THE EFFECT OF FIREFIGHTER CREW SIZE ON TIME TO COMPLETE ESSENTIAL FIRE FIGHTING TASKS

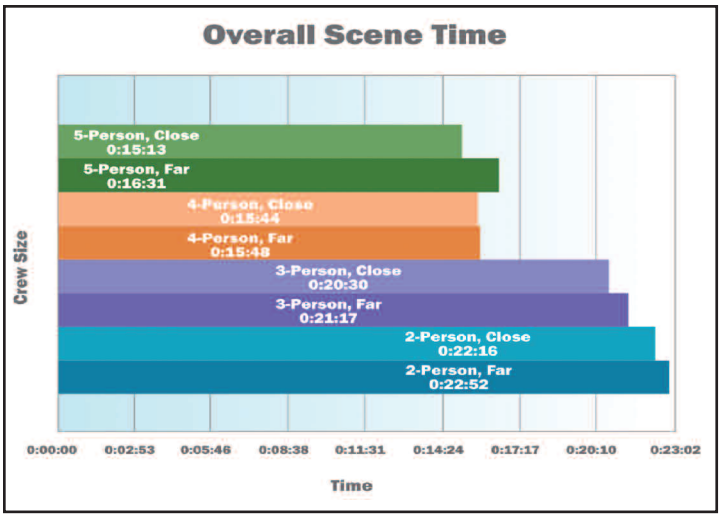
Many individual tasks have to be completed to control and extinguish a fire. The time before a fire grows large enough to go beyond the room of origin and becomes out of control can be quite small. Arriving early and completing tasks quickly and efficiently is understandably a goal of every fire department, but firefighter safety must not be compromised by sending too few firefighters to perform fireground tasks. A scientifically based research project[1] has provided data to compare the time it takes different crew sizes to complete twenty-two essential tasks that must be performed on low hazard structure fires that occur in communities throughout North America.

Overall Scene Time

Overall scene time is the time that it takes the firefighters to complete all 22 tasks. Four- and five-person crews operating on a low-hazard structure fire were able to complete the 22 essential firefighting and rescue tasks 7 minutes faster—nearly 30 percent faster than two-person crews and 5.1 minutes —- 25 percent faster than three-person crews.

The overall scene time measure is critical to the fire crew's ability to complete their work safely and return to the station in order to be available for the next fire call. In addition, firefighter crews that complete several of the tasks simultaneously, rather than consecutively, are able to complete all tasks and are less fatigued. It is important to note that previous studies have documented significant benefits for five-person crews for medium- and high-hazard structures, particularly in urban settings, unlike the low-hazard residential fire scenario examined in this study.

The following graph shows task completion time by crew size and the interval between arrival of successive apparatus (close stagger vs. far stagger).



Saving 5 to 7 minutes in controlling and extinguishing a fire can be the difference between a fireground success and a tragedy.

NIST Report on Residential Structure Fire

The study is the first to quantify fire service lifesaving and firefighting operations for a low-hazard residential structure including the effects of changes in crew size, arrival time, and stagger on rescue and suppression effectiveness.[i]

The study included more than 60 controlled fire experiments, both in our large fire laboratory and at the custom low-hazard residential burn building constructed at the Montgomery County Training Academy.

Overall, the results of the study show that that the number of fire service crew members in each company responding to a fire in a 2,000 square-foot, two-story structure had a substantial effect on the crew's ability to protect lives and property. The results also provide quantitative data to fire chiefs and public officials responsible for determining safe staffing levels, appropriate station locations, and necessary funding for community and firefighter safety.

Methods

A team of fire service experts designed a research methodology that led to over 60 experiments measuring time-to-task completion with crew sizes of two, three, four, and five firefighters, with different arrival times and different intervals between arrival of each apparatus. A burn building with sophisticated instrumentation was specially constructed for the project. Twenty-two key tasks were measured, beginning with the first engine stopped at the fire hydrant and ending with a fan operating at the front door for mechanical ventilation. Using firefighters acquainted with the tasks as timers and corroborating their data with video records, the researchers accurately timed each task as it was performed by the different crew sizes. Personnel from the Montgomery County (Maryland) and Fairfax County (Virginia) Fire and Rescue Departments performed the various tasks specified by the research methodology.

NIST National Institute of Standards and Technology U.S. Department of Commerce

[1] Funded by a grant from the Department of Homeland Security/Federal Emergency Management Agency Grant Program Directorate for Assistance to Firefighters Grant Program, the project was conducted by a research partnership of the Commission on Fire Accreditation International, the International Association of Fire Chiefs, the International Association of Firefighters, the National Institute of Standards of Technology, and Worcester Polytechnic Institute. The complete report is available for download at http://www.nist.gov/cgi-bin/view_pub.cgi?pub_id=904607&division=866