

Brock D. Hedegaard, Ph.D., P.E.

University of Wisconsin - Madison
Department of Civil and Environmental Engineering
2318 Engineering Hall
1415 Engineering Drive
Madison, WI 53706-1691

Phone (office): 608-890-3276
Phone (cell): 406-489-1985
Email: hedegaard@wisc.edu

Experience

Assistant Professor 2014-present
University of Wisconsin – Madison, WI
Areas of interest include structural monitoring and simulation of disproportionate collapse. Courses taught in structural analysis and concrete design. Expected courses to be developed in structural monitoring.
Advises 2 PhD students and 5 MS students, and has graduated 5 MS students

Education

Doctor of Philosophy in Civil Engineering June 2014
University of Minnesota
Dissertation: Modeling and Monitoring the Long-Term Behavior of Post-Tensioned Concrete Bridges
Advisors: Catherine French, Carol Shield

Master of Science in Civil Engineering July 2010
University of Minnesota

Bachelor of Science in Civil Engineering May 2008
Montana State University-Bozeman
Minor in Mathematics
University Honors Program Baccalaureate with Distinction

Research Interests

Assistant Professor August 2014
Department of Civil and Environmental Engineering, University of Wisconsin – Madison – present

Substructural Identification for Structural Health Monitoring

Investigate substructural identification strategies for structural health monitoring of in situ structures subject to variable environments. Translate baseline data between similar substructures of dissimilar structural systems for economic deployments.

Simulation of Disproportionate Collapse of Concrete Buildings

Develop design methodology for predicting the safety of concrete buildings against disproportionate collapse following extreme loading events.

Prognostication of Residual Strength using Structural Monitoring

Develop predictive mapping from identified stiffness and residual deformations to residual capacity and remaining energy-dissipation capability for structural components damaged during extreme events.

Graduate Research Assistant

Department of Civil Engineering, University of Minnesota

Jan. 2009 –
June 2014

Monitoring and Data Interpretation of I-35W St. Anthony Falls Bridge

Collected and analyzed data from nearly 500 sensor channels monitoring the time-dependent and temperature-dependent structural behavior of the I-35W St. Anthony Falls Bridge. Performed time-dependent modeling of bridge using rate-type creep models accounting for construction scheduling.

Modeling of Precast Composite Slab Span Bridges

Developed finite element models for investigating inverted-tee precast composite slab span bridges with regards to transverse load distribution, crack control along longitudinal panel joints, and effects of skew angle.

Teaching

Instructor for CE 340 – Structural Analysis I

University of Wisconsin - Madison

Introductory topics for analysis of structures. Class of 55 to 60 undergraduates.

2015-2018

Instructor for CE 547 – Concrete Structures II

University of Wisconsin - Madison

Advanced topics related to reinforced concrete structures. Class of 8 to 18 students, mostly graduate students with some undergraduate students.

2014-2017

ASCE ExCEEEd Teaching Workshop Fellow and Graduate

Florida Gulf Coast University

Selected for fellowship to attend the ASCE ExCEEEd Teaching Workshop, a six-day practicum on developing intellectual excitement and student rapport in teaching.

2016

Journal Publications

1. **Hedegaard, B.D.**, and Wang, S. (2017). "Prediction of Long-Term Basic Creep using Multiscale Modeling," (Submitted to *ACI Materials Journal*, November 2017.)
2. Xiao, H., and **Hedegaard, B.D.** (2017). "Flexural, Compressive Arch, and Catenary Mechanisms in Pseudostatic Progressive Collapse Analysis." *Journal of Performance of Constructed Facilities*, Vol. 32, No. 1, 04017115.
3. Gaebler, K.O., **Hedegaard, B.D.**, Shield, C.K, and Linderman, L.E. (2017). "Signal Selection and Analysis Methodology of Long-Term Vibration Data from the I-35W St. Anthony Falls Bridge." (Submitted to *Structural Control and Health Monitoring*, January 2017.)
4. **Hedegaard, B.D.**, French, C.E.W., and Shield, C.K. (2017). "Long-Term Monitoring Strategy for Time-Dependent Deflections of Posttensioned Concrete Bridges." *Journal of Bridge Engineering*, Vol. 22, No. 11, 04017095.

5. **Hedegaard, B.D.**, French, C.E.W., and Shield, C.K. (2017). "Time-Dependent Monitoring and Modeling of I-35W St. Anthony Falls Bridge. I: Analysis of Monitoring Data." *Journal of Bridge Engineering*, Vol. 22, No. 7, 04017025.
 6. **Hedegaard, B.D.**, French, C.E.W., and Shield, C.K. (2017). "Time-Dependent Monitoring and Modeling of I-35W St. Anthony Falls Bridge. II: Finite Element Modeling." *Journal of Bridge Engineering*, Vol. 22, No. 7, 04017026.
 7. **Hedegaard, B.D.**, French, C.E.W., and Shield, C.K. (2016). "Effects of Cyclic Temperature on the Time-Dependent Behavior of Post-Tensioned Concrete Bridges," *Journal of Structural Engineering*, Vol. 142, No. 10, 04016062.
 8. **Hedegaard, B.D.**, Shield, C.K., and French, C.E.W. (2014). "Smearred-bar model for viscoelastic analysis of uncracked reinforced concrete structures," *Journal of Structural Engineering*, Vol. 141, No. 7, 04014167.
 9. **Hedegaard, B.D.**, French, C.E.W., and Shield, C.K. (2013). "Investigation of thermal gradient effects in the I-35W St. Anthony Falls Bridge," *Journal of Bridge Engineering*, Vol. 18, No. 9, pp. 890-900.
 10. **Hedegaard, B.D.**, French, C.E.W., Shield, C.K., Stolarski, H.K., and Jilk, B.J. (2013). "Instrumentation and modeling of I-35W St. Anthony Falls Bridge," *Journal of Bridge Engineering*, Vol. 18, No. 6, pp. 476-485.
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Technical Reports

1. **Hedegaard, B.D.**, Cramer, S., and Xie, Y. (2016). *Freeze-Thaw Evaluation of Concrete Using Prairie State Energy Class F Fly Ash*. Wisconsin Department of Transportation, Madison, WI.
 2. French, C.E.W., Shield, C.K., and **Hedegaard, B.D.** (2014). "Modeling and Monitoring the Long-Term Behavior of Post-Tensioned Concrete Bridges," *Report MN/RC 2014-39*, Minnesota Dept. of Transportation, St. Paul.
 3. **Hedegaard, B.D.** (2014). *Modeling and Monitoring the Long-Term Behavior of Post-Tensioned Concrete Bridges*. Ph.D. Dissertation.
 4. French, C.E.W., Shield, C.K., Stolarski, H.K., **Hedegaard, B.D.**, and Jilk, B.J. (2012). "Instrumentation, monitoring, and modeling of the I-35W Bridge," *Report MN/RC 2012-24*, Minnesota Dept. of Transportation, St. Paul.
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Conference Proceedings (* presenter)

1. **Hedegaard, B.D.***, and Shotwell, B. (2017). "Substructural identification using inverse dynamics and the Remote Sensing System." *I3ANCRiSST*, Tokyo, Japan.
2. **Hedegaard, B.D.***, French, C.E.W., and Shield, C.K. (2015). "Modeling and Prediction of Time-Dependent Deformations of the I-35W St. Anthony Falls Bridge." *CONCREEP-10*, Vienna, Austria.
3. **Hedegaard, B.D.***, French, C.E.W., and Shield, C.K. (2015). "Time-Dependent Consideration of I-35W St. Anthony Falls Bridge Including Long-Term Monitoring Applications." *6AESE/11ANCRiSST*, Urbana-Champaign, Illinois.
4. French, C.E.W.*, **Hedegaard, B.D.**, Shield, C.K., Stolarski, H.K., and Jilk, B.J. (2010). "I35W collapse, rebuild, and structural health monitoring – challenges associated with structural health monitoring of bridge systems," *37th Annual Review of Progress in Quantitative Nondestructive Evaluation*, San Diego, California.
5. **Hedegaard, B.D.***, French, C.E.W., Shield, C.K., Stolarski, H.K., and Jilk, B.J. (2010). "Instrumentation and monitoring of I35W St. Anthony Falls Bridge," *Concrete Bridge Conference Proceedings: Achieving Safe, Smart & Sustainable*, Phoenix, Arizona.

6. **Hedegaard, B.D.**, French, C.E.W.*, Shield, C.K., Stolarski, H.K., and Jilk, B.J. (2010).
“Instrumentation and monitoring of I35W St. Anthony Falls Bridge,” *3rd fib-PCI Congress Proceedings*, Washington, DC.
 7. French, C.E.W.*, Shield, C.K., Stolarski H.K., **Hedegaard, B.D.**, and Jilk, B.J. (2009).
“Instrumentation and monitoring of I35W St. Anthony Falls Bridge,” *US-Japan Bridge Workshop*, Tsukuba, Japan.
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Grants

1. **Funding Agency:** National Center for Freight Infrastructure Research and Education
Research Title: Staged Concrete Bridge Deck and Overlay Pours Adjacent to Live Traffic
Time Period: October 1, 2015 – September 30, 2017
Funding Amount: \$14,000
Team: Gustavo Parra (PI), **Brock Hedegaard** (Co-PI)
2. **Funding Agency:** Wisconsin Highway Research Program
Research Title: Staged Concrete Bridge Deck and Overlay Pours Adjacent to Live Traffic
Time Period: October 1, 2015 – September 30, 2017
Funding Amount: \$140,000
Team: Gustavo Parra (PI), **Brock Hedegaard** (Co-PI)
3. **Funding Agency:** Wisconsin Alumni Research Foundation
Research Title: Sustainable concrete structures – designing for 100 years of deflection in civil infrastructure using mesoscale models
Time Period: July 1, 2015 – June 30, 2016
Funding Amount: \$36,953
Team: **Brock Hedegaard** (PI)
4. **Funding Agency:** Wisconsin Alumni Research Foundation
Research Title: Substructural damage detection in large civil structures subject to variable environments
Time Period: September 1, 2016 – August 31, 2017
Funding Amount: \$38,823
Team: **Brock Hedegaard** (PI)
5. **Funding Agency:** Wisconsin Department of Transportation
Research Title: Evaluation of Marissa Type F Ash
Time Period: February 5, 2016 – January 31, 2017
Funding Amount: \$51,028
Team: Steve Cramer (PI), **Brock Hedegaard** (Co-PI)
6. **Funding Agency:** Wisconsin Alumni Research Foundation
Research Title: Multiscale neural network material models for simulating collapse of reinforced concrete structures
Time Period: July 1, 2017 – June 30, 2018
Funding Amount: \$39,270
Team: **Brock Hedegaard** (PI)
7. **Funding Agency:** Minnesota Department of Transportation
Research Title: 10-Year Review of Monitoring System of I-35W Saint Anthony Falls Bridge

Time Period: July 1, 2018 – November 30, 2019
Funding Amount: \$7,000 (subcontract only, total contract is \$70,355)
Team: Lauren Linderman (PI), Carol Shield (Co-PI), **Brock Hedegaard** (consultant)

8. **Funding Agency:** LafargeHolcim
Research Title: Evaluation of Elm Road Type F Ash
Time Period: September 1, 2017 – August 31, 2018
Funding Amount: \$58,500
Team: Steve Cramer (PI), **Brock Hedegaard** (Co-PI)

Professional Licensure

Professional Engineer

State of Wisconsin, No. 45279-6

2016-present

Professional Memberships

American Concrete Institute

Secretary of Committee 209: Creep and Shrinkage in Concrete
Voting member of Subcommittee 209D: Numerical Modeling and 3D Analysis
Voting member of Committee 342: Evaluation of Concrete Bridges
Associate member of Committee 435: Deflections
Voting member of Committee 444: Structural Health Monitoring and Instrumentation

American Society of Civil Engineers

Member

AESE/ANCRiSST Scientific Committee

2015

Service and Outreach

Bridge Doctors – Civil Engineering Outreach

Discuss structural health monitoring with elementary schools in south-central Wisconsin, including Brookfield, Columbus, Janesville, Madison, and Verona.

2015-2017

UW-Madison Faculty Senate Alternative

Attend faculty senate meetings and vote on initiatives related to faculty governance.

2014-2016

UW-Madison CEE Structures Faculty Search and Screen Committee

Served on Search and Screen Committee for Structures PVL.

2016

UW-Madison ASCE Student Steel Bridge Competition Advisor

Faculty advisor for UW Chapter of ASCE Student Steel Bridge Competition team.

2016-2017