

Exponent®
Engineering & Scientific Consulting

Aaron Freidenberg, Ph.D., P.E.

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Professional Profile

Dr. Freidenberg specializes in root cause failure analysis and structural forensics. He has investigated the quality of the design and construction of structures whose performance did not meet expectations, including investigation of the nature and scope of structural damage resulting from blast, impact, earthquake, wind, fatigue, fire, snow, and construction loads. His past investigations include evaluation of structural damage to residential structures, structural failures of high-rise curtain walls, and collapses of vehicular bridges.

Dr. Freidenberg employs state-of-the-art engineering analysis and investigative techniques, including high-fidelity finite element analysis modeling. He has developed and published some of these investigative techniques on failure analyses of timber, concrete, and steel structures. Dr. Freidenberg also has expertise in dispute resolution, including domestic and international arbitration disputes in the energy and transportation sectors.

Prior to joining Exponent, Dr. Freidenberg was an Assistant Professor in the Department of Civil and Mechanical Engineering at the U.S. Military Academy in West Point, NY, where he taught a variety of mechanics courses and also served as Associate Director for the Center for Innovation and Engineering where he developed partnerships with other researchers.

Academic Credentials & Professional Honors

Ph.D., Structural Engineering, University of California, San Diego, 2013

M.S., Civil Engineering, Princeton University, 2009

B.S., Civil Engineering, University of Southern California, 2007

Licenses and Certifications

Professional Engineer Civil, California, #92528

Professional Engineer Civil, New Mexico, #30426

Professional Engineer Civil, Washington, #22009464

California CalSAFE SAP (Safety Assessment Program) Evaluator Certified

Washington WASafe BSE (Building Safety Evaluator) Certified

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Academic Appointments

Assistant Professor, U.S. Military Academy, West Point, 2014-2019

Visiting Assistant Professor, Manhattan College, 2013-2014

Professional Affiliations

American Institute of Steel Construction (AISC)

Precast Concrete Institute (PCI)

Reviewer, Taylor & Francis, ASCE, Sage Journals

Publications

Freidenberg A, Saraf V, Hunt J, McDonald B, Osteraas J. Load and Capacity Considerations for Stringers in Shoring Towers. Proceedings, Forensic Engineering, Seattle, WA, 2024.

Hunt J, Freidenberg A. Hanging Load Failures in Wood Beams. Proceedings, Forensic Engineering, Denver, CO, 2022.

Finch J, Deppe A, Cummins C, Segletes S, Jeffrey L, Freidenberg A. Buried Blast Performance and Analysis of Additively Manufactured TI-6AL-4V Truss Structures. Army Research Laboratory; Report No.: ARL-TR-8917. Aberdeen Proving Ground, MD, 2020.

Freidenberg A, Milliman LR, Parmer B, Olaolorun G, Pape E, Durant B. Validation of Prestressed Concrete High-Fidelity Finite Element Analysis. PCI Journal 2019; 64(5): 30-42.

Drummond R, Sun C, Valkenburg A, Freidenberg A, Bruhl JC. Computer Predictions of Tunnel Response to Blast. Proceedings, Structures Congress, Orlando, FL, 2019.

Bruhl JC, Gash RJ, Freidenberg A, Conley CH, Moody PM. Helping Students Learn Engineering Mechanics Concepts Through Integration of Simulation Software in Undergraduate Courses. Proceedings, ASEE Annual Conference, Salt Lake City, UT, 2018.

Freidenberg A, Bruhl JC, Conley CH, Randow CL. High Fidelity Structural Analysis for Undergrad Structural Engineering Students. Proceedings, Structures Congress, Fort Worth, TX, 2018.

Chansuk, P, Freidenberg A, Quadrato CE, Rogers MM. Influence of Plate Stiffener Geometries on LTB Capacity. Proceedings, Structural Stability Research Council (SSRC), Orlando, FL, 2016.

Stewart LK, Freidenberg A, Hegemier GA. Design and Testing of Steel Stud Wall Systems for Blast Mitigation. Proceedings, 13th Structures Under Shock and Impact (SUSI), New Forest, UK, 2014.

Freidenberg A, Aviram A, Stewart LK, Whisler D, Kim H, Hegemier GA. Demonstration of Tailored Impact to Achieve Blast-Like Loading. International Journal of Impact Engineering 2014; 71: 97-105.

Stewart LK, Freidenberg A, Rodriguez-Nikl T, Oesterle M, Wolfson J, Durant B, Arnett K, Asaro RJ, Hegemier GA. Methodology and Validation for Blast and Shock Testing of Structures using High-speed Hydraulic Actuators. Engineering Structures 2014; 70:168-180.

Freidenberg A, Stewart LK, Hegemier GA. Advancements in Blast Simulator Analysis. Proceedings, 84th Shock and Vibration Symposium (SAVE), Atlanta, GA, 2013.

Freidenberg A, Lee CW, Durant B, Nesterenko VF, Stewart LK, Hegemier GA. Characterization of the Blast Simulator Elastomer Material Using a Pseudo-Elastic Rubber Model. International Journal of Impact Engineering 2013; 60:58-66.

Herning G, Garlock MEM, Freidenberg A. Comparison of Welded and Post-Tensioned Steel Moment-Resisting Frames. Proceedings, Steel Structures in Seismic Areas (STESSA), Santiago, Chile, 2012.

Presentations

Cohen-Waeber J, Freidenberg A. Geotechnical and Structural Forensics Case Studies. UW Department of Civil and Environmental Engineering. Seattle, WA, 2025.

Freidenberg A. Structural Forensics Case Studies. UCSD Department of Structural Engineering. La Jolla, CA, 2023.

Beyzaei, C, Freidenberg A. Structural and Geotechnical Engineering Failure Investigations. UCSD Department of Structural Engineering. La Jolla, CA, 2020.

Freidenberg A. Cadet Simulation-Based Engineering. Harvey Mudd College Department of Engineering seminar series. Claremont, CA, 2019.

Sun C, Valkenburg A, Barron C, Freidenberg A. Underground Reinforced Concrete Structures Subject to Above-Ground Blast. 26th Annual ARL/USMA Technical Symposium (AUTS). Aberdeen Proving Ground, MD, 2018.

Floam H, Hochfelder C, Lloyd J, Cummins C, Freidenberg A. Underbody Blast Protection: Service Academy Competition. 26th Annual ARL/USMA Technical Symposium (AUTS). Aberdeen Proving Ground, MD, 2018.

Freidenberg A. Running a Finite Element Analysis on a DoD HPC. U.S. Military Academy (USMA) seminar series. West Point, NY, 2017.

Freidenberg A., Lee CW. Simulating Rubber Impact: Pseudo-Elastic Material Model vs. UMAT. 24th Annual ARL/USMA Technical Symposium (AUTS). Aberdeen Proving Ground, MD, 2016.

Freidenberg A. Advancements in Blast Simulator Analysis. Army Research Lab Weapon and Materials Research Directorate seminar series. Aberdeen Proving Ground, MD, 2016.

Freidenberg A. Simulation-Based Engineering using LS-DYNA. USMA Department of Civil & Mechanical Engineering seminar series. West Point, NY, 2014.

Project Experience

Collapse & Damage Investigations

- **Concrete Structures**
    - *Townhouses (SE Asia):* Investigated structural damage in hundreds of units caused by ground heave. Documented field conditions and performed finite element and structural analyses of moment frames, shear walls, and slabs to verify root causes and recommend repairs.
    - *Viaduct Collapse:* Analyzed corbel failure during construction using advanced finite element modeling to identify design and/or construction deficiencies.

- *Various Structures:* Determined causes of damage to reinforced and prestressed concrete systems from a variety of mechanisms, including excessive service deflection, blast/impact, buckling/instability, soil buoyancy and surcharge, and fire exposure.

- **Steel Structures**
  - *Gymnasium Roof Collapse:* Investigated truss failure through detailed analysis of members and welds; identified design and/or construction defects.
  - *Lattice Towers:* Analyzed damage to snow-loaded towers to identify design and/or construction defects.
  - *Pedestrian Bridge/Conveyor:* Determined cause of collapse due to bolt fatigue through site documentation and high-fidelity modeling.
  - *Falsework/Shoring Failures:* Conducted advanced analysis of temporary steel works, including a buckling failure leading to falsework collapse underneath a skew bridge.
  - *Various Structures:* Performed failure investigations on a wide range of structures, including heavy and slender plate girders, pre-engineered metal building systems, cold-formed light gauge steel walls, expansion joints, military vehicle underbody structures, grain silo hoppers, and poles/masts.

- **Wood Structures**
  - *Bridges and Roofs:* Assessed damage to wood/glulam systems caused by deep checks, rot, and cross-grain tension.
  - *Residential Buildings:* Investigated failures in houses across California and Washington related to explosions, vehicle/tree impacts, water intrusion, ground movement, wind, and fire.

Major Design Disputes

- Evaluated design and construction cost overruns for major infrastructure and energy projects across the U.S. and Middle East. Projects included hospitals, power plants, petrochemical and storage facilities, highways, and transit stations.