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Jacob E. Hiller

Academic Background

Ph.D. Civil Engineering, October 2007 Specialty: Transportation Facilities
University of Illinois at Urbana-Champaign *Urbana, Illinois*
Thesis Title: Development of Mechanistic-Empirical Principles for Jointed Plain Concrete
Pavement Fatigue Design
Thesis Advisor: Dr. Jeffery R. Roesler

M.S. Civil Engineering, December 2000 Specialty: Infrastructure
Michigan State University *East Lansing, Michigan*
Thesis Title: Optimizing the Efficiency of Transverse Joints and Cracks in Roller-
Compacted Concrete Pavements
Thesis Advisor: Dr. Neeraj J. Buch

B.S. Civil Engineering, August 1997 With Honors
Michigan State University *East Lansing, Michigan*

Licensing

Engineer-in-Training (Michigan)

Research Interests

Mechanistic-empirical design and rehabilitation of rigid pavements, fatigue of concrete, pavement sustainability, stress relaxation and creep, micro-structural evaluation, environmental impacts of concrete, accelerated pavement testing, and use of fracture mechanics in concrete pavements.

Research Experience

Assistant Professor Michigan Technological University 8/2007 – present

- Efficient Use of Recycled Concrete in Transportation Infrastructure

Sponsor: Michigan Department of Transportation

Characterizing recycled concrete materials for use in new PCC, AC, and base layer pavement applications. Includes characterization of recycled concrete in terms of aggregate properties, solubility of contaminants, stabilization potential, chloride content, ASR potential, freeze-thaw, air void system, effect on HMA and new PCC physical properties.

Research Assistant/Fellow University of Illinois 1/2001 – 8/2007

- Development of Caltrans Rigid Pavement Mechanistic-Empirical Design Guide

Sponsor: University of California-Berkeley/Caltrans/FHWA-NHI

Utilized statistical distributions of pavement input parameters in conjunction with finite element analysis to develop algorithm for fatigue life of rigid

pavement structures in the state of California. Investigated issues with stress range, temperature/moisture curling of concrete slabs, axle spacing, load transfer, fracture-based size effect of slab strength, and limit state design analysis.

- Evaluation and Implementation of Improved CRCP and JPCP Design Methods for Illinois

Sponsor: Illinois Department of Transportation/Illinois-ACPA

Conducting feasibility study into rigid pavement design guide update for the state of Illinois focusing on applicability of load spectra and temperature effects on pavement fatigue, ramp design, and the use of widened concrete lanes.

- Fatigue Resistance of Airport Concrete Pavements

Sponsor: FAA Center of Excellence for Airport Technology

Assisted in construction of numerous concrete slabs for laboratory testing under monotonic and fatigue loading. Also conducted data analysis of results on effects due to various load pulses, size effect, geometric configuration, stress range, and maximum stress effects.

- Accelerated Pavement Testing of Continuously Reinforced Concrete Pavements

Sponsor: Illinois Department of Transportation

Assisted in preparation and placement of multiple configurations of steel reinforcement for 1,000 ft CRCP test section used for accelerated load testing.

Research Assistant University of Minnesota 6/2000 - 12/2000

- Effect of Curling and Warping on Early and Long-Term Performance of JCPs

Sponsor: Federal Highway Administration

Performed data analysis of strains and surface measurements of four PCC test sections across the country to assess early age properties relating to moisture, shrinkage, and cyclical temperature fluctuations after construction.

- Reconstruction of Mn/ROAD Test Cells 32, 52, and 53

Sponsor: Minnesota Department of Transportation

Helped finalize embedded gage positioning as well as facilitate PCC test cell construction. Also assisted in post-construction material testing and around-the-clock profiling of surfaces.

Research Assistant Michigan State University 1/1998 - 6/2000

- Optimizing the Efficiency of Joints and Cracks in RCC Pavements

Sponsor: Portland Cement Association

Utilized existing load transfer data of RCC pavements within North America to assess stress reduction alternatives for extremely long crack spacings and wide crack openings that naturally occur. Conducted finite element analyses of typical sections to produce recommendations on design and rehabilitation alternatives.

- Material-Related Distresses in PCC Pavements in Michigan-Phase II

Sponsor: Michigan Department of Transportation

Initiated follow-up study on Phase I of this collaborative project with Michigan Technological University, which included site selection, FWD testing, core

sampling, and data collection of construction records. Also assisted in initial laboratory analysis of samples through strength testing, rapid chloride permeability, and air void system analysis.

➤ **Material-Related Distresses in PCC Pavements in Michigan-Phase I**

Sponsor: Michigan Department of Transportation

Conducted a feasibility study of the Michigan PCC pavement network in collaboration with Michigan Technological University to assess the severity and extent of distresses such as alkali-silica reaction, durability cracking, sulfate attack, etc. using field evaluation and pavement management system database.

➤ **Factors Affecting Shear Capacity of Transverse Cracks in Jointed Concrete Pavements**

Sponsor: Michigan Department of Transportation

Facilitated FWD testing, coring, and construction record data collection of over 60 test sections during a 3-year project to assess load transfer capabilities of joints and cracks across Michigan. Also conducted large-scale lab testing of load transfer under repeated loading using numerous aggregate types and gradations.

Undergraduate Researcher Michigan State University 4/1996 - 6/1997

➤ **Impact of Processed Cellulose Fibers on PCC Properties**

Sponsor: MSU Composite Materials and Structure Center

Conducted materials tests (including flexural and compressive strength, impact, fracture toughness, and freeze-thaw) to assess impact of cellulose fiber dosage on crack suppression and stabilization characteristics.

➤ **Study of High Early Strength Concrete Mix Designs as a Paving Material**

Sponsor: Michigan Department of Transportation

Conducted strength and material property tests in order to correlate with measured maturity readings for five standard MDOT PCC mix designs used in early traffic opening situations (patches, intersections, etc.).

Teaching Experience

Assistant Professor Michigan Tech University 8/2007 - present

Currently teaching CE 4401 (Pavement Design), which includes the topics of distress identification, subgrade and granular materials, traffic characterization, HMA and PCC pavement analysis and design.

Instructor University of Illinois 1/2007 - 5/2007

Served as lead instructor of CEE 415 (Geometric Design of Roads), which includes the topics of traffic estimates, highway geometrics, location planning, intersection design, structural and drainage design of surface, finance, and maintenance planning.

Teaching Assistant Michigan State University 8/1998 - 5/2000

Performed laboratory experiments with junior and senior level students in CE 312 (Introduction to Soil Mechanics) as well as grading homework, lab reports, and assisting in exam preparation.

Graduate Assistant

University of Notre Dame 8/1997 - 12/1997

Held office hours for junior and senior level students in CE 336 (Structural Mechanics I), dealing with beams, trusses, and frames using a variety of solution methods while also grading papers and exams.

Academic Honors and Awards

Illinois Chapter of American Concrete Pavement Association Graduate Fellowship, 2006

Bengt F. Friberg Award (Best Young Author), August 2005

Bestowed by International Society for Concrete Pavements for paper titled “Large-Scale Airfield Concrete Slab Fatigue Tests” (with J.R. Roesler and P.C. Littleton) at the 8th International Conference on Concrete Pavements in Colorado Springs, CO

B.F. McCullough Award (Best Poster Presentation), August 2005

Bestowed by International Society for Concrete Pavements for poster titled “Development of Innovative Mechanistic Empirical Fatigue Analysis for Jointed Plain Concrete Pavements” at the 8th International Conference on Concrete Pavements in Colorado Springs, CO

Federal Highway Administration Eisenhower Graduate Transportation Fellowship, 2002 - 2005

Awarded \$100,000 fellowship to conduct research on Ph.D. thesis topic as top candidate for year 2002

Portland Cement Association Research Fellowship Grant, 1999 - 2000

Awarded \$20,000 fellowship for research proposal on “Optimizing the Efficiency of Joints and Cracks in Roller-Compacted Concrete Pavements”

MSU Department of Civil and Environmental Engineering Graduate Fellowship, 1998

MSU College of Engineering Undergraduate Scholarship, 1996 – 1997

Consulting Activities

Dynatest Consulting, Inc. (Ventura, CA) and the University of California-Davis (2005)

Technical assistance with development of mechanistic-empirical pavement catalog design

Crawford, Murphy, and Tilly, Inc., Springfield, IL (2001)

Conducted maturity analysis and subsequent training at Capitol Airport, Springfield, IL.

Illinois Department of Transportation, Springfield, IL (2001)

Assisted with investigation of new concrete pavement design for a mining road.

Professional Affiliations and Activities

Secretary for *2nd Workshop on Advanced Characterization, Modeling, and Design of Concrete Pavements*, UC-Berkeley Richmond Field Station, Richmond, California, August 2008

Secretary for *Workshop on Fracture Mechanics for Concrete Pavements: Theory to Practice*, Copper Mountain, Colorado, August 2005

Transportation Research Board, student affiliate (Since 2002)
AFD50 – *Rigid Pavement Design*, young member (2004- 2007)
AFD40 – *Full-Scale and Accelerated Pavement Testing*, friend
AFD70 – *Pavement Rehabilitation*, friend
AFD80 – *Strength and Deformation Characteristics of Pavement Sections*, friend

International Society for Concrete Pavements (ISCP), student member (Since 2001)
Originator and Co-Editor of bi-monthly ISCP E-Newsletter (Since 2004)
Website development and maintenance
Leading initiative for multi-lingual website/newsletter translation

American Concrete Institute (ACI), member (Since 1999)

Chi Epsilon, member (Since 1996)

American Society of Civil Engineers (ASCE), student member (Since 1994)

Reviewer for *Transportation Research Record*, *International Journal of Pavement Engineering*, *Journal of Mechanics of Materials and Structures*, and several conference proceedings

Refereed Journal Publications

Roesler, J.R., Hiller, J.E. and Littleton, P.C., Large-Scale Airfield Concrete Slab Fatigue Tests, *International Journal of Concrete Pavements*, ISCP, Vol. 1, No. 1, Dec. 2005, pp. 66-87. (published among award-winning papers from 8th Int'l Conference on Concrete Pavements)

Hiller, J.E. and Roesler, J.R., Determination of Critical Concrete Pavement Fatigue Damage Locations Using Influence Lines, *Journal of Transportation Engineering*, ASCE, Vol. 131, No. 8, July/August 2005, pp. 599-607.

Hiller, J.E. and Buch, N., Assessment of Retrofit Dowel Benefits in Cracked Portland Cement Concrete Pavements, *Journal of Performance of Constructed Facilities*, ASCE, Vol. 18, No. 1, February 2004, pp. 29-35.

Hiller, J.E. and Roesler, J.R., Transverse Joint Analysis for Use in Mechanistic-Empirical Design of Rigid Pavements, *Transportation Research Record 1809*, TRB, National Research Council, Washington, DC, 2002, pp. 42-51.

Van Dam, T.J., Buch, N., Hanson, K.F., Hiller, J.E., Sutter L.L., and Muethel, R. Michigan's Approach to a State-Wide Investigation of Material-Related Distress (MRD) in Concrete Pavements, *Transportation Research Record 1775*, TRB, National Research Council, Washington, DC, 2001, pp. 1-10.

Buch, N., Frabizzio, M.A., and Hiller, J.E., Impact of Coarse Aggregates on Transverse Crack Performance in Jointed Concrete Pavements, *ACI Materials Journal*, Vol. 97, No. 3, May-June 2000, pp. 325-332.

Buch, N., Rehman, M.O. and Hiller, J.E., Impact of Processed Cellulose Fibers on Portland Cement Concrete Properties, *Transportation Research Record 1668*, TRB, National Research Council, Washington, DC, 1999, pp. 72-80.

Conference Publications

Hiller, J.E. and Roesler, J.R., Location and Timing of Fatigue Cracks on Jointed Plain Concrete Pavements, Abstract accepted for *Proceedings of the Sixth RILEM International Conference Cracking in Pavements*, Chicago, IL, June 2008.

Hiller, J.E. and Roesler, J.R., Alternative Failure Modes for Long-Life Jointed Plain Concrete Pavements, *Proceedings of the International Conference on Long-Life Concrete Pavements*, Chicago, IL, September 2006, pp. 265-284.

Roesler, J.R., Hiller, J.E. and Littleton, P.C., Large-Scale Airfield Concrete Slab Fatigue Tests, *Proceedings of the 8th International Conference on Concrete Pavements, Vol. 3*, Colorado Springs, CO, August 2005, pp. 1247-1268.

Hiller, J.E. and Buch, N., Analysis of Roller-Compacted Concrete (RCC) Pavement Design Methods, *Proceedings of the 7th International Conference on Concrete Pavements, Vol. 2*, Orlando, FL, September 2001, pp. 775-789.

Hiller, J.E. and Buch, N., Investigation of Dowel Bar Retrofitting on PCC Pavement Responses, *Proceedings of the 7th International Conference on Concrete Pavements, Vol. 2*, Orlando, FL, September 2001, pp. 623-637.

Buch, N. and Hiller, J.E., Mechanical Properties of Fiber Reinforced High Strength Concrete, *Proceedings of the Asia-Pacific Specialty Conference on Fibre Reinforced Concrete*, Singapore, August 1997.

Research Reports

Roesler, J.R., Littleton, P.C., Hiller, J.E., and Long, G.E., *Effect of Stress State on Concrete Slab Fatigue Resistance, Final Report*, Federal Aviation Administration, Atlantic City, NJ, October 2004.

Hiller, J.E., *Optimizing the Efficiency of Transverse Joints and Cracks in Roller-Compacted Concrete Pavements*, R&D No. 2421, Portland Cement Association, Skokie, IL, 2001.

Frabizzio, M.A., Hiller, J.E., and Buch, N., *Factors Affecting Shear Capacity of Transverse Cracks in Jointed Concrete Pavements, Final Report*, Research Report RC-1385, Michigan Department of Transportation, Lansing, MI, May 2000.

Hiller, J.E., Buch, N. and Van Dam, T.J., *Material Related Distresses in Michigan's PCC Pavements: Phase I, Final Report*, Research Report RC-1377, Michigan Department of Transportation, Lansing, MI, October 1998.

Conference Presentations

“Alternative Failure Modes for Long-Life Jointed Plain Concrete Pavements”, International Conference on Long-Life Concrete Pavements, Chicago, IL, September 2006.

“Development of Innovative Mechanistic Empirical Fatigue Analysis for Jointed Plain Concrete Pavements”, 8th International Conference on Concrete Pavements – Research In-Progress Poster Session, Colorado Springs, CO, August 2005

“Assessment of Retrofit Dowel Benefits in Cracked PCC Pavements”, 81st Annual Meeting of Transportation Research Board, Washington, DC, January 2002.

“Transverse Joint Analysis for Use in Mechanistic-Empirical Design of Rigid Pavements”, 81st Annual Meeting of Transportation Research Board, Washington, DC, January 2002.

“Investigation of Dowel Bar Retrofitting on PCC Pavement Responses”, 7th International Conference on Concrete Pavements, Orlando, FL, September 2001.

“Analysis of Roller-Compacted Concrete (RCC) Pavement Design Methods”, 7th International Conference on Concrete Pavements, Orlando, FL, September 2001.

“Investigation of Dowel Bar Retrofitting on PCC Pavement Responses”, ACI Spring 2001 Convention, Philadelphia, PA, March 2001.

“Impact of Processed Cellulose Fibers on Portland Cement Concrete Properties”, 78th Annual Meeting of the Transportation Research Board, Washington, DC, January 1999.