



## BARRY L. BINGHAM, P.E.

### Principal Engineer

M.S., Civil Engineering, Columbia University

B.S., Civil Engineering, U.S. Air Force Academy

#### Areas of Practice

Mr. Bingham works at BakerRisk's San Antonio office in the Structures Group. His background is in structural analysis and design (static and dynamic), finite element analysis, coupled thermal/mechanical analysis, Computational Fluid Dynamics (CFD), and engineering model development. He has extensive experience developing engineering computer models to predict the response of structural systems to impulsive loads (explosives effects, blast, and ground shock).

#### Experience

- Mr. Bingham has performed three-dimensional (3-D) finite element analysis (FEA) of structures (steel frame, reinforced concrete, and wood frame) subjected to blast loads using structural and solid elements with explicit modeling of connection strengths and failure. He developed a rebar/concrete bond interface model for use in DYNA-3D for characterizing large deformation of reinforced-concrete elements including severe damage, cracking and failure. He has performed dynamic progressive-collapse design and analysis of federal office buildings using finite elements.
- Designed many different types of structural and architectural components including reinforced-concrete frames, steel frames, precast concrete panels, cast-in-place concrete components, glazed curtain walls, punched and ribbon windows, skylights, cold-formed framing and walls, a variety of roof systems, frangible blowout panels, connections, etc. Blast response criteria have been per requirements from different United States agencies including the General Services Administration (GSA), Department of Defense (DoD), Department of State (DS), Department of Veterans Affairs (VA), Department of Defense Explosives Safety Board (DDESB), and American Society of Civil Engineers (ASCE).
- Mr. Bingham has performed review/coordination of blast design calculations from third party submittals for the new construction of federal building projects.
- Has performed structural failure analyses in support of accident investigations, gathered field data during site investigations, and performed detailed finite element analyses of observed catastrophic responses to include weld failures, crack growth, large plastic strains, and large displacements.
- Authored and presented courses in Structural Response/Analysis and the use of finite element methodology.
- Performed numerous CFD analyses of the chemical detonation process of advanced explosives in a variety of geometric settings (open air, tunnels, fully buried, and multi-roomed structures) and their subsequent interaction with target elements, and designed and managed the construction of containment structures for high explosive weapons.
- Performed thermal heat transfer analyses for a variety of different structural systems with a variety of thermal loads, boundary conditions, interfaces, and associated thermal/mechanical stresses.
- Dynamic design and analysis of structural systems and components using a wide variety of analysis tools including Single-Degree-of-Freedom (SDOF), Multi-Degree-of-Freedom (MDOF), multi-disciplined engineering models, and commercial structural codes. Mr. Bingham developed the MDOF code accounting for back-surface pressure on blast loaded components which plays an important role in relatively light-weight structures like pre-engineered metal buildings (PEMBs) and tents.
- Authored the Applied Engineering Cap Model with Three Invariants (AEC-3I) for modeling the behavior of frictional materials (concrete, rock and soils) to very large strains, including failure in finite element codes. This material model has been implemented into DYNA-3D, EPIC (a finite element code used at Eglin AFB Research Lab), PRONTO (a finite element code used at Sandia National Labs), and MAGI (a Smoothed Particle Hydrodynamics code used at Los Alamos National Labs). This model has been used in numerous successful finite-element predictions of catastrophic field tests in explosive loading of structural assets, weapon penetration events, and cratering/ground shock environments.
- In cooperation with the University of New Mexico, Mr. Bingham helped develop and implement decohesion algorithms for modeling crack initiation and propagation in metals and frictional materials for use in finite element codes.
- Mr. Bingham helped design a full-scale test reaction structure for subjecting full-scale building columns to blast loads from terrorist-type explosions. He then budgeted, scheduled, and field-managed the construction of the column-test reaction structure at an explosive test range on Kirtland Air Force Base, New Mexico.
- Program Manager and primary code developer for BEAMS, an engineering code for defining the air blast loads from conventional weapon detonations on detailed computer-aided-design (CAD) representations of military targets. He has



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written 3-D kinematics analysis codes for modeling rigid body motion under impulsive and transient loads. The 3-D kinematic codes have modeled the motion of spinning projectiles during flight and penetration processes, and overturning/translation of objects to blast loads.

- Performed 3-D FEA of numerous deep underground tunnel facilities in a layered-rock geology subjected to ground shock from large-yield explosive sources. His analysis included investigation of rock material properties from controlled laboratory experiments, adaptation of laboratory test data to computer material model parameters, and modeling of different types of tunnel liner systems including unlined, rock bolts, reinforced concrete, steel, shock-isolated liners, and different combinations thereof.
- Mr. Bingham was a Program Manager for a test series for intercontinental ballistic missile shelters and performed design and analysis of reinforced concrete structures and structure-soil interaction. He also managed the field testing of reinforced concrete structures subjected to blast and fragment loading from high explosive weapons.

**Professional Chronology**

Air Force Weapons Laboratory, Kirtland AFB (1979-83, USAF Captain); Applied Research Associates (Senior Engineer/Principal Scientist, 1983-2006); Baker Engineering and Risk Consultants, Inc. (Principal Engineer 2006-present).

**Professional Registrations / Certifications**

i Professional Engineer in Texas (License No. 126120), Colorado (License No. 19901), New Mexico (License No. 14638), and Nebraska (License No. E-15313)

**Professional Memberships**

American Society of Civil Engineers (ASCE MB 236682)