Learning from Disaster: Fundamental Behavior of Steel Beam-Columns Under Fire Loading

It has been shown that the stability of steel building structures subjected to realistic fire loading is governed by the behavior of the steel beam-columns. The overall goal of this project was to develop knowledge of the fundamental behavior and stability of steel beam-columns under combined structural fire loads. The study meets a critical need identified by the National Institute of Standards and Technology (NIST) Building Fire Research Laboratory (BFRL) in the aftermath of the World Trade Center collapse, which is to develop and validate test methods, analytical tools, and guidelines necessary to evaluate the fundamental behavior and fire performance of structural components and the system as a whole.

In order to characterize the fundamental beam-column behavior due to combined thermal and mechanical loads, a three-phase approach was used. First, experimental tests were conducted on steel wide-flange specimens to investigate beam-column response under varying axial and thermal load levels. Second, the behavior was modeled using sequentially coupled finite element analyses of the beam-columns under combined loading. Finally, a parametric study was completed through the use of a computational section-based fiber model from which a closed-form prediction of the moment-curvature-thrust-temperature (M-Φ-P-T) response of steel wide-flange sections was developed.

Biography

Andrea E. Surovek is an Associate Professor of Civil and Environmental Engineering at the South Dakota School of Mines and Technology in Rapid City, South Dakota, USA. She completed her Ph.D. in Structural Engineering at Georgia Tech in 2001, and received a BSCE, MSCE and BA from Purdue University. Dr. Surovek's primary research is focused on the behavior, analysis and design of steel buildings. She is a member of the Structural Stability Research Council (SSRC) Executive Committee, chairs the ASCE/SEI Technical Administrative Committee on Metals, and serves on the AISC Task Committee on Loads, Analysis and Systems.