beginning in 1999 and ending in 2004, 75 firefighters died in the line of duty from either trauma or smoke inhalation while operating at structure fires. Of those 75 deaths, 32 can be attributed directly to some form of catastrophic structural collapse. That's 43 percent of the 75 total deaths. Structural failures not only claimed the lives of firefighters working within structures, but also the lives of four firefighters working outside of structures but within the collapse zone. All four of those firefighters were officers. The majority (18) of these collapses occurred at residential structures; eight occurred on commercial properties, mostly stores and offices. It's also important to note that all six of the deaths that took place on public assembly property, such as churches and community halls, were caused by collapses.

The four remaining causes are not mutually exclusive, but they do present recognizable, and therefore correctable, issues. The worst of these factors over the past 5 years has been firefighter disorientation, directly contributing to the deaths of 24 firefighters, or 32 percent of fireground fatalities. Disorientation has been a significant problem since the fire service first began entering burning structures to extinguish fires and rescue trapped civilians. More than 100 years later, it's still a leading cause of fireground deaths. As is the case with collapses, the majority of disorientation fatalities (13) occurred at residential structures. Eleven disorientation deaths happened on commercial properties, and two occurred on industrial properties.

Another contributing event: emergency evacuations, which led to 11 deaths, or 15 percent of the total. These situations are particularly saddening, because the incident commander (IC) has reevaluated the risks and benefits of having crews work within a structure and decided, for their safety, to pull them out. Unfortunately, an individual or a crew fails to completely vacate the structure. What should have been a life-saving initiative on the part of the IC now becomes a life-saving operation for everyone else on the fireground. A lack of adequate accountability contributes to and compounds unsafe evacuations. Over the past 5 years, six firefighters have lost their lives while evacuating commercial structures; five have lost their lives evacuating residential structures.

The fourth factor is an exponentially growing threat on the fireground: flashovers, which killed six firefighters, or 8 percent of the total fireground LODDs between 1999 and 2004. According to the "Essentials of Fire Fighting, 4th Edition," a flashover is "the transition between the growth and the fully developed fire stages … the fire changes from one that is dominated by the burning of the materials first ignited to one that involves all of the *exposed combustible surfaces* within the compartment."[2] Essentially, a flashover is the point where enough heat builds up within a space to ignite all materials inside that space, including victims and firefighters. All six flashover deaths occurred within residential structures.

The final direct cause of fireground LODDs: entanglement. Five trapped, caught or entangled firefighters perished in 5 years—7 percent of all the fireground deaths. Entanglement is an unavoidable issue when operating in structures, since wires abound in modern buildings and smoke conditions obscure hazards. Tools, limbs, bunker gear and SCBAs—items that normally protect firefighters— are all potential entanglement hazards. Debris, furniture and structural elements are also capable of entangling or entrapping firefighters working within a structure. Of the five firefighters killed as a result of entanglement, three died in commercial structures and two in residential structures.

THE SOLUTIONS

Although the fireground is an inherently dangerous place to work, it doesn't need to be deadly. Through training, research and more training, firefighters and their officers can become aware of warning signs and proactively prevent potentially life-threatening scenarios. With the five major contributing factors in fireground LODDs identified, it's possible to work toward solutions today that will ensure everybody goes home tomorrow. Let's look at some solutions for each of the factors separately.

Collapse

Preventing deaths associated with collapse requires knowledge and communication. All firefighters, whether volunteer or career, must know and understand building construction. Everyone operating on the fireground must be aware of the fact that buildings built with trusses will catastrophically fail under fire conditions in a short amount of time. Type I, or fire-resistive, construction will remain more structurally sound during a fire due to its reinforced construction, as opposed to Type V, or wood-frame, construction.[3] Training is key to understanding and recognizing elements of building construction.

Additionally, firefighters must recognize warning signs of structural instability, including, but not limited to, "cracks or separation in walls, floors, ceilings, and roof structures … evidence of existing structural instability … loose bricks, blocks, or stones … deteriorated mortar between the masonry … [and] prolonged fire exposure to the structural members."[4] All of this information must be included in the IC's risk-benefit analysis, which must be constantly reevaluated. When firefighters see these signs of collapse, interior firefighting becomes far too great a risk.

Disorientation

Training can also combat disorientation. Departments can easily create scenarios that require firefighters to navigate situations while blindfolded and wearing full personal protective equipment (PPE). They can learn to use walls and hoselines to keep themselves oriented when visibility is masked. Mazes help build firefighter confidence in similar situations by placing them in a disorienting environment where they can learn safely. Many fire departments now have ropes and thermal imagers at their disposal as well, but such tools are useful only if department personnel are properly trained in their use and function. An hour of familiarization at the firehouse can potentially save a life later.

Firefighters must also be trained to always operate on the buddy system as a crew, and each crew should be required to have a functioning radio they know how to use. Crews help eliminate disorientation, but in the event that a crew becomes lost, they should be encouraged to call in a mayday (for more on maydays, see "Mayday 101," p. 168).

Emergency Evacuations

The problem of emergency evacuations is born out of a breakdown in crew integrity and poor accountability. Cohesive crews not only reduce disorientation, but they also look out for one another. Eliminating freelancing will improve the chances all personnel are aware of the all-out order, and ensure no individual goes missing. In the event that an individual does go missing, however, an accountability system, along with a personnel accountability report (PAR) following the evacuation, will identify those individuals or crews who have failed to exit the building. The quicker this information becomes available, the quicker an in-place rapid intervention team (RIT) can enter the structure and rescue those individuals. Firefighters should be reminded that evacuations are not races, nor are they panic situations. They must be controlled and orderly.

As with all LODD causes, training is essential to ensure emergency evacuations happen as needed. Firefighters can train on RIT operations and on how to self-extricate from hazardous situations.

Flashovers

Flashovers are an increasing fact of life for fire departments and personnel. As developers design and build homes that hold in more and more heat, and as alerting devices become quicker, cheaper and more readily available, firefighters will find themselves responding to more and more structures that have not yet flashed or self-vented. Where once a single panel of glass may have blown out, newer double- and triple-paned windows turn buildings into ovens.

But firefighters and officers can predict and prevent flashovers. Proper ventilation and effective communication between ladder and engine crews can alleviate the build-up of heat before the room flashes. Engine and ladder personnel must work together, since ventilation and extinguishment are coordinated activities. Proper ventilation will also increase visibility and allow engine crews to get closer to the fire, making extinguishment easier.

Once again, training plays a key role. Personnel should be trained to recognize the warning signs of a flashover, such as thick smoke that is pulled down only to rise back up, pockets of fire burning in the smoke and unusually intense heat. Firefighters should also check the atmosphere periodically by sending a small burst of water to the ceiling. Water that does not return has encountered extreme heat and vaporized. Finally, any department that has access to a flashover training simulator should use it. There, firefighters can observe a flashover without getting hurt, better preparing them for conditions they may encounter at real fires.

PHOTO COURTESY NIOSH

Two firefighters were injured and one firefighter lost his life when this home flashed over.

Entanglement

Entanglement is an individual issue that becomes the concern of the entire crew and the IC when conditions deteriorate. The most important thing to remember in an entanglement scenario is to remain calm. Like everything else in the fire service, this can be achieved through training. As part of disorientation training, instructors can slip ropes over participants' SCBAs to simulate hanging wires, requiring that they dislodge themselves. Additionally, firefighters should be able to operate all parts of their SCBA and effectively manage all tools in blinding conditions while remaining calm. Some firefighters carry wire cutters in their bunker gear, but like any other tool, cutters are only as effective as the time spent training with them. With some simple training exercises, cohesive crews, in-place RITs and effective radio communications, deaths as a result of entanglement can be eliminated from the fireground.

CHANGE BEGINS WITH EACH OF US

Fire departments have always been as successful as the sum of their parts. Dedicated, well-trained and educated firefighters and officers are capable of so much more than departments that have not made training a priority. Most fireground LODDs can be eliminated if every firefighter makes a point to practice safe techniques. When one firefighter fails to be safe, every firefighter suffers the consequences.

The first of the 16 life safety initiatives speaks of a cultural change within the fire service, and that change begins in the hearts and minds of all firefighters, from the chiefs to the recruits.

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NOTES

[1] National Fallen Firefighters Foundation, "Firefighter Life Safety Summit Initial Report"; www.everyonegoeshome.org/pdf/Summit%20Reports/Initial_Summit_Report.pdf.

[2,3,4] International Fire Service Training Association, "Essentials of Firefighting, 4th Edition." Oklahoma: Fire Protection Publications, 1998; p. 49, 65–67, and 73–74, respectively.