

Chuck A. Plaxico, Ph.D.



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Curriculum Vita

EXPERTISE

Design and analysis of impact resistant structures, crashworthiness of transportation vehicles, impact mechanics, nonlinear dynamic finite element analysis, nonlinear dynamics, and structural design.

EDUCATION

Ph.D., Civil Engineering, Worcester Polytechnic Institute (Minor in Mechanical Engineering)
M.S., Civil Engineering, University of Mississippi
B.S., Civil Engineering, University of Mississippi

QUALIFICATIONS

Dr. Plaxico is a consultant in the area of roadside safety with expertise in crashworthiness analysis and design of materials and structures. He has been active in roadside safety research for more than 20 years and is active with the Transportation Research Board Subcommittee for Roadside Safety (AFB20). During the past twenty plus years his research has involved analyses of vehicular impact, crashworthiness of roadside safety devices (e.g., guardrail, bridge rail, crash cushion), ballistic loading on human tissue, and ballistic loading on structures using nonlinear explicit finite element methods (LS-DYNA and ABAQUS). Dr. Plaxico has worked on research projects sponsored by the Federal Highway Administration, the National Cooperative Highway Research Program, the National Transportation Research Center, Inc., State DOT's, the Army Test Center, the US Department of Defense, US Department of energy, and various commercial/industrial companies. Dr. Plaxico holds U.S. patents on a variable force energy dissipater and decelerator ([U.S. patent No. 6,962,245B2](#)), a fully recoverable/self-restoring crash cushion ([U.S. Patent No. 7,168,880](#) issued 1/30/2007), a rebound control material ([U.S. Patent No. WO2009/117348](#)), and a rotary motion device driven by electroactive polymer materials ([U.S. Patent No. 9,379,644 B2](#)).

HONORS AND HONOR SOCIETIES

- Received award from R&D magazine for an innovative crash cushion design, called the RACE Safety Barrier (2005)
- Recipient of the Outstanding Masters Student in the School of Engineering (1995)
- Graduate Assistant in National Need (GANN) fellow (1992-1995)
- President of Chi Epsilon honor society (1992)
- Chi Epsilon civil engineering honor society (1991-present)
- Tau Beta Pi engineering honor society (1991-present)

PROFESSIONAL SERVICES

- Transportation Research Board Subcommittee for Roadside Safety, AFB20 (member 2008 – 2014).
- Paper Reviewer for the Transportation Research Record Journal
- Paper Reviewer for the Journal of Bridge Engineering
- Paper Reviewer for the Journal of Transportation Safety & Security

PATENTS

1. “Variable force energy dissipater and decelerator,” Patent No. US 6,962,245 B2, January 22, 2004.
2. “Impact Attenuator System”, Patent No. US 7,168,880 B2, January 30, 2007.
3. “Rebound Control Material,” US Patent Application No. 2009/117348, April 21, 2011.
4. “Electroactive Polymer (EAP) – Based Rotary Motion Devices,” Patent Application No. WO 2011/163530 A1, December 29, 2011.
5. “Vibration Modes of Faces for Golf Club Heads or Other Ball Striking Devices,” US Patent Application No. S.N. 13/834,357: PF 1303.

EXPERIENCE

2010 – Present: *Vice President and Partner, Roadsafe LLC* – Non-linear Finite Element Analysis Group Leader. Research involves transportation safety, crash analysis and crashworthy design of highway roadside safety structures.

2009 – 2010: *Consultant and Independent Contractor*, Research involved analysis, development of tractor-semitrailer finite element models for assessing crashworthiness of roadside safety systems, and updating the AASHTO-ARTBA-AGC Task Force 13 Luminaire Guide.

2003 – 2009: *Senior Research Scientist, Equipment Development and Mechanical Systems, Battelle Memorial Institute* - Non-linear Finite Element Analysis Group Leader. Director of the Center of Excellence in Finite Element Analysis of Roadside Safety Features awarded by FHWA. Research

involved analysis, design and development of roadside safety systems and impact analysis (including ballistic impact) on materials and structures.

2002 – 2003: *Adjunct Assistant Professor, Department of Civil and Environmental Engineering, Worcester Polytechnic Institute – Courses Taught: Matrix Analysis of Structures and Finite Element Modeling for Impact Analysis.*

1998 – 2003: *Associate Research Engineer, Department of Civil and Environmental Engineering, Worcester Polytechnic Institute - Research activities focused on non-linear finite element analysis of vehicles and crashworthy structures.*

1997 – 1998: *Associate Research Scientist, Center for Computer-Aided Design at the University of Iowa - Investigator and analyst at the Center for Computer Aided Design. Research activities focused on non-linear finite element analysis of vehicles and roadside safety barrier crashworthiness.*

1993 – 1996: *Research Assistant, the University of Mississippi - Performed research in a variety of areas including:*

- Seismic response of the Baptist Memorial Hospital in Desoto County Mississippi using the finite element code ABAQUS.
- Developed methodology to analyze the linear and nonlinear viscoelastic behavior of fiber reinforced/epoxy resin matrix materials employing Aboudi's micro-mechanical "method of cells". Used this methodology to determine the time/stress-dependent properties of resin-matrix composites and incorporated it into ABAQUS as a user material subroutine.
- The above mentioned methodology was adapted for analysis of the nonlinear behavior of particulate/asphalt.
- Analyzed the seismic response of several structures on the campus of the University of Mississippi (including two student dorms, the student union, the coliseum, the infirmary, one of the historical buildings, a bridge, and a water tower), using the finite element code ABAQUS.
- Developed a finite element model of a pavement system which was used to simulate dynamic loading conditions.
- Developed finite element models of various structural systems to determine their dynamic response due to impact conditions.

SPONSORED RESEARCH PROJECTS (Select Projects)

1. *MASH TL3 Transition Design for the Quick-Change Moveable Barrier*, Lindsay Products, Inc. (May 2017 – Present)
2. *MASH TL4 Evaluation of Median Barrier Extension Design Concepts for the Bronx-Whitestone Bridge Median Barrier Using Finite Element Analysis*, Triborough Bridge & Tunnel Authority. (June 2017 – Present)

3. *MASH TL3 Design and Evaluation of the Quick-Change Moveable Barrier*, Lindsay Products, Inc. (April 2016 – November 2016)
4. *Development of Energy Absorbing Elements for Head Impact Protection for Sports Helmets and Vehicle Headliner Application*, Windpact, Inc. (November 2016 – Present)
5. *MASH TL3 Redesign and Evaluation of the ABSORB Crash Cushion*, Lindsay Products, Inc. (November 2016 – March 2017).
6. *MASH TL5 Evaluation of the Modified Oregon Three-Tube Bridge Rail*, New York Thru-Way Authority. (July 2016 – December 2016)
7. *MASH TL2-TL4 Evaluation of the Quick-Change Moveable Barrier*, Lindsay Products, Inc. (March 2016 – December 2016)
8. *Design Modification of the Oregon Three-Tube Bridge Rail*, New York Thru-Way Authority. (Nov 2015 – April 2016)
9. *Evaluation and Design of a TL-3 Bridge Guardrail System Mounted to Steel Fascia Beams*, Ohio Department of Transportation. (January 2015 – April 2017)
10. *Development of an Esthetic Bridge Railing for the Pulaski Skyway Project*, New Jersey Department of Transportation. (2014 – December 2016)
11. *Modified NETC-4-Bar Bridge Rail for Steel Through-Truss Bridges*, Structural Bridges, Quebec. (July 2013 – December 2013).
12. *Evaluation of the Performance Limits of the Existing Guardrail on the TRC Test-Track*, The Transportation Research Center, East Liberty, OH. (October 2012 – July 2013).
13. *Guidelines for Shielding Bridge Piers*, National Cooperative Highway Research Program (NCHRP) Project 12-90 Phase I, II, III, National Academy of Sciences. (November 2012 – Present)
14. *Criteria for Restoration of Longitudinal Barriers – Phase II*, National Cooperative Highway Research Program (NCHRP) Project 22-28, National Academy of Sciences. (January 2012 – June 2015)
15. *Consideration of Roadside Features in the Highway Safety Manual*, National Cooperative Highway Research Program (NCHRP) Project 17-54, National Academy of Sciences. (April 2011 – Present)
16. *Recommended Guidelines for the Selection of Test Level 2 through 5 Bridge Railings*, National Cooperative Highway Research Program (NCHRP) Project 22-12(03), National Academy of Sciences. (January 2010 – October 2013)
17. *Update of the Roadside Safety Analysis Program (RSAP)*, National Cooperative Highway Research Program (NCHRP) Project 22-27, National Academy of Sciences. (2009 – 2012)
18. *Update to A Guide to Standardized Highway Lighting Pole Hardware*, Wyoming Department of Transportation. (2006 – 2012)

19. *Design, Development and Qualification of a Self-Restoring Crash Cushion – Tau IIR*, Barrier Systems Inc. (2010)
20. *Enhanced Finite Element Analysis Crash Model of Tractor-Trailers – Phase C*, National Transportation Research Center, Inc. (2009 – 2010)
21. *Enhanced Finite Element Analysis Crash Model of Tractor-Trailers – Phase B*, National Transportation Research Center, Inc. (2008 – 2009)
22. *Enhanced Finite Element Analysis Crash Model of Tractor-Trailers – Phase A*, National Transportation Research Center, Inc. (2007 – 2008)
23. *Analysis of the CrashGard Sand Barrel Crash Cushion – Phase II*, Plastic Safety Systems, Inc. (2009)
24. *Analysis of the CrashGard Sand Barrel Crash Cushion – Phase I*, Plastic Safety Systems, Inc. (2008)
25. *Development of Verification and Validation Procedures for Computer Simulation used in Roadside Safety Applications*, National Cooperative Highway Research Program. (2007 – 2010)
26. *Ballistic Impact Chest Simulator and Measurement System*, US Army Test Center, Aberdeen Proving Ground, MD. (2006 – 2007)
27. *Development of a 50-inch Portable Concrete Barrier*, Ohio Department of Transportation, Columbus, OH. (2004 – 2006)
28. *Simulation and Analysis of Test Level 3 Impact on ODOT GR2.2 Guardrail System*, Ohio Department of Transportation, Columbus, OH. (2004 – 2006)
29. *Investigate the Impact of a Chrysler 300E with a G4(1W) Guardrail System with a 150-mm high asphalt B curb*, Malcolm H. Ray, Canton, ME. (2004)
30. *Analysis of Roadside Safety Barriers for WPI*, Worcester Polytechnic Institute, Worcester, MA. (2004)
31. *Simulation and Analysis of a Guardrail System Impacted by a 3/4-ton Pickup Truck – Phase III*, Battelle Memorial Institute, Columbus, Ohio. (2001)
32. *Simulation and Analysis of a Guardrail System Impacted by a 3/4-ton Pickup Truck – Phase II*, Battelle Memorial Institute, Columbus, Ohio. (2001)
33. *Simulation and Analysis of a Guardrail System Impacted by a 3/4-ton Pickup Truck – Phase I*, Battelle Memorial Institute, Columbus, Ohio. (2001)
34. *Improvement of Curb-Guardrail Systems for Roadside Safety Application Using Finite Element Analysis*, Federal Highway Administration, Washington D.C. (2001 -2003)
35. *Development of Design Guidelines for the Use of Curbs and Curb-Barrier Combinations on High-Speed Roadways*, National Cooperative Highway Research Program Project 22-17, National Academy of Sciences, Washington D.C. (2000 – 2003)

36. *Development of a New Roadside Barrier System*, subcontract from the University of West Virginia, National Cooperative Highway Research Program, Washington D.C. (2000 – 2002)
37. *Improvement of the G2 (weak-post) Guardrail System*, Pennsylvania Department of Transportation. (1999 – 2000)
38. *Development of Finite Element Models for Roadside Safety Applications*, Federal Highway Administration, Washington, D.C. (1998 – 2000)
39. *Side Impact Test and Evaluation Procedures*, Federal Highway Administration, Washington, D.C. (1996 – 2000)
40. *In-Service Evaluation of Traffic Barriers*, National Cooperative Highway Research Program Project 22-13, National Academy of Sciences, Washington, D.C. (1996 – 2000)
41. *In-Service Evaluation of Traffic Barriers in Iowa*, Iowa Department of Transportation Project 19.2, Iowa Department of Transportation, Washington, D.C. (1997 – 1999)
42. *Simulation of Roadside Safety Structures*, Federal Highway Administration, Washington, D.C. (1996 – 1997)

PUBLICATIONS

1. Ray, M.H., C.E. Carrigan, and C.A. Plaxico, “Heavy Vehicle Encroachment Trajectories,” Transportation Research Circular Number E-C220 on pages 820-830, Transportation Research Board, Washington, D.C., 2017. Available online: <http://onlinepubs.trb.org/onlinepubs/circulars/ec220.pdf>
2. Plaxico, C.A. and T.O. Johnson, “Applying Finite Element Analysis to Assess the Crash Performance of Modified R350 TL4 Bridge Rail Design in Accordance with the Federal-Aid Reimbursement Eligibility Process,” *Transportation Research Board Roadside Safety Conference*, Paper Reference No. 0824-000106, San Francisco, June 2017.
3. Plaxico, C.A. and T.O. Johnson, “Design and Evaluation of a Fascia Mounted Bridge Rail for Steel Bridges on Local Roadways,” *Transportation Research Board Roadside Safety Conference*, Paper Reference No. 0824-000105, San Francisco, June 2017.
4. Plaxico, C.A., “Designing a TL-3 Bridge Guardrail System Mounted to Steel Fascia Beams for use on Ohio’s Local System,” In Proceeding of the 70th Ohio Transportation Engineering Conference (OTEC), Columbus, Ohio, October 24-26, 2016.
5. Johnson, T.O., C.A. Plaxico and M.H. Ray, “Development of a Web-Based Program for Assessing Guardrail Damages and Determining if Repair is Warranted,” Transportation Research Board 95th Annual meeting, Paper 16-2707 (in proceedings), Transportation Research Board, Washington, D.C., 2016.

6. Plaxico, C.A. and M.H Ray, "Quantitative Method for Assessing Deterioration Level of Round Wood Guardrail Posts," *Transportation Research Record No. 2521* pp. 84-93, Journal of the Transportation Research Board, Washington, D.C., 2015.
7. Martin, Y., C.A. Plaxico, C.D. Annan, and M. Farard, "Modification de la conception des dispositifs de retenue sur les ponts au Canada et aux États-Unis," 21e Colloque sur la progression de la recherche québécoise sur les ouvrages d'art, May 7, 2014.
8. Ray, M.H., C.E. Carrigan and C.A. Plaxico, "Selection Table Development for Bridge Railing," *Transportation Research Record No. 2437* pp. 10-19, Transportation Research Board, Washington, D.C., 2014.
9. Ray, M.H., C.E. Carrigan and C.A. Plaxico, "Method for Modeling Crash Severity with Observable Crash Data," *Transportation Research Record No. 2437* pp. 1-9, Transportation Research Board, Washington, D.C., 2014.
10. Stasik, M., Moore, M., Plaxico, C.A., and Sayre, J., "Electroactive Polymer (EAP) mobility Device," SPIE Smart Structure and Materials and Nondestructive Evaluation and Health Monitoring, March 2013.
11. Mongiardini, M., Ray, M.H., and Plaxico, C.A., "Development of a Programme for the Quantitative Comparison of a Pair of Curves", *International Journal of Computer Applications in Technology*, Vol. 46, No. 2, 2013.
12. Ray, M.H., Mongardini, M., Plaxico, C.A. and Anghileri, M., "Recommended Procedures for Verification and Validation of Computer Simulations used for Roadside Safety Applications," National Cooperative Highway Research Program Report No. 179, National Academy of Sciences, Washington, D.C., 2011.
13. Ray, M.H., Mongardini, M. and Plaxico, C.A. "Quantitative Methods for Assessing Similarity between Computational Results and Full-Scale Crash Tests," *Transportation Research Record Paper No. 12-2437* (in review), Transportation Research Board, Washington, D.C., 2012.
14. Ray, M.H., Carrigan, C.E. and Plaxico, C.A. "Estimating Crash Costs in the Updated Roadside Safety Analysis Program," *Transportation Research Record Paper No. 12-2684*, Transportation Research Board, Washington, D.C., 2012.
15. Ray, M.H., Carrigan, C.E. and Plaxico, C.A. "The Application of the Probability of Injury Method in the Roadside Safety Analysis Program (RSAP)," *Transportation Research Record Paper No. 12-3739* (in review), Transportation Research Board, Washington, D.C., 2012.
16. Ray, M.H., Carrigan, C.E. and Plaxico, C.A. "Benefit-Cost Analysis of Median Alternatives: An Example Problem to Demonstrate Updated Procedures in RSAP," *Transportation Research Record Paper No. 12-2680* (in review), Transportation Research Board, Washington, D.C., 2012.
17. Plaxico, C.A., Kennedy, J.C., and Miele, C.R., "Evaluation and Redesign of a Culvert Guardrail and Transition System," Technical Report, Ohio Department of Transportation, 2007.

18. Kennedy, J.C., Plaxico, C.A., and Miele, C.R., "Design, Development and Qualification of a New Guardrail Post," *Transportation Research Record 1984*, Paper No. 06-0428, Transportation Research Board, Washington, D.C., 2006.
19. Plaxico, C.A., Ray, M.H., Weir, J.A., Orengo, F., Tiso, P., McGee, H., Council, F. and Eccles, K., Recommended Guidelines for Curb and Curb-Barrier Installations, National Cooperative Highway Research Program Report No. 537, ISBN 0-309-08820-8, National Academy of Sciences, Washington, D.C., 2005.
20. M. H. Ray, C. A. Plaxico, J. A. Weir, F. Council, Recommended Guidelines for Curb and Curb-Barrier Combinations, National Cooperative Highway Research Program Report No. 490, ISBN 0-309-08762-7, National Academy of Sciences, Washington, D.C., 2005.
21. Ray, M.H, Oldani, E. and Plaxico, C.A., Design and Analysis of an Aluminum F-Shape Bridge Railing, *International Journal of Crash Worthiness*, Volume , Woodhead Publishing, Cambridge, UK, 2004.
22. Kennedy, J.C., Plaxico, C.A., and Miele, C.R., "Design, Development and Qualification of a New Guardrail Post," In Proceedings of *Innovative Applications of Finite Element Modeling in Highway Structures*, New York, NY, August 2003.
23. Ray, M.H., Weir, J.A., Plaxico, C.A. and K. Hiranmayee, "Evaluating the Results of Side Impact Crash Tests of Roadside Safety Hardware," *Accident Analysis and Prevention*, Volume (in review), Pergamon Press, New York, 2003 (expected).
24. Ray, M.H., Plaxico, C.A. and Hedstrom, P., "Anthropometric Test Results in Side Impact Crashes of Varying Severity," *Accident Analysis and Prevention*, Volume 8, No. 3, pp 001-009, Pergamon Press, New York, 2003.
25. Plaxico, C.A., Mozzarelli, F. and Ray, M.H., "Tests and Simulation of W-Beam Rail-to-Post Connection," *International Journal of Crashworthiness*, Volume 8 No. 6, Woodhead Publishing, Cambridge, UK, 2003.
26. Orengo, F., Plaxico, C.A., and Ray, M.H., "Modeling Tire Blow-Out in Roadside Hardware Simulations Using LS-DYNA," In Proceeding of *International Mechanical Engineering Congress & Exposition*, American Society of Mechanical Engineers, Washington, D.C., November 2003.
27. Tiso, P., Plaxico, C.A., and Ray, M.H., "An Improved Truck Model for Roadside Safety Simulations: Part II – Suspension Modeling," *Transportation Research Record No. 1797*, Transportation Research Board, Washington, D.C., 2002.
28. Ray, M.H., Plaxico, C.A., Engstrand, K. and McGinnis, R.G. "Improvements to the Weak-Post W-Beam Guardrail," *Transportation Research Record No. 1743*, Paper No. 01-2282, Transportation Research Board, Washington, D.C., 2001.
29. Ray, M.H., Plaxico, C.A. and Engstrand, K. , "Performance of W-beam Splices," *Transportation Research Record No. 1743*, Paper No. 01-2420, Transportation Research Board, Washington, D.C., 2001.

30. Plaxico, C.A., Ray, M.H. and K. Hiranmayee, "Comparison of the Impact Performance of the G4(1W) and G4(2W) Guardrail Systems Under NCHRP Report 350 Test 3-11 Conditions," *Transportation Research Record*, Paper No. 00-0525, Transportation Research Board, Washington D.C., 2000.
31. Patzner, G.S., Plaxico, C.A. and Ray, M.H., "Effect of Post and Soil Strength on the Performance of the Modified Eccentric Loader Breakaway Cable Terminal (MELT)," *Transportation Research Record*, Paper No. 990046, Transportation Research Board, Washington D.C., 1999.
32. Patzner, G.S., Plaxico, C.A. and Ray, M.H., "Effect of Post and Soil Strength on the Performance of a Guardrail Terminal," In Proceedings of 12th Engineering Mechanics Conference, American Society of Civil Engineers (ASCE), Reston, VA, 1998.
33. Plaxico, C.A., Patzner, G.S., Ray, M.H., "Finite Element Modeling of a Guardrail Post Mounted in Soil," In Proceedings of 12th Engineering Mechanics Conference, American Society of Civil Engineers (ASCE), Reston, VA, 1998.
34. Plaxico, C.A., Patzner, G.S., Ray, M.H., "Finite Element Modeling of Guardrail Timber Posts and the Post-Soil Interaction," *Transportation Research Record*, Paper No. 980791, Transportation Research Board, Washington D.C., 1998.
35. Plaxico, C.A., Hackett, R.M. and Uddin, W., "Simulation of Vehicle Impacting a Modified Thrie-Beam Guardrail," *Transportation Research Record*, Record No. 1599, Transportation Research Board (TRB), Washington, D.C., 1997.
36. W. Uddin, Z. Pan, P. Noppakunwijai, C.A. Plaxico, R.M. Hackett, "Finite Element Dynamic Analysis of Distressed Asphalt Pavements," 8th International Conference on Asphalt Pavements, Seattle, Washington, August 10-14, 1997, Proceedings, International Society for Asphalt Pavements.
37. Plaxico, C.A., Uddin, W., and Hackett, R.M., "A Micromechanical Model for Asphalt Materials," American Society of Civil Engineers, Washington, D.C., November 1996.
38. Plaxico, C.A., Hackett, R.M., Uddin, W. and Adef, S.E. "Crashworthiness Analysis of a Modified Thrie-Beam Guardrail," Proceedings of the 32nd Annual Technical Meeting of the Society of Engineering Science, New Orleans, October 29 - November 2, 1995, pp. 201-202.
39. Plaxico, C.A., Hackett, R.M. and Uddin, Waheed, "A Micromechanical Analysis of the Viscoelastic Response of Resin Matrix Composites," Proceedings of the International Conference on Fiber Reinforced Structural Plastics in Civil Engineering, Madras, India, December 18-20, 1995, pp. 99-108.