Exponent®
Engineering & Scientific Consulting

John Zolock, Ph.D., P.E.

Principal Engineer | Vehicle Engineering
Natick
+1-508-652-8507 | jzolock@exponent.com

Professional Profile

John Zolock, PhD, PE, ACTAR is a Principal Engineer in the Vehicle Engineering Practice, specializing in ground transportation crash analysis and reconstruction, vehicle crashworthiness and occupant protection, and the analytical and experimental evaluation of physical dynamic systems.

Expertise in Accident Reconstruction

Dr. Zolock has participated in more than 1,000 engineering- and scientific-based accident reconstruction matters across a diverse range of ground transportation modes. This work encompasses incidents involving automobiles; buses (transit, coach, shuttle, school); pedestrians; medium and heavy trucks (straight trucks, tractor-semitrailers, and vocational trucks); motorcycles (on-road, dirt bike, scooter, three-wheel); go-karts; bicycles; golf carts; off-highway recreational vehicles; heavy equipment; construction equipment; and rail vehicles (passenger, locomotive, freight, subway).

He has specialized expertise in analyzing factors that may contribute to and/or cause ground transportation accidents, such as roadway conditions; line-of-sight; vehicle speed and stopping distance; the performance and function of vehicle components and systems; right-of-way violations and centerline encroachments; vehicle handling characteristics; and collision avoidance and Advanced Driver Assistance Systems (ADAS) technology.

Specialized Technical Expertise

Dr. Zolock's extensive experience spans advanced methodologies and testing protocols, enhancing his consulting contributions to accident reconstruction. Dr. Zolock's work integrates material science, applied mechanics, dynamics, vibrations, Finite Element Analysis (FEA), biomechanics, and human injury testing using Anthropomorphic Test Devices (ATDs). His experience spans photogrammetry, passenger vehicle and heavy truck event data recorder (EDR) download and analysis, dynamic system testing, dynamic system simulation, full scale rail vehicle testing, along with physical testing and evaluation of the design and performance of Roll Over Protection Structures (ROPS) for off-highway recreational vehicles. Dr. Zolock also has expertise in automobile full-scale crash testing, dolly rollover testing, handling testing, sled testing, and regulatory compliance testing (relative to Federal Motor Vehicle Safety Standards) which enhances his consulting contributions to the reconstruction of accidents.

Dr. Zolock regularly utilizes the latest software and hardware tools to collect, synthesize, and interpret the electronic data, videos, and images stored in vehicles and equipment. This includes imaging data from event data recorders (EDR), electronic control modules (ECMs), engine control modules, brake control modules, airbag control modules (ACM), advanced driver assistance systems (ADAS), and telematics systems including Geotab, Lytx, Omnitracs, PeopleNet, Samsara, and Tesla.

Using photogrammetry - a scientific method for obtaining precise and reliable measurements of objects and features captured in photographs and video – has been a cornerstone of Dr. Zolock's engineering work. He has been utilizing photogrammetry in its various forms for more than 25 years and on hundreds of different circumstances. These include ground-based and close-range photogrammetry methods such as image rectification, camera-matching, and reverse projection applied to still images, stationary and moving videos, and secondary recordings of a video playback (video-of-a-video).

For more than 20 years Dr. Zolock use been using human modeling with the MAthematical DYnamic MOdels (MADYMO) simulation software to analyze complex human motion scenarios such as vehicle-to-vehicle collisions, vehicle-to-pedestrian collisions, vehicle-to-bicycle collisions, vehicle-to-motorcycle collisions, human motion during vehicle rollovers, impacts from moving equipment, impacts from flying or falling objects, humans falling from height, humans falling over railings, humans falling from vehicles, humans falling into openings, and humans sitting onto furniture. Additionally, Dr. Zolock has also used MADYMO when working with consumer and industrial products companies to evaluate the safety of products, prototypes, and experimental transportation systems. Dr. Zolock has conducted research programs that have explored the validity of the MADYMO simulation-based tool for human modeling.

Vehicle Rollovers

Dr. Zolock has specialized expertise developed through extensive work on hundreds of vehicle rollover accidents. In this area, he has contributed to the rollover accident community by conducting multiple sophisticated research studies that employed various rollover methodologies, advancing the understanding of vehicle and occupant kinematics and dynamics in real-world rollover crashes.

Vehicle Research and Testing

Dr. Zolock has conducted research and testing involving rail vehicles, passenger cars, trucks, and pedestrians. The testing has been utilized to validate reconstructions, understand vehicle and occupant kinematics and dynamics, assess restraint system performance, and research the performance of occupant protection systems in the context of the crashworthiness of vehicle structures. As a result of this work, Dr. Zolock is highly knowledgeable in the configurations and measurements obtained by the Anthropomorphic Test Devices (ATDs, test dummies) used in crash and rollover testing, and how that testing relates to simulation utilizing MADYMO and relevant Injury Assessment Reference Values (IARVs).

Regulatory and Standards

Dr. Zolock is well-versed in state and federal safety standards and consumer information ratings associated with vehicle performance in static and dynamic testing. Dr. Zolock has evaluated vehicles with respect to National Highway Traffic Safety Administration (NHTSA) FMVSS Regulations, Federal Railroad Administration Regulations (FRA), American Public Transportation Association (APTA) recommended practices, and the ANSI/ROHVA standards. Dr. Zolock has developed specialized expertise in designing and conducting vehicle crash and sled tests, handling tests, automotive component testing, and restraint system evaluations that relate to a specific accident or relevant regulations. Dr. Zolock has conducted physical testing and evaluated the design and performance of Roll Over Protection Structures (ROPS) for off-highway recreational vehicles, as well as evaluated the kinematics and dynamics of these recreational vehicles.

Motorcycle

Dr. Zolock is an experienced motorcycle operator with specialized expertise in motorcycle accident reconstruction and handling dynamics. He rides regularly and has completed both classroom and hands-on riding skills training in on-road, off-road (dirt bike), and three-wheel motorcycle operation.

Professional Background

Prior to joining Exponent, Dr. Zolock served nine years as a Mechanical Engineer at the U.S. Department of Transportation's Volpe National Transportation Systems Center in Cambridge, Massachusetts. His work focused on research and development projects addressing railroad vehicle-track interaction, train-derailment causation and prevention, train make-up and performance, rail vehicle suspension design and performance, rail vehicle crashworthiness, accident injury causation, and occupant safety and protection for rail vehicles.

Academic Contributions

While working at the Volpe Center, Dr. Zolock wrote a Ph.D. dissertation at Tufts University titled, "A Methodology for the Modeling of Forced Dynamical Systems from Time Series Measurements using Time-Delay Neural Networks." The dissertation studied the use of artificial intelligence (neural networks) to predict the wheel/rail force response of rail vehicles to track geometry variation.

While at Penn State University, Dr. Zolock wrote a thesis titled, "Experimental Observation and Characterization of Tire Standing Waves." At Penn State, Dr. Zolock's curriculum focused on experimental and analytical dynamics, vibrations, modal analysis, signal analysis, mechanics of materials, and composite materials. Previous work experience at Micro Motion included experimental and analytical modal analysis of Coriolis-based mass flow meters and high-pressure feed-through testing and design.

Education and Credentials

Dr. Zolock's formal educational background includes a Bachelor of Science degree in Mechanical Engineering from Grove City College, a Master of Science degree in Engineering Science and Mechanics from the Pennsylvania State University, and a Doctoral degree in Mechanical Engineering from Tufts University. Dr. Zolock is a registered professional mechanical engineer in six states, including Connecticut, Massachusetts, Michigan, New York, Pennsylvania, and Rhode Island. Dr. Zolock is a certified traffic accident reconstructionist by the Accreditation Commission for Traffic Accident Reconstruction (#2550).

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Tufts University, 2005

M.S., Engineering Science and Mechanics, Penn State University, 1997

B.S., Mechanical Engineering, Grove City College, 1994

Recipient of 2012 SAE Arch T. Colwell Award for outstanding paper (2010-01-0515) presented at SAE

Licenses and Certifications

Professional Engineer, Connecticut, #PEN.0028194

Professional Engineer Mechanical, Massachusetts, #48127

Professional Engineer, Michigan, #6201314947

Professional Engineer, New York, #88006

Professional Engineer, Pennsylvania, #PE079651

Professional Engineer, Rhode Island, #PE.0009625

Prior Experience

Senior Mechanical Engineer (Structures and Dynamics Division), U.S. Department of Transportation/Research and Innovative Technology Administration/Volpe National Transportation Systems Center, 1998-2006

Research Assistant, Department of Engineering Science and Mechanics, The Pennsylvania State University, 1995-1997

Teacher Assistant in the Department of Engineering Science and Mechanics, The Pennsylvania State University, 1995

Mechanical Engineering Intern, Micro Motion Incorporated, 1992-1993

Professional Affiliations

Society of Automotive Engineers (member)

American Society of Mechanical Engineers (member)

National Society of Professional Engineers (PE Status and member)

National Association of Professional Accident Reconstruction Specialists (member)

Publications

Croteau, J., Toney-Bolger, M., Isaacs, J.L., Shurtz, B. et al., Seatback Strength and Its Effect on In-Position and Out-of-Position ATD Loading in High-Speed Rear Impact Sled Tests, SAE Technical Paper 2022-01-0856, 2022, doi:10.4271/2022-01-0856.

Rapp van Roden, E. and Zolock, J., Using the Instantaneous Center of Rotation to Examine the Influence of Yaw Rate on Occupant Kinematics in Eccentric Planar Collisions, SAE Technical Paper 2022-01-0826, 2022, doi:10.4271/2022-01-0826.

Parenteau C, Croteau J, and Zolock J, The Effect of Crash Severity and Structural Intrusion on ATD Responses in Rear-End Crashes. SAE Technical Paper 2020-01-1224, 2020, https://doi.org/10.4271/2020-01-1224.

Zolock J, Senatore C, Yee R, Larson R et al. The use of stationary object radar sensor data from Advanced Driver Assistance Systems (ADAS) in accident reconstruction. SAE Technical Paper 2016-01-1465, 2016, doi:10.4271/2016-01-1465.

Larson R, Croteau J, Bare C, Zolock J, et al. Steering maneuver with furrow-tripped rollovers of a pickup and passenger car. SAE Technical Paper 2015-01-1477, 2015. doi:10.4271/2015-01-1477.

Heller M, Sharpe S, Newberry W, Dibb A, Zolock J, et al. Occupant kinematics and injury response in steer maneuver-induced furrow tripped rollover testing. SAE International Journal of Transportation Safety 3(2):2015. doi:10.4271/2015-01-1478.

Parker D, Zolock J, Keefer D. A study of vehicle impacts during dolly rollover tests and comparison to frontal and side impact tests. Society of Automotive Engineers, 2014-01-0529, April 2014.

Croteau J, Zolock J, Larson R, Bare C, Peterson D, Parker D. Dynamic response of vehicle roof structure and ATD neck loading during dolly rollover tests. Society of Automotive Engineers, 2010-01-0515, April 2010.

Zolock J, Greif R. A methodology for the modeling of forced dynamical systems from time series measurements using time-delay neural networks. J Vibration Acoustics 2009; 131(1).

Zolock J, Greif R. A methodology for the modeling of rail vehicles from time series measurements using time-delay neural networks. American Society of Mechanical Engineers Rail Transportation Division Fall Technical Conference, RTDF2007-46022, November 2007.

Martinez E, Zolock J, Tyrell D. Crush analyses of multi-level equipment. American Society of Mechanical Engineers, IMECE2006-13214, November 2006.

Martinez E, Zolock J, Tyrell D. Review of severe deformation recommended practice through analysis-comparison of two cab car end frame designs. American Society of Mechanical Engineers, ASME2005-70043, March 2005.

Zolock J, Greif R. Application of time series analysis and neural networks to the modeling and analysis of forced vibrating mechanical systems. American Society of Mechanical Engineers, ASME2003-55519, November 2003.

Zolock JD, Tyrell D.C. Locomotive cab occupant protection. American Society of Mechanical Engineers, ASME2003-44121, November 2003.

Martinez E, Zolock J, Tyrell D. Rail-car impact tests with steel coil: Car crush. American Society of Mechanical Engineers, JRC2003-1656, April 2003.

Tyrell D, Zolock J, VanIngen-Dunn C. Train-to-train impact test: Occupant protection experiments. American Society of Mechanical Engineers, IMECE2002-39611, November 2002.

Tyrell D, Zolock J, VanIngen-Dunn, C. Rail passenger equipment collision tests: Analysis of occupant protection measurements. Rail Transportation, American Society of Mechanical Engineers, RTD-Vol. 19, November 2000.

Chatterjee A, Cusumano JP, Zolock JD. On contact-induced standing waves in rotating tires: Experiment and theory. Journal of Sound and Vibration 1999; 227(5):1049-1081.

Chatterjee A, Cusumano JP, Zolock JD. Standing waves in a simple model of a rotating balloon tire. ASME Winter Annual Meeting November 1997.

Cusumano JP, Zolock JD. An experimental study of tire standing waves on a small-scale test rig. SAE Aerospace Atlantic Conference, SAE961301, May 1996.

Technical Reports

Tyrell D, Severson K, Zolock J, Perlman A. Passenger rail two-car impact test Volume I: Overview and selected results. U.S. Department of Transportation/Federal Railroad Administration; DOT/FRA/ORD-01/22.1, January 2002.

Public Abstracts of Presentations

Zolock J, Deconstructing Accident Reconstruction of Motor Vehicle Crashes - An Engineering Expert Perspective, New Hampshire Association of Criminal Defense Lawyers CLE, November 14, 2025.

Zolock J, Zipperle G, Infinite Jest: The Impact of Evolving Driving Technology in Personal Injury Claims,

Transportation Lawyers Association (TLA) 2022 Transportation Lawyers Institute, November 18, 2022.

Zolock J, Lavoie M, Catastrophic Motor Vehicle Accidents and the Benefits of Early Involvement by Counsel and Experts, Massachusetts Defense Lawyers Asswociation, May 21, 2021.

Zolock J, Use of Computer Simulation to Analyze Auto Accidents, National Association of Subrogation Professionals, June 18, 2019.

Zolock J, Shapiro B, Bracher P, Use of Computer Simulation to Analyze Accidents with Emphasis on Vehicle Handling and Collisions, Claims and Litigation Management 2019 Transportation Webinar Series, February 13, 2019.

Zolock J, Danthurthi S, Use of Computer Simulation in Litigation — with emphasis on Vehicles, Humans, and Structures, Maryland Defense Counsel, May 17, 2018.

Zolock J, Senatore C, Investigation and Reconstruction of Automobile and Heavy Truck Accidents, American Society of Safety Engineers, March 22, 2017.

Zolock J, Loud W, Passenger Car and Heavy Truck Advanced Driver Assistance Systems - How will this technology change accident investigation, Claims and Litigation Management Webinar, February 8, 2017.

Zolock J. Passenger car and heavy truck advanced driver assistance systems: How will technology change accident investigation? Philadelphia Association of Defense Counsel Annual Meeting, June 7, 2016.

Zolock J, Rodowicz K., Accident Reconstruction & Biomechanics in Auto Liability Cases: Testing & the Seat Belt Defense, November 24, 2015.

Zolock J, Seusing C, Loud W, Event data from automobile Electronic Control Modules (ECM's), Claims and Litigation Management 2013 Transportation Committee Mini-Conference, June 14, 2013.

Zolock J, Frank B, Event data from automobile Electronic Control Modules (ECM's), Massachusetts Defense Lawyers Annual Meeting, May 12, 2011.

Zolock JD. Rail passenger equipment outermost end door removable panels. Federal Railroad Administration — Railroad Safety Advisory Committee Passenger Safety Working Group/Emergency Preparedness Task Force Meeting, Boston, MA, April 19 2005.

Zolock JD. Artificial neural network approach to modeling dynamic mechanical systems. University of Rhode Island Seminar Series in Mechanical Engineering, Kingston, RI, April 23, 2004.

Zolock JD, Tsai T. Equalized truck performance modeling and testing. Transportation Research Board 78th Meeting, Washington, D.C, January 10-14 2000.

Zolock JD, Carr G. A case study of commuter rail low speed derailments. ARM-Corporation Wheel/Rail Interface Seminar, Chicago, IL, May 12-13, 1999.

Zolock JD, Cusumano JP. An experimental study of tire standing waves. 133rd Meeting of the Acoustic Society of America, State College, PA, June 16-19, 1997.

Additional Education & Training

Dirt Bike School Level 2 Intermediate Skill Building, 2025

Crown Equipment Operator Training, 3 Wheel Sit-Down Counterbalance, 2025

Symposium on EDR Research and Training, NAPARS, 2025

Heavy Vehicle Event Data Recorder (HVEDR) Use in Traffic Crash Investigation Analyst Training, NAPARS, 2025

The Successes, Limitations, and Future of Automatic Emergency Braking Systems (AEB), NAPARS, 2025

Forensic Photography Symposium, 2025

2D HE Hoisting License Continuing Education – Massachusetts, 2024

Introduction to Brake Control Systems: ABS, TCS, and ESC, SAE International 2023

Motorcycle Collision Reconstruction, Lightpoint Learning, March 2023

Bendix Online Air Brake Training Couse ABT101, 2023

Satellite Photogrammetry, EZ-pdh.com, 2023

Aerial Photogrammetry, EZ-pdh.com, 2023

Introduction to sUAS for Land Surveyors, EZ-pdh.com, 2023

Airborne Topographic LiDAR, EZ-pdh.com, 2023

Stress and Strain in Soils, EZ-pdh.com, 2023

Engineering Description of Soils and Rocks, EZ-pdh.com, 2023

Accident Reconstruction Digital Summit, SAE International, 2022

HVE Forum, Engineering Dynamics Company LLC, 2022

Forensic Photography Symposium, Eugene Liscio, 2022

Accident Reconstruction, The Autonomous Vehicle and ADAS, SAE International, 2021

HVE Forum Workshop, Engineering Dynamics Company LLC, 2020

Side Impact Occupant Safety and CAE, SAE International, 2019

FAA Part 107 Aeronautical Knowledge Test Preparation Course, Drone Pilot Ground School, 2019

World Reconstruction Exposition, 2016

Accessing and Interpreting Heavy Vehicle Event Data Recorders Seminar, SAE International, 2015

Investigating Motor Vehicle Crashes with Utility Poles and Trees, SSR Training, 2014

Field Inspections: Tips and Techniques, The Practicing Institute of Engineering Inc, 2014

Crash Data Retrieval User Summit, Collision Safety Institute, 2014

Crash Data Retrieval Technician Level I and II, Collision Safety Institute, 2013

Vehicle Frontal Crash Occupant Safety and CAE, SAE International, 2013

HVE Forum Workshop, Engineering Dynamics Company LLC, 2012

Bosch Crash Data Retrieval Data Analyst Course, Collision Safety Institute, 2011

Bosch Crash Data Retrieval Technician Level 1 Course, Collision Safety Institute, 2011

Vehicle Dynamics for Passenger Cars and Light Trucks e-Seminar, SAE International, 2011

Hazardous Waste Operations and Emergency Response Training, 29 CFR 1910.120

Highway-Rail Grade Crossing Safety Course, University of Wisconsin, 2008

Engineering Fundamentals of Rail Transit Passenger Systems: Light Rail, Commuter Rail, and Rapid transit, University of Wisconsin, 2008

Traffic Accident Reconstruction, Northwestern University Center for Public Safety, 2007

Occupant and Vehicle Kinematics in Rollovers, SAE International, 2007

Mathematical Dynamic Models (MADYMO) Modeling Simulation Software Introduction Training, 2003

Injuries, Anatomy, Biomechanics, and Federal Regulations Seminar, Society of Automotive Engineers, 2001

Railroad Derailment Cause Finding and Prevention Seminar, Rail Sciences Inc., 1999

Dale Carnegie Leadership Training Course Graduate and Course Assistant, 1993-1994