

PROFILE

Mr. Steve MacInnis is a Senior Principal Consultant with over 40 years of engineering and failure analysis investigation experience. This includes investigating and managing complex and multidisciplinary mechanical and civil losses, as well as offshore/onshore oil and gas operations experience. Mr. MacInnis also has over 25 years of experience as an expert in vehicle accident reconstruction, tire and wheel failures; occupant dynamics and personal injury investigations. He has been court qualified over 50 times at all levels in Alberta, British Columbia, and Saskatchewan (qualifications always accepted) in the areas of vehicle accident reconstruction, mechanical and civil issues, and injury causation. His strengths include the following:

- ▶ Mechanical Failures
- ▶ Building Structural & Foundation Failures
- ▶ Mobile Mining Equipment
- ▶ Vehicle Component Failures
- ▶ Manufacturing
- ▶ Oil and Gas Operations
- ▶ Plumbing and Piping
- ▶ Structural Component Failures
- ▶ Sanitary/Storm Line Failures
- ▶ Industrial Machinery
- ▶ Collision Reconstruction
- ▶ Collision Dynamics & Severity
- ▶ Computer Simulations
- ▶ Crash Data Retrieval [CDR]
- ▶ Occupant Kinematics
- ▶ Event Data recorders (EDRs)
- ▶ Perception-Response Times
- ▶ Potential to Avoid
- ▶ Human Factors
- ▶ Tire and Wheel Failures
- ▶ Personal Injury Investigations
- ▶ Code Assessments

EDUCATION

Bachelor of Engineering (High Distinction)

Civil Engineering (major) and Materials Engineering (minor), 1974

Carleton University – Ottawa, Ontario

Post-graduate courses in statistics and geology

LICENSES

Professional Engineer (P.Eng.):

- ▶ Alberta
- ▶ British Columbia

CERTIFICATIONS

Tire Industry Association – Certified Instructor, Automobile Tire Service, 2009

Tire Industry Association – Certified Instructor, Commercial Tire Service, 2010

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WEBSITE

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PROFESSIONAL BACKGROUND

April 2018 – Present: Envista Forensics, formerly SAMAC Engineering, Ltd. – Calgary, Alberta
Senior Principal Consultant

May 1992 – March 2018: SAMAC Engineering, Ltd. – Calgary, Alberta
President / Failure Analysis Engineering Specialist

Responsible, either directly or as review and approving engineer, for over 3000 vehicle accident reconstructions and over 1200 failure analyses (mechanical and civil). File types technically reviewed and approved included commercial, industrial, biomechanical, civil, and metallurgical.

November 1981 – September 1991: Shell Canada, Ltd. – Halifax, Nova Scotia and Calgary, Alberta
Drilling and Mechanical Engineer / Supervisor / Arctic and Offshore Project Coordinator

January 1976 – October 1981: Energy, Mines and Resources – Ottawa, Ontario
Regulatory Offshore Drilling and Project Engineer

April 1975 – December 1975: Ogilvie & Associates – Calgary, Alberta
Structural Engineer

May 1974 – March 1975: Imperial Oil – Calgary, Alberta
Facilities / Structural Engineer

PROFESSIONAL AFFILIATIONS

- ▶ Society of Automotive Engineers
- ▶ Association for the Advancement of Automotive Medicine (AAAM)
- ▶ Canadian Association of Technical Accident Investigators and Reconstructionists
- ▶ Tire Industry Association
- ▶ Wheel and Tire Council, SEMA

CONTINUING EDUCATION

MECHANICAL / OIL & GAS

Subsea Production Systems, 1 week, IHRDC, Aberdeen, November 1988

Hydrocarbon Processing, 2 weeks, Shell Oil, Houston, March 1987

Well Performance & Testing, 1 week, Petroleum Society of CIM, Halifax, March 1985

Solids Control in Drilling Fluids, 1 week, George Ormsby, Calgary, June 1982

Subsea Drilling Systems, 2 weeks, Vetco Offshore, Ventura, April 1982

Production Engineering, 2 weeks, Federal Government, Ottawa, July 1981

Log Interpretation, 1 week, Schlumberger, Ottawa, July 1981

Reservoir Engineering, 2 weeks, Federal Government, Ottawa, June 1981

Subsea Well Pressure Detection and Control, 1 week, Magcobar, St. John's, May 1981

Cameron Subsea Systems, 1 week, Cameron Offshore, St. John's, May 1981

Blowout Prevention & Well Control, 2 weeks, PITS, Edmonton, February 1980

Geology of Fossil Fuels, post-graduate course, Carleton University, Ottawa, May 1979

Blowout Prevention School, 1 week, Shell Canada, Calgary, January 1979

Drilling Practices School, 2 weeks, Preston Moore, Calgary, May 1977

Mechanical Engineering course, 2 months, Imperial Oil in-house, Calgary, 1974-75

ACCIDENT RECONSTRUCTION

Advanced CDR Applications (Rick Ruth, PE), Calgary, 2014

A Crash Data Retrieval (CDR) workshop focusing on advanced CDR applications. Topics included recording methods, accuracy, accelerometers, and new manufacturers. (3 days)

Human Factors in Collisions (Patrick Robins), Calgary, 2014

A workshop on driver perception-reaction times, and the human factors involved in collision reconstruction including vision, nighttime visibility, driver expectancy, driver behaviour, etc. Vehicle and roadway/environment factors were also covered. (3 days)

Motorcycle Collision Reconstruction, Calgary, 2012

Analyzing accidents involving motorcycles. Topics included braking capability, scene markings, pre- and post-impact movements, and deceleration rates reconstruction. Extensive braking and avoidance testing. (5 days, Northwestern)

CDR Technician Level 2, Calgary, 2012

A course in downloading event data recorders using specialized equipment by re-powering the vehicle through the fuse panel using both in-car and external power. (1 day)

CDR Technician and Analyst Courses, Calgary, 2006 & 2010, New Vehicles 2011

Downloading and analyzing event data recorders from GM, Ford, Chrysler and Toyota vehicles. Available data may include accelerations, speeds, braking, engine speeds, and numerous other sets of data pre- and post-impact. (5 days and 2 days)

Advanced PC-Crash Simulations and Animations, Toronto, 2009

Advanced features of PC-Crash version 8.1. Collision theories, kinematic path backwards, animations, rollovers, ellipsoid and mesh multi-body models, and trailers. (2 days)

Pedestrian Collision Investigation Course, Calgary, 2007

Detailed review of the available methods used to analyze pedestrian or bicycle related collisions. Full-scale testing and reconstruction of different types of impacts. (5 days)

Commercial Vehicle Collision Reconstruction, Calgary, 2005

Topics included braking capability, scene markings, pre- and post-impact movements, and rollovers. Vehicle brake testing, including tractor-trailers and buses. (5 days)

Low-Speed Collisions and EDR data, Edmonton, 2004

Accident reconstruction review including the analysis of low-speed collisions and potential data recorded within vehicle event data recorders during low-speed events. (1 day)

HiLo Seminar, Vancouver, 1997

Low-speed collision analysis, use of the PC Crash simulation and animation program, and full-scale high-speed crash tests to validate the computer simulations. (5 days)

EDC Computer Simulations, Los Angeles, 1995

Use of the EDSMAC computer simulation program based on U.S. National Highway Traffic Safety Association's SMAC and CRASH3 programs. (5 days)

Traffic Accident Reconstruction (1&2), Chicago, 1992

Conservation of momentum and energy, occupant kinematics, pedestrian, motorcycle and tractor-trailer collisions, and perception reaction times. (3 weeks, Northwestern)

Traffic Accident Investigation, Chicago, 1992

Accident investigation including road markings, lamp examination, and tire failures.

TIRES & WHEELS

Tire Forensics (Tom Giapponi, PE), Calgary, 2015

A course on tires failures, and determining root cause(s) of tire failures. Methodologies and techniques of proper tire inspections were also discussed. (2 days)

Basic Tire Mechanics (Tom Giapponi, PE), Calgary, 2015

Basic tire mechanics, materials, sidewall stamping, tire types, load, pressure, tread patterns, tire inspection, and basic tire failure identification. (1 day)

Commercial Tire Service – Instructor's Course, Baltimore, 2010

Instructor's course to train and certify commercial tire shop staff on servicing large truck tires, including tire replacement. Hands-on mounting, installing, and repairing truck tires plus all aspects of servicing and repairing medium truck tires and wheels. (4 days, TIA)

Automotive Tire Service – Instructor's Course, Denver, 2009

Course to train and certify tire shop staff on passenger vehicle tire replacement considerations, mounting and demounting, repairing tires, and TPMS. (TIA, 3 days)

Tire Technology Seminar, Akron, 2008

A comprehensive short course on tire and wheel engineering, regulations, compounding, manufacturing, testing, traction, service issues, and tire/vehicle mechanics. Included tire test procedures and pressure testing a passenger tire to failure. (STL, 2.5 days)

Tire Mechanics Short Course, Akron, 2008

An advanced engineering course on loading mechanisms, tire forces, footprint mechanics, FEA modelling, chemistry, stress analysis, and regulations. (University of Akron, 4 days)

Tire and Wheel Safety Issues, Detroit, 2007

A technical course on tire and wheel safety, including construction, failure modes, tire grip, hydroplaning, brake performance, burst pressures, wheel issues, oversteering/loss of control, and rollover thresholds. (SAE, 1 day)

The Tire as a Vehicle Component, Detroit, 2007

Tire design and manufacturing course presented by SAE. (1 day)

Tire Retread Plant Operations, Calgary, 2006

Review of retread plant operations including analysis of typical failure modes and the repair process. (1/2 day)

FIRE & SAFETY***Prisoner Transport Vehicles, Nashville and Philadelphia, 2006***

Review of prisoner transport design and operational requirements with vehicle manufacturers, prisoner transport firms, and large prisons. (4 days)

Investigating Vehicle Fires, Calgary, 2001

Analysis of burned vehicles and how to determine the cause and origin of the fire. Extensive hands-on origin and cause investigations of burned vehicles.

Fraud Fire Seminar, Calgary, 1993

Fire origin and cause, particularly fraud-related investigations such as arson. (3 days)

Fire Fighter Training, Victoria, 1971

Royal Canadian Navy training with focus on shipboard techniques. (3 days)

RESEARCH AND TESTING**▶ *Torque Variations in Wheel Nuts, 2007 – 2010***

A study to determine the relationship between the torque required to back-off wheel lug nuts on a vehicle versus the original torque valve used to install the wheel.

▶ *High Speed Yaw Research, 2007 and 2008*

Lead engineer for a series of 21 high-speed yaw tests (90 km/h) in partnership with the Calgary Police Service. Three different vehicles were tested with each being equipped with a fifth wheel speed sensor, VC3000 accelerometer, and a DAQ computer. Yaw marks were surveyed and photographed. Data was used for a peer-reviewed SAE paper on accurate measurement of yaw marks, analysis methodology, and analyzing vehicle speeds and movements during yaw via computer simulation.

▶ *Fire Causation Due to Sawdust Ignition, 2006*

Full-scale testing to determine the likelihood of sawdust igniting after removal from a stained and finished wood floor. A data acquisition system was designed and built to digitally record the entire exemplar event over an 18-hour period using multiple video cameras and temperature sensors.

▶ *Cargo Net Testing, 2005 – 2009*

Reviewed and approved ongoing full-scale tests of prototype cargo nets at SAMAC's testing facility. Designed for use in pickups, technical reports are prepared confirming whether nets meet certification requirements and to determine breaking strength of net.

▶ *Non-OEM Seat and Seatbelt Installations, 2002 – 2010*

Designed, manufactured and installed test system to record seatbelt and seat tests via a data acquisition system. Typically used to design and test the installation of non-OEM seats and seatbelts in heavy trucks. Certify installations to be in compliance with CMVSS 207(1), 210(7) & (8).

- ▶ **Maneuvering Capability of an Overloaded Vehicle, 2002**
Testing of a 1998 Honda Prelude at Race City Speedway to objectively compare the vehicle's maneuvering capability with normal occupant loading versus being loaded beyond its Gross Vehicle Weight Rating (GVWR).
- ▶ **Low-Speed Impacts and Acceleration Testing, 1996 – 2009**
Lead engineer or technical reviewer of numerous low-speed vehicle tests undertaken at SAMAC. Include instrumented impacts and video analysis.
- ▶ **Mine Haul Truck Hydraulic Control Systems, Las Vegas, 2001**
Testing hydraulic control systems for brake, steering and dump systems (up to 3,000 psi and 300 gpm) for mine and haul trucks weighing up to 600 tons.

I have also researched and designed deep water drilling risers; tested offshore drilling unit anchor chains; and analyzed subsea hydraulic control systems.

PUBLICATIONS

- ▶ **Event Data Recorder Use in Canadian Criminal and Civil Collision Reconstruction, 2015**
Co-author of a peer-reviewed paper published by the European Association for Accident Research and Accident Analysis and presented at their 2015 conference in Edinburgh, United Kingdom.
- ▶ **Variability of Yaw Calculations from Field Testing, SAE 2009-01-0103, 2009**
Co-author of a peer-reviewed paper published by the Society of Automotive Engineers (SAE) based on two years of high-speed vehicle testing. The paper discusses the accuracy of the yaw formula at higher speeds, the optimal chord length to be used, and use of the center of gravity method.
- ▶ **Factors Affecting the Accuracy of Nonmetric Analytical 3-D Photogrammetry Using Photomodeler, SAE 1999-01-0451, 1999**
Co-author of a peer-reviewed paper published by the Society of Automotive Engineers (SAE) based on the accuracy of 3-D photogrammetry as a tool for use in vehicle accident reconstruction.
- ▶ **Low Speed Collisions – Analysis of Collision Severity, 1996**
Lead author for article published in The Barrister (ACTLA). Also technical reviewer for a second article by our biomechanical engineer on the Biomechanics of Low-Speed Impacts.
- ▶ **Review of Ocean Ranger Recommendations, 1992**
An internal report prepared for the National Energy Board engineering staff regarding the implementation status of the safety and technical recommendations from the sinking of the Ocean Ranger off of Newfoundland in February 1982.
- ▶ **Casing Design for High Pressure Wells, 1981**
An internal Shell Oil Canada report on how to design well casing strings for up to 15,000 psi wellhead pressures.

PRESENTATIONS

- ▶ **Slips, Trips and Falls, 2010 – 2016**
Multiple presentations to insurers and legal counsel in Alberta reviewing slip and fall events, areas where the technical analysis would be of assistance, and current research issues.

- ▶ **Preventing Mine Haul Truck Fire Losses and Operator Safety, 2003**
Invited speaker to Arch Coal's Black Thunder Mine in Gillette, Wyoming (the largest surface coal mine in North America) to address fire safety in mine haul trucks.
- ▶ **Forensic Investigation of Mine Haul Truck Losses, 2002**
Invited speaker and moderator of the manufacturing session at the Enhanced Fire Protection Symposium for Large-Scale Mining Equipment in Edmonton. Session attended by surface mining firms, suppliers, and insurers from across North America.
- ▶ **Haul Truck and Shovel Fires – Problems and Solutions, 2001**
Organized and chaired industry meeting in Fort McMurray attended by all major prospects and equipment suppliers to discuss the solutions to haul truck and shovel fires.
- ▶ **High-Speed Impacts and Pedestrian Collision Testing, 2000**
Organizer and lead presenter for a half-day seminar in Calgary on low-speed collisions, biomechanics, industrial failure analysis, and high-speed collision analysis. Included two-vehicle high-speed collisions and a pedestrian collision. Approximately 170 attendees.
- ▶ **Low-Speed Collision Analysis, Biomechanics and Testing, 1997**
Organizer and lead presenter for a one-day seminar in Calgary on low-speed collisions, including collision analysis and biomechanics of injury. Approximately 60 attendees.
- ▶ **The Low-Speed Package, 1995**
Invited speaker to an Insurance Institute of Alberta seminar. Presented session on low-speed analysis techniques and supported biomechanical session. Approximately 50 attendees.
- ▶ **Engineering Investigation of Personal Injury Accidents, 1995**
Reviewed the issues and approaches to investigating and analyzing personal injury accidents with the personal injury sub-sections of the Calgary and Edmonton Bar Associations.
- ▶ **Investigation of a Ladder Fall, 1994**
Lead expert on a ladder fall in Vancouver where extensive on-scene testing and mathematical analysis provided the basis for a verbal presentation to the Canadian Society of Forensic Scientists.

I have provided over 100 additional accident reconstruction and failure analysis presentations to legal firms, insurance companies, and schools across Western Canada.