Fire Engineering®

Porches: Not As Inviting As You May Think

by Kriss Garcia

You have been dispatched to a one-story, single-family dwelling with occupants reporting that their bedroom is on fire. On arrival, you see fire and smoke showing from two windows on the B side under a fairly large and inviting porch. The relatively small, single room-and-contents fire is on the main floor and seems to be fairly routine. Just after crews enter the front door on the A side and make their way to the main body of fire, the smoke exhausting the windows ignites. What a moment ago was a fire well within your threshold of control is now a fully involved building, and the entrance that firefighters used for their initial attack is severely compromised, jeopardizing the interior crew. Similar scenarios are occurring with increased frequency throughout our current fire service delivery environment.

After reviewing several near-miss videos and National Institute of Occupational Safety and Health reports, it is clear from the fires I have reviewed that fire exhausting from a window or a door under a covered porch appears to be a common factor in some rapid and extreme structure fire behavior. After a recent visit and brainstorming session in Australia with some of our more analytical international friends, it became apparent that, when looking at fire behavior, we have to consider incidents where fire is exhausting into an open covered porch as different from other fires.

Every firefighter understands that the fire loading in today's structures consists of combinations of synthetics, which make the products of combustion much more toxic and volatile than fires of just a few years ago. As these products of combustion exhaust from the building, they readily expand. Generally speaking, although all smoke may be considered fuel, the darker the smoke, and the more rapid it expands as it exhausts from the structure, the more dangerous it is, or the more potential energy is stored within it.

While studying the reproduction of backdraft fires in models and large-scale evaluations, it was not simply the color of the smoke that indicated imminent extreme fire behavior but also the smoke's texture. Smoke that did not have a clean and clear outline or appeared to be fuzzy had the highest possibility of predicting aggressive fire growth. The higher the interior pressure, the fuzzier the smoke appeared. Under these conditions, the fuzzy appearance is more identifiable because of the rapid expansion from this area of high pressure to the low pressure on the exterior.

In direct correlation to the synthetics of today's fire loads is the direct relationship to the potential energy those products of combustion contain. When this element of highly volatile products of combustion is combined with the structural component of a covered porch, everything necessary for extreme fire behavior and rapid, or even explosive, fire behavior exists.

Over the years, more firefighters have come to realize that smoke is a fuel. That consideration alone is not enough to keep firefighters from being injured during fireground operations. We must also consider where that smoke/fuel is and if an ignition source is associated with it. It is this ignition source or heat sink that porches may contain that is spelling disaster for some of today's firefighting operations. These areas of retained heat may not always be porches: Large overhangs and carports are also examples of areas that can retain temperatures well above the ignition temperature of the exhausting fuel.

While inside the structure, products of combustion will actually be less likely to ignite because the mixture is too rich and too oxygen-deprived for ignition to occur. The interior pressure of the structure also limits the ability of these products of combustion to ignite. The presence of a porch may signify a large surface area of retained ignition temperature. As this very hot and highly flammable environment exhausts from the building, it rapidly expands. As this expansion occurs, what was once an environment that was too rich to ignite is now free to expand and attain the optimum mixture as it reaches the unlimited supply of oxygen under the porch. As this environment full of extreme potential energy heats the underside of the porch, ignition temperatures are easily reached.

Without the presence of the porch, heat would naturally rise and exhaust away from the dwelling. Smoke, or the fuel, is also free to expand away from the structure, without the associated temperature that the covered porch may retain. However, when this exhaust is under a porch, expansion occurs, and it is associated with the increased temperatures on the underside of the porch. The incident commander should fully appreciate that this situation, which combines an optimum flammable mixture plus an ever-increasing ignition temperature, has all the makings of an event with the potential for extreme fire behavior. Relatively speaking, the larger the porch, the larger the potential for disaster, since the larger the surface area of the porch, the more heat is retained. More covered square footage also means a larger area of possible optimum mixture of the smoke/fuel we are worried about. These two items spell increased potential for extreme fire behavior, which will jeopardize firefighter safety.

As this potential energy is ignited by the high temperatures retained on the underside of the porch, the products of combustion rapidly expand. . As this rapid expansion happens, ignition moves toward the interior much like a fuse being lit. The interior pressure is increased at an explosive rate because of the rapid expansion in an enclosed space, which, in turn, causes a dramatic increase of interior pressure to the point where window failure will occur. As windows fail, more oxygen becomes available to the fire, causing it to grow rapidly. When this takes place, interior firefighters relate similar descriptions of the task in which they are involved. Firefighters in several of these situations relate that they were "blown off the line." Often, this ignition occurs after the interior fire has been extinguished and crews have let their guard down.

So, what do we do about this problem? First and foremost, firefighters and incident commanders must have an increased level of appreciation for fires at structures with covered porches. Remember, the larger the porch, the greater the potential for disaster. It is not enough to consider the interior of the building on fire: You must also include the porch as a significant element in your size-up. This element creates so much potential for aggressive fire development that it warrants the same level of concern as any other hazard on the fireground. Often, you hear incident commanders or safety officers announce to all members on the fireground safety concerns such as imminent collapse or downed power lines. Porches warrant the same level of respect and communication. We have to have the ability to decrease the ignition temperature the porch retains. If the area of concern is in close proximity to the attack entrance, the first interior crew should wet down the porch prior to entering the structure.

In training scenarios, this technique seems to decrease the temperature of the underside of the porch as evaporation takes place. If the area under the porch is not near the attack entrance, assign additional crews to cool the underside of the porch, being careful not to direct hose streams into the building through the exhaust. Give the same tactical priority to decreasing the possibility of the porch's igniting as the possibility that utilities might ignite. In a practical sense, this means that backup crews deployed as an immediate rapid intervention team or additional crews can be assigned to keep the underside of the porch cool.

Where does ventilation fall into the equation? We have not done full-scale testing to evaluate this, but we can answer it based on past practice and theory. If possible, crews should exhaust the interior structure through windows that are not under a covered porch. If you have no choice, backup crews should commit to the porch area in an attempt to keep the temperature on the underside of the porch as low as possible. I don't believe using pressurization during the attack or post-knockdown should change the dangers associated with porches, except for the fact that the crews will have less time to get to the main body of the fire, decreasing the time frame during which this potential exists. Regardless, if windows and doors are exhausting under a large covered porch, give special consideration to keep the temperature low enough to avoid ignition.

Without the ability to do full-scale or even limited-scale evaluations of the conditions I am describing, models appear to be a great means of demonstrating this theory. The four-

compartment fire-training model uses the 3-D or Compartment Fire Based Training (CFBT), which can easily be modified to include covered porches. With these models, it is also easy to modify the porch size to represent the more dramatic potential larger porches create. The plans can be downloaded, without charge, at http://www.cfbt-us.com

The best means of preventing injury associated with extreme fire behavior is to continually focus on situational awareness. The large porch many find so inviting and comfortable can and will spell disaster for firefighters and those we are sworn to protect. As we operate in these types of conditions, we have to look at porches as a significant element in the extreme fire behavior equation. We know we have a tremendous amount of potential energy in the smoke/fuel. We must consider the ignition temperature that large covered porches and other exterior heat sinks may add to the potential for fire.

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