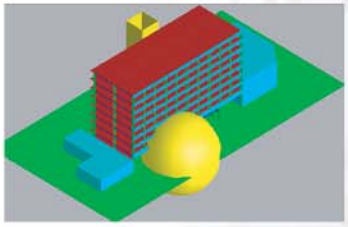
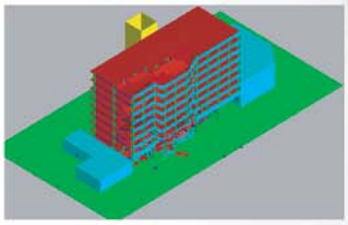
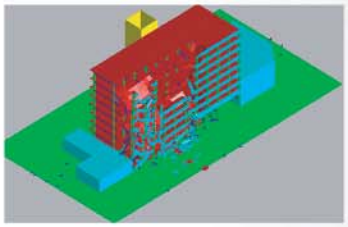
Extreme Loading in Action

This software has been tested using the design of the Murrah Federal Building in Oklahoma City. Simulating a blast similar to the actual explosion, Extreme Loading calculated the effects according to the building's structural dimensions and reinforcements, friction parameters, load distribution, and nonstructural components. **Extreme Loading's collapse simulation was similar to what was observed in the actual case in both progression and completion.**







Other Applications for Extreme Loading

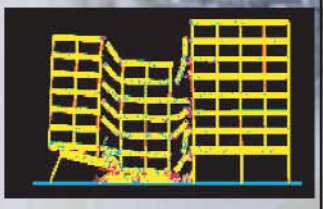
Demolition Analysis

Earthquake Engineering

Rockfall Engineering

Packaging Analysis

Nonlinear Structural Analysis



prevent building collapse

with

Extreme Loading

progressive collapse simulation and analysis software

identify design hazards

▼

develop enhancement strategies

▼

▼

before a blast occurs

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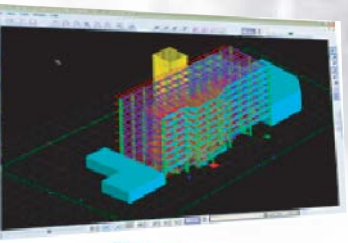
EXTREME LOADING

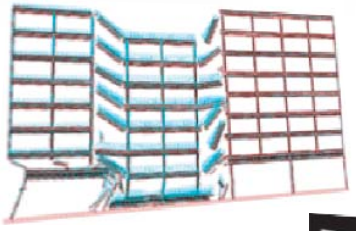
MEETS THE NEEDS OF HOMELAND SECURITY AND ARCHITECTURAL AND STRUCTURAL SAFETY DEMANDS

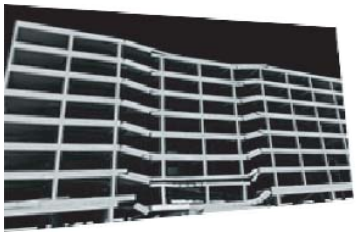
Before April 19, 1995, earthquakes often were considered the primary cause of building collapse. But with the bombing of the Murrah Federal Building in Oklahoma City—and the even more devastating attacks on the World Trade Center and Pentagon in 2001—terrorism has raised the stakes for security experts and structural engineers.

Blasts are among the most powerful of extreme loads. Even small explosives can inflict sizeable damage to a structure if they are set in the right location. Design hazards must be identified and mitigated to successfully suppress devastation before a blast occurs.

Applied Science International has created a breakthrough software program—**Extreme Loading**—to help ensure the safety of buildings and other structures. Using this software, security experts can identify the vulnerabilities in an existing structure or the plans for a new building, allowing the critical structural elements to be reinforced to prevent building collapse.







What Does Extreme Loading Do?

Extreme Loading analyzes the effects of various blast scenarios on an existing structure or new design, answering key safety and security questions:

Variables	Collapse Behavior	Scenario Assessment
structure type [building, bridge, tower]	loading	Will the building collapse?
structure materials [reinforced concrete, steel]	crack initiation	How will it collapse?
blast type [accident, bomb, impact]	crack propagation	What will be the duration?
blast location [interior, perimeter, aerial]	element separation	What happens to nearby buildings?
blast magnitude	element collision	What is the affected perimeter?
blast duration	progressive collapse	
	collision with adjacent structures	

What Makes Extreme Loading Better?

Previously, many collapse simulation programs used the finite element method (FEM) to conduct a collapse analysis. FEM, however, is not effective when the locations of cracks are unknown, when cracks are wide, or when elements actually separate. In short, FEM can model events up until the moment of collapse, but it cannot be used to analyze the stage and progression of collapse.

Extreme Loading uses a new analytic approach—the Applied Element Method (AEM)—to accurately calculate and model progressive nonlinear behavior.

Advantages

- Provides insight into all stages of collapse
- Includes effects of pressure waves—providing comprehensive blast modeling
- Accurately analyzes various explosion scenarios
- Offers 2-D and 3-D analysis
- Presents structural responses in real time
- Includes effects of nonstructural elements (e.g., windows, interior walls)
- Identifies impact on surrounding structures
- Provides rapid modeling time