



Erin J. Potma, Ph.D., P.Eng.

Senior Consultant/District Manager
Biomechanics and Transportation Divisions

Background

Dr. Potma received her Ph.D. in Mechanical Engineering from Queen's University. She is a registered professional engineer with academic and research experience comprising multiple aspects of biomechanical and biomedical engineering, including: advanced mechanics, tissue mechanics, joint biomechanics, medical imaging and computing, human factors and ergonomics, medical device development, and applications of 3D printing in medicine.

Dr. Potma's primary areas of forensic consulting expertise include biomechanical injury assessment, collision reconstruction, and mechanical and medical device failure assessments. She provides biomechanical analyses regarding occupant kinematics, restraint use, head injury, helmet usage, fitness and sporting incidents, playground incidents, and other incidents leading to human injury. She also conducts slip, trip, and fall investigations comprising both gait and movement analysis as well as building and staircase assessments. Dr. Potma has reconstructed collisions involving low- and high-speed impacts, rollovers, pedestrian and cyclists, motorcycles, snowmobiles, tractor-trailers, and other types of accidents. She has also analyzed mechanical failures and malfunctions including those involving medical devices and hospital equipment.

She has training in medicine and surgery, as well as an extensive publication record and collaborative research experience in the field of orthopedics. She has performed biomechanical analyses on human subjects, animal models, and tissue specimens during both live and cadaveric testing with biomedical instrumentation, and has characterized these results using both mathematical and computational models.

She is also an active member of the Canadian Association of Technical Accident Investigators and Reconstructionists and the Society of Automotive Engineers.

Contact Information

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Professional Engagements

• Medical Research and Development

- Computer-Assisted Wrist Surgery – Kingston, ON (2008-2011), Developed and evaluated novel techniques, software, and hardware tools invoking medical image formatting, optical tracking, and additive manufacturing for percutaneous scaphoid fixation.
- Human Joint Kinematics – Kingston, ON (2008-2010), Investigated the motion of the human hip, shoulder, ankle, and wrist using optical tracking technology and medical imaging in human cadaveric and in-vivo specimens.
- Stereophotogrammetry for Orbital Examinations – Kingston, ON (2006-2008), Developed and tested hardware and software methods to extract three-dimensional data from two-dimensional photographs of the eyes.
- Kinematic Geometry of Osteotomies – Kingston, ON (2003-2005), Developed a mathematical model to describe surgical bone realignments and used this as the basis for a software planning environment.
- Queen’s University Solar Vehicle Team – Kingston, ON (1999-2002), Acted as mechanical and systems manager in the development of two generations of solar vehicles. Drove across Canada in 2000 to set a Guinness World Record, and participated in the American and World Solar Challenge.

Forensic Engagements

• Biomechanical Investigations

- Injury Consistency Assessment – Evaluated whether diagnosed hand injuries were consistent with the reported circumstances of the incident.
- Seatbelt Evaluation – Evaluated the contribution of seatbelt misuse to injuries sustained in a head-on impact.
- Waterpark Injury Assessment – Measured the forces and accelerations involved in a waterpark ride and opined on injury risk in setting of pre-existing injuries.

• Slip/Trip/Fall Investigations

- Stair Fall Assessment – Assessed injuries to determine if fall was slip, trip, or misstep; evaluated contribution of building code deficiencies to fall.
- Slip and Fall Assessment – Evaluated motions from surveillance video; evaluated mechanism and factors contributing to fall; conducted slip testing using BOT-3000E.

• Traffic Accident Reconstruction

- Fatal Bus Collision – Evaluated traffic signal timing and GPS data; determined circumstances of collision, conducted collision simulations, and assessed opportunity to avoid.

- Nighttime Cyclist Collision – Performed lighting level measurements and conducted calibrated visibility study to evaluate avoidance opportunity.
- Winter Maintenance Assessment – Determined contribution of snow/ice to cause of collision; evaluated weather data, patrol, and plow logs with respect to maintenance standards.
- **Mechanical Device Assessment**
 - Ladder Fall – Examined ladder and reconstructed scene; evaluated witness testimony to assess contribution of misuse to failure event.
 - Medical Device Evaluation – Measured the force generated by a chiropractic adjustment device and evaluated the potential of injuries claimed from its use.

Professional Experience

- **Rimkus Consulting Group, Inc.** **2016 – Present**
 - Senior Consultant/District Manager – Biomechanics and Transportation Divisions
Provides consulting services to insurance carriers, law firms, and corporate clients. Practice areas include multiple aspects of collision reconstruction and biomechanical evaluations. Provides injury consistency analysis in vehicular accidents and other incidents. Performs occupant motion studies to determine seatbelt use, the effects of airbag interaction, and determination of occupant positions. Uses both computer and physical models to reconstruct accidents and to measure the load and injury levels. Evaluates medical devices and mechanical equipment failures and malfunctions. Conducts road safety evaluations including lighting, visibility, winter maintenance, and signage. In charge of office operations and personnel in the Toronto, Canada and Syracuse, New York offices.
- **Advantage Forensics, Inc.** **2012 – 2016**
 - Associate Engineer
Main practice areas included: collision reconstruction, pedestrian and cyclist impacts, occupant kinematics, seatbelt and safety restraint assessment, biomechanical injury assessment, movement and gait analysis, slips/trips/falls, head injury and helmet assessment, and sports and fitness accidents.

Responsible for evidence gathering such as site measurements and inspection of vehicle collision damage, slip testing of surfaces (BOT-3000), designing and conducting mechanical experiments to assess injury mechanisms and product failures, using software to develop collision and biomechanical models, evaluating types and pattern of injuries, journal research, report writing, client presentations, and court testimony.
- **Queen’s University and Human Mobility Research Centre** **2003 – 2012**

- Graduate Student Researcher

Researcher at a multidisciplinary, collaborate research center integrating engineers, clinicians, and scientists. Practical experience working in a hospital environment and operating room with surgeons and clinicians.

Research projects included: stereophotogrammetry in eye examinations, use of optical tracking and medical imaging to study the kinematics of human joints, the development of novel techniques and tools to facilitate orthopedic interventions, and the use of additive manufacturing in medical applications.

Responsibilities included experimental design, data collection and analysis, project management, and knowledge translation. Practical skills included: knowledge of medical device standards, medical imaging and processing, optical tracking, laser-scanning, 3D printing, mechanical testing of biological tissues, and tissue microscopy.

- **Dataradio/CalAmp/QED Computer Systems** 1999 – 2008
 - Student Researcher (contract)
Mechanical design of electronics component cables, interface and housing, printed circuit board design, testing and design of microsystems and electronics components, webpage development, tested a voice encoding/decoding paradigm for radio communication.

Education and Certifications

- **Mechanical Engineering, Ph.D.:** Queen's University, Canada (2013)
 - Comprehensive major: tissue mechanics; minors: dynamics and solid mechanics
 - Graduate courses: tissue engineering, medical informatics, computer assisted surgery, biomechanics of human joints, and spatial transformations
 - Thesis: "Developing and Evaluating Computer-Assisted Surgical Techniques for Percutaneous Scaphoid Fixation using Additive Manufacturing Technology"
- **Mechanical Engineering, M.Sc. (Eng.):** Queen's University, Canada (2005)
 - Graduate courses: biological signal analysis, medical physics, and tissue mechanics
 - Thesis: "A Virtual-Joint Model for Computer-Assisted Preoperative Planning of Osteotomy"
- **Mechanical Engineering, First Class, B.Sc. (Eng.):** Queen's University in Canada (2003)
 - Electives in biomechanics and mechatronics; additional courses in biology, organic chemistry, and psychology
 - Thesis: "A Basket Gate Synchronization System for Cargo Vessels"
- **Completed two years of M.B.B.S. program:** Flinders University School of Medicine (2007-2008)
 - Electives in anatomy, microbiology, and rural health
- **Registered Professional Engineer:** Professional Engineers Ontario

- **Registered Professional Engineer:** Association of Professional Engineers and Geoscientists of British Columbia
- **Certified Accident Reconstructionist:** Accreditation Commission for Traffic Accident Reconstruction
- **Certified Playground Inspector:** Canadian Parks and Recreation Association

Continuing Education

- **Traffic Crash Reconstruction/Vehicle Occupant Safety:** Human Factors for Traffic Crash Reconstruction (2017); CDR Operators Course (2017); Traffic Crash Reconstruction 2, Northwestern University (2016); Frontal Crash Occupant Safety and CAE, Society of Automotive Engineers (2015); Crush Energy Analysis in Collision Reconstruction, CATAIR (2014); PC Crash Expert Level Training Course titled “Rollovers” (2013); PC Crash Expert Level Training Course titled “Trucks and Trailers” (2013)
- **Other:** Personal Injury Alliance Practical Strategies for Experts (2014); National Expert Witness Academy Course, The Advocates Society in Toronto (2013)

Publications, Presentations, and Invited Lectures

- **Refereed Journal Articles**
 - “Investigating the performance of a wrist stabilization device for image-guided percutaneous scaphoid fixation” *Journal of Computer Assisted Radiology and Surgery*, 2014
 - “Computer-assisted percutaneous scaphoid fixation: concepts and evolution” *Journal of Wrist Surgery*, 2013
 - “Using additive manufacturing in accuracy evaluation of reconstructions from computed tomography. Proceedings of the Institution of Mechanical Engineers” *Journal of Engineering in Medicine*, 2013
 - “Volume rendering of 3D fluoroscopic images for percutaneous scaphoid fixation: An in vitro study. Proceedings of the Institution of Mechanical Engineers” *Journal of Engineering in Medicine*, 2013
 - “Analyzing Shoulder Translation with Navigation Technology” *Journal of Computer Assisted Radiology and Surgery*, 2012
 - “Volume-Slicing of Cone Beam Computed Tomography Images for Navigation of Percutaneous Scaphoid Fixation” *Journal of Computer Assisted Radiology and Surgery*, 2012
 - “Computer assisted LISS plate placement: an in-vitro study” *Computer-Aided Surgery*, 2009
- **Refereed Conference Papers**
 - “A Practical Tool for Ambient Illumination Comparisons at Dusk/Dawn” *In Proceedings of the Human Factors and Ergonomics Society Annual Meeting/SAGE Publications*, 2016
 - “Practical Method for Forensic Testing of Fall Impact Effects on the Human Spine” *Human Factors and Ergonomics Conference*, 2013
 - “On the use of laser scans to validate reverse engineering of bony anatomy” *Stud Health Technol Inform*, 2011
 - “Calibration and use of intraoperative cone-beam computed tomography: An in vitro study for wrist fracture” *Proc Med Image Comput Comput Assist Interv.*, 2010

- “Kinematic geometry of osteotomies” *Med Image Comput Assist Interv.*, 2005
- **Refereed Conference Abstracts**
 - “Computer Assistance for Internal Fixation of Scaphoid Fractures” *Canadian Military and Veteran Health Research Forum*, 2012
 - “Surgical navigation can detect aspherical hip motion” *In Intl Comput Assist Radiol Surg*, 2012
 - “A wrist stabilization device for internal fixation of scaphoid fractures” *Int J. Comput Assist Radiol Surg*, 2012
 - “Analyzing shoulder translation with navigation technology” *Intl Comput Assist Radiol Surg*, 2012
 - “Use of intraoperative 3D volume visualization for navigated bone tumor resection” *In Proc Comput Assist Orthop Surg*, 2012
 - “Could posterior capsule tightness be a contributor to anterior shoulder instability?” *In Can Orthop Assoc*, 2012
 - “Navigation of guidewire placement using volume slicing of 3D cone-beam computed tomography (CBCT) images for percutaneous scaphoid fixation” *In Can Orthop Assoc*, 2012
 - “Volume-slicing of cone beam computed tomography images for navigation of percutaneous scaphoid fixation” *Intl Comput Assist Radiol Surg*, 2011
 - “Quantitative analysis of 3-dimensional rendering of human hip joints” *Intl Comput Assist Radiol Surg*, 2011
 - “Comparison of 3D volume rendering to volumetric slicing of cone-beam computed tomography for navigation of percutaneous scaphoid fixation” *In Proc Comput Assist Orthop Surg*, 2011
 - “Investigating the contribution of soft tissues to impingements at the hip joint: A preliminary study” *In Proc Comput Assist Orthop Surg*, 2011
 - “3D accuracy of rendering hip joints for patient-specific templates” *In Proc Comput Assist Orthop Surg*, 2011
 - “Can rapid prototyping accurately represent the 3D shape of the hip?” *In Proc Orthop Res Soc, Paper*, 2011
 - “Percutaneous scaphoid fixation using computer-assisted navigation with intraoperatively-acquired images” *In Can Orthop Assoc, Paper*, 2011
 - “Reverse Engineering of Bony Anatomy from CT Images” *Medicine Meets Virtual Reality*, 2010
 - “Accuracy and precision of directly navigated scaphoid pinning and conventional percutaneous pinning” *In Proc Comput Assist Orthop Surg*, 2010
 - “Accuracy and precision of percutaneous scaphoid fixation using 3D volumetric navigation” *In Proc Am Soc Surg Hand*, 2010
 - “Computer-assisted LISS plate placement: An in vitro study” *In Proc Comput Assist Orthop Surg*, 2006
 - “Computer-assisted oblique osteotomy planning” *In Proc Orthop Res Soc, Paper*, 2006
- **Other Publications**
 - “The Hitchhiker’s Guide to Having Your Hand Run Over” *Forensic Progression Group Newsletter*, 2016
 - “The Changing World of Collision Fraud Investigation” *WP Magazine*, 2016

- **Invited Lectures**

- “Human Factors and Ergonomics in Forensics” *University of Toronto, 2013-2015; Ryerson University, 2015*
- “Forensic Biomechanics” *University of Toronto, 2014-2015*
- “Musculoskeletal Disorders in Human-Centered Systems and Forensics” *University of Toronto, 2013-2015*