



Exponent®
Engineering & Scientific Consulting

Mark Viz, Ph.D., P.E.

Principal Engineer | Mechanical Engineering
Chicago
+1-312-999-4203 | mviz@exponent.com

Professional Profile

Dr. Viz specializes in performance evaluation and mechanical analysis of railcar and aircraft structures. He also specializes in risk, reliability, and mechanical integrity assessments of a variety of process plant equipment such as pressure vessels and tanks, and certain types of transportation vessels including railcar tanks, intermodal vehicles, and over-the-road tank trailers.

Dr. Viz also has experience in component life reliability assessments, “repair or replace” risk decisions, and statistical analysis of in-service component performance. Other areas of Dr. Viz’s specific academic expertise include nonlinear finite element analysis, metal and composite material testing, fatigue and fracture mechanics, and statistical data reduction methods. He has investigated and/or consulted in matters involving railcar derailments, tank car ruptures, releases of hazardous materials in transportation, coal mining haulage accidents, rotor failures, bus rollovers, pressure vessel explosions, and other industrial accidents.

Given his expertise in engineering mechanics, Dr. Viz also performs engineering evaluations and analyses involving the mechanical performance of a variety of machines and products. Some of these devices include elements of cranes and lifting devices (e.g., wire rope failures, hydraulic and valve failures), elements of elevators, a variety of industrial machines (e.g., printing equipment, CNC machine tools, pumps, compressors), certain aspects of machine guarding and lock-out/tag-out procedures, and specialized evaluations of consumer products. Dr. Viz’s involvement in these types of cases typically involves the synthesis and execution of a variety of engineering mechanics calculations and analyses.

Prior to joining Exponent, Dr. Viz was a Product Development Engineer at the GATX Rail Corporation. His responsibilities included new rail car design and development, budget and schedule management, and sales and marketing support. Dr. Viz was also heavily involved in the regulatory environment concerning the transportation of hazardous materials in rail tank cars. Dr. Viz also served as a Specialist Engineer in the Structural Damage Technology group at the Boeing Company. He was responsible for the durability and damage tolerance analysis and testing of a wide variety of aircraft structures from wing and fuselage sections to individual fasteners. He has also taught probability, statistics, and mechanics of materials at the college level.

Academic Credentials & Professional Honors

Ph.D., Theoretical and Applied Mechanics, Cornell University, 1996

B.S., Aeronautics and Astronautics, Massachusetts Institute of Technology (MIT), 1990

Licenses and Certifications

Professional Engineer, Illinois, #62062247

Respirator and SCBA fit-tested and trained

Mining Safety and Health Administration (MSHA) Part 46 and Part 48 trained

Prior Experience

Director of Applied Mechanics, Packer Engineering, 2001-2003

Product Development Engineer, GATX Rail, 1999-2001

Specialist Engineer - Structural Damage Tolerance, Boeing, 1997-1999

Professional Affiliations

American Society of Mechanical Engineers—ASME (member)

American Institute of Aeronautics and Astronautics—AIAA (member)

Society for Risk Analysis—SRA (member)

Publications

Viz MJ. Failure analysis in the design cycle. Presented as a guest lecture for CIV-ENG 395-0 Engineering Forensics course, Evanston, IL, April 16, 2008.

Viz MJ, Momsen RH. Reliability and risk management of railcar truck castings in high mileage, high gross rail load service: A case study. Presented at the Annual Meeting of the Society for Risk Analysis, Baltimore, MD, December 5, 2006.

Morrison III DR, Ogle RA, Viz MJ, Carpenter AR, Su YS. Investigating chemical process accidents: Examples of good practices. Process Safety Progress 2006; 25:71-77, March.

Ogle RA, Morrison III DR, Viz MJ. Emergency response to a non-collision HAZMAT release from a railcar. Process Safety Progress 2005; 24:81-85, June.

Morrison III DR, Ogle RA, Viz MJ, Carpenter AR, Su YS. Investigating chemical process accidents: Examples of good practices. Presented at the Process Plant Safety Symposium, 2005 Spring National Meeting, American Institute of Chemical Engineers, Atlanta, GA, April 11-13, 2005.

Zehnder AT, Viz MJ. Fracture mechanics of thin plates and shells under combined membrane, bending, and twisting loads. Applied Mechanics Reviews 2005; 58:37-48, January.

Ogle RA, Viz MJ, Morrison III DR, Carpenter AR. Bulk transportation of hazardous materials by rail: Lessons learned from non-collision accidents. Presented at the 2004 Annual Symposium, Mary Kay O'Connor Process Safety Center, Texas A&M University, College Station, TX, October 2004.

Ogle RA, Morrison III DR, Viz MJ. Emergency response to a non-collision HAZMAT release from a railcar. Presented at the 19th Annual CCPS International Conference, Emergency Planning: Preparedness, Prevention and Response, American Institute of Chemical Engineers, Orlando, FL, June 2004.

Ogle RA, Viz MJ, Carpenter AR. Lessons learned from HAZMAT accident investigations. Presented at the

17th Annual AAR/BOE Hazardous Materials Seminar, Association of American Railroads/Bureau of Explosives, Houston, TX, May 2004.

Zehnder AT, Potdar YK, Viz MJ. Fatigue fracture in plates in tension and out-of-plane shear. *Fatigue and Fracture of Engineering Materials and Structures* 2000; 23:403-415.

Viz MJ. Fatigue fracture of 2024-T3 aluminum plates under in-plane symmetric and out-of-plane anti-symmetric mixed-mode deformations. Ph.D. Dissertation, Cornell University, 1996.

Potyondy DO, Viz MJ, Zehnder AT, Rankin CC, Riks E. Computation of membrane and bending stress intensity factors for thin cracked plates. *International Journal of Fracture* 1995; 72:21-38.

Viz MJ, Zehnder AT, Bamford JD. Fatigue fracture of thin plates under tensile and transverse shear stresses. *Fracture Mechanics*, 26th Volume. ASTM STP 1256, Reuter WG, Underwood JH, and Newman JC (eds), American Society for Testing and Materials, pp. 631-651, 1995.

Viz MJ, Zehnder AT. Fatigue crack growth in 2024-T3 aluminum under tensile and transverse shear stresses. *Proceedings, FAA/NASA International Symposium on Advanced Structural Integrity Methods for Airframe Durability and Damage Tolerance*. NASA CP-3271, pp. 891-910, 1992

Viz MJ, Zehnder AT, Ingraffea AR. Fatigue fracture in thin plates subjected to tensile and shearing loads: Crack tip fields, J integral and preliminary experimental results. *Proceedings, 7th International Congress on Experimental Mechanics*, Society of Experimental Mechanics; 1992: 44-50.

Project Experience

Directed, managed, and performed numerous rail tank car failure cause and origin investigations, most involving the release of hazardous materials. Projects typically involve extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Managed and performed numerous rail tank car loading and unloading incident investigations, often involving worker injuries or fatalities.

Investigated the unintentional uncoupling of mining service cars in a Virginia underground coal mine. The uncoupling resulted in a runaway car situation that led to the fatalities of two miners. Project work included incident modeling and reconstruction, performance calculations, and inspections.

Actively directing a lengthy study involving the investigation of railroad track ballast fouling and coal dust mitigation evaluations for coal transport out of the Powder River Basin in Wyoming. Project work includes measurement of fugitive dust emissions, static and dynamic (over-the-road) monitoring of dust loss from railcars, cost analysis for proposed mitigation techniques, and analysis of health and safety issues.

Managed and performed projects for multiple clients involving the mechanical integrity assessment and fitness-for-service evaluations of railcar truck castings (bolsters and side frames). These projects have typically involved the development and implementation of non-destructive examination procedures for both on-car and off-car examination, cyclic fatigue testing, mechanical and metallurgical testing, engineering evaluation of test results with respect to mechanical performance, and development of engineering plans to manage fleet components over the projected remaining useful service life. Have presented findings to the Association of American Railroads (AAR) for multiple clients.

Performed risk, reliability, and mechanical integrity assessments for a variety of process plant equipment including piping and tanks. Select assignments have involved flash train tanks at a bauxite to alumina processing plant, piping and vessels at a district cooling ammonia refrigeration plant, liquid carbon dioxide

storage tanks, baghouse equipment at cement kilns, and a variety of other equipment subject to OSHA PSM (process safety management) and EPA RMP (risk management plan) regulations.

Directed, managed, and performed numerous incidents involving the release of hazardous materials from transportation vessels, including rail tank cars, intermodal containers, and over-the-road tank trailers. Projects typically have involved extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Performed design evaluation and risk assessment of a manufacturer's new product offering that provides GPS location and condition monitoring of railcars while in-transit. System includes remote sensing, GPS and satellite uplink equipment, all packaged in a field-hardened package. Project work included FMEA (failure modes and effects analysis), reliability modeling, and predictions for warranty structuring and material compatibility analyses.

Performed mechanical performance and stress analysis calculations for a fleet of coal railcars that exhibited top chord and side sheet buckling failures. The project involved performing detailed field inspections of the damaged railcars, finite element analysis (FEA) of the cars, and a determination of the in-service loads that were needed to produce the exhibited damage.

Managed and performed a collision damage assessment and engineering repair oversight for a major accident involving a monorail train in the Pacific northwest. Project work included responsibility for oversight of repair plans, mechanical contractor selection and qualification review, quality assurance oversight, schedule analysis, and general technical consulting. Project involved extensive field work and multiple presentations to technical staff and insurance adjusters.

Performed numerous mechanical performance analyses/evaluations for a variety of machines and products including:

- Manufacturing machinery (printing and binding equipment, forming and cutting machines, product conveying equipment, certain types of CNC machine tools)
- Elements of machine guarding and lock-out/tag-out procedures (drum foamers, printing and binding equipment, packaging equipment)
- Elements of crane and lifting devices (e.g., scissor lifts), including wire rope failures, hydraulic cylinder failures, holding valve failures, and stability issues
- Elements of consumer product performance including structural performance and mechanical response.

Additional Education & Training

Completion of Highway-Rail Grade Crossing Safety course offered through the University of Wisconsin - Madison, 12-13 November 2019

Completion of Aircraft Accident Investigation Orientation for Aviation Professionals course offered by the NTSB, 27-28 October 2021

Completion of Accident Investigation Orientation for Rail Professionals course offered by the NTSB, 8-10 November 2021

Completion of Ethics for Engineers course offered by ASME, 5 January 2022