References and Bibliography

1. AA. Aluminum Design Manual. ADM2015. Aluminum Association, Inc., Washington, DC, 2015.

2. AASHTO. Construction Manual for Highway Construction. American Association of State Highway and Transportation Officials, Washington, DC, 1990.

3. AASHTO. LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. American Association of State Highway and Transportation Officials, Washington, DC, 2015.

4. AASHTO. Roadside Design Guide. American Association of State Highway and Transportation Officials, Washington, DC, 2011.

5. AASHTO. Standard Specifications for Highway Bridges. American Association of State Highway and Transportation Officials, Washington, DC, 2002.

6. AASHTO. Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. American Association of State Highway and Transportation Officials, Washington, DC, 2013.

7. AASHTO and AWS. AASHTO/AWS D1.5M/D1.5:2015 Bridge Welding Code. American Association of State Highway and Transportation Officials, Washington, DC, and American Welding Society, Miami, FL, 2015.

8. AASHTO–AGC–ARTBA. A Guide to Standardized Highway Lighting Pole Hardware. Joint Report from Task Force 13, American Association of State Highway and Transportation Officials, Associated General Contractors of America, American Road and Transportation Builders Association. AASHTO, Washington, DC, April 1980. [Maintained as an online guide.]

9. AASHTO–AGC–ARTBA. A Guide to Standardized Highway Barrier Hardware. Joint Report from Task Force 13, American Association of State Highway and Transportation Officials, Associated General Contractors of America, American Road and Transportation Builders Association. AASHTO, Washington, DC, 1995. [Maintained as an online guide.]

10. AASHTO–AGC–ARTBA. A Guide to Small Sign Support Hardware. Joint Report from Task Force 13, American Association of State Highway and Transportation Officials, Associated General Contractors of America, American Road and Transportation Builders Association. AASHTO, Washington, DC, 1998.

11. AISC. Steel Construction Manual, 14th Edition. American Institute of Steel Construction, Inc., Chicago, IL, 2011.

12. Alberson, D. C. and D. L. Ivey. Improved Breakaway Utility Pole, AD-IV. In Transportation Research Record 1468. Transportation Research Board, Washington, DC, December 1994.

13. Beason, W. L. and T. J. Hirsch. Measurement of Heavy Vehicle Impact Forces and Inertial Properties, FHWA-RD-89-120. Texas Transportation Institute, Texas A&M University, College Station, Texas, May 1989.

14. Beedle, L. S. Plastic Design of Steel Frames. John Wiley & Sons, Inc., New York, NY, 1958.

15. Bligh, R. P., D. C. Albertson, W. L. Menges, and R. R. Haug. Evaluation of Dual Support, Triangular Slip-Base Sign Installations. In Accident Investigation Quarterly and Journal, No. 41. Accident Reconstruction Network (ARC Network), Waldorf, MD, 2006.

16. Bligh, R.P., and W.L. Menges. MASH TL-3 Testing and Evaluation of the Midwest Cable Median Barrier. Texas Transportation Institute Proving Ground, Texas A&M University, College Station, TX, December 2011.

17. Bligh, R. P., H. E. Ross, and D. L. Bullard. Test and Evaluation of Arizona Slip-Away Base Luminaire Supports: Final Report. Report No. 7236-1F. Final Report to the Arizona Department of Transportation. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, September 1994.

18. Bligh, R. P. and D. L. Sicking. Applications of Barrier VII in the Design of Flexible Barriers. In Transportation Research Record 1233. Transportation Research Board, Washington, DC, 1990.

19. Brauer, S. K., J. B. Mayer, and R. E. Kirksey. 1800-lb Pendulum Mass with 10-Stage Crushable Nose Element Calibration Tests PCAL-1 & PCAL-2, Southwest Research Institute Test Report. Southwest Research Institute, San Antonio, TX, October 1987.

20. Bronstad, M. E. Guardrail Ends. Proceedings for the American Association for Automotive Medicine, San Antonio, TX, 1983, pp. 389–407.

21. Bronstad, M. E., L. R. Calcote, and C. E. Kimball. Concrete Median Barrier Research. Final Report, Contract DOTFH-11-8130, Volumes I and II. Southwest Research Institute, San Antonio, TX, June 1976.

22. Bronstad, M. E. and J. D. Michie. National Cooperative Highway Research Program Report 239: Multiple-Service-Level Highway Bridge Railing Selection Procedures. NCHRP, Transportation Research Board, Washington, DC, November 1981.

23. Bronstad, M. E., J. D. Michie, and J. D. Mayer, Jr. National Cooperative Highway Research Program Report 289: Performance of Longitudinal Traffic Barriers. NCHRP, Transportation Research Board, Washington, DC, June 1987.

24. Bronstad, M. E., et al. Guardrail-Bridge Rail Transition Designs. Research Report FHWA/RD-86/178, Volume I. Southwest Research Institute, San Antonio, TX, April 1988.

25. Brown, C. M. Validation of the ENSCO Surrogate Bogie Vehicle. Research Report, U.S. Department of Transportation Contract No. DTFH61-91-Z-00002, Federal Highway Administration Report No. FHWA-Rd-93-074. Advanced Technology & Research Corp., Laurel, MD, for Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1994.

26. Buth, C. E., W. L. Menges, K. K. Mak, and R. P. Bligh. Transitions from Guardrail to Bridge Rail That Meet Safety Performance Requirements. In Transportation Research Record 1720. Transportation Research Board, Washington, DC, 2000.

27. Buth, E., et al. Development of Safer Bridge Railing Designs. Final Report Draft, FHWA Contract FH-1-9181. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, February 1981.

28. Buth, E., et al. Performance Limits of Longitudinal Barrier Systems. Final Report on Contract DTFH61-82-C-00051. Texas Transportation Institute, Texas A&M Research Foundation, College Station, TX, May 1985.

29. Calcote, L. R. Development of a Cost-Effectiveness Model for Guardrail Selection. Final Report on Contract DOT-FH11-8827. Southwest Research Institute, San Antonio, TX, November 1977.

30. Campise, W. L. Comparative Crash Tests Conducted on Seven Different Makes and Models of Truck Mounted Attenuators (TMAs): Final Report. Final Report to the Texas Department of Transportation, Texas Transportation Institute, Texas A&M University, College Station, TX, August 1991.

31. Carney, J. F., III. Development of a Metal Tube Crash Cushion for Narrow Hazard Highway Sites. Report FHWA-CTRD-HPR-1080. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1986.

32. Carney, J. F., III, S. Chatterjee, and R. B. Albin. Development of a 100-km/h Reusable High-Molecular Weight/High-Density Polyethylene Truck-Mounted Attenuator. In Transportation Research Record 1647. Transportation Research Board, Washington, DC, November 1998.

33. Carney, J. F., III, C. E. Dougan, and E. C. Lohrey. NCHRP Report 350 Crash Test Results for Connecticut Truck-Mounted Attenuator. In Transportation Research Record 1528. Transportation Research Board, Washington, DC, 1996.

34. Chisholm, D. B. and J. G. Viner. Dynamic Testing of Luminaire Supports. Report No. FHWA-RD-73-55. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1972.

35. Chou, C. C., K. Hancock, and S. Basu. NARD: Numerical Analysis of Roadside Design, Version 2.0. Final Report on Contract DTFH61-87-Z-00116. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, July 1989.

36. Chou, C. C., et al. Guard Version 3.1 Users and Programmers Manual. Final Report on Contract DTFH61-87-Z-00116. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, July 1989.

37. Consolazio, G., K. Gurley, R. Ellis, and J. Wilkes. Temporary Low Profile Barrier for Roadside Safety: Phase II. Phase II Report to the Florida Department of Transportation, University of Florida, Gainesville, FL, January 2003.

38. Council, F. M., et al. Safe Geometric Design for Minicars. Report No. FHWA/RD-87/047. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, March 1987.

39. Crain Communications, Inc. Market Data Book. Published by Automotive News magazine. Crain Communications, Inc., Detroit, MI, 2008.

40. Deleys, N. J. Safety Aspects of Roadside Cross Section Design. Final Report, FHWA Contract No. DOT-FH-11-8189, Report No. FHWA-RD-75-41. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, February 1975.

41. Deleys, N. J. and L. O. Parada. Rollover Potential of Vehicles on Embankments, Side Slopes, and Other Roadside Features. Final Report, Contract No. DTFH61-83-C-00060. Calspan Corp., Buffalo, NY, August 1986.

42. Dewey, J. F., et al. A Study of the Soil-Structure Interaction Behavior of Highway Guardrail Posts. Research Report 3431. Texas Transportation Institute, Texas A&M University System, College Station, TX, July 1983.

43. Edwards, T. C., et al. National Cooperative Highway Research Program Report 77: Development of Design Criteria for Safer Luminaire Supports. NCHRP, Transportation Research Board, Washington, DC, 1969.

44. Eggers, D. W., and T. J. Hirsch. The Effects of Embedment Depth, Soil Properties, and Post Type on the Performance of Highway Guardrail Post. Research Report 405-1. Texas Transportation Institute, Texas A&M University System, College Station, TX, August 1986.

45. European Committee for Standardization. Road Restraint Systems. BS EN 1317.

46. Faller, R. K., K. A. Polivka, Beau D. Kuipers, R. W. Bielenberg, J. D. Reid, J. R. Rohde, and D. L. Sicking. Midwest Guardrail System for Standard and Special Applications. In Transportation Research Record 1890. Transportation Research Board, Washington, DC, 2004.

47. Faller, R. K., J. D. Reid, and J. R. Rohde. Approach Guardrail Transition for Concrete Safety Shape Barriers. In Transportation Research Record 1647. Transportation Research Board, Washington, DC, November 1998.

48. Faller, R. K., M. A. Ritter, S. R. Duwadi, and Barry T. Rosson. Railing Systems for Use on Timber Deck Bridges. In Transportation Research Record 1656. Transportation Research Board, Washington, DC, 1999.

49. Faller, R. K., B. T. Rosson, M. A. Ritter, E. A. Keller, and S. R. Duwadi. Development of Two Test Level 2 Bridge Railings and Transitions for Use on Transverse Glue-Laminated Deck Bridges. In Transportation Research Record 1743. Transportation Research Board, Washington, DC, 2001.

50. Faller, R. K., D. L. Sicking, K. A. Polivka, J. R. Rohde, and B. W. Bielenberg. Long-Span Guardrail System for Culvert Applications. In Transportation Research Record 1720. Transportation Research Board, Washington, DC, 2000.

51. FHWA. Cost-Effectiveness of Small Highway Sign Supports. FHWA Contract FH-11-8821, Report No. HWA/RD/80/502. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1980.

52. FHWA. Specifications for the Collection and Storage of Crash Test Data, Volume II. Report No. FHWA-RD-91-039. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1991.

53. FHWA. Manual on Uniform Traffic Control Devices (MUTCD). Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 2009.

54. Fleck, J. T. Validation of the Crash Victim Simulator. Report No. DOT-HS-806 279, Volumes I through IV. U.S. Department of Transportation, Washington, DC, December 1981.

55. Foedinger, R., J. F. Boozer, M. E. Bronstad, and J. W. Davidson. Development of Energy-Absorbing Composite Utility Pole. In Transportation Research Record 1851. Transportation Research Board, Washington, DC, 2003.

56. Ford Motor Company. 2005 Body Builder Layout Book, Truck Body Builder Advisory Service, Appendix—Design Recommendations, Second Unit Body Mounting. Ford Motor Company, 2005, pp. 186–194. [https://www.fleet.ford.com/truckbbas/topics/2005/subm.html]

57. Ghanoudi, M. K., C. M. Brown. Testing of a Modified Oregon Multidirectional Slip-Base Sign Support, Foil Test Numbers. Report to MiTech Incorporated for Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1997.

58. Griffin, L. I., III, et al. An Evaluation of Selected Truck Mounted Attenuators (TMAs) with Recommended Performance Specifications. Texas Transportation Institute, Texas A&M University, College Station, TX, December 1990.

59. Gurfinkel, G. Wood Engineering. Southern Forest Products Association, New Orleans, LA, 1973.

60. Hansen, A. G., M. W. Hargrave, and C. R. Horr. Validation of a Surrogate Vehicle for Luminaire Support Certification Testing. In Transportation Research Record 1233. Transportation Research Board, Washington, DC, 1989.

61. Haque, F., and N.M. Sheikh. Vehicle Dynamics Analysis of MASH Pickup and Small Car Traversal through Symmetric V-Ditch. Texas A&M Transportation Institute, Texas A&M University, College Station, TX, September 2013.

62. Hargrave, M. W., A. G. Hansen, and J. A. Hinch. A Summary of Recent Side Impact Research Conducted by the Federal Highway Administration. American Society of Civil Engineers, Reston, VA, 1989.

63. Hascall, J. A. Investigating the Use of Small-Diameter Softwood for Guardrail Posts. Master’s Thesis, Submitted to the Graduate College of the University of Nebraska-Lincoln, Lincoln, NE, December 2005.

64. Henson, A., et al. Development of Additional Federal Outdoor Impact Laboratory (FOIL) Facilities, Volume II: Validation of the FOIL Pendulum Upgrade. Research Report, U.S. Department of Transportation Contract No. DTFH61-87-X-00044, Federal Highway Administration Report No. FHWA-RD-90-085. Scientex Corporation for Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1990.

65. Heydinger, G. J. and R. A. Bixel. Rollover Stability Measurements for 2002 New Car Assessment Program (NCAP). Final Report on Contract DTNH22-01-C-02004. National Highway Traffic Safety Administration, S.E.A. Inc., Columbus, OH, December 2002.

66. Hinch, J., et al. Foil Construction, Laboratory Procedures to Determine the Breakaway Behavior of Luminaire Supports in Mini-Sized Vehicle Collisions, Volume I, II, III, Report Numbers FHWA-RD-86-105-107. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1987.

67. Hinch, J., et al. Impact Attenuators: A Current Engineering Evaluation. In Transportation Research Record 1198. Transportation Research Board, Washington, DC, 1988.

68. Hirsch, T. J. Longitudinal Barriers for Busses and Trucks. In Transportation Research Record 1052. Transportation Research Board, Washington, DC, 1986.

69. Holloway, J. C., D. L. Sicking, and B. T. Rosson. Performance Evaluation of NDOR Mountable Curbs. Report No. TRP-03-37-93. Final Report to the Nebraska Department of Roads, Midwest Roadside Safety Facility, Civil Engineering Department, University of Nebraska-Lincoln, Lincoln, NE, June 1994.

70. Humphries, J. and T. D. Sullivan. Guidelines for the Use of Truck-Mounted Attenuators in Work Zones. In Transportation Research Record 1304. Transportation Research Board, National Research Council, Washington, DC, 1991.

71. ISO. Road Vehicles with Two Axles-Determination of Centre of Gravity. Reference Number ISO 10392:2011. International Organization for Standardization, Geneva, Switzerland, March 15, 2011.

72. Ivey, D. L. and Morgan, J. R. Timber Pole Safety by Design. In Transportation Research Record 1065. Transportation Research Board, Washington, DC, 1986.

73. Ivey, D. L. and D. L. Sicking. “The Influence of Pavement Edge and Shoulder Characteristics on Vehicle Handling and Stability.” In Transportation Research Record 1084. Transportation Research Board, Washington, DC, 1986.

74. James, M. E. and H. E. Ross, Jr. HVOSM User’s Manual. Research Report 140-9. Texas Transportation Institute, Texas A&M University, College Station, TX, August 1974.

75. Karcher, J. Vehicle Dynamics Modeling and Simulation for the Safety Evaluation, Selection, and Placement of Cable Barrier Systems. The George Washington University, Master’s Thesis, Washington, DC, 2009.

76. Klien, R. M., W. A. Johnson, and H. T. Szostak. Influence of Roadway Disturbances on Vehicle Handling. Final Report, Contract DOT-HS-5-01223. Systems Technology, Inc., Joliet, IL, October 1976.

77. Labra, J. J. Development of Safer Utility Poles. Contract DOT-FH-11-8909, Final Report. Southwest Research Institute, San Antonio, TX, February 1980.

78. Laker, I. B. and A. R. Payne. Transportation Research Circular Number 396: Theoretical Head Impact Velocity Concept. Transportation Research Board, National Research Council, Washington, DC, May 1992.

79. Lampela, A. A. and A. H. Yang. Analysis of Guardrail Accidents in Michigan. Report TSD-243-74. Michigan Department of State Highways and Transportation, July 1974.

80. Lawrence, L. R. and J. H. Hatton, Jr. Crash Cushions Selection Criteria and Design. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, September 1975.

81. Leonin, C. and R. Powers. In-Service Evaluation of Experimental Traffic Barriers: An Interim Report. Report No.FHWA-DP64/EP7-1. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, April 1986.

82. Livermore Software Technology Corporation. LS-DYNA software. Livermore Software Technology Corporation, 7374 Las Positas Rd., Livermore, CA.

83. Mak, K. K., R. P. Bligh, and W. B. Wilson. Wyoming Road Closure Gate. In Transportation Research Record 1528. Transportation Research Board, Washington, DC, September 1996.

84. Mak, K. K. and D. L. Sicking. Rollover Caused by Concrete Safety Shaped Barrier. In Transportation Research Record 1258. Transportation Research Board, Washington, DC, 1992.

85. Mak, K. K., D. L. Sicking, and H. E. Ross, Jr. Real World Impact Conditions for Ran-Off-the-Road Accidents. In Transportation Research Record l065. Transportation Research Board, Washington, DC, 1986.

86. Marzougui, D., C. D. Kan, and K. S. Opiela. Evaluation of the Influences of Cable Barrier Design and Placement on Vehicle to Barrier Interface. NCAC Document 2008-W-001. National Crash Analysis Center, George Washington University, Washington, D.C., 2008.

87. Marzougui, D., C. D. Kan, and K. S. Opiela. Further Considerations for Effective Median Barrier Lateral Placement for Varying Highway Cross Sections. Journal of the Transportation Research Board, Issue 2437, Washington DC, 2014, pp 63-77.

88. Marzougui, D., C. D. Kan, and K. S. Opiela. Vehicle Dynamics Investigations to Develop Guidelines for Crash Testing Cable Barriers on Sloped Surfaces. Working Paper NCAC 2010-W-009. National Crash Analysis Center, George Washington University, Ashburn, Virginia, August 2010.

89. Marzougui, D., U. Mahadevaiah, F. Tahan, C. D. Kan, R. McGinnis, and R. Powers. Development of Guidance for the Selection, Use, and Maintenance of Cable Barrier Systems. National Cooperative Highway Research Program (NCHRP) Report No. 711. Transportation Research Board of the National Academies, Washington, DC, 2012.

90. Marzougui, D., K.S. Opiela, C. C. Story, C. D. Kan, and E. Arispe. Testing and Analyses of Sloped Terrain Effects on Vehicle Trajectories and Kinematics. Internal Report. Center for Collision Safety and Analysis, George Mason University, Virginia, 2014.

91. Mauer, F., D. L. Bullard, D. C. Alberson, and W. L. Menges. Development and Testing of Steel U-Channel Slip Safe Sign Support. In Transportation Research Record 1599. Transportation Research Board, Washington, DC, 1997.

92. Michie, J. D. National Cooperative Highway Research Program Report 230: Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances. NCHRP, Transportation Research Board, Washington, DC, March 1981.

93. Michie, J. D. Performance and Operational Experience of Truck-Mounted Attenuators, NCHRP Project 20-5, Topic 22-01. National Academy Press, Transportation Research Board, Washington, DC, 1992.

94. Michie, J. D., L. R. Calcote, and M. E. Bronstad. National Cooperative Highway Research Program Report 115: Guardrail Performance and Design. NCHRP, Transportation Research Board, Washington, DC, 1971.

95. Mongiardini, M., R. K. Faller, S. K. Rosenbaugh, and J. D. Reid. Test Matrices for Evaluating Cable Median Barriers Placed in V-Ditches. Research Report TRP-03-265-12. Midwest Road Safety Facility, University of Nebraska, Lincoln, NE, 2012.

96. NCHRP. Determination of Safe/Cost Effective Roadside Slopes and Associated Clear Distances. National Cooperative Highway Research Program Project 17-11(02), Texas Transportation Institute, Texas A&M University, College Station, Texas. (in progress).

97. NCHRP. National Cooperative Research Report 665: Identification of Vehicular Impact Conditions Associated with Serious Ran-Off-Road Crashes. NCHRP, Transportation Research Board, Washington, DC, 2010.

98. NHTSA. National Accident Sampling System, Vehicle Measurement Techniques. National Highway Traffic Safety Administration, U.S. Department of Transportation, Oklahoma City, Oklahoma, 1998.

99. NSC. Vehicle Damage Scale for Traffic Accident Investigators. National Safety Council, 444 Michigan Avenue, Chicago, Illinois, 60611, 1984.

100. Olson, R. M., et al. National Cooperative Highway Research Program Report 149: Bridge Rail Design: Factors, Trends, and Guidelines. NCHRP, Transportation Research Board, Washington, DC, 1974, 49 pp.

101. Olson, R. M., et al. National Cooperative Highway Research Program Report 150: Effect of Curb Geometry and Location on Vehicle Behavior. NCHRP, Transportation Research Board, Washington, DC, 1974.

102. Paulsen, G. W. and J. D. Reid. Nonlinear Finite-Element Analysis of Dual Support Breakaway Sign. In Transportation Research Record 1528. Transportation Research Board, Washington, DC, September 1996.

103. Perchonok, K. et al. Hazardous Effect of Highway Features and Roadside Objects, Vol. 2, FHWA Report No. FHWA-RD-78-202. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, September 1978.

104. Perera, H. S. Development of an Improved Highway-Vehicle-Object-Simulation Model for Multi-Faced Rigid Barriers. In Transportation Research Record 1233. Transportation Research Board, Washington, DC, 1989.

105. Pfiefer, B. G., J. C. Holloway, R. K. Faller, E. R. Post, and D. L. Christiansen. Full-Scale Crash Tests on a Luminaire Support 4-Bolt Slipbase Design. In Transportation Research Record 1367. Transportation Research Board, Washington, DC, 1992.

106. Pinelli, J. P., C. S. Subramanian, and J. Tabora. Experimental Study of Breakaway Highway Sign Connections. In Journal of Transportation Engineering, Vol. 128, No. 1. American Society of Civil Engineers, Reston, VA, January 2002.

107. Polivka, K. A., R. K. Faller, J. C. Holloway, J. R. Rohde, and D. L. Sicking. Safety Performance Evaluation of Missouri’s Self-Driving Temporary Sign Stands. Transportation Research Report No. TRP-03-97-00. Final Report to the Midwest States’ Regional Pooled Fund Program, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, NE, December 13, 2000.

108. Polivka, K. A., R. K. Faller, and J. R. Rohde. Guardrail Connection for Low-Fill Culverts. In Transportation Research Record 1851. Transportation Research Board, Washington, DC, 2003.

109. Polivka, K. A., R. K. Faller, D. L. Sicking, J. D. Reid, J. R. Rohde, and J. C. Holloway. Crash Testing of Missouri’s W-Beam to Thrie Beam Transition Element. Final Report to the Midwest State’s Regional Pooled Fund Program, Transportation Research Report No. TRP-03-94-00, Project No. SPR-3(017)-Year 9. Midwest Roadside Safety Facility, University of Nebraska, Lincoln, NE, September 12, 2000.

110. Polivka, K.A., et al. Development of the Midwest Guardrail System (MGS) W-Beam to Thrie-Beam Transition. In Transportation Research Record 2025. Transportation Research Board, National Research Council, Washington, DC, 2007.

111. Powell, G. H. A Computer Program for Evaluation of Automobile Barrier Systems. Report DOT-RD-73-51. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1973.

112. Ray, M. H. Preliminary Recommendations for Performing Side Impact Crash Tests of Roadside Safety Features. In Issues for Improving Roadside Safety, Transportation Research Circular. Transportation Research Board, Washington, DC, 1999.

113. Ray, M. H. and J. F. Carney, III. Side Impact Test and Evaluation Procedures for Roadside Structure Crash Tests. Final Report, Contract DTFH61-88-R-00092, Department of Civil and Environmental Engineering, Vanderbilt University, Nashville, TN, March 1992.

114. Ray, M. H. and J. F. Carney, III. Test and Evaluation Criteria for Side Impact Crash Tests. In ASCE Journal of Transportation, Vol. 120 No. 4. American Society of Civil Engineers, Reston, VA, July/August 1993.

115. Ray, M. H., M. W. Hargrave, J. F. Carney, III, and K. Hiranmayee. Side Impact Test and Evaluation Criteria for Roadside Safety Hardware. In General Design and Roadside Safety Features, Transportation Research Record 1647. Transportation Research Board, Washington, DC, 1999.

116. Ray, M. H. and K. Hiranmayee. Evaluating Human Risk in Side Impact Collisions with Roadside Objects. In Roadside Safety Features and Hydraulic, Hydrology and Water Quality Issues, Transportation Research Record 1720. Transportation Research Board, Washington, DC, 2000.

117. Ray, M. H. and J. D. Michie. Evaluation of Design Analysis Procedures and Acceptance Criteria for Roadside Hardware Vol. IV: The Importance of the Occupant Risk Criteria. Report No. FHWA/RD-87/099. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, July 1987.

118. Ray, M. H., J. A. Weir, and J. A. Hopp. National Cooperative Highway Research Program Report No. 490: In-Service Performance of Traffic Barriers. NCHRP, Transportation Research Board, Washington, DC, 2003.

119. Ray, M. H., et al. Evaluation of Design Analysis Procedures and Acceptance Criteria for Roadside Hardware Vol. V: Hazards of the Redirected Car. Report No. FHWA/RD-87/100, Federal Highway Administration, U.S. Department of Transportation, Washington, DC, July 1987.

120. Reid, J. D. Designing for the Critical Impact Point on a New Bullnose System. In International Journal of Crashworthiness, Vol. 5, No. 2. Taylor and Francis Group, Oxfordshire, UK, 2000, pp. 141–152.

121. Reid, J. D. Dual-Support Breakaway Sign with Modified Fuse Plate and Multidirectional Slip Base. In Transportation Research Record 1528. Transportation Research Board, Washington, DC, September 1996.

122. Reid, J. D. New Breakaway Mailbox Designed Using Nonlinear Finite Element Analysis. In Finite Elements in Analysis and Design, Vol. 32, No. 1. Elsevier Ltd., Kiplington Oxford, UK, March 1999, pp. 37–49.

123. Reid, J. D. and G. W. Paulsen. Design and Simulation of Large Breakaway Signs. In Journal of Transportation Engineering, Vol. 124, No. 1. American Society of Civil Engineers, Reston, VA, 1998.

124. Reid, J. D., J. R. Rohde, and D. L. Sicking. Box-Beam Burster Energy-Absorbing Single-Sided Crash Cushion. In Transportation Research Record 1797. Transportation Research Board, Washington, DC, 2002.

125. Reid, J. D., D. L. Sicking, and R. P. Bligh. Critical Impact Point for Longitudinal Barriers. In Journal of Transportation Engineering, Vol 124, No. 1. American Society of Civil Engineers, Reston, VA, January–February 1998, pp. 65–72.

126. Rohde, J. R., D. L. Sicking, and J. D. Reid. Box-Beam Burster Energy-Absorbing Terminal Bridge Pier Protection System. In Transportation Research Record 1851. Transportation Research Board, Washington, DC, 2003.

127. Ross, H. E. Jr., H. S. Perera, D. L. Sicking, and R. P. Bligh. National Cooperative Highway Research Program, Report 318: Roadside Safety Design for Small Vehicles. Transportation Research Board, Washington, DC, 1989, 70 pp.

128. Ross, H. E., Jr., and E. R. Post. Criteria for Guardrail Need and Location on Embankments. Research Report 140-4. Texas Transportation Institute, Texas A&M University, College Station, TX, August 1971.

129. Ross, H. E. Jr., D. L. Sicking, R. A. Zimmer, and J. Michie. National Cooperative Highway Research Program Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features. NCHRP, Transportation Research Board, Washington, DC, 1993, 132 pp.

130. Ross, H. E., Jr., et al. Safety Treatment of Roadside Drainage Structures. In Transportation Research Record 868. Transportation Research Board, Washington, DC, 1982.

131. Rowhani, P., D. Glauz, and R. L. S. Stoughton. Vehicle Crash Tests of Concrete Median Barrier Retrofitted With Slipformed Concrete Glare Screen. In Transportation Research Record 1419.Transportation Research Board, Washington, DC, 1993.

132. SAE International. Collision Deformation Classification, Standard J224\_201105. Society of Automotive Engineers, New York, NY, 2011.

133. SAE International. On-Highway Vehicles and Off-Highway Machinery, Volume 4 of 1986 SAE Handbook. Society of Automotive Engineers, Warrendale, PA, 1986. No longer available.

134. Salmon, C. G. and J. E. John. Steel Structures. Harper & Row Publishers, New York, NY, 1990.

135. Schiefferly, C. and J. Marlow. Development of a Lightweight Truck Mounted Attenuator. Report 32036-609934. California Department of Transportation, Sacramento, CA, July 1983.

136. Segal, D. J. Highway-Vehicle-Object-Simulation-Model 1976, Report No. FHWA-RD-75-162 through 165, Four volumes. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, February 1976.

137. Sicking, D. L., S. Hemsorach, and R. P. Bligh. Critical Impact Locations for Longitudinal Barriers. In Journal of Transportation Engineering, Vol 124, No. 1. American Society of Civil Engineers, Reston, VA, January–February 1998, pp. 65–72.

138. Sicking, D. L., J. R. Rohde, and J. D. Reid. Design and Development of Steel Breakaway Posts. In Transportation Research Record 1720. Transportation Research Board, Washington, DC, 2000.

139. Sicking, D. L. and H. E. Ross, Jr. Structural Optimization of Strong Post W-beam Guardrail. In Transportation Research Record 1133. Transportation Research Board, Washington, DC, 1987.

140. SIS. European Standard SS-EN 1317-1, Road restraint systems—Part 1: Terminology and general criteria for test methods. European Committee for Standardization, Ref. No. SS-EN 1317-1:2010 E. Swedish Standards Institution, Stockholm, Sweden, July 2010.

141. SIS. European Standard SS-EN 1317-2, Road restraint systems—Part 2: Performance classes, impact test acceptance criteria, and test methods for safety barriers including vehicle parapets. European Committee for Standardization, Ref. No. SS-EN 1317-2:2010 E. Swedish Standards Institution, Stockholm, Sweden, July 2010.

142. SIS. European Standard SS-EN 1317-3, Road restraint systems—Part 3: Performance classes, impact test acceptance criteria, and test methods for crash cushions. European Committee for Standardization, Ref. No. SS-EN 1317-3:2010 E. Swedish Standards Institution, Stockholm, Sweden, July 2010.

143. Snyder, R. G. State-of-the-Art-Human Impact Tolerances. SAE 700398 (rev. August 1970); reprinted from 1970 International Automobile Safety Conference Compendium, May 1970.

144. Solomon, D. and H. Boyd. Model Procedure for In-Service Evaluation of Roadside Safety Hardware Devices. Report No. FHWA-IP-86-8. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, April 1986.

145. Solomon, P. L. The Simulation Model of Automobile Collisions (SMAC) Operator’s Manual. National Highway Traffic Safety Administration, Washington, DC, October 1974.

146. Stolle, C. S. Cable Median Barrier Failure Analysis and Remediation. University of Nebraska-Lincoln, PhD Dissertation, Lincoln, Nebraska, December 2012.

147. Stolle, C. S. and D. L. Sicking. Cable Median Barrier Failure Analysis and Prevention. Midwest Roadside Safety Facility, University of Nebraska, Lincoln, NE, 2012.

148 Stoughton, R. L., J. R. Stoker, and E. F. Nordlin. Vehicular Impact Tests of a Truck Mounted Attenuator Containing Vermiculite Concrete Cells. Report 33001-609936. California Department of Transportation, Sacramento, CA, June 1980.

149. Stout, D., J. Hinch, and D. Sawyer. Guardrail Testing Program. Final Report on Contract DTFH71-87-C-00002, Ensco Inc., Springfield, VA, June 1990.

150. Stout, D., J. Hinch, and T. L. Yang. Force-Deflection Characteristics of Guardrail Posts. Final Report on Contract DTFH61-85-C-00099. Ensco Inc., Springfield, VA, September 1988.

151. TASS. MADYMO. Computer simulation program developed by TASS, 38701 Seven Mile Road, Suite 260, Livonia, MI 48152.

152. Thomson, R. and J. Valtonen. Vehicle Impacts in V-Shaped Ditches. In Transportation Research Record 1797. Transportation Research Board, Washington, DC, 2002.

153. TRB. Proposed Full-Scale Testing Procedures for Guardrails. In Highway Research Board Circular 482. Transportation Research Board, Washington, DC, September 1962.

154. TRB. Recommended Procedures for Vehicle Crash Testing of Highway Appurtances. In Transportation Research Circular 191. Transportation Research Board, Washington, DC, 1978.

155. TTI. Test Risk Assessment Program (TRAP) Version 2.2, User’s Manual. Developed by CAPSHER Technology, Inc. for Texas Transportation Institute, Texas A&M University, College Station, Texas, July 2002.

156. U.S. DOT. Vehicle Measurement Techniques. National Automotive Sampling System (NASS), Transportation Safety Institute, U.S. Department of Transportation, Oklahoma City, OK, September 29, 1998.

157. UMTRI. Delphi V-Forecast and Analysis of the U.S. Automotive Industry through the Year 2000. University of Michigan Transportation Research Institute, Ann Arbor, MI, July 1989.

158. Viano, D. C., and I. V. Lau. Biomechanics of Impact Injury. Research Publication GMR-6894. General Motors Research Laboratories, Warren, Michigan, December 1989.

159. Wards. Wards Automotive Yearbook 2002. Wards Communications, Southfield, MI, 2002.

160. Weaver, G. D., E. L. Marquis, and R. M. Olson. National Cooperative Highway Research Program Report 158: The Relation of Side Slope Design to Highway Safety. NCHRP, Transportation Research Board, Washington, DC, 1975.

161. Zimmer R. R. and D. L. Ivey. Influence of Roadway Surface Holes on the Potential for Vehicle Loss of Control. Research Report 328-2F. Texas Transportation Institute, Texas A&M University, College Station, TX, August 1983.