Insurance Institute for Business & Home Safety®

Vulnerability of Vents to Wind-Blown Embers: Executive Summary

Stephen L. Quarles, Ph.D.

August 2017

Introduction

The importance of embers in causing building ignitions has been discussed in reports from post-fire investigations as early as 1945 in Australia, after the Beaumaris Fire in Melbourne, and 1961 in the U.S. after the Bel Air Fire in Southern California. Embers landing on or near a building can result in ignition of a home or business. Embers can ignite combustible material directly and can also cause spot fires capable of igniting a building. If enough embers are able to enter the building through a vent or open window, they can ignite materials inside the building. An ember that gets inside an attic or crawl space could ignite items stored in those locations, such as newspapers and cardboard boxes. This reports adds to a growing body of literature on how buildings can be ignited by wind-blown embers by focusing on the vulnerability of vents to embers. Ember entry through vents can result in ignition of combustible materials in the attic, and result in a building burning from the inside out.

IBHS Wind-Driven Ember Research

Researchers at IBHS, led by Dr. Quarles, have been studying how embers penetrate vents since 2010. A second series of experiments, expanding on the 2010–2011 experiments, was conducted during 2013–2014. This study was designed to clarify the relative importance of vent type and location on the entry of embers into the attic space of a house or commercial building.

Common types of attic vents were evaluated during these tests. Vents are designated as “inlet” or “outlet” vents based on whether air flows into or out of the given attic space vent under natural convection conditions. Inlet vents were always in the under-eave area and included vents installed in an open-eave configuration, where the vent is in the solid-wood blocking between roof rafters (or trusses) as well as vents installed in a soffited-eave configuration. Outlet vents were located either on the gable end wall or on the roof, including both ridge and off-ridge locations. The detailed report describes the various configurations of each tested vent.

One inlet and one outlet vent scenario was installed during each experimental series. Three fluctuating wind speeds were used to evaluate the influence of wind. The test building was placed on a turntable. Conducting tests at different building orientations allowed the effect of wind direction to be evaluated. Video- and non-video-based measurements were used to evaluate the ability of a given vent to resist the intrusion of wind-blown embers.

Major Findings and Recommendations

1. There are two options for inlet vents, both located in the under-eave area:
    - Vents in the between-rafter blocking in open-eave construction
    - Vents in the soffit material in soffited-eave construction

    Vents located in soffited-eave construction were shown to limit ember entry and should therefore be the preferred construction type.

2. ¼-in. (6 mm) mesh screening should not be used to cover any vent. Finer mesh sizes of ⅛ in. (3 mm) or 1/16 in. (1.5 mm) are preferred. The finer 1/16-in. mesh screen will require more cleaning-related maintenance to remove the debris that can accumulate on the screen surface.

3. The wildfire-resistant vents used in the gable end location performed better than the respective backing screen mesh alone.

4. Due to the relatively larger size of gable end vents, they are particularly vulnerable to ember entry, even with mitigation techniques. This location should be avoided in favor of other less vulnerable vent locations with appropriate design features.

5. Avoid using non-wildfire-resistant off-ridge and ridge vents. Of the ridge and off-ridge outlet vent options, the following performed well:
    - Miami-Dade wind-driven-rain-compliant ridge vent
    - Wildfire-resistant (steel wool fill) off-ridge vent
    - Turbine (off-ridge) vent

6. Wind-blown vegetative debris must be removed from the inlet of all ridge and off-ridge vents, paying particular attention to vents with plastic components. Plastic components are commonly used in ridge vents.