

# Thomas Schumacher

Civil and Environmental Engineering  
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## Curriculum Vitae

### Education

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2010	PhD	Civil Engineering	Oregon State University	Corvallis, OR
2006	M.S.	Civil Engineering <sup>1</sup>	Oregon State University	Corvallis, OR
2000	B.S.	Civil Engineering	Bern University of Applied Sciences	Burgdorf, Switzerland
1995	F.D. <sup>2</sup>	Civil Engineering	School for Industrial Professions	Bern, Switzerland

<sup>1</sup> Minor in Mechanical Engineering

<sup>2</sup> Federal Diploma as *Civil Engineering Draftsman*. Concentration: reinforced concrete structures.

### Employment

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2016-Present	<i>Associate Professor</i>	Civil and Environmental Engineering, Portland State University, Portland, OR
2015-2016	<i>Assistant Professor</i>	Civil and Environmental Engineering, Portland State University, Portland, OR
2010-2015	<i>Assistant Professor</i>	Civil and Environmental Engineering, University of Delaware, Newark, DE
01-06/2010	<i>Post-Doctoral Research Associate</i>	School of Civil and Construction Engineering, Oregon State University, Corvallis, OR Adviser: Dr. Christopher Higgins, PhD, PE
01-06/2007	<i>Visiting Graduate Student</i>	Department of Civil and Environmental Engineering, University of California, Berkeley, CA Adviser: Dr. Steven Glaser, PhD, Chair of Civil Systems
2004-2009	<i>Graduate Research Assistant</i>	School of Civil and Construction Engineering, Oregon State University, Corvallis, OR Adviser: Dr. Christopher Higgins, PhD, PE
2000-2004	<i>Structural Engineer and Project Manager</i>	Civil Engineering and Surveying Consulting Office of Mr. Andreas Gerber, Civil Engineer ETH, Zweisimmen, Switzerland
1995-1996	<i>Cement Mason</i>	Construction Company of Mr. Thomas Schmutz, Ueberstorf, Switzerland
1991-1995	<i>Civil Engineering Draftsman Trainee</i>	Civil Engineering Consulting Office of Mr. Paul Keller, Civil Engineer HTL, Schwarzenburg, Switzerland

### Professional Registration

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2012	PE	State of Delaware
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Dissertation

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Schumacher, T. (2009). New Acoustic Emission Applications in Civil Engineering. PhD Dissertation. Oregon State University. Corvallis, OR, USA. November 20. PhD dissertation adviser and committee chair: Dr. Christopher, Higgins, PhD, PE. Other committee members: Dr. Brian Bay, Dr. Michael Scott, Dr. Steven Lovejoy, and Dr. Philip Humphrey. URL: <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/13873/SchumacherThomas2010.pdf>.

Refereed Publications (Graduate Advisee; Undergraduate Advisee)

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*Book Chapters*

Mhamdi, L., Schumacher, T., and Linzer, L. (2015). Acoustic Emission (AE) and Related Non-destructive Evaluation (NDE) Techniques in the Fracture Mechanics of Concrete: Fundamentals and Applications, Chapter 5 - Seismology-based Acoustic Emission Techniques for Monitoring of Fracture Processes in Concrete Structures. Book editor: Ohtsu, M., *Woodhead Publishing*. April 1. DOI: 10.1016/B978-1-78242-327-0.00005-2.

*Journal Articles*

25. Shariati, A. and Schumacher, T. Eulerian-Based Virtual Visual Sensors to Measure Dynamic Displacements of Structures. *Structural Control and Health Monitoring*. Accepted for publication on November 29, 2016.
24. Walker, K., Miller, T. H., Gupta, R., Shariati, A., and Schumacher, T. Development of Virtual Visual Sensor Applications for Wood Structural Health Monitoring. *ASTM Journal of Testing and Evaluation*. Accepted for publication on October 18, 2016.
23. Gollob, S., Kocur, G. K., Schumacher, T., Mhamdi, L., and Vogel, T. (2017). A Novel Multi-Segment Path Analysis based on a Heterogeneous Velocity Model for the Localization of Acoustic Emission Sources in Complex Propagation Media. *Ultrasonics*. Vol. 74(2), pp. 48-61. DOI: 10.1016/j.ultras.2016.09.024.
22. Maresca, J. A., Moser, P., and Schumacher, T. (2017). Analysis of Bacterial Communities in and on Concrete. *Materials and Structures*. Vol. 50(1), Article 25. DOI: 10.1617/s11527-016-0929-y.
21. Adarkwa, O., Attoh-Okine, N., and Schumacher, T. (2016). Using Tensor Factorization to Predict Network-Level Performance of Bridges. *ASCE Journal of Infrastructure Systems*. Online first on November 14. DOI: 10.1061/(ASCE)IS.1943-555X.0000339.
20. Ahmed, S., Doshi, S., Schumacher, T., Thostenson, E. T., and McConnell J. (2016). Development of a Novel Integrated Strengthening and Sensing Methodology for Steel Structures using CNT-based Composites. *ASCE Journal of Structural Engineering*. Online first on October 26. DOI: 10.1061/(ASCE)ST.1943-541X.0001697.
19. Mhamdi, L., Schumacher, T., and Linzer, L. (2016). Characterization of Flexural and Shear Cracks in Reinforced Concrete Beams Using Moment Tensor Inversion from Acoustic Emission Signals. *ASCE Journal of Structural Engineering*. Online first on September 27. DOI: 10.1061/(ASCE)ST.1943-541X.0001666.
18. Radovic, M., Ghonima, O., and Schumacher, T. (2016). Data Mining of Concrete Bridge Deck Parameters in the National Bridge Inventory by Two-step Cluster Analysis. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*. Online first on July 20. DOI: 10.1061/AJRUA6.0000889.

17. Dai, H., Gallo, G. J., Schumacher, T., and Thostenson, E. T. (2016). A Novel Methodology for Spatial Damage Detection and Imaging Using a Distributed Carbon Nanotube-based Sensor Combined with Electrical Impedance Tomography. *Journal of Nondestructive Evaluation*. Vol. 35(2), Article 26. DOI: 10.1007/s10921-016-0341-0.
16. Mhamdi, L., and Schumacher, T. (2015). A Comparison between Time-of-Arrival and Novel Phased Array Approaches to Estimate Acoustic Emission Source Locations in a Steel Plate. *Journal of Nondestructive Evaluation*. Vol. 34(4), Article 38. DOI: 10.1007/s10921-015-0311-y.
15. Shariati, A., Schumacher, T., and Ramanna, N. (2015). Eulerian-Based Virtual Visual Sensors to Detect Natural Frequencies of Structures. *Journal of Civil Structural Health Monitoring*. Vol. (5)4, pp. 457-468. DOI: 10.1007/s13349-015-0128-5.
14. Dai, H., Thostenson, E. T., and Schumacher, T. (2015). Processing and Characterization of a Novel Distributed Strain Sensor Using Carbon Nanotube-Based Nonwoven Composites. *Sensors*. Vol. (15)7, pp. 17728-17747. DOI: 10.3390/s150717728.
13. Clem, D. J., Schumacher, T., and Deshon, J. P. (2015). A Consistent Approach for Processing and Interpretation of Data from Concrete Bridge Members Collected with a Hand-Held GPR Device. *Construction and Building Materials*. Vol. 86, pp. 140-148. DOI: 10.1016/j.conbuildmat.2015.03.105.
12. Linzer, L., Mhamdi, L., and Schumacher, T. (2015). Application of a Moment Tensor Inversion Code Developed for Mining-Induced Seismicity to Fracture Monitoring of Civil Engineering Materials. *Journal of Applied Geophysics*. Vol. 112, pp. 256-267. DOI: 10.1016/j.jappgeo.2014.12.001.
11. Schumacher, K., Schumacher, T., and Agbemabiese, L. (2014). Quantification and Probabilistic Modeling of CRT Obsolescence for the State of Delaware. *Waste Management*. Vol. 34(11), pp. 2321-2326. DOI: 10.1016/j.wasman.2014.07.011.
10. Schumacher, T. and Thostenson, E. T. (2014). Development of Structural Carbon Nanotube-Based Sensing Composites for Concrete Structures. *Journal of Intelligent Material Systems and Structures*. Vol. 25(11), pp. 1331-1339. DOI: 10.1177/1045389X13505252.
9. Schumacher, T. and Shariati, A. (2013). Monitoring of Structures and Mechanical Systems Using Virtual Visual Sensors for Video Analysis: Fundamental Concept and Proof of Feasibility. *Sensors*. Vol. 13(12), pp. 16551-16564. DOI: 10.3390/s131216551.
8. Grosse, C. U. and Schumacher, T. (2013). Anwendungen der Schallemissionsanalyse an Betonbauwerken (English title: Acoustic Emission Monitoring Applications for Concrete Structures). *Bautechnik*. Vol. (90)11, pp. 721-731. DOI: 10.1002/bate.201300074.
7. Higgins, C., Hafner, A., Turan, O. T., and Schumacher, T. (2013). Experimental Tests of Gusset Plate Connections with Sway-Buckling Response. *ASCE Journal of Bridge Engineering*. Vol. (18)10, pp. 980-991. DOI: 10.1061/(ASCE)BE.1943-5592.0000433.
6. Schumacher, T., Straub, D., and Higgins, C. (2012). Toward a Probabilistic Acoustic Emission Source Location Algorithm: A Bayesian Approach. *Journal of Sound and Vibration*. Vol. 331(19), pp. 4233-4245. DOI: 10.1016/j.jsv.2012.04.028.
5. Arndt, R. W., Schumacher, T., Algernon, D., and Kee, S.-H. (2011). Strategien der Bauwerkserhaltung von Autobahnbrücken in den USA-mit Unterstützung von zerstörungsfreier Prüfung und Bauwerksmonitoring (English title: Strategies for Maintenance of Highway Bridges in the US-with the Support of Nondestructive Testing and Structural Health Monitoring). *Bautechnik*. Vol. 88(11), pp. 793-804. DOI: 10.1002/bate.201101513.
4. Bradner, C., Schumacher, T., Cox, D., and Higgins, C. (2011). Experimental Setup for a Large-Scale Bridge Superstructure Model Subjected to Waves. *ASCE Journal of Waterway, Port, Coastal, and Ocean Engineering*. Vol. 137(1), pp. 3-11. DOI: 10.1061/(ASCE)WW.1943-5460.0000059.

3. Schumacher, T., Higgins, C., and Lovejoy, S. (2011). Estimating Operating Load Conditions on Reinforced Concrete Highway Bridges with *b*-Value Analysis from Acoustic Emission Monitoring. *Structural Health Monitoring*. Vol. 10(1), pp. 17-32. DOI: 10.1177/1475921710365424.
2. Schumacher, T., Higgins, C., and Lovejoy, S. (2010). Detection of Vehicles with Studded Tires Using Acoustic Emission Sensors Mounted to Highway Bridges. *ASCE Journal of Transportation Engineering*. Vol. 136(5), pp. 480-487. DOI: 10.1061/(ASCE)TE.1943-5436.0000062.
1. Schumacher, T., Higgins, C., Glaser, S. D., and Grosse, C. U. (2007). Demand on Flexural Tension Steel Reinforcement Anchorage Zones in Full-Scale Bridge Bent Caps Quantified by Means of Acoustic Emission. *Journal of Acoustic Emission*. Vol. 25(1), pp. 316-323. URL: <http://www.ndt.net/article/jae/papers/25-316.pdf>.

### Research Reports

15. Tabrizi, A., Clarke-Sather, A., and Schumacher, T. (2016). Bridge Retrofit Replacement Decisions: Tools to Assess Sustainability and Aid Decision Making. *Final Report DTRT13-UTC28*. Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC). August 2016.
14. Wynn, J., Ahmed, S., Schumacher, T., McConnell, J., and Thostenson, E. T. (2016). Holistic Rehabilitation of Fatigue-Cracks in Steel Bridge Members Using Carbon Nanotube-Based Composites: A Feasibility Study. *Final Report DCT 257*. Delaware Department of Transportation (DelDOT). May 2016. URL: <http://sites.udel.edu/dct/files/2013/10/Rpt-257-Fatigue-Cracks-Steel-Bridges-Schumacher-BRDG422155-1hc0k28.pdf>.
13. Porter, T. and Schumacher, T. (2015). System Capacity of Vintage Reinforced Concrete Moment Frame Culverts. *Final Report DCT 252*. Delaware Department of Transportation (DelDOT). August 31, 2015. URL: <https://sites.udel.edu/dct/files/2013/10/Report-252-Moment-Frame-Culverts-1u6mmzg.pdf>.
12. Shariati, A., Schumacher, T., and Ramanna, N. (2014). Exploration of Video-based Structural Health Monitoring Techniques. *Final Report (CAIT-UTC-038)*. Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC). October. URL: <http://trid.trb.org/view/2013/P/1333178>.
11. Glisic, B., Schumacher, T., and Betti, R. (2014). Multi-Sensor Sheets Based on Large-Area Electronics for Advanced Structural Health Monitoring of Civil Infrastructure. *Final Report CAIT-UTC-025*. Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC). September. URL: <http://cait.rutgers.edu/files/CAIT-UTC-025-final.pdf>.
10. Daniel, J. R., Hao, W., and Schumacher, T. (2014). Safety and Accessibility of Dynamic Message Signs (DMS). *Final Report (FHWA-NJ-2014-016)*. New Jersey Department of Transportation (NJDOT). August. URL: <http://www.state.nj.us/transportation/refdata/research/reports/FHWA-NJ-2014-016.pdf>.
9. Schumacher, T., Righman-McConnell, J., Mhamdi, L., and Ahmed, S. (2014). Quantitative Acoustic Emission Monitoring of Fatigue Cracks in Fracture Critical Steel Bridges. *Final Report (CAIT-UTC-007)*. Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC). January 31. URL: <http://trid.trb.org/view/2014/M/1307063>.
8. Schumacher, T., Chen, A., Ozturk, S., and Attoh-Okine, N. (2013). Development of Rapid Assessment Tools for Structural Parts after Extreme Events. *Final Report*. University of Delaware University Transportation Center (UD-UTC). November 24. URL: [http://www.ce.udel.edu/UTC/downloads2013/Schumacher\\_UD-UTC%20Final%20Report%20Development%20of%20rapid%20assessment%20tools.pdf](http://www.ce.udel.edu/UTC/downloads2013/Schumacher_UD-UTC%20Final%20Report%20Development%20of%20rapid%20assessment%20tools.pdf).
7. Schumacher, T. (2013). Quantitative Acoustic Emission Monitoring for Reinforced Concrete Bridges. *Final Report*. University of Delaware Research Foundation (UDRF). August 30.

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6. Schumacher, T. (2012). Non-Destructive Testing of Wood-Based Composites Using Ultrasonic Stress Wave Propagation Techniques. *Final Report*. University of Delaware Research Foundation (UDRF). December 1.
5. Clem, D. J. and Schumacher, T. (2011). Impulse Response on the Branchport Bridge in Long Branch, NJ. *Technical Report*. Cherry, Weber & Associates, Phillipsburg, NJ. October 26.
4. Bradner, C., Schumacher, T., Cox, D., and Higgins, C. (2011). Large-Scale Laboratory Observations of Wave Forces on a Highway Bridge Superstructure. *Final Report (OTREC-RR-11-10)*. Oregon Transportation Research and Education Consortium (OTREC). Portland, OR. October. URL: [http://ntl.bts.gov/lib/42000/42800/42826/OTREC-RR-11-10\\_Final.pdf](http://ntl.bts.gov/lib/42000/42800/42826/OTREC-RR-11-10_Final.pdf).
3. Schumacher, T. (2009). New Acoustic Emission Applications in Civil Engineering. *PhD Dissertation*. Oregon State University. Corvallis, OR, USA. November 20. URL: <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/13873/SchumacherThomas2010.pdf>.
2. Schumacher, T. (2008). Acoustic Emission Methods Applied to Conventionally Reinforced Concrete Bridge Girders. *Research Report SPR 633 (FHWA-OR-RD-09-04)*. Oregon Department of Transportation (ODOT). Salem, OR, USA. September. URL: [http://www.oregon.gov/ODOT/td/tp\\_res/docs/reports/2008/ae\\_techniques.pdf](http://www.oregon.gov/ODOT/td/tp_res/docs/reports/2008/ae_techniques.pdf).
1. Schumacher, T. (2006). Acoustic Emission Monitoring of Flexural Tension Reinforcement Anchorage Zones in Full-Scale Bridge Bent Caps. *M.S. Project Report*. Oregon State University. Corvallis, OR, USA. November 21.

### Non-Refereed Publications (Graduate Advisee)

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#### Conference Papers

23. Gollob, S., Mhamdi, L., Kocur, G., Schumacher, T., and Vogel, T. (2016). A Novel Multi-Segment Path Analysis-Based Technique for Acoustic Emission Source Localization in Complex Solid Media. *Proceedings of the 9th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-9)*. Berkeley, CA. May 29-June 1. DOI: 10.21012/FC9.041.
22. Shafique, A., Sagar, D., Schumacher, T., Thostenson, E. T., and McConnell, J. (2016). Novel Self-Sensing Carbon Nanotube-based Composites for Rehabilitation of Structural Steel Members. *AIP Conference Proceedings (Proceedings of QNDE. Minneapolis, MN. July 26-31, 2013)*. Vol. 1706. DOI: 10.1063/1.4940589.
21. Shariati, A. and Schumacher, T. (2015). SHM Using Eulerian-based Virtual Visual Sensors: Introduction of a New Black-and-white Target for Improved SNR. *Structural Health Monitoring 2015 (Proceedings of IWSHM. Palo Alto, CA. September 1-3, 2015)*. DOI: 10.12783/SHM2015/203.
20. Shariati, A. and Schumacher, T. (2015). Oversampling in Virtual Visual Sensors as a Means to Recover Higher Modes of Vibration. *AIP Conference Proceedings (Proceedings of QNDE. Boise, ID. July 20-25, 2014)*. Vol. 1650, pp. 1717-1724. DOI: 10.1063/1.4914793.
19. Adarkwa, O., Schumacher, T., and Attoh-Okine, N. (2014). Multiway Analysis of Bridge Structural Types in the National Bridge Inventory (NBI): A Tensor Decomposition Approach. *IEEE Conference Publications (IEEE International Conference on Big Data, Washington, D.C. October 27-30)*. DOI: 10.1109/BigData.2014.7004423.
18. McConnell, J., Schumacher, T., Thostenson, E. T., Wennick, T., and Keller, P. (2014). Evaluating Structural Steel for Reuse through Field Monitoring. *IABSE Symposium Report (Proceedings of IABSE Madrid Symposium: Engineering for Progress, Nature and People. Madrid, Spain. September 3-5, 2014)*. pp. 3174-3181(8). DOI: 10.2749/222137814814069985.

17. Schumacher, T., Thostenson, E. T., Dai, H., and Gallo, G. (2014). Damage Detection with Carbon Nanotube-Based Sensing Composites. *Proceedings of the American Society for Composites 29<sup>th</sup> Technical Conference*. La Jolla, CA. September 8-10. On CD only.
16. Celaya, M., Schumacher, T., Tabrizi, K., Bitsko, G., and Shokouhi, P. (2014). Field Verification of Nondestructive Testing Technologies for Condition Assessment of Concrete Bridge Decks: A Case Study. *Proceedings of NDE/NDT for Structural Materials Technology for Highway & Bridges*. Washington, D.C. August 25-27. pp. 36-44.
15. Dai, H., Schumacher, T., and Thostenson, E. T. (2014). Development of a Carbon Nanotube-based Sensing Approach for Structural Health Monitoring of Civil Infrastructure. *Proceedings of the 10<sup>th</sup> fib International PhD Symposium*. University of Laval, Quebec City, Canada. July 21-23. pp. 341-347. URL: [https://www.fib-phd.ulaval.ca/fileadmin/fib/documents/Proceedings/The\\_10th\\_fib\\_International\\_PhD\\_Symposium\\_in\\_Civil\\_Engineering\\_-\\_2014\\_Quebec\\_city\\_-\\_Canada.pdf](https://www.fib-phd.ulaval.ca/fileadmin/fib/documents/Proceedings/The_10th_fib_International_PhD_Symposium_in_Civil_Engineering_-_2014_Quebec_city_-_Canada.pdf).
14. Chen, A. and Schumacher, T. (2014). Estimation of In-situ Stresses in Concrete Members Using Polarized Ultrasonic Shear Waves. *AIP Conference Proceedings (Proceedings of QNDE. Baltimore, MD. July 21-26, 2013)*. Vol. 1581, pp. 903-908. DOI: 10.1063/1.4864917.
13. Chen, A. and Schumacher, T. (2014). Characterization of Flaws in Structural Steel Members Using Diffuse Wave Fields. *AIP Conference Proceedings (Proceedings of QNDE. Baltimore, MD. July 21-26, 2013)*. Vol. 1581, pp. 761-768. DOI: 10.1063/1.4864897.
12. Higgins, C., Lehrman, J., Bradner, C., and Schumacher T. (2014). Hybrid Testing of a Prestressed Girder Bridge to Resist Wave Forces. *The 29<sup>th</sup> US-Japan Bridge Engineering Workshop (Proceedings of the 29<sup>th</sup> BWS, Tsukuba Science City, Japan. November 11-13, 2013)*. URL: [http://www.pwri.go.jp/eng/ujnr/tc/g/pdf/29/29-1-4\\_Higgins.pdf](http://www.pwri.go.jp/eng/ujnr/tc/g/pdf/29/29-1-4_Higgins.pdf).
11. Cruz M. and Schumacher, T. (2014). Service-Life Prediction of Concrete Bridge Decks Using Bayesian Networks. *Safety, Reliability, Risk and Life-Cycle Performance of Structures and Infrastructures (Proceedings of ICOSSAR, New York, NY. June 16-20, 2013)*. CRC Press. ISBN-13: 978-1138000865.
10. Dai, H., Schumacher, T., and Thostenson, E. T. (2014). Structural Health Monitoring of Civil Infrastructure Using Carbon Nanotube-Based Sensing Composites. *Safety, Reliability, Risk and Life-Cycle Performance of Structures and Infrastructures (Proceedings of ICOSSAR, New York, NY. June 16-20, 2013)*. CRC Press. ISBN-13: 978-1138000865.
9. Linzer, L., Schumacher, T., and Mhamdi, L. (2013). The Application of Moment Tensor Inversion Methods to Fracture Monitoring Of Civil Engineering Materials. 13th SAGA Biennial Conference & Exhibition (*Proceedings of SAGA-AEM 2013. Mpumalanga, South Africa. October 6-11*). EarthDoc. URL: <http://earthdoc.eage.org/publication/publicationdetails/?publication=73022>.
8. Clem, D. J., Popovics, J. S., Schumacher, T., Oh, T., Ham, S., and Wu, D. (2013). Understanding the Impulse Response Method Applied to Concrete Bridge Decks. *AIP Conference Proceedings (Proceedings of QNDE. Denver, CO. July 15-20, 2012)*. Vol. 1511, pp. 1333-1340. DOI: 10.1063/1.4789197.
7. Mhamdi, L., Schumacher, T., and Linzer, L. (2013). Development of Seismology-based Acoustic Emission Methods for Civil Infrastructure Applications. *AIP Conference Proceedings (Proceedings of QNDE. Denver, CO. July 15-20, 2012)*. Vol. 1511, pp. 1363-1370. DOI: 10.1063/1.4789201.
6. Schumacher, T., Higgins, C., and Lovejoy, S. (2013). Acoustic Emission Monitoring of Conventionally Reinforced Concrete Highway Bridges Under Service Conditions. *Nondestructive Testing of Materials and Structures (Proceedings of NDTMS-2011. Istanbul, Turkey. May 15-18, 2011)*. Vol. 6, pp. 847-853. DOI: 10.1007/978-94-007-0723-8\_121.



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5. Schumacher, T. and Straub, D. (2011). A Bayesian Acoustic Emission Source Location Algorithm: Extended Model. *Applications of Statistics and Probability in Civil Engineering (Proceedings of ICASP11. Zurich, Switzerland. August 1-4, 2011)*. pp. 91-98. DOI: 10.1201/b11332-16.
4. Bradner, C., Schumacher, T., Cox, D., and Higgins, C. (2009). Large-Scale Laboratory Measurements of Wave Forces on Highway Bridge Superstructures. *Coastal Engineering 2008 (Proceedings of ICCE; Hamburg, Germany; August 31-September 5, 2008)*. Vol. 5, pp. 3554-3566. DOI: 10.1142/9789814277426\_0295.
3. Schumacher, T. (2008). Large-Scale Wave Flume Experiments on Highway Bridge Superstructures Exposed to Hurricane Wave Forces. *Proceedings of the 7<sup>th</sup> fib International PhD Symposium*. Stuttgart, Germany. September 10-13. On CD only.
2. Schumacher, T., Higgins, C., Bradner, C., Cox, D., and Yim, S. (2008). Large-Scale Wave Flume Experiments on Highway Bridge Superstructures Exposed to Hurricane Wave Forces. *Proceedings of the Sixth National Seismic Conference on Bridges and Highways (6NSC)*. Charleston, SC. July 27-30. On CD only.
1. Schumacher, T., Higgins, C., Bradner, C., and Cox, D. (2008). New Innovative Large-Scale Laboratory Setup for Experiments on Highway Bridge Superstructures Exposed to Wave Forces. *Proceedings of the National Concrete Bridge Conference (NCBC)*. St. Louis, MO. May 4-7. On CD only.

### *Articles in Technical Magazines*

2. Shariati, A. and Schumacher, T. (2014). Structural Health Monitoring Using Eulerian-Based Virtual Visual Sensors for Video Analysis. *The ISHMII Monitor*. International Society for Structural Health Monitoring of Intelligent Infrastructure. Vol. 9(2). December. URL: <http://www.ishmii.org/wp-content/uploads/2014/12/ISHMII-Monitor-December-2014.pdf>.
1. Schumacher, T. and Thostenson, E. T. (2013). Development of Carbon Nanotube-Based Sensing Layers for Structural Health Monitoring of Concrete Bridges. *The ISHMII Monitor*. International Society for Structural Health Monitoring of Intelligent Infrastructure. Vol. 8(1). June. URL: <http://www.ishmii.org/wp-content/uploads/2013/06/ISHMII-Monitor-June-2013.pdf>.

### Technical Presentations (Graduate Advisee; Undergraduate Advisee)

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### *Invited Presentations and Seminars*

11. Schumacher, T. (2015). Novel Self-Sensing Carbon Nanotube-Based Composites for Holistic Rehabilitation of Highway Bridges. *Plenary Talk*. 4th International Bridge Maintenance and Management Conference. Highway Research Institute, Ministry of Transport of China. Chongqing, China. November 16-17.
10. Schumacher, T. (2015). Novel Distributed Sensing Methodologies for NDT and SHM of Bridges. *Construction Material Seminar*. University of Illinois at Urbana-Champaign, Champaign, IL. March 4.
9. Schumacher, T. (2014). Novel Sensing Methodologies for Non-Destructive Testing and Structural Health Monitoring. *Structural Engineering Seminar*. Portland State University, Portland, OR. October 20.
8. Schumacher, T. (2014). Non-Destructive Testing of Concrete: Opportunities and Challenges. *Dinner Meeting of the Eastern Pennsylvania & Delaware Chapter, American Concrete Institute (EPDACI)*. King of Prussia, PA. March 20.
7. Schumacher, T. (2014). Novel Methodologies for Non-Destructive Testing and Monitoring of Civil Infrastructure. *Structural Engineering Seminar*. Oregon State University, Corvallis, OR. March 17.

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6. Schumacher, T. (2012). Emerging Technologies for Structural Health Monitoring of Critical Civil Infrastructure. *Civil Engineering Graduate Seminar*. Rutgers–The State University of New Jersey, Piscataway, NJ. October 10.
5. Schumacher, T. (2012). Emerging Technologies for Inspection and Monitoring of Critical Civil Infrastructure. *Structural Engineering and Mechanics Seminar*. University of Colorado Boulder, Boulder, CO. July 20.
4. Schumacher, T. (2012). Emerging Technologies for Structural Health Monitoring of Concrete Highway Bridges. *CEE Departmental Seminar*. Princeton University, Princeton, NJ. March 26.
3. Schumacher, T. (2011). Acoustic Emission Monitoring. *Seminar given during a short course on NDE for the infrastructure prior to the conference Review of Progress in Nondestructive Evaluation (QNDE)*. Burlington, VT. July 16-22.
2. Schumacher, T. (2010). Acoustic Emission Monitoring of Civil Engineering Infrastructure. *Research Seminar*. Federal Institute of Technology Zurich (ETHZ), Zurich, Switzerland. July 2.
1. Schumacher, T. (2010). Acoustic Emission Monitoring of Reinforced Concrete Structures. *Research Seminar*. Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland. January 8.

### **Conference Presentations**

21. Schumacher, T. and Harris, D. K. (2016). Monitoring of Concrete Bridges Using Digital Videos and Imagery. *Session entitled Overview and Applications of SHM Technologies for Concrete Structures at the ACI Fall 2016 Convention*. Philadelphia, PA. October 23-27.
20. Schumacher, T. and Shariati, A. (2016). Estimation of Bridge Cable Forces using Virtual Visual Sensors from Digital Videos. *ASNT NDE/NDT for Highways and Bridges: Structural Materials Technology*. Portland, OR. August 29-31.
19. Schumacher, T., Thostenson, E. T., and Dai, H. (2016). Carbon Nanotube-based Composites for Concrete Applications. *ASNT NDE/NDT for Highways and Bridges: Structural Materials Technology*. Portland, OR. August 29-31.
18. Schumacher, T., Thostenson, E. T., and McConnell, J. (2016). Development of Carbon Nanotube (CNT)-Based Sensing Composites for Infrastructure Health Monitoring. *ASCE Geotechnical and Structural Engineering Congress*. Phoenix, AZ. February 14-17.
17. Schumacher, T. and Chen, A. (2014). Estimation of In-Situ Stresses in Concrete Using Polarized Shear Waves. *The Corvallis Workshops – Innovative Characterization Tools to Assess Performance of Cement-Based Materials*. Oregon State University, Corvallis, OR. July 15-18.
16. Schumacher, T. and Chen, A. (2013). Characterization of Damage in Structural Steel Members Using Diffuse Wave Fields. *Review of Progress in Nondestructive Evaluation (QNDE)*. Baltimore, MD. July 21-26.
15. Schumacher, T., Mhamdi, L., and Linzer, L. (2013). Seismology-based Acoustic Emission Techniques for Monitoring of Fracture Processes in Concrete Structures. *Session entitled NDT/AE Applications on Concrete and Concrete Structures at the 8<sup>th</sup> International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-8)*. Toledo, Spain. March 10-14.
14. Schumacher, T. and Mhamdi, L. (2012). Acoustic Emission Monitoring of Concrete Structures: Qualitative vs. Quantitative Methods. *Special session entitled Applications of Acoustic Emission for Reinforced Concrete at the ACI Fall 2012 Convention*. Toronto, Canada. October 21-25.
13. Schumacher, T. and Thostenson, E. T. (2012). Development of Structural Composite Sensing Layers for SHM of Reinforced Concrete Bridges. *NDT/NDE for Highways & Bridges: Structural Materials Technology (SMT)*. New York, NY. July 21-24.



## Thomas Schumacher

12. Schumacher, T., Mhamdi, L., and Linzer, L. (2012). Quantitative Acoustic Emission Monitoring Techniques Applied to Civil Engineering Structures. *Review of Progress in Nondestructive Evaluation (QNDE)*. Denver, CO. July 15-20.
11. Schumacher, T. and Straub, D. (2012). Development of a Probabilistic Acoustic Emission Source Location Algorithm. *54<sup>th</sup> Acoustic Emission Working Group Meeting (AEWG-54)*. Princeton Junction, NJ. May 21-22.
10. Schumacher, T. and Thostenson, E. T. (2011). Structural Health Monitoring of Concrete Structures using a Carbon Nanotube-Based Composite Sensing Layer. *Session entitled Research in Progress at the ACI Fall 2011 Convention*. Cincinnati, OH. October 16-20.
9. Schumacher, T., Higgins, C., and Lovejoy, S. (2011). Acoustic Emission Monitoring of Conventionally Reinforced Concrete Highway Bridges Under Service Conditions. *International Symposium on Nondestructive Testing of Materials and Structures (NDTMS 2011)*. Istanbul, Turkey. May 15-18.
8. Schumacher, T., Higgins, C., Bradner, C., and Cox, D. (2011). Dynamic Response Of A Large-Scale Prestressed Concrete Girder Bridge Subjected To Hurricane Wave Forces. *Special session entitled Bridge Survivability under Extreme Multi Hazard Loading at the ACI Spring 2011 Convention*. Tampa, FL. April 3-7.
7. Schumacher, T., Straub, D., and Higgins, C. (2010). Toward a Fully-Probabilistic Stress Wave Source Location Algorithm: a Bayesian Approach. *ASNT 19<sup>th</sup> Annual Research & Spring Conference*. Williamsburg, VA. March 22-26.
6. Schumacher, T., Higgins, C., Bradner, C., and Cox, D. (2009). Large-Scale Laboratory Wave Flume Experiments on Highway Bridge Superstructures Exposed to Wave Forces. *SEI-ASCE Structures Congress*. Austin, TX. April 30-May 2.
5. Schumacher, T. (2008). Large-Scale Wave Flume Experiments on Highway Bridge Superstructures Exposed to Hurricane Wave Forces. *7<sup>th</sup> fib International PhD Symposium*. Stuttgart, Germany. September 10-13.
4. Schumacher, T., Higgins, C., Bradner, C., Cox, D., and Yim, S. (2008). Large-Scale Wave Flume Experiments on Highway Bridge Superstructures Exposed to Hurricane Wave Forces. *Sixth National Seismic Conference on Bridges and Highways (6NSC)*. Charleston, SC. July 27-30.
3. Schumacher, T., Higgins, C., Bradner, C., and Cox, D. (2008). New Innovative Large-Scale Laboratory Setup for Experiments on Highway Bridge Superstructures Exposed to Wave Forces. *National Concrete Bridge Conference (NCBC)*. St. Louis, MO. May 4-7.
2. Schumacher, T., Higgins, C., Glaser, S., and Grosse, C. (2007). Demand on Flexural Tension Steel Reinforcement Anchorage Zones in Full-Scale Bridge Bent Caps Quantified by Means of Acoustic Emission. *Sixth International Conference on Acoustic Emission (ICAE-6) and 50<sup>th</sup> Meeting of the Acoustic Emission Working Group (AEWG-50)*. Lake Tahoe, NV. October 29-November 2.
1. Schumacher, T., Higgins, C., and Lovejoy, S. (2006). Acoustic Emission Testing for Diagonally-Cracked Conventionally Reinforced Deck Girder Bridges. *49<sup>th</sup> Meeting of the Acoustic Emission Working Group (AEWG-49)*. Berkeley, CA. June 19-21.

### **Other Presentations and Short Talks**

15. Schumacher, T. (2015). The Need for Sustainable Engineering. *Invited talk given as part of the Delaware Environmental Institute (DENIN) speaker series entitled Earth. Equity. Environment*. Newark, DE. May 11.
14. Schumacher, T. (2015). Sustainability and the Built Environment. *Guest lesson given as part of the undergraduate course BUAD667 Sustainability and Green Business*. Newark, DE. April 29.

## Thomas Schumacher

13. Schumacher, T. (2014). Sustainability and the Built Environment. *Guest lesson given as part of the undergraduate course BUAD467 Sustainability and Green Business*. Newark, DE. November 11.
12. Schumacher, T. (2014). Sustainability and the Built Environment. *Guest lesson given as part of the graduate-level course BUAD667 Sustainability and Green Business*. Newark, DE. April 16.
11. Schumacher, T. (2014). Life in Grad School and Academia. *Civil Engineering Graduate Student Recruiting Lunch*. Oregon State University, Corvallis, OR. March 7.
10. Schumacher, T. and Shariati, A. (2014). Video-Based Structural Health Monitoring. *University of Delaware University Transportation Center (UD-UTC) Brown Bag Discussion*. Newark, DE. March 4.
9. Schumacher, T. and Shariati, A. (2014). Video-Based Structural Health Monitoring. *Technical communication during the AFF40(1) committee meeting at the Transportation Research Board (TRB) 93<sup>rd</sup> Annual Meeting*. Washington, D.C. January 12-16.
8. Schumacher, T. (2013). Systems Thinking and Sustainability in the Context of Civil Engineering. *Guest lesson given as part of the graduate-level course BUAD667 Sustainability and Green Business*. Newark, DE. April 22.
7. Schumacher, T. (2012). Department of Civil and Environmental Engineering: Sustainability Initiative; *UD Speaker Presentations during the UD Sustainability Institute 2012*. Newark, DE. November 30.
6. Schumacher, T. (2012). The Bridge Doctor at Work: How to Check the Vitals of a Bridge. *College of Engineering Staff Lunch and Learn Seminar*. University of Delaware, Newark, DE. April 26.
5. Schumacher, T. and Thostenson, E. T. (2012). Structural Health Monitoring of Civil Infrastructure Using Carbon Nanotube-Based Composite Sensing Layers. *Technical communication during the AFF40(1) committee meeting; Transportation Research Board (TRB) 91<sup>th</sup> Annual Meeting*. Washington, D.C. January 22-26.
4. Schumacher, T. (2011). Hurricane Wave Forces on Highway Bridge Superstructures: Large-Scale Experimental Observations and AASHTO Guidelines. *Lecture given as part of the graduate-level course CIEG667 Extreme Events*. University of Delaware, Newark, DE. April 17.
3. Schumacher, T. (2011). Acoustic Emission Monitoring and Ultrasonic Testing of Reinforced Concrete at the University of Delaware. *Technical communication during the AFF40(1) committee meeting. Transportation Research Board (TRB) 90<sup>th</sup> Annual Meeting*. Washington, D.C. January 23-27.
2. Schumacher, T. and Higgins, C. (2009). OSU: The Life-Changing Experience. *OSU Foundation President's Dinner*. Portland Art Museum, Portland, OR. October 16.
1. Schumacher, T., Higgins, C., and Lovejoy, S. (2006). Acoustic Emission-Laboratory Study at Oregon State University. *Research presentation during pre-session of the Kiewit Lecture Series*. Oregon State University, Corvallis, OR. February 15.

### Honors, Grants, and Fellowships

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#### ***Sponsored Research Grants***

18. Development of Structural Carbon Nanotube-Based Sensing Composites for Rehabilitation of Deteriorating and Fatigue-Damaged Steel Bridges. Thomas Schumacher (PI) and Erik T. Thostenson and Jennifer Righman-McConnell (Co-PIs). *Federal Highway Administration-Exploratory Advanced Research (FHWA-EAR) Program*. 09/09/2013-09/08/2018. \$749,972.
17. Carbon Nanotube-Based Sensing Composites: A Novel Distributed Sensing Approach for Structural Health Monitoring. Thomas Schumacher (PI) and Erik T. Thostenson (Co-PI). *National Science Foundation (NSF-CMMI)*. 08/01/2012-07/31/2016. \$300,000.

## Thomas Schumacher

16. Reuse of Structural Steel: Towards maximizing the Greenness of Buildings. Jennifer Righman-McConnell (PI) and Thomas Schumacher (Co-PI) and Erik T. Thostenson (Co-PI). *National Science Foundation (NSF-CBET)*. 09/01/2013-08/31/2017. \$299,330.
15. Seismic Performance Design Criteria for Bridge Bent Plastic Hinge Regions. Peter Dusicka (PI) and Thomas Schumacher (Co-PI). *Oregon Department of Transportation (ODOT)*. 10/01/2016-05/30/2018. \$225,000.
14. Advancing Steel and Concrete Bridge Technology to Improve Infrastructure Performance, Task 10: Bridge Deck Durability Study-A Probabilistic Service-Life Prediction Model (This is a collaborative project led by Lehigh University). Thomas Schumacher (PI) and Harry W. Shenton, Nii O. Attoh-Okine, and Dennis R. Mertz (Co-PIs). *Federal Highway Administration (FHWA)*. 11/15/2013-05/14/2016. \$181,509.
13. Multi-Sensor Sheets Based on Large-Area Electronics for Advanced Structural Health Monitoring of Civil Infrastructure. Branko Glisic (PI, Princeton University), Thomas Schumacher (Co-PI), and Raimondo Betti (Co-PI, Columbia University). *Rutgers Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC)*. 01/01/2013-08/31/2014. \$174,219.
12. Safety and Accessibility of Dynamic Message Signs (DMS). Janice Daniel (PI, New Jersey Institute of Technology), Thomas Schumacher (Co-PI), and Wei Hao (Co-PI, New Jersey Institute of Technology). *New Jersey Department of Transportation (NJDOT)*. 07/01/2013-06/30/2014. \$97,322.
11. Capacity of Reinforced Concrete Moment Frame Culverts. Thomas Schumacher (PI). *Delaware Department of Transportation (DelDOT)*. 09/01/2012-08/31/2014. \$72,984.
10. Rehabilitation of Fatigue-Cracks in Steel Bridges: Evaluation of Fatigue-Cracks in the Field and Laboratory Testing. Thomas Schumacher (PI) and Jennifer Righman-McConnell and Erik T. Thostenson (Co-PIs). *Delaware Department of Transportation (DelDOT)*. 10/25/2013-10/24/2015. \$66,848.
9. Non-Destructive Testing of Deteriorated Concrete Bridge Decks Using Vibration and Stress Wave Methods. Thomas Schumacher (PI) and Dennis R. Mertz (Co-PI). *Delaware Department of Transportation (DelDOT)*. 09/01/2011-08/31/2013. \$62,250.
8. Development of Rapid Assessment Tools for Structural Parts after Extreme Events Using Stress Wave Methods. Thomas Schumacher (PI) and Nii O. Attoh-Okine (Co-PI). *University of Delaware University Transportation Center (UD-UTC)*. 09/01/2011-08/31/2013. \$59,473.
7. Quantitative Acoustic Emission Monitoring of Fatigue Cracks in Fracture Critical Steel Bridges. Thomas Schumacher (PI) and Jennifer Righman-McConnell (Co-PI). *Rutgers Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC)*. 09/01/2012-01/31/2014. \$57,020.
6. Exploration of Video-Based Structural Health Monitoring Techniques. Thomas Schumacher (PI) and Nakul Ramanna (Co-PI). *Rutgers Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC)*. 09/01/2013-08/31/2014. \$50,000.
5. Implementation of Rapid Assessment Tools for Structural Parts after Extreme Events. Thomas Schumacher (PI). *University of Delaware University Transportation Center (UD-UTC)*. 09/01/2012-08/31/2013. \$48,137.
4. Bridge Retrofit or Replacement Decisions: Tools to assess Sustainability and Aid Decision-making. Abigail Clarke-Sather (PI) and Thomas Schumacher (Co-PI). *Rutgers Center for Advanced Infrastructure and Transportation University Transportation Center (CAIT-UTC)*. 01/01/2015-12/31/2015. \$45,139.
3. Structural Health Monitoring of Reinforced Concrete Structures Using Quantitative Acoustic Emission Methods. Thomas Schumacher (PI). *University of Delaware Research Foundation (UDRF)*. 06/01/2011-05/31/2013. \$35,000.

## Thomas Schumacher

2. Tapping into Multiple Intelligences to Develop a Smart Cities Agenda for Portland State University. Thomas Schumacher (PI) and Jeffrey Gerwing (Co-PI). *Portland State University Institute for Sustainable Solutions (ISS)*. 10/01/2016-09/30/2017. \$6,000.
1. Non-Destructive Evaluation of Glue Line Distribution in Wood Composites. Thomas Schumacher (PI). *University of Delaware Research Foundation (UDRF)*. 06/01/2012-08/31/2012. \$3,500.

### ***Sponsored Educational Grants***

Integrating Service-Learning Modules to Help Students Apply Learning about Sustainability in the Minor of Sustainable Infrastructure Classes. Abigail Clarke-Sather (PI) and Thomas Schumacher (Co-PI). *University of Delaware Center for Teaching & Assessment of Learning*. 06/01/2014-05/31/2015. \$9,000.

### ***Un-sponsored Research***

5. Strength of Steel Bolted Connections with Filler Plates. Peter Dusicka (PI) and Thomas Schumacher (Co-PI). Start date: 10/2015.
4. A Prediction Model for Hurricane-Induced Wave Forces on Bridge Superstructures Based on Large-Scale Laboratory Experiments. Thomas Schumacher (PI), Christopher Higgins (Co-PI, Oregon State University), and Daniel Cox (Co-PI, Oregon State University). Start date: 09/2015.
3. Ultrasonic testing of concrete using full waveform comparison techniques. Thomas Schumacher (PI). Start date: 05/2015.
2. Fracture Monitoring in Concrete Using Seismology-Based Quantitative Acoustic Emission Techniques. Thomas Schumacher (PI), Lassaad Mhamdi (Co-PI), and Lindsay Linzer (Co-PI, University of the Witwatersrand). Start date: 09/2014.
1. Detection of Concrete Deterioration Employing Naturally-Occurring Bacterial Communities. Julia Maresca (PI, University of Delaware) and Thomas Schumacher (Co-PI). Start date: 06/2013.

### ***Honors and Awards***

- 2014 Outstanding Reviewer: Journal of Infrastructure Systems, ASCE
- 2014 Nominated for Excellence in Undergraduate Academic Advising and Mentoring Award: The University of Delaware
- 2014 Nominated for Excellence in Teaching Award: The University of Delaware
- 2013 Participant: Center for Sustainable Engineering (CSE) Workshop
- 2013 Nominated for College of Engineering Excellence in Teaching Award: The College of Engineering at the University of Delaware
- 2012 College of Engineering Excellence in Teaching Award: The College of Engineering at the University of Delaware
- 2008 Best Newcomer: Ernst & Sohn, fifth place for lecture given during the 7<sup>th</sup> *fib International PhD Symposium in Civil Engineering*. University of Stuttgart, Germany. September 10-13.
- 2007 Oregon State University Student of the Year: Oregon Transportation and Research Education Consortium (OTREC)
- 2000 Best Graduating Student Award: Bern University of Applied Sciences

# Thomas Schumacher

## *Fellowships*

- 2016 Portland State University Travel Grant, \$3,000
- 2012 ExCEED Assistant Mentor: American Society of Civil Engineers (ASCE), \$1,200
- 2011 ExCEED Teaching Fellow: American Society of Civil Engineers (ASCE), \$2,075
- 2010 Fellowship for Prospective Researchers: Swiss National Science Foundation (SNSF), \$44,000
- 2006 Kiewit Center Graduate Fellowship: Kiewit Center for Infrastructure and Transportation, \$10,000
- 2005 College of Engineering Graduate Fellowship: Oregon State University College of Engineering, \$5,000

## **Other Research and Creative Achievements**

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### *Patents*

Schumacher, T. and Thostenson, E. T. (2014). Integrated Strengthening and Monitoring of Structures Using Structural Carbon Nanotube-Based Sensing Patches. *United States Provisional Patent*. Application 61/941,686. Filing date: February 19. This provisional application was incorporated by reference into non-provisional patent application 14/606,292 on January 27, 2015. Inventor: Erik T. Thostenson.

# Thomas Schumacher

## Teaching, Mentoring and Curricular Achievements

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### *Teaching*

#### ***Portland State University***

<i>Term</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Enrollment</i>	<i>Credits</i>
Winter 2017	CE 325	Structural Analysis II	40 UG	4
	CE 529/629	Structural Dynamics II	9 G	4
Fall 2016	CE 423/523	Structural Dynamics I	16 UG/15 G	4
	CE 510/610 <sup>1</sup>	Sensing and Monitoring in Civil Infrastructure Engineering	4 G	4
Spring 2016	CE 325	Structural Analysis II	39 UG	4
Winter 2016	CE 529/629	Structural Dynamics II	10 G	4
Fall 2015	CE 423/523	Structural Dynamics I	11 UG/16 G	4

#### ***University of Delaware***

<i>Semester</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Enrollment</i>	<i>Credits</i>
Spring 2015	CIEG 604	Prestressed Concrete Design	17 UG/G	3
Fall 2014	CIEG 402	Introduction to Sustainability Principles in Civil Engineering	29 UG	3
Fall 2013	CIEG 402 <sup>1</sup>	Introduction to Sustainability Principles in Civil Engineering	16 UG	3
	CIEG 865 <sup>2</sup>	Structures Seminar	16 G	1
Spring 2013	CIEG 604	Prestressed Concrete Design	7 UG/ 11 G	3
Fall 2012	CIEG 301	Structural Analysis	92 UG/ 10 HUG	4
Spring 2012	CIEG 667 <sup>1</sup>	Non-Destructive Testing for Civil Engineers	21 G	3
	CIEG 865 <sup>2</sup>	Structures Seminar	11 G	1
Fall 2011	CIEG 301	Structural Analysis	105 UG/ 3 HUG	4
Spring 2011	CIEG 604	Prestressed Concrete Design	25 G	3

#### ***Oregon State University***

<i>Term</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Enrollment</i>	<i>Credits</i>
Fall 2009	CE 481/581 <sup>3</sup>	Reinforced Concrete I	88 UG/ 4 G	4
Fall 2008	CE 481/581 <sup>3</sup>	Reinforced Concrete I	73 UG/ 5 G	4

UG = Undergraduate students

HUG = Honors undergraduate students

G = Graduate students

<sup>1</sup> Newly introduced and developed course, not previously taught

<sup>2</sup> Co-taught with M. Chajes, D. Mertz, J. Righman-McConnell, and H. Tripp Shenton

<sup>3</sup> Taught as *Instructor of Record* during PhD studies



# Thomas Schumacher

## Student Course Evaluations

### Portland State University

Course	Term	Ans./ Total <sup>1</sup>		Avg. Subsect. 1	Avg. Subsect. 2	Avg. Subsect. 3	Avg. <sup>2</sup>
CE 325	S 2016	21/39	Myself	1.51	3.76	1.40	1.46
			Dept.	1.93	3.48	1.86	1.90
			Ratio <sup>3</sup>	1.28	0.93	1.33	1.30
CE 529/629	W 2016	6/10	Myself	1.40	4.17	1.39	1.40
			Dept.	1.59	4.07	1.43	1.51
			Ratio <sup>3</sup>	1.14	0.98	1.03	1.08
CE 423/523	F 2015	12/25	Myself	2.18	3.67	2.03	2.11
			Dept.	2.47	3.60	2.48	2.48
			Ratio <sup>3</sup>	1.13	0.98	1.22	1.18

<sup>1</sup> Number of students that answered the course evaluations/total students in the course

<sup>2</sup> Average of the average scores for Subsections 1 and 3, not incl. Subsection 2

<sup>3</sup> Ratio of the PSU CEE faculty's mean score to my score, i.e. numbers greater than 1 mean that I received a better score than the average department faculty member (and vice versa).

Scale: 1 (strongly agree) – 5 (strongly disagree)

#### Subsection 1–Course

- The course material is logical, well organized and presented at an appropriate pace.
- The textbook(s) is appropriate, supports my understanding of the course content and contributes to my learning.
- Projects and assignments contributed to my learning the course material.
- The exams reflected the material presented in lectures, readings and homework.
- The course was excellent, overall.

#### Subsection 2–Difficulty

- Compared to other courses you have taken in Civil and Environmental Engineering, this course is: ...

#### Subsection 3–Instructor

- The course instructor(s) communicates ideas clearly and can be easily understood.
- Supporting materials and technology are used appropriately and enhance my learning experience.
- The instructor(s) is able to stimulate my interest in the course subject.
- I can approach the instructor with questions or problems related to the course.
- Homework and exams are returned in a timely fashion.
- The instructor(s) is effective and engaging in the classroom.

# Thomas Schumacher

## University of Delaware

Course	Sem.	Ans./ Total <sup>1</sup>		QID 1	QID 2	QID 3	QID 4	QID 461	Avg.
CIEG 604	S 2015	16/17	Myself	4.44	4.81	4.25	4.44	4.13	4.41
			College	4.41	4.58	4.04	3.99	3.76	4.16
			Ratio <sup>2</sup>	1.01	1.05	1.05	1.11	1.10	1.06
CIEG 402	F 2014	28/28	Myself	4.56	4.26	3.96	4.00	3.86	4.13
			College	4.48	4.61	4.12	4.01	3.78	4.20
			Ratio <sup>2</sup>	1.02	0.92	0.96	1.00	1.02	0.98
CIEG 402	F 2013	16/16	Myself	4.75	4.31	4.38	4.75	4.69	4.58
			College	4.42	4.54	4.09	4.03	3.71	4.16
			Ratio <sup>2</sup>	1.07	0.95	1.07	1.18	1.26	1.10
CIEG 604	S 2013	16/18	Myself	4.75	4.81	4.56	4.63	4.50	4.65
			College	4.39	4.58	4.08	4.02	3.78	4.17
			Ratio <sup>2</sup>	1.08	1.05	1.12	1.15	1.19	1.12
CIEG 301	F 2012	93/102	Myself	4.31	4.55	3.31	3.77	2.95	3.78
			College	4.36	4.50	4.02	3.90	3.60	4.08
			Ratio <sup>2</sup>	0.99	1.01	0.82	0.97	0.82	0.93
CIEG 667	S 2012	11/21	Myself	4.27	4.27	4.27	4.64	3.79	4.25
			College	4.34	4.53	3.99	3.93	3.67	4.09
			Ratio <sup>2</sup>	0.98	0.94	1.07	1.18	1.03	1.04
CIEG 301	F 2011	88/108	Myself	4.64	4.67	4.00	4.21	3.67	4.24
			College	4.28	4.43	3.93	3.85	3.51	4.00
			Ratio <sup>2</sup>	1.08	1.05	1.02	1.09	1.05	1.06
CIEG 604	S 2011	18/25	Myself	3.33	4.17	3.72	4.39	3.33	3.79
			College	4.38	4.57	4.00	3.91	3.65	4.10
			Ratio <sup>2</sup>	0.76	0.91	0.93	1.12	0.91	0.92

<sup>1</sup> Number of students that answered the course evaluations/total students in the course

<sup>2</sup> Ratio of my score to the UD CoE faculty's mean score, i.e. numbers greater than 1 mean that I received a better score than the average college faculty member (and vice versa).

Scale: 5 (strongly agree) – 1 (strongly disagree)

QID 1–The instructor is well prepared for class.

QID 2–The instructor has a thorough knowledge of the subject.

QID 3–The instructor communicates the subject well.

QID 4–The instructor stimulates interest in the course subject.

QID 461–The instructor is one of my best teachers.

# Thomas Schumacher

## *Individual Student Advising and Mentoring*

- Jeffrey Roberts, PhD Candidate, Civil & Environmental Engineering, Portland State University, 2016-Present
- Alaa Hameed, PhD Candidate, Civil & Environmental Engineering, Portland State University, 2015-Present
- Ali Hafiz, PhD Candidate, Civil & Environmental Engineering, Portland State University, 2015-Present
  - **2016: ASNT Graduate Travel Fellowship to attend 2016 Spring ASNT Research Symposium**
- Shafique Ahmed, PhD Candidate, Civil & Environmental Engineering, University of Delaware, 2013-Present
- Omar Ghonima, PhD Candidate, Civil & Environmental Engineering, University of Delaware, 2013-Present
- Hongbo Dai, PhD Candidate, Civil & Environmental Engineering, University of Delaware, 2012-Present
  - **2016: R. L. McCullough Award for journal paper "A Novel Methodology for Spatial Damage Detection and Imaging Using a Distributed Carbon Nanotube-based Sensor Combined with Electrical Impedance Tomography". University of Delaware Center for Composite Materials, May 6, 2016.**
  - **2015: One of four student plenary speakers during the 5<sup>th</sup> Annual University of Delaware Graduate Research Forum.**
  - **2014: Third place overall for the best paper and presentation at the 10th fib International PhD Symposium in Civil Engineering. University of Laval, Quebec City, Canada. July 21-23.**
  - **2013: One of five best presentations given during AISIM9, invited to present at the 2014 TRB Annual Meeting in Washington, D.C.**
- Ali Shariati, PhD, Civil & Environmental Engineering, University of Delaware, 2013-2016
  - Dissertation: *Video Based Structural Health Monitoring Using Virtual Visual Sensors*. Accepted structural engineering position with Solar Energy World
- Lassaad Mhamdi, PhD, Civil & Environmental Engineering, University of Delaware, 2011-2015
  - Dissertation: *Seismology-based Approaches for the Quantitative Acoustic Emission Monitoring of Concrete Structures*. Accepted post-doctoral research associate position at Portland State University.
- Salih Mahmood, M.S. Student, Civil & Environmental Engineering, Portland State University, 2015-Present
- Arsha Tabrizi, MCE, Civil & Environmental Engineering, University of Delaware, 2014-2016
  - Thesis: *Sustainability Costing to Aid Bridge Management Decision Making: A Case Study on Bridge Deck Expansion Joint Replacements*. Accepted structural engineering position with TY Lin International.
- Tayler C. Wennick, MCE, Civil & Environmental Engineering, University of Delaware, 2013-2016
  - Thesis: *Measuring Strains During Construction of a Steel Building Using a Wireless Sensor Network*. Accepted structural engineering position with Whitman, Requardt & Associates.
- Jordan W. L. Wynn, MCE, Civil & Environmental Engineering, University of Delaware, 2013-2015
  - Thesis: *A Holistic Rehabilitation Strategy for Fatigue-Cracked Steel Bridge Members*. Accepted civil engineering position with the U.S. Army Corps of Engineers.
- Timothy J. Porter, MCE, Civil & Environmental Engineering, University of Delaware, 2012-2015
  - Thesis: *System Capacity of Vintage Reinforced Concrete Moment Frame Culverts*. Accepted bridge engineering position with Whitman, Requardt & Associates.

## Thomas Schumacher

- Mariana X. Cruz, MCE, Civil & Environmental Engineering, University of Delaware, 2011-2013
  - Thesis: *Probabilistic Service Life Prediction Model for Concrete Bridge Decks*. Accepted structural engineering position with Defense Sciences, Inc.
  - **2012: ACI Foundation Graduate Scholarship**
- Andrew H. Chen, MCE, Civil & Environmental Engineering, University of Delaware, 2011-2013
  - Thesis: *Rapid Assessment Tools for Structural Members Using Ultrasonic Stress Wave Techniques*. Accepted structural engineering position with Greenman-Pedersen, Inc.
- Samet Ozturk, MCE, Civil & Environmental Engineering, University of Delaware, 2012-2013
  - Switched into the University of Delaware railroad engineering program. Currently a PhD student at Columbia University.
- Daniel J. Clem, MCE, Civil & Environmental Engineering, University of Delaware, 2011-2013
  - Thesis: *Evaluation of Impulse Response & Ground-Penetrating Radar as a Means of Non-Destructive Testing of Concrete Bridge Decks*. Accepted bridge engineering position with Pennoni Associates, Inc.
- Evan M. Ferguson, BCE, Civil & Environmental Engineering, University of Delaware, 2014-2015
- Jordan P. Deshon, BCE, Civil & Environmental Engineering, University of Delaware, 2013-2015
- Tiera G. Rollins, BCE, Civil & Environmental Engineering, University of Delaware, 2012-2014
  - **2013: NASA Delaware Space Grant Undergraduate Tuition Award**
- Oliver W. Hoy, BCE, Civil & Environmental Engineering, University of Delaware, 2012-2013
- Vincent J. Ciarlo, BCE, Civil & Environmental Engineering, University of Delaware, 2012-2012
- Jean C. Vilalta, BCE, Civil & Environmental Engineering, University of Delaware, 2012-2012
- Kaitlyn N. Gisonda, BCE, Civil & Environmental Engineering, University of Delaware, 2011-2013
- Mary-Kate Sutter, BCE, Civil & Environmental Engineering, University of Delaware, 2011-2012

### ***Member of Graduate Committee***

- Ramiro A. B. Gallardo, PhD, Civil & Environmental Engineering, Portland State University, 2015-Present (Adviser: Dr. Peter Dusicka, PhD, PE)
- Wisam Aules, PhD Student, Civil & Environmental Engineering, Portland State University, 2015-Present (Adviser: Dr. Franz Rad, PhD, SE)
- Stephan Gollob, PhD Candidate, Civil Engineering, Swiss Federal Institute of Technology (ETH) Zurich, 2014-Present (Adviser: Prof. Thomas Vogel)
- Philipp Keller, PhD Candidate, Civil & Environmental Engineering, University of Delaware, 2014-Present (Adviser: Dr. Jennifer Righman-McConnell, PhD)
- Christina Cercone, PhD, Civil & Environmental Engineering, Lehigh University, 2014-2016 (Adviser: Dr. Clay Naito, PhD)
- Offei A. Adarkwa, PhD, Civil & Environmental Engineering, University of Delaware, 2014-2015 (Adviser: Dr. Nii Attoh-Okine, PhD)
- Malgorzata W. Felux, PhD, Civil Engineering, Swiss Federal Institute of Technology (ETH) Zurich, 2012-Present (Adviser: Prof. Thomas Vogel).
- Yasir M. Saeed, M.S., Civil & Environmental Engineering, Portland State University, 2016. (Adviser: Dr. Franz Rad, PhD, SE)
- Zachary R. Melrose, M.S., Mechanical Engineering, University of Delaware, 2013-2014 (Adviser: Dr. Erik T. Thostenson, PhD).

# Thomas Schumacher

## *Undergraduate Advising and Career Mentoring*

- 14 B.S. Students, Civil & Environmental Engineering, Portland State University, 2015–Present
- 35 BCE Students (Class of 2018), Civil & Environmental Engineering, University of Delaware, 2014–2015
- 35 BCE Students (Class of 2014), Civil & Environmental Engineering, University of Delaware, 2010–2014

## *Visiting Scholars*

- Qiang Wang, Professor, CSC Scholar, China Jiliang University, 2016-Present
- Stephan Gollob, PhD Candidate, ETH Zurich, 2016
- Jinjie Men, PhD, Associate Professor, CSC Scholar, 2013-2014
- Mohammad Samrah, B.S. Summer Exchange Student, 2013
- Georg Kocur, PhD, Research Affiliate MIT, 2012
- Jose F. Rave Arango, B.S., Visiting Scholar, 2012

## *New Courses Developed*

- *CE 510/610 Sensing and Monitoring in Civil Infrastructure Engineering* (introduced Fall 2016). The course presents the theory and fundamentals for non-destructive testing and monitoring of civil infrastructure. The following topics are discussed: non-destructive testing vs. structural health monitoring, data acquisition, the measurement process, sensors, sampling, linear systems, digital signal processing and filtering, signal interpretation.
- *CIEG 402 Introduction to Sustainability Principles in Civil Engineering* (introduced Fall 2013). The main objective of this course is to engrain in the students critical thinking and questioning, a key prerequisite to solve the complex real-world global challenges that our society is facing. The reason being that sustainable development requires thinking beyond standard engineering approaches and necessitates holistic social, environmental, and economic considerations. The first part of the course introduces students to the big challenges of society such as depletion of resources, energy production, climate change, and the interaction of technology, society, and the environment. The second part focuses on design and implementation of high-performance buildings using assessment systems such as Green Globes and LEED. This course is required for students in the new Sustainable Civil Infrastructure Minor in Civil and Environmental Engineering, University of Delaware.
- *CIEG 667 Non-Destructive Testing for Civil Engineers* (introduced Spring 2012). The main objective of this graduate-level course is to discuss and apply the most commonly used non-destructive testing (NDT) methods for the assessment of civil infrastructure. The course includes class sessions that discuss theories, physical principles, strengths and limitations, and applications; and hands-on laboratory sessions that employ actual testing with a range of non-destructive tools.

## Community Outreach

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### *STEM Outreach*

- Presentation and hands-on laboratory module for 24 high school students on the topic “Natural Hazards and How Civil Engineers Deal with Them” as part of the Invention Bootcamp held at Portland State University, Portland, OR. July 12, 2016.
- Invited visit to talk about Portland’s bridges in light of the Cascadia Event to 1<sup>st</sup> and 2<sup>nd</sup> grade students at the Class Academy, Portland, OR. March 4, 2016.
- Engineering professional mentor for 9<sup>th</sup> grade STEM students at the MOT Charter School, Middletown, DE. Monthly visits in Fall 2014.

### *Media Outreach*

- ASCE SmartBrief (2016). Researchers Use Nanotechnology to Detect Bridge Failure. November 8. URL: <http://www2.smartbrief.com/servlet/encodeServlet?issueid=3EB5CA1F-9980-4D0B-B5EA-070CA900C030&sid=f86a461f-0493-4014-9029-1382ef0b39c3>.
- DJC Oregon (2016). New Building Technology Being Put to Test. Oregon Daily Journal of Commerce. September 24. URL: <http://djcoregon.com/news/2016/03/25/new-technology-for-the-building-industry-being-put-to-the-test/>.
- PSU (2015). Portland State Expertise Tapped for China's Bridges. December 16. URL: <http://www.pdx.edu/news/portland-state-expertise-tapped-chinas-bridges>.
- UDaily (2014). Steel Yourself - Engineering Research Aimed at Environmentally Sustainable Building Construction. *University of Delaware Office of Communications & Marketing*. June 3. URL: <http://www.udel.edu/udaily/2014/jun/steel-reuse-060314.html>.
- UDaily (2013). Monitoring Concrete - UD Professors Study Microbes as Potential Biomarkers for Damaged Concrete. *University of Delaware Office of Communications & Marketing*. April 25. URL: <http://www.udel.edu/udaily/2013/apr/microbes-concrete-042513.html>.
- DJC Oregon (2012). Innovative ‘Smart Skin’ for Bridges has Oregon Roots. *Oregon Daily Journal of Commerce*. September 24.
- UDaily (2012). Tiny Tubes Tell of Threat - Research Team Investigates Carbon Nanotube Composites for Structural Health Monitoring. *University of Delaware Office of Communications & Marketing*. September 18. URL: <http://www.udel.edu/udaily/2013/sep/nanotubes-infrastructure-091812.html>.

## Scholarly Works in Progress

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### *Book Chapters*

2. Schumacher, T. and Mhamdi, L. Structural Health Monitoring Technologies for Concrete Structures, Section 4.1.1–Acoustic Emission Sensors. *Technical Report*. American Concrete Institute (ACI) Technical Committee 444–Structural Health Monitoring and Instrumentation. Submitted to ACI Committee 444 in Spring 2014. In review.
1. Pour-Ghaz, M. and Schumacher, T. Structural Health Monitoring Technologies for Concrete Structures, Section 4.1.1–Conductive Surface Sensors. *Technical Report*. American Concrete Institute (ACI) Technical Committee 444–Structural Health Monitoring and Instrumentation. Submitted to ACI Committee 444 in Fall 2014. In review.



*Refereed Journal Articles*

Shariati, A. and Schumacher, T. Estimation of Cable Forces in Bridge Cables Using Eulerian Virtual Visual Sensors. Submitted to the *ASCE Journal of Bridge Engineering* on November 30, 2016. In review.

**Professional Development Activities**

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- Federal Highway Administration (FHWA): Exploratory Advanced Research (EAR) Program Joint Workshop: Structural Sensor Systems. *Participant and presenter*. McLean, VA. October 4, 2016.
- Highway Research Institute, Ministry of Transport of China. 4th International Bridge Maintenance and Management Conference. *Plenary speaker and participant*. Chongqing, China. November 16-17, 2015.
- Federal Highway Administration (FHWA): Exploratory Advanced Research (EAR) Program Joint Workshop: Structural Sensor Systems. *Participant and presenter*. McLean, VA. July 14-15, 2015.
- Delaware Valley Green Building Council (DVGBC) and Temple University: Tri-State Sustainability Symposium. *Participant*. Philadelphia, PA. March 6, 2015.
- University of Delaware: Track Maintenance Planning in the Era of Big Data Mini-Conference. *Participant*. Newark, DE. December 9, 2014.
- Oregon State University: The Corvallis Workshops – Innovative Characterization Tools to Assess Performance of Cement-based Materials. *Participant and presenter*. Corvallis, OR. July 15-18, 2014.
- Center for Sustainable Engineering (CSE): Teaching Workshop. *Participant*. Atlanta, GA, June 27-28, 2013
- American Society of Civil Engineers (ASCE): ExCEED Teaching Workshop. *Assistant Mentor*. Fort Myers, FL. June 23-29, 2012.
- Federal Highway Administration (FHWA): NDE Virtual Laboratory Development Workshop. *Participant*. McLean, VA. December 19, 2011.
- Federal Highway Administration (FHWA): Bridge Inspection Non-Destructive Evaluation Showcase. *Participant*. Woodside, DE. November 22, 2011.
- University of Delaware Sustainability Task Force (UDSTF): Mid-Atlantic Regional Institute on Sustainability in Higher Education. *Participant*. Newark, DE. November 4, 2011.
- Quantitative Nondestructive Evaluation (QNDE): Short course on NDE for the infrastructure. *Presenter and Panel Member*. Burlington, VT. July 16-17, 2011.
- American Society of Civil Engineers (ASCE): ExCEED Teaching Workshop. *Teaching Fellow*. Tyler, TX. July 10-15, 2011.
- University of Delaware: Winter Faculty Institute: Impactful Learning. *Participant*. Newark, DE. January 6, 2011.
- American Society of Civil Engineers (ASCE) & California Emergency Management Agency (CalEMA): Safety Assessment Program Evaluator Training. *Participant*. Portland, OR. October 19, 2010.
- United States Green Building Council (USGBC): LEED Core Concepts and Strategies. *Participant*. Corvallis, OR. February 27, 2010.
- American Concrete Institute (ACI) & Portland Cement Association (PCA): ACI 318-08 Building Code Seminar. *Participant*. Portland, OR. October, 9, 2008.
- Oregon Department of Transportation (ODOT) & Federal Highway Administration (FHWA): Load & Resistance Factor Rating of Highway Bridges. *Participant*. Salem, OR. March 22, 2006.

**Governance Activities for the University, College, Department**

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***University Service***

- Faculty Affiliate of the Delaware Environmental Institute (DENIN), University of Delaware, 2014-2015
- External student advisor for various bridge projects for Engineers without Borders (EWB) at UD, 2014-2015
- Co-chair of the University of Delaware Sustainability Task Force (UDSTF) Executive Council, 2013-2015
- Faculty member on the University of Delaware Sustainability Task Force (UDSTF) Executive Council, 2011-2015

***College Service***

- Member of the strategic planning group, since October 2015
- Led Punkin' Chunkin' activity during Hallowe'engineering event organized by the College of Engineering's K-12 Outreach program, October 30, 2013.
- Organize seminars in the area of non-destructive testing and structural health monitoring. Past speakers include: Dr. Christian Grosse, Technical University Munich, Dr. John Popovics, University of Illinois at Urbana-Champaign, Dr. Branko Glisic, Princeton University, and Dr. Christopher Higgins, Oregon State University, 2011-2015.

***Department Service***

- Search committee chair for the 2017 geotechnical faculty position, since October 2016
- Faculty representative on the CEE Advisory Council, since June 2016
- Member of the curriculum committee, since October 2015
- Member of the ad-hoc departmental vision committee, since October 2015
- Member of the graduate admission committee, since 2015
- Faculty mentor during the 9<sup>th</sup> Annual Inter-University Symposium on Infrastructure Management (AISIM). Berkeley, CA, June 6-7, 2013
- Member of the search committee for a new Laboratory Manager, June 2012
- Taught annual FE exam review sessions on structural design, since 2010
- Department representative in the University of Delaware Sustainability Task Force (UDSTF), since 2011
- Co-faculty advisor for the Chi-Epsilon Civil Engineering Honor Society, 2011
- Member of the strategic planning group for education, since April 2011
- Founder and leader of the IMMCI Research Group in 2010
- Undergraduate adviser for the civil engineering class of 2014

Professional Service

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*Technical Committees*

- ACI 342-Evaluation of Concrete Bridges and Bridge Elements, associate member since 2015
- RILEM TC-ISC: In-Situ Strength Assessment of Concrete, senior member since 2012
- ACI 123-Research and Current Developments, voting member from 2010-2015. Responsibilities:
  - Organizer and moderator of two 123 Forums: Spring 2014 (Title: Non-destructive testing of concrete: capabilities and limitations) and Spring 2013 (Title: What is the biggest analytical gap in the analysis of reinforced/prestressed concrete and what are the implications for structural design codes?).
  - Co-moderator of session entitled *Research in Progress* during Spring and Fall Conventions. Spring 2011-Fall 2012.
- ACI 444-Structural Health Monitoring and Instrumentation, voting member since 2010. Responsibilities:
  - Leading development of a technical committee report entitled *Structural Health Monitoring Technologies for Concrete Structures*.
- ACI 228-Nondestructive Testing of Concrete, associate member since 2010
- TRB AFN20-Properties of Concrete, friend since 2011
- TRB AFF40(1)-Nondestructive Evaluation of Structures, friend since 2011

*Guest Technical Editor*

- Special issue in the journal *Sensors* entitled *Novel Sensors and Sensing Methodologies for Non-Destructive Testing and Structural Health Monitoring*. Deadline for submissions: April 30, 2015. URL: [http://www.mdpi.com/journal/sensors/special\\_issues/NSNDTSHM](http://www.mdpi.com/journal/sensors/special_issues/NSNDTSHM). Total technical articles published: 23.

*Conference Committees*

- Member of the scientific committee on structural engineering. *19<sup>th</sup> World Conference on Non Destructive Testing (WCNDT)* in Munich, Germany. June 13-17, 2016.
- Member of the scientific advisory committee and session co-moderator. *31<sup>st</sup> European Conference on Acoustic Emission Testing (EWGAE)*. Dresden, Germany. September 3-5, 2014.

*Expert Panels*

- Panel member on special discussion held as part of the 'Short Course on NDE for the Infrastructure'. *Review of Progress in Nondestructive Evaluation (QNDE)*. Burlington, VT. July 16-22, 2011.
- Panel member on discussion entitled 'Establishing the Integrity of Bridge Structures Using Acoustic Emission'. *Sixth International Conference on Acoustic Emission (ICAE-6) & 50<sup>th</sup> Meeting of the Acoustic Emission Working Group (AEWG-50)*. Lake Tahoe, NV. October 29-November 2, 2007.

*Proposal Reviews*

- CMMI Directorate, Arlington, VA. December 10-11, 2012.

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## *Book Reviews*

- *Reinforced Concrete-Mechanics & Design*, 5<sup>th</sup> edition, Wight & MacGregor, Pearson Education, Inc.

## *Book Chapter Reviews*

- Chapter 6 in *Smart Composites: Mechanics and Design*. CRC Press. Taylor & Francis Group, LLC, 2014.

## *Journal Article Reviews*

- Reviewer for more than 10 technical journals in the area of structural engineering and mechanics, bridge engineering, non-destructive testing, structural health monitoring, data analysis, and probabilistic methods.

## **Memberships in Professional Societies**

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- International Union of Laboratories and Experts in Construction Materials (RILEM), since 2012
- International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII), since 2012
- The Association for the Advancement of Sustainability in Higher Education (AASHE), since 2011
- ASCE Delaware Section; since 2010
- Precast/Prestressed Concrete Institute, since 2010
- Acoustic Emission Working Group (AEWG), since 2007
- American Concrete Institute (ACI), since 2005
- American Society of Civil Engineers (ASCE), since 2005
- American Society for Nondestructive Testing (ASNT), since 2005