Studying how skyscraper foundations stand up to earthquakes

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UC Davis engineers are preparing to conduct the first rigorous tests of how the steel columns that secure skyscrapers to their foundations stand up during earthquakes, research that could make the towering structures safer -- and perhaps less expensive to build.

"This is the most crucial connection in the building, but there is really not much known about how they behave in earthquakes," said Amit Kanvinde, professor of civil and environmental engineering at UC Davis and leader of the project.

The research is among the latest in a long list of innovative earthquake-related studies at UC Davis, which is home to the largest geotechnical centrifuge in the United States and one of the most sophisticated virtual reality laboratories in the world. The centrifuge has been used to study how soils behave during earthquakes, while the virtual reality lab has been called on to help understand the 2010 Haiti earthquake and this year's Japan quake, among others.

In smaller buildings, steel support columns typically end in a metal plate that is bolted to a concrete foundation. Flexing of the metal plate allows it to absorb earthquake shaking without breaking free.

But in modern high-rise buildings of 40 to 50 stories, the forces involved become so large they would pull the bolts free. Instead, the steel pillars that support skyscrapers are embedded in concrete.

"Without scientific backing, we could be over- or under-engineering these foundations," Kanvinde said.

The experiments, to begin in 2012, will be carried out in the earthquake simulation laboratory at the Richmond Field Station in Berkeley, part of the national Network for Earthquake Engineering Simulation sponsored by the National Science Foundation. (UC Davis' geotechnical centrifuge is part of the same national network.)

Kanvinde's team will construct experiments with 10- to 20-foot-wide concrete footings and 20-foot-tall steel columns, subject them to simulated earthquake stresses, and see how they behave.

Provided by University of California - Davis