

NIST data: Enabling the technical-basis for evacuation planning of high-rise buildings

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Researchers at the National Institute of Standards and Technology (NIST) are stepping up the pace for designing safer building evacuations by releasing large, numerical data sets that track the movement of people on stairs during high-rise building evacuation drills. The data sets will ensure that architects, engineers, emergency planners and others involved in building design have a strong technical basis for safer, more cost-effective building evacuations.

"While stairs have been used in buildings for ages, there is little scientific understanding of how people use them," explained NIST researcher Erica Kuligowski. "For example, we know little of how the width of the stair affects the flow rate, whether people grow fatigued as they descend from tall buildings, or how people merge into a crowded stairwell."

Working with the Public Buildings Service at the U.S. General Services Administration (GSA), NIST researchers made video recordings of [evacuation](http://www.nist.gov/bfrl/fire_research/building-occupant-evacuation.cfm) drills in stairwells at nine buildings ranging in height from six to 62 stories tall. The first data sets being released (available at www.nist.gov/bfrl/fire_research/building-occupant-evacuation.cfm) come from four of the buildings and include movement information on more than 3,000 people. Other evacuation data will be posted on the NIST Web site as it becomes available.

NIST researchers have already reported analysis of some of the underlying data at human behavior and fire conferences and will report

more in the future. These reports, like most egress studies, provide their findings, but without the raw data.

"The raw data NIST is providing will help to ensure that GSA and others have the scientific basis necessary to provide safe and cost-effective building evacuation," said Kuligowski.

GSA provided research funding support for the project. NIST researchers hope that making the data available will help to develop new evacuation models, provide assessment of the accuracy of existing egress models, and ensure that building owners and managers have a sound basis for evacuation planning.

Before each drill, researchers positioned video cameras to record an overhead view of the evacuation that would not interfere with occupants evacuating the building. Images were pixilated to protect the identity of the building occupants. In most experiments, cameras captured a view of that floor's main landing, the door opening into the stairwell and two to three steps on both sides of the main landing.

Using the videos, researchers developed spreadsheets of data on people's movements. For each occupant, researchers noted the time the individual first entered the video and captured data about their movements until they left the building. Additionally, researchers noted other factors that might influence speed, including the number of people in close proximity, whether they were helping another person, and whether they were carrying something. They also noted if the occupant handrail was used and how much space the person occupied in the stairwell.

"These data will allow researchers to calculate movement speeds of people traveling down stairs as a function of stair width, occupant density, total distance traveled, and merging characteristics at stair landings that could influence updating building safety requirements,"

Kuligowski said.

This knowledge also will assist in [building](#) design and perhaps influence standards on how occupants evacuate during emergencies, she added.

Provided by National Institute of Standards and Technology

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