



**Meridian One**

Consulting Engineers

**Andrew H. Tudor, P.E.**  
**President**

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## **PERSONAL**

Business: Meridian One, Inc.  
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Des Plaines, Illinois 60016-3551  
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## **EDUCATION**

University of Illinois at Chicago Circle, Chicago, Illinois  
Master of Science in Mechanics and Materials Engineering, April 1982

Illinois Institute of Technology, Chicago, Illinois  
Graduate courses applicable to Ph.D. in Mechanical Engineering, January 1980

University of Illinois, Champaign-Urbana, Illinois  
Bachelor of Science in Mechanical Engineering, May 1975

## **EMPLOYMENT**

**Meridian One, Inc.**  
***October 1997 - Present***

Consultation in the areas of mechanical engineering analysis, design and safety. Technical research and analysis, regulations compliance, failure analysis and forensic engineering. General Industry/ Construction/ Product/ Process safety. Accident investigation, accident reconstruction, accident analysis. 24/7 availability. Product development, failure modes and effects analysis, hazards analysis and safety research. Laboratory and/or field experimental investigations to test/evaluate product/process performance. Research in areas involving patents, standards, specifications and codes.

**Triodyne Inc., Niles, Illinois**

***Principal Mechanical Engineer, September 1989 - October 1997***

Mechanical engineering analysis, design and safety. Technical research and analysis, government regulations compliance and forensic engineering. Application of analytical or computer methods to solve a variety of problems including machines, mechanisms, and structures for the analysis of force, motion and/or stress. Field and/or laboratory investigations to test and evaluate product performance. Literature research in areas involving patents, standards, specifications and codes. Provided engineering services to Triodyne Recreation Engineering (amusement park rides) and Triodyne Fire and Explosion (piping, valves, regulators, etc.).

**Schwinn Bicycle Company, Chicago, Illinois**

***Manager, Research and Development, January 1984 - November 1988***

Responsible for the technical direction and control of engineering functions to ensure design and development of both new and existing health and fitness products. Human factors engineering. Implemented Engineering Computers for design, manufacturing and theoretical structural analysis. Also implemented PC-based data acquisition systems in the laboratory for automated testing. Applied analytical methods to produce the lightest (optimum) fiber-reinforced plastic bicycle frame in the world. The methodology involves utilizing particular materials (graphite, fiberglass, kevlar®, etc.) and solving for the particular lay up to obtain the desired strength and /or stiffness parameter, yet utilizes the least amount of material (minimum weight). Additional parameters were tube cross section, joint design and manufacturing methodology to produce a monocoque (one piece) frame. Also developed the tooling design and manufacturing methodology to mass produce the structure. Created technology and applied for two patents. Provided technical support for product liability cases.

**Bently-Nevada Corporation, Burr Ridge, Illinois**

***Consultant, Mechanical Systems, April 1982 - December 1982***

Consultant to industry on acceptance testing and field commissioning of rotating machinery. Instrumented, acquired, analyzed and recommended corrective action on engines, jets, pumps, compressors and large rotating machinery. Vibration control, diagnostics, balancing, protection systems, preventative and predictive maintenance programs.

**Roy C. Ingersoll Research Center, Borg Warner Corporation, Des Plaines, Illinois**  
***Summer Master's Intern, Summer 1981***

Experimental stress analysis of roller chain used in the (automotive) Continuously

Variable Transmission (CVT). Stress analysis of clutch springs and automotive compressor valves utilizing photoelastic methods.

**Natural Gas Pipeline Company of America, (Subsidiary of Peoples Gas Company), Chicago, Illinois**

***Mechanical Systems Project Engineer, Special Engineering Services, May 1975 - December 1980***

A utility transporting natural gas (methane) from wellhead to the Chicago Market. Designed, analyzed and conducted field tests on (high pressure) piping systems, valves, pumps, engines, compressors for the validation of design parameters such as horsepower, flow, noise, vibration and stress. Generated computer models to predict system performance reflecting design and test data. Designed field tests based on analytical models to measure dynamic strains in crankshaft of 3200 horsepower mainline turbo-charged engine/compressor units, analyzed data and recommended corrective action on 53 engine/compressor units to eliminate all crankshaft, mainframe and foundation failures.

**Martin Nagy Tonella Consulting Engineers, Chicago, Illinois**  
***Engineer, Summer 1974***

Calculated heating, ventilating and air conditioning requirements for residential and commercial structures. Later developed one of the projects academically at the University of Illinois, Champaign-Urbana, Illinois, using a computer to simulate a time-dependent analysis of peak cooling loads.

**Super-Cut Industries, Chicago, Illinois**  
***Draftsman, Summer 1972***

Design of diamond grinding wheels used to make optical lenses.

Paymaster Corporation, Chicago, Illinois  
Draftsman, April - September 1969, June - September 1970

Modifications to dies used in stamping operations.

Clark Gas Company, Chicago, Illinois  
Gas Station Attendant, part-time 1968 - 1971

**PROFESSIONAL DEVELOPMENT:**

1. "Machinery Vibration," The Vibration Institute, Cherry Hill, New Jersey, November 1977.

2. "Mechanical Piping Dynamics," Southwest Research Institute, San Antonio, Texas, April 1978.
3. Rotating Machinery Behavior and Analysis, Bently-Nevada Corporation, Minden, Nevada, October 1982.
4. "Finite Element Modeling and Analysis," Structural Dynamics Research Corporation, June 1984.
5. "Composites - Design, Analysis, and Testing," Society for Experimental Mechanics, Chicago, Illinois, January 1985.
6. "Proper Handling of Toxic Substances," Schwinn Certification, Chicago, Illinois, September 1986.
7. "Materials - Advanced Materials Technology '87," Society of Advanced Materials and Process Engineering, Anaheim, California, 1987.
8. "Composites Design," 32nd International Society for Advanced Materials and Process Engineering Symposium and Exhibition, Seattle, Washington, April 1987.
9. American Society of Mechanical Engineers - Engineering Design Show, Chicago, Illinois, 1986, 1987, 1988.
10. National Sporting Goods Association Convention, Dallas Texas, 1987, 1988. Chicago 1998.
11. Created theme for IBM by providing technical materials in the areas of mechanical design, analysis and manufacturing. Autofacts, Detroit, Michigan, February 1988.
12. Society of Advanced Materials and Process Engineering; Materials-Pathway to the Future, Seattle, Washington, March 1988.
13. Registered Professional Engineer, State of Illinois, 062-046566.
14. Listed in Clark County, Nevada for Amusement Code Special Cases, Amusement Ride Pre-Submittal - Operation and Maintenance Manuals and Amusement Ride Operation Testing and Inspection.
15. 15. United States/Canada Joint Certification to receive military critical technical data. DD2345, March 1988-May 1993.
16. Society of Automotive Engineers: The Hybrid Electric Vehicle, Chicago, Illinois,

November 1993.

17. American National Standards Institute, "Strengthening the U.S. Voice in International Standardization," Arlington, Virginia, October 1996.
18. International Mechanical Engineering Congress and Exposition, Atlanta, Georgia, November 1996.
19. American Society for Testing Materials. Committee F-8 on Sports Equipment and Facilities, New Orleans, Louisiana, December 1996, Saint Louis, May 1997, San Diego, December 1997, Atlanta, May 1998, Nashville, December 1998, Seattle, May 1999, New Orleans, December 1999, Toronto, Canada, May 2000.
20. International Mechanical Engineering Congress and Exposition, Chicago, March 1998.
21. National Sporting Goods Association Convention, Chicago, July 1998
22. Interbike, Anaheim, California, September 1997, Las Vegas, Nevada, September 1998.
23. ASSE/OSHA 11th Annual Joint Safety Conference, Holiday Inn O'Hare International, Rosemont, Illinois, September 27-28, 1999.
24. Fab Tech International (Robots), Tube and Pipe International Exhibition and Presstech International, November 1997, Chicago, Illinois, November 1999.
25. International Mechanical Engineering Congress and Exposition and The National Plant Engineering Show, Chicago, March 1999.
26. Chicago Manufacturing Center, "Manufacturing Counts," hosted by The Chicago Manufacturing Center, Crain's Chicago Business and Illinois Institute of Technology, Sheraton Chicago Hotel and Towers, November 1999.
27. Ergonomics Standard, OSHA, January 21, 2000, Itasca Country Club, Itasca, Illinois.
28. American Society of Safety Engineers- 40 hour preparation for the Certified Safety Professional Examination, Des Plaines and North Aurora, Illinois, February thru April 2000. Taught statics and mechanics.
29. National Restaurant Association, McCormick Place, Chicago, Illinois, May 2000.
30. Occupational Safety and Health Administration (OSHA) focus group participant on OSHA's American Customer Satisfaction Index Survey. Marriot Schaumburg,

June 2000.

31. ASSE/OSHA 12th Annual Joint Safety Conference, The Galvin Center at Motorola, Inc., September 2000.
32. 2000 ASME International Mechanical Engineering Congress and Exposition, Orlando, Florida, November 5-10, 2000.
33. Thunderstorms, Tornadoes, Lightning: American Society of Safety Engineers seminar, U.S. Department of Commerce - National Weather Service, Itasca Country Club, April 20, 2001.
34. Boating Safety Education, Illinois Department of Natural Resources, Cert. No. 90606, North Park Village, Chicago, Illinois, April 21, 2001.
35. ASSE/OSHA 13th Annual Joint Safety Conference, Northern Illinois University, Naperville, Illinois, September 5-6, 2001. Sessions attended:
  - a. Accident Investigations
  - b. Most Frequently Cited Construction Standards
  - c. Fire Protection
  - d. Health Hazards on Construction Sites
  - e. Lockout/Tagout
  - f. Forklift Training Requirements
36. American Society of Safety Engineers, 2001 Leadership Conference, October 25-27, 2001, Westin O'Hare, Rosemont, Illinois.
37. Understanding the Workers' Compensation System, Eugene F. Keefe, Esq., AMK&K, The Wellington, Arlington Heights, Illinois, April 19, 2002.
38. House of Delegates, American Society of Safety Engineers, June 9, 2002, Gaylord Opryland Resort, Nashville, Tennessee.
39. ASSE/OSHA 14th Annual Joint Safety Conference, Northern Illinois University - Naperville, September 4-6, 2002. Sessions attended:
  - a. Steel Erection
  - b. Fire Protection Systems
  - c. ANSI Update on Machine Guarding
  - d. Trenching and Excavation
  - e. Crane Accidents in Construction
40. American Society of Safety Engineers: Invited Speaker Topics: 2002-2003:

- a. Workplace Violence
  - b. Safety thru Design
  - c. Tower Cranes, Erection & Dismantling
  - d. Weapons of Mass Destruction
  - e. What Every Safety Professional Needs to Know About Product Safety & Liability
  - f. OSHA Subpart B Scaffolds
41. House of Delegates & American Society of Safety Engineers - Professional Development Conference, Safety 2003, June 22-25, 2003, Denver, Colorado: Colorado Convention Center. Sessions attended:
- a. Building a Successful Machine Guarding Program
  - b. Practical Field Methods for Assessing Ergonomic Risk Factors
  - c. Ergonomics for the Construction Industry
  - d. Analytical Techniques for Investigating Accidents
  - e. Using the ANSI Z535 Standards
  - f. A Guide to Effective Signage
  - g. The Role of Body Mechanics Training in an Ergonomics and Injury Prevention Process
  - h. Machine Safeguards: What to Use and When
  - i. Usage and Selection of Fall Protection Equipment
42. ASSE/OSHA 15th Annual Joint Safety Conference, Northern Illinois University - Naperville, Illinois, August 12-15, 2003. Sessions attended:
- a. Fall Protection - Advanced
  - b. Tower Cranes
  - c. Accident Investigation
  - d. Power Tool Safety
  - e. Scaffolds the New Rules in Chicago
  - f. Electrical
43. American Society of Safety Engineers – President - Northeast Illinois Chapter 2002-2003: Newsletter, Public Relations, Jobs, President - elect, and Past President duties, a three year minimum commitment.
44. American Society of Safety Engineers – Safety Professional of the Year – SPY Award December, 2003
45. ASSE/OSHA 17th Annual Joint Safety Conference, Northern Illinois University - Naperville, Illinois, September 28, 2005.
46. ASSE/OSHA 18th Annual Joint Safety Conference, Northern Illinois University - Naperville, Illinois, September 20, 2006. Sessions attended:

- a. Accident Investigation (What OSHA Expects)
  - b. Back Works and Body Mechanics
47. ASTM; November 6-9, 2001, Dallas, Texas - Sports Committees - Standards Development.
  48. Interbike: ASTM Standards Conference and Bicycle Industry Show and Conference; October 14, 2003, Las Vegas, Nevada- Typically held every year- attended in person or thru voting / teleconferences regarding meetings and standards development.
  49. International Standards Organization (ISO) Technical Committee 149 Cycles and Major Sub-Assemblies; 1983-Present (Observer Status)
  50. ASSE (News); September 8, 2005 - Press Release: North/West Suburban Illinois Safety Professionals Support Disaster Relief Efforts Following Hurricane Katrina
  51. ASSE-NEIL; 2005-2006 - Public Relations Chair.
  52. Chicagoland Safety Conference; September 18-22, 2006. Day 1 and 2 attended.
  53. ASTM; May 16 & 17, 2006 - Toronto, California - U.S. Product Safety Commission F08.96 US ISO/TAG, CEN Standards, Frames, Suspensions, Composites and Wheels
  54. Society of Casualty Safety Engineers; April 6, 2007:
    - a. Soft Tissue Injuries in the Construction Industry
  55. Northeast Illinois Chapter-American Society of Safety Engineers Leadership and Honoring Past Presidents; July 2007.
  56. ASSE/OSHA 20th Annual Joint Safety Conference, Northern Illinois University; September 15-18, 2008. Sessions attended:
    - a. Machine Safeguarding
  57. Society of Casualty Safety Engineers; April 9, 2010.
    - a. Crane Safety
  58. ASSE/OSHA 22nd Annual Joint Safety Conference, Northern Illinois University; September 13-16, 2010. Sessions attended:



- a. Fall Protection
59. American Society for Testing Materials. Committee F-8 on Sports Equipment and Facilities. Sports equipment -- typically standards review and development- since 1996 in ASTM and before in predecessor ANSI TAG to ISO Committee. Too many committees and issues to list, but have developed standards, voted for/against standards in the following areas:
- a. Bicycle Conditions
  - b. Forks and Suspension Systems/ metallic and composite materials
  - c. Frames, loading and fatigue- metallic and composite
  - d. Wheels and Retention Devices
  - e. Handlebars and stems
  - f. Bicycle helmets /and as used in other sports (skating, skateboards, etc.)
  - g. Toys as incorporated in (other) standards
  - h. Safety issues as related by accident statistics
60. American Society for Testing Materials. Committee F-8 on Sports Equipment and Facilities. Sports equipment - Standard ASTM F2043 development, September 2013.

## **TECHNICAL PROJECTS / REPORTS**

1. Compressor Performance, Gas Production and Engine Specific Fuel Consumption of DeLaval/Enterprise HVA-8 Engine Compressor Units, June 1977.
2. Reciprocating Compressor Valve Design Based on Performance and Reliability, June 1978.
3. Water Pump Requirements on the Cooper- Bessemer 7,200 Horsepower, W-330 Unitized Engine, July 1978.
4. Foundation Failures of Worthington UTC Engine/Compressor Units on the Gulf-Coast Line, June 1979.
5. Crankshaft and Mainframe Problems- Worthington UTC Engine Analysis, November 1979.
6. Field Balancing of an Allis-Chalmers 45 Megawatt Steam Turbine, September 1982.

7. Vibration Tests of a Skid-Mounted RB-211 Rolls-Royce Gas Turbine/ GT-56 Power Turbine/Dresser Pacific 3-Stage Sea Water Injection Unit, August 1982.
8. Design and Development of the Welded Aluminum Bicycle Frame, March 1986.
9. Design of a Bicycle Helmet for Conformance to ANSI Z90.4, Protective Headgear-for- Bicyclists, March 1984.
10. Noise and Vibration Analysis of a Geared Exerciser, May 1987.
11. Design and Fabrication of a Bicycle Frame Utilizing Composite Materials, January 1988.
12. Design Review of a Stationary Exerciser Trainer with a Computer Controlled Variable Load, June 1988.
13. Stress Analysis and Design of a Large Extrusion Roll, May 1992.
14. Force Analysis of a Bowstring Lattice Truss, June 1992.
15. Vibration Analysis and Positional Accuracy of a Positive Drive Cam System, February 1995. Dynamic Analysis of the Feed Mechanism in a Large Automotive Tri-Axis Transfer Press, December 1993. Kinematics Analysis of the Feed Mechanism in a Large Automotive Tri-Axis Transfer Press, November 1992. (Computer mathematical simulations also developed). U. S. Clearing, Hitachi Zosen,- Similar analysis performed on Danly/Komatsu press, 1996.
16. Mechanical Vibration of a Hand Held Power Tool, 1994-1996.
17. Analysis of an Acetylene Tank, December 1995.
18. Design Review of an Amusement Park Ride, January 1996.
19. Experimental Determination of Discharge Characteristics of High Speed Bucket Elevators, April 1996.
20. In-Line Skating and Skateboarding: Injury Patterns and Prevention, November 1997.
21. Mechanical and Experimental Analysis of High Speed Cutter Heads (Lawn & Garden Equipment). February 1998.
22. Mechanical and Experimental Analysis - Design of High Speed Cutter Heads (Lawn & Garden Equipment). August 1999.

23. Man - Machine Systems - Guarding, 1999 - 2000.
24. Concepts in Machine Guarding and Safeguarding - Guarding, 1989 - 2000.
25. Development of a Shellfish Cutting Tool. 2003.
26. ASTM Working Group - Standards Development: 1996-Present.
27. Development of a novel fall protection system for trucking applications utilizing the new ANSI Z359.X series standards, 2006.
28. Vancouver 2010 Winter Olympics - Re: On Nodar Kumaritashvili' s Fatal Luge Crash:
  - a. By Candus Thomson, Tribune Olympic Bureau: Tudor Interview: - "Grade Continues to Slide", February 18, 2010: Chicago Tribune February 19, 2010:
  - b. February 18, 2010: "Luge Officials were warned of Olympic track's hazards"
  - c. October 15, 2010: Canadian Broadcasting Company Interview, Gil Shochat - Documents review and preliminary analysis of speeds at Whistler Track for upcoming special entitled, "Death at The Olympics". CBC TV.
29. Professional Ropes Course Association (PRCA), ANSI Accredited Standards Developer- Detailed Review and Comment on (Zip Lines) Draft BSR /PRCA 1-2006ED3-200X American National Standard, January 20, 2011.

## **ACADEMIC AFFILIATIONS**

1. Northwestern University, Department of Civil Engineering, Evanston, Illinois. Member of the Technical Advisory Committee for Composite Materials, September 1989, Advisor.
2. University of Illinois, Department of Mechanical Engineering, Summer Ph.D. Intern Program, April 1987.
3. Carnegie Mellon University, Carnegie Mellon Pioneers Human Powered Vehicle, November 1987, Consultant.
4. University of Wisconsin-Madison, Department of Engineering Mechanics, January 1986, Advanced Experimental Stress Analysis-EM610, Research Project.

5. Northern Illinois University, College of Engineering & Technology, Environmental Health and Safety Advisory Board Member. Northern Illinois University, DeKalb, IL. Member 2005-present.

## **PROFESSIONAL LECTURES**

1. "Wheels," guest speaker, Wheeling Wheelman, February 1984.
2. "Composite in the Bicycling Industry," paper presented, Society of Manufacturing Engineers, November 1988.
3. "Bicycle Analysis and Design," guest speaker, Illinois Institute of Technology, Wheaton, Illinois, February 1988.
4. "Product Testing for Compliance to Consumer Product Safety Commission," University of Wisconsin -Madison. Department of Engineering Mechanics, January 1988.
5. "Bicycle Wheels and Frames," Evanston Bicycle Club, April 1996, Transmissions and Helmets, August 1998.
6. "The Nuisance Fire Problem with Acetylene B Cylinders," 1996 International Mechanical Engineering Congress and Exposition, Atlanta, Georgia, November 1996.
7. "In-Line Skating and Skateboarding: Injury Patterns and Prevention," 1997.
8. International Mechanical Engineering Congress and Exposition, Dallas, Texas, November 1997.
9. "Machine Guarding - Power Transmission, Presses and Robots," ASSE/OSHA 11th Annual Joint Safety Conference, Rosemont, Illinois, September 1999.
10. "Woodworking Machines and Guarding," ASSE/OSHA 12th Annual Joint Safety Conference, The Galvin Center at Motorola, Inc., September 2000.
11. "Concepts in Machine Guarding and Safeguarding," 2000 International Mechanical Engineering Congress and Exposition, Orlando, Florida, November 2000.
12. Guest Lecturer for classes, Tech 434, "Human Factors in Industrial Accident Prevention," and Tech 435 "Legal Aspects of Safety," Northern Illinois University, DeKalb, Illinois, April 23, 2002. Lectures entitled "Accident Investigation" and "Design Safety."

13. "Personal Watercraft – Action/Reaction Hazards," 2004 International Mechanical Engineering Congress and Exposition, Safety Engineering and Risk Analysis –Forensic Analysis and Product Liability Issues, Anaheim, California, Nov 2004
14. "Risk Assessment and Product Liability" presented on February 3, 2012 to the Society of Casualty Safety Engineers at Des Plaines Elk Club, 495 Lee Street, Des Plaines, Illinois 60016.
15. "Risk Assessment and Product Liability" presented on June 28, 2012 to Clausen Miller PC, 10 South LaSalle Street, Chicago, Illinois 60603. Attendees received college equivalent credit for attending this seminar.

## **TECHNICAL PUBLICATIONS**

1. "The Analysis of Stress Transmission in Skulls Using Photoelastic Coatings," Society for Experimental Stress Analysis, March 1984.
2. "Composites in the Bicycle Industry," Society of Manufacturing Engineers, Nov 1988.
3. "Hand-Arm Vibration - Product Design Principles," Journal of Safety Research, National Safety Council and Elsevier Science Ltd., Volume 27/Number 3/Fall 1996.
4. "The Nuisance Fire Problem with Acetylene B Cylinders," 1996 International Mechanical Engineering Congress and Exposition, Safety Engineering and Risk Analysis, Atlanta, Georgia; November 1996.
5. In-Line Skating and Skateboarding: Injury Patterns and Prevention," 1997 International Mechanical Engineering Congress and Exposition, Safety Engineering and Risk Analysis, Dallas, Texas; November 1997.
6. "Concepts in Machine Guarding and Safeguarding," 2000 International Mechanical Engineering Congress and Exposition, Safety Engineering and Risk Analysis - Safety through Design, Orlando, Florida; November 2000.
7. American Society of Testing Materials (ASTM), Conshohocken, Pennsylvania, 1995- Present - Working Group F08.10.02 - Standards Development - ASTM F2273-03 & F2274-03: 1995-Present.
8. "Personal Watercraft – Action/Reaction Hazards," 2004 International Mechanical Engineering Congress and Exposition, Safety Engineering and Risk Analysis –Forensic Analysis and Product Liability Issues, Anaheim, California, Nov 2004.

## PROFESSIONAL SOCIETIES

1. American Society of Safety Engineers (ASSE), Professional Member 12/2008 #290264; Northeastern Illinois Chapter (NEIL) - President 2002-2003- Greater Chicago Chapter Professional Member 2009- present.
2. American Standards and Testing Methods (ASTM), Committee F08 - Sports Equipment and Facilities. Vice Chairman, Forks and Suspensions - 1995-2004. Continue in various capacities on committees (to present), see also 59 in Professional Development .
3. American National Standards Institute Technical Advisory Group (ANSI TAG to ISO) to the International Standards Organization for Bicycles. 2005-Present - Observer
4. American Society of Mechanical Engineers (ASME).
5. Society of Automotive Engineers (SAE) - member.
6. Society of Experimental Mechanics (SEM), formerly Society for Experimental Stress Analysis (SESA).
7. Society for the Advancement of Material and Process Engineering (SAMPE).
8. National Safety Council (NSC) - corporate member.
9. Professional Ropes Course Association (PRCA), 2010 member.

9/2013