WPI research team to conduct tests aimed at better understanding post-earthquake fires

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A team of researchers from the Department of Fire Protection Engineering at Worcester Polytechnic Institute (WPI) will conduct groundbreaking tests on May 23-25 aimed at better understanding the effects of earthquakes on building systems designed to suppress or prevent the spread of fires. The test are part of a major $5 million study, supported by a coalition of government agencies and industry partners, seeking to learn what needs to be done to ensure that high-value buildings, such as hospitals and data centers, can remain operational in the aftermath of earthquakes.

The study, which is being conducted on the nation's largest outdoor shake table, at the Englekirk Structural Engineering Center at the University of California, San Diego, has already subjected a full-scale, five-story building, equipped with a working elevator, sprinkler systems, an intensive care unit, a surgery suite, and computer servers, to series of simulated earthquakes, some registering as high as 7.9 on the Richter scale. During three weeks of seismic testing, engineers have monitored the building's performance through more than 500 channels of data from a wide range of sensors.

The fire testing, which began during the seismic experiments with regular observations of the effects of the shaking on installed fire protection systems, is being led by Brian Meacham, associate professor of fire protection engineering at WPI. The overall goal is to gather data that will help engineers better model the fire performance of earthquake damaged buildings. "Knowing how fire protection systems might fail in

an earthquake, and how the fire and smoke might spread, will allow us to design more resilient systems and provide better protection to people, property, and mission," Meacham says.

After each phase of the seismic tests, which included shaking with and without a base isolation system—large cylindrical rubber bearings that isolated the 80-foot-tall building from most of the lateral motion it would normally experience during a temblor—the WPI researchers entered the building to inspect passive fire protection components, including doors, ceiling systems, partition walls, and firestop materials, to see how they fared. If these systems are compromised in an earthquake, they could allow flames and smoke to spread and air to enter a room to feed a fire. They also inspected the condition of active fire suppression systems, particularly sprinklers.

Next week, the WPI team will conduct a series of fire tests on the building's third floor. They will ignite pans of heptane, a liquid fuel that burns hot enough to simulate full burning within a compartment. Using temperature and smoke movement sensors, the researchers will assess how damage from the simulated earthquakes affect the ability of the active and passive fire protection systems to contain fires and prevent the spread of smoke.

Though post-earthquake fires are a well-known and serious hazard, very little is known about the performance of fire protection systems in earthquakes, Meacham says. The data gathered through this research could help inform more effective fire codes. In addition, this study will provide a unique opportunity to simultaneously observe the effects of shaking and fire on building systems, which could lead to new multi-hazard computer models that could help architects and engineers design safer buildings.

Provided by Worcester Polytechnic Institute