

**Biographical Information of Chris T. Hendrickson**

Chris Hendrickson is the Hamerschlag University Professor Emeritus, Faculty Director of the Traffic 21 Institute at Carnegie Mellon University, member of the National Academy of Engineering and Editor-in-Chief of the ASCE Journal of Transportation Engineering.

His research, teaching and consulting are in the general area of engineering planning and management, including design for the environment, system performance, construction project management, finance and computer applications. He has co-authored seven books: 'Life Cycle Assessment: Quantitative Approaches for Decisions That Matter' ([www.lcatextbook.com](http://www.lcatextbook.com)), 'Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach' (Resources for the Future, 2006), 'Civil Systems Planning, Investment and Pricing' (<http://cspbook.ce.cmu.edu/>), 'Project Management for Construction' (Prentice-Hall, 1989, updated on the web at <http://www.ce.cmu.edu/PMBook/>), 'Transportation Investment and Pricing Principles' (John Wiley & Sons, 1984), 'Knowledge Based Process Planning for Construction and Manufacturing' (Academic Press, 1989) and 'Concurrent Computer Integrated Building Design' (Prentice-Hall, 1994). In addition, he has published numerous articles in the professional literature.

His education includes BS and MS degrees from Stanford University, a M.Philosophy degree in economics from Oxford University, and a Ph.D. from the Massachusetts Institute of Technology.

Prof. Hendrickson has been the recipient of the 2009 Faculty Award of the Carnegie Mellon Alumni Association (2009), Turner Lecture Award of the American Society of Civil Engineers (2002), the Fenves Systems Research Award from the Institute of Complex Engineering Systems (2002), AT&T Industrial Ecology Fellowships (2000-2002), a Lucent/NSF Industrial Ecology Fellowship (1998), the ASCE Masters Transportation Engineering Award (1994), the Outstanding Professor of the Year Award of the ASCE Pittsburgh Section (1990), the ASCE Huber Civil Engineering Research Award (1989), the Richard Teare Teaching Award from the Carnegie Institute of Technology (1987) and a Rhodes Scholarship (1973). He is a Fellow of the American Association for the Advancement of Science (2007), a Distinguished Member of the American Society of Civil Engineers (2007), member of the National Academy of Construction (2014), and an Emeritus Member of the Transportation Research Board (2004).

His professional career includes research contributions in computer-aided engineering, transportation systems, construction project management and environmental systems. Central themes in his work are a systems wide perspective and a balance of engineering and management considerations. His doctoral work included the development of a travel distance formula for random stops still in use for home service planning (1978). He pioneered models of dynamic traffic equilibrium, including time-of-day departure demand models. He was an early contributor to the development of probabilistic network

analysis for lifeline planning after seismic events. His work in construction project management emphasized the importance of the owner's viewpoint throughout the project lifecycle. With others at Carnegie Mellon's Engineering Design Research Center, he developed a pioneering, experimental building design system in the early 1990s that spanned initial concept through construction scheduling and animation. Since 1994, he has concentrated on green design, exploring the environmental life cycle consequences of alternative product and process designs. He has contributed software tools and methods for sustainable construction, pollution prevention and environmental management, including life cycle analysis software (<http://www.eiolca.net> ) and a widely cited analysis of the life cycle consequences of lead acid battery powered vehicles.

Dr. Hendrickson has been active in several professional and civic organizations. He has received teaching awards, published extensively on engineering education, and led the very successful undergraduate engineering curriculum reform at Carnegie Mellon in 1989/90.

#### ADDRESS

Department of Civil and Environmental Engineering  
Carnegie Mellon University  
Pittsburgh, PA 15213-3890  
Phone: 412.268.1066; Fax: 412.268.7813  
E-mail: [cth@cmu.edu](mailto:cth@cmu.edu)

#### VITAL STATISTICS

Born: March 31, 1950; Oakland, California  
Married, three children

#### CURRENT AND PAST POSITIONS

2015-present	Hamerschlag University Professor Emeritus, Carnegie Mellon
2014-2015	Hamerschlag University Professor, Carnegie Mellon
2015-present	Faculty Director, Traffic21 Institute, Carnegie Mellon
2012-2014	Duquesne Light Company University Professor, Carnegie Mellon
1996-2012	Duquesne Light Company Professor of Engineering, Carnegie Mellon
1996-2006	Head, Dept of Civil and Environmental Engineering, Carnegie Mellon
1995-2014	Co-Director, Green Design Institute, Carnegie Mellon
1991-1996	Assoc. Dean for Academic Affairs, Engineering (CIT), Carnegie Mellon
1987-1996	Professor, Dept of Civil and Environmental Engineering, Carnegie Mellon
1989-1996	Education Dir., Engineering Design Research Center, Carnegie Mellon
1983-1987	Associate Professor, Dept of Civil Engineering, Carnegie Mellon
1978-1983	Assistant Professor, Department of Civil Engineering, Carnegie Mellon

#### EDUCATION

Ph.D., Civil Engineering; Massachusetts Institute of Technology, 1978

B. Phil. (now renamed Master of Philosophy), Economics; Oxford University, 1975  
MS, Civil Engineering; Stanford University, 1973  
BS, General Engineering (Resources Strategy); Stanford University, 1973

## PROFESSIONAL HONORS

- Elected member National Academy of Construction, 2014.
- Elected member National Academy of Engineering, 2011.
- Faculty Service Award, Carnegie Mellon Alumni Association, 2009.
- Distinguished Member, American Society of Civil Engineers, 2007.
- Fellow, American Association for the Advancement of Science, 2007.
- Member Emeritus, Committee on Applications of Emerging Technology, Transportation Research Board, 2003.
- Turner Lecture Award, American Society of Civil Engineers, 2002.
- Steven Fenves Systems Engineering Research Award, Carnegie Mellon, 2002.
- AT&T Industrial Ecology Fellow – 2000, 2001
- Lucent and National Science Foundation Industrial Ecology Fellow - 1999
- Duquesne Light Company Professor of Engineering, Carnegie Mellon, 1997-
- EPA Regional Administrator's Environmental Excellence Award and the 1995 Texas Environmental News Award for Pollution Prevention Video Training, National Environmental Technology Network - Featured Participant
- Frank M. Masters Transportation Engineering Award, American Society of Civil Engineers, 1994
- Outstanding Paper of the Year, ASCE Journal of Transportation Engineering, 1992
- Outstanding Professor of the Year Award, ASCE Pittsburgh Section, 1990.
- Walter L. Huber Civil Engineering Research Prize, ASCE, 1989
- Benjamin Richard Teare Teaching Award, Carnegie Institute of Technology 1987
- Chi Epsilon 1986
- C.E. Ladd Research Award, Carnegie Institute of Technology 1979
- MIT Austin Fellowship 1976-1977
- Rhodes Scholar 1973-1975
- Phi Beta Kappa 1972
- Tau Beta Pi 1971

## PROFESSIONAL AFFILIATIONS

American Association for the Advancement of Science

American Economic Association

American Society of Civil Engineers

Transportation and Development Institute, Board of Directors, 2006-2010

Editor-in-Chief, Journal of Transportation Engineering, 2007-present

Body of Knowledge Committee of the Task Committee on Academic Prerequisites for Professional Practice, 2003-2004

Chairman, Department Head's Executive Committee, 2000-2002

Member, Department Head's Council, 1998-2002  
 Managing Editor, Journal of Transportation Engineering, 1992-2007  
 Member, Comm. on Social and Environmental Concerns in Construction, 2001-2006  
 Chairman, Urban Transportation Division Executive Committee, 1989-1990  
 Member, Urban Transportation Division Executive Committee, 1988-1991  
 Secretary, Urban Transportation Division Executive Committee, 1985-1988  
 Chairman, Urban Transportation Economics Committee, 1982-1985  
 Faculty Advisor, Carnegie Mellon University ASCE Student Chapter, 1981-1984  
 American Society of Engineering Education  
 Association of Environmental Engineering and Science Professors  
 Construction Industry Institute  
 Member, Advanced Technology Task Force, 1988-1991  
 Member, Technology Task Force, 1986-1988  
 INFORMS, Transportation Science Section Board, 1984-1987  
 International Society for Industrial Ecology  
 National Research Council, National Academies:

- Federal Highway Administration Research and Technology Coordinating Committee 2015-2018
- Committee on Pathways to Urban Sustainability 2015-2017
- Committee on Reinvesting in Inland Waterways: What Policymakers Need to Know, 2013-2015
- Committee to Evaluate Energy-Efficiency and Sustainability Standards Used by the Department of Defense for Military Construction and Repair, 2012-2013
- Comm. on Review of Federal Railroad Administration R, D & D, 2011-2012, 2013-2015
- Comm. on Underground Engineering for Sustainable Development, 2010-2013.
- Comm. on Assessing the Results of External Independent Reviews for US DOE Projects, 2006
- Comm. on Independent Scientific Review of Everglades Restoration Progress, 2005-2010
- Comm. on Review of Management Practices on the Boston Central Artery ('Big Dig') Project, 2004
- Comm. on Estimating Demand for the National Advanced Driving Simulator, 2000.

Transportation Research Part C, Associate Editor, 1993-1996  
 Transportation Research Board, National Research Council  
 Executive Committee, 2012-2018  
 Subcommittee on Planning and Policy Review 2014-2018  
 Group 5 Council, 2000-2004  
 Chairman, Committee A2H01, Applications of Emerging Technology, 1988-1995  
 University Representative, 1982-1988, 1999-2002

## CIVIC AFFILIATIONS

Board of Trustees, St. Edmund's Academy, Pittsburgh, 1998-2004

Rhodes Scholarship Foundation

Secretary, PA State Selection Committee, 1996-2000

Secretary, District Selection Committee, 1996-1997

Member, PA and WV State Selection Committees, 1980-1995 (various)

Member, District IX Selection Committee, 2005, 2008

FIFA Certified Soccer Referee, 1996-2000

## PATENTS AWARDED

#5,448,484 "A Neural Network-based Vehicle Detection System and Method,"  
September 5, 1995 (with Darcy Bullock and Jim Garrett)

## COURSES TAUGHT

Undergraduate:

Introduction to Civil and Environmental Engineering

Analysis, Synthesis and Evaluation

Benefit-Cost Analysis

Computer Aided Tools for Civil Engineers

Engineering Economics

Introduction to Computer Methods in Civil Engineering

Project Management for Construction

Systems Engineering I (Deterministic Models)

Systems Engineering II (Probabilistic Models)

Traffic Flow Theory and Operations

Graduate:

Advanced Project Management

Analysis of Network Based Systems

Civil Systems Investment and Planning

Computer-Aided Engineering Tools

Demand Analysis and Forecasting

Infrastructure Management

Industrial Ecology and Sustainable Engineering

Life Cycle Assessment and Green Design

Management Principles and Practices for Environmental Engineering

Probability and Estimation for Engineering Systems

Risk and Reliability Analysis

Special Topics in Engineering Planning and Management

Special Topics in Transportation Modeling and Simulation

Continuing (courses exceeding two days):

Green Engineering and Management (Tepper Business School Executive

Education Program, CMU)  
Design Project Management and Design for Disposal (Carnegie Bosch Institute)  
Transportation Investment and Pricing (Transportation Research Institute,  
Carnegie Mellon University)  
Construction Project Investment and Management (Engineering Advancement  
Association of Japan)

## ADVISORY AND REVIEW BOARDS

University of California, Irvine, College of Engineering, 2016.  
Northwestern University Transportation Center, 2015.  
University of Texas, Austin, Architectural Engineering, 2015.  
University of Toronto, Civil Engineering, 2012  
MIT Civil and Environmental Engineering Corporation Visiting Committee 2011-2014  
US Army Construction Engineering Research Laboratory, 2009.  
Akron University, Department of Civil Engineering, 2009.  
Cornell University, Department of Civil and Environmental Engineering, 2006  
University of California at Berkeley, Department of Civil and Environmental  
Engineering, 2005  
University of Waterloo, Department of Civil and Environmental Engineering, 2005  
Rensselaer Polytechnic Institute, Civil Engineering, 2002-2004  
Civil Engineering Research Foundation, Strategic Planning Task Force, 2001.  
Stanford University, Department of Civil and Environmental Engineering, Co-Chair,  
2001.  
University of Maryland, Department of Civil Engineering 2000.  
National Science Foundation, Civil and Mechanical Systems, 1999.  
West Virginia University, Department of Civil and Environmental Engineering, 1998-  
2004.  
University of Minnesota, Department of Civil Engineering 1997.

## BOOKS

1. Matthews, H. Scott, Chris Hendrickson and Deanna Matthews, 'Life Cycle Assessment: Quantitative Approaches for Decisions That Matter,' 2014, [www.lcatextbook.com](http://www.lcatextbook.com).
2. Hendrickson, C. and H. Scott Matthews, 'Civil Systems Planning, Investment and Pricing,' 2011, <http://cspbook.ce.cmu.edu/> (this is an updated and revised version of Wohl and Hendrickson 1984.)
3. Hendrickson, Chris T., Lester B. Lave, H. Scott Matthews, Arpad Horvath, Satish Joshi, Francis C. McMichael, Heather MacLean, Gyorgyi Cicas, Deanna Matthews and Joule Bergerson, 'Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach,' Resources for the Future, 2006.
4. Fenves, S., U. Flemming, C. Hendrickson, M. Maher, R. Quadrel, M. Terk, and R. Woodbury, Concurrent Computer-Integrated Building Design, Prentice-Hall, 1993. (Reviewed in ASCE J. of Architectural Engineering, Sept. 1995).

5. Hendrickson, C. and T. Au, Project Management for Construction, Prentice-Hall, New York, 1989. Other Editions and Authorized Translations:
  - a. Hendrickson, C.T., Project Management for Construction, (2<sup>nd</sup> edition), <http://www.ce.cmu.edu/PMBook/>, 2000.
  - b. Chinese Translation: Higher Education Press, 2005.
  - c. Farsi Translation: M.T. Bankie, 1995
  - d. Spanish Translation: Diego Arturo L. de Ortigosa, 1994.
6. Zozaya-Gorostiza, C., C. Hendrickson and D. Rehak, Knowledge Based Process Planning for Construction and Manufacturing, Academic Press, Cambridge, MA, 1989.
7. Wohl, M. and C. Hendrickson, Transportation Investment and Pricing Principles, John Wiley and Sons, New York, 1984.

#### EDITED VOLUMES

1. Crittenden, John, Chris Hendrickson, and Bill Wallace, "Creating Infrastructure for a Sustainable World," Proceedings of the 2014 International Conference on Sustainable Infrastructure, American Society of Civil Engineers, November 2014.
2. Hendrickson, C. and S.G. Ritchie, "Applications of Advanced Technologies in Transportation," ASCE Specialty Conference Proceedings, April, 1998.
3. Hendrickson, C. and K. Sinha, Pacific Rim TransTech Conference Proceedings, Volume I "Advanced Technologies," American Society of Civil Engineers, 1993.
4. Ritchie, S.G. and C. Hendrickson, International Conference on Artificial Intelligence Applications in Transportation Engineering, Conference Preprints, Engineering Foundation, San Buenaventura, CA, June, 1992.
5. Hendrickson, C. and K. Sinha, First International Conference on Applications of Advanced Technologies in Transportation Engineering, ASCE Specialty Conference, San Diego, CA, Feb. 1989.
6. Gadsden, J. and C. Hendrickson, "Special Issue: Planning," International Journal for Artificial Intelligence in Engineering, Vol. 4, No. 2, April 1988.
7. Bers, E. and C. Hendrickson, Managing Urban Transportation as a Business, Proceedings of an ASCE Specialty Conference, Orlando, Florida, 1987.
8. Hendrickson, C. (ed.) "Transportation Systems and Logistics", Transportation Research, Special Issue, Vol. 19B, No. 5, Oct. 1985.
9. Chatterjee, A. and C. Hendrickson (eds.) Innovative Strategies to Improve Urban Transportation Performance, Proc. of an ASCE Specialty Conference, Knoxville, TN, 1984.

#### ARTICLES AND OTHER PUBLISHED MATERIALS

1. Tugce Yuksel, Mili-Ann M Tamayao, Chris Hendrickson, Inês ML Azevedo, Jeremy J Michalek, (2016), Effect of regional grid mix, driving patterns and climate on the comparative carbon footprint of gasoline and plug-in electric vehicles in the United States, Environmental Research Letters, 11(4).

2. Michelle S Tom, Paul S Fischbeck, Chris T Hendrickson, (2015), Energy use, blue water footprint, and greenhouse gas emissions for current food consumption patterns and dietary recommendations in the US, Environmental Systems and Decisions.
3. Committee on Reinvesting in Inland Waterways, (2015), 'Funding and Managing the US Inland Waterways System: What Policymakers Need to Know,' Transportation Research Board Special Report 315.
4. RM Hoesly, HS Matthews, C Hendrickson, (2015) Energy and Emissions from US Population Shifts and Implications for Regional GHG Mitigation Planning, Environmental Science & Technology, 2015
5. MAM Tamayao, JJ Michalek, C Hendrickson (2015) Regional Variability and Uncertainty of Electric Vehicle Life Cycle CO2 Emissions across the United States, Environmental Science & Technology, 2015
6. Peck, Dana, HS Matthews, P Fischbeck, CT Hendrickson 'Failure rates and data driven policies for vehicle safety inspections in Pennsylvania, Transportation Research Part A: Policy and Practice, 2015.
7. Chester, Mikhail V., Josh Sperling, Eleanor Stokes, Braden Allenby, Kara Kockelman, Chris Kennedy, Larry Baker, James Keirstead, and Chris T. Hendrickson. "Positioning Infrastructure and Technologies for Low-carbon Urbanization." *Earth's Future* (2014).
8. DiPietro, Gwen Shepherd, H. Scott Matthews, and Chris T. Hendrickson. "Estimating economic and resilience consequences of potential navigation infrastructure failures: A case study of the Monongahela River." *Transportation Research Part A: Policy and Practice* 69 (2014): 142-164.
9. Mashayekh, Yeganeh, Chris T. Hendrickson, and H. Scott Matthews. "LEED-Certified Residential Brownfield Development as a Travel and Greenhouse Gas Emission Reduction Strategy." *ASCE Journal of Urban Planning and Development* (2014).
10. Jiang, Mohan, Xiaoju Chen, Farshad Rajabipour, and Chris T. Hendrickson. "Comparative Life Cycle Assessment of Conventional, Glass Powder, and Alkali-Activated Slag Concrete and Mortar." *ASCE Journal of Infrastructure Systems* (2014). [http://dx.doi.org/10.1061/\(ASCE\)IS.1943-555X.0000211](http://dx.doi.org/10.1061/(ASCE)IS.1943-555X.0000211)
11. Tom, Michelle, Paul Fischbeck, and Chris Hendrickson. "Excess passenger weight impacts on US transportation systems fuel use (1970–2010)." *Journal of Transport & Health* (2014) DOI: 10.1016/j.jth.2014.05.001
12. Magsino, Sammantha L., Paul H. Gilbert, Samuel T. Ariaratnam, Nancy Rutledge Connery, Gary English, Conrad W. Felice, Youssef Hashash et al. "Underground Engineering for Sustainable Urban Development." In *Geo-Congress 2014 Technical Papers@ sGeo-characterization and Modeling for Sustainability*, pp. 3861-3870. ASCE.
13. Jiang, Mohan, Chris Hendrickson, and Jeanne VanBriesen, (2014) 'Life Cycle Water Consumption and Wastewater Generation Impacts of a Marcellus Shale Gas Well,' Environmental Science & Technology, 48(3), 1911-1920, DOI: 10.1021/es4047654.

14. Traut, Elizabeth, TWC Cherng, Chris Hendrickson and Jeremy Michalek, (2013), 'US Residential Charging Potential for Electric Vehicles,' *Transportation Research Part D: Transportation and the Environment*, 25, 139-145.
15. Hendrickson, Chris, Deborah Lange, Yeganeh Mashayekh, Amy Nagengast and Shengnan Zhang, (2013) 'Estimation of Comparative Life Cycle Costs and Greenhouse Gas Emissions of Residential Brownfield and Greenfield Developments,' in *Proc. of the 2nd Conf. on Green Streets, Highways and Development*, ASCE, pp. 306-326.
16. Mashayekh, Yeganeh and Chris Hendrickson (2013), 'Benefits of Proactive Monitoring of Traffic Signal Timing Performance Measures - Case Study of a Rapidly Developing Network,' in *Proc. of the Second Conf. on Green Streets, Highways and Development*, ASCE, pp. 202-211.
17. Hendrickson, Chris (2013). 'Improving Transportation System Performance: Construction-Zone Capacity Bottleneck Example,' *ASCE J. Transportation Engineering*, 139(11), 1047.
18. Nagengast, Amy, Chris Hendrickson, and H. Scott Matthews. "Variations in photovoltaic performance due to climate and low-slope roof choice." *Energy and Buildings Vol. 64*, pp. 493-502, (September 2013).
19. National Research Council. *Underground Engineering for Sustainable Urban Development*. Washington, DC: The National Academies Press, 2013.
20. National Research Council. *Energy-Efficiency Standards and Green Building Certification Systems Used by the Department of Defense for Military Construction and Major Renovations*. Washington, DC: The National Academies Press, 2013.
21. Traut, E., C. Hendrickson, E. Klampfl, Y. Liu and J. Michalek (2012). "Optimal Design and Allocation of Electrified Vehicles and Dedicated Charging Infrastructure for Minimum Life Cycle Greenhouse Gas Emissions and Cost," *Energy Policy* 51(0), pp. 524–534.
22. Heard, R., C. Hendrickson and FC McMichael, (2012) 'Sustainable Development and Physical Infrastructure Materials,' *MRS Bulletin* 37(04), 389-394.
23. Nealer, R., HS Matthews and C. Hendrickson, (2012), 'Assessing the Energy and Greenhouse Gas Emissions Mitigation Effectiveness of Potential US Modal Freight Policies,' *Transportation Research Part A*, 46(3), 588-601.
24. Mashayekh, Yeganeh, Chris Hendrickson and H. Scott Matthews (2012) *The Role of Brownfield Developments in Reducing Household Vehicle Travel*, *ASCE J. of Urban Planning and Development*, 138(3), 206-214. doi: 10.1061/(ASCE)UP.1943-5444.0000113
25. Hendrickson, Chris, (2012), 'Sustainable Energy Challenges for Civil Engineering Management,' *ASCE J. of Management in Engineering*, 28(1), pp. 2-4, doi.org/10.1061/(ASCE)ME.1943-5479.0000074.
26. Mashayekh, Yeganeh, Paulina Jaramillo, Costa Samaras, Chris Hendrickson, Michael Blackhurst, Heather L. MacLean and H. Scott Matthews, (2012), 'Potentials for Sustainable Transportation in Cities to Alleviate Climate Change Impacts,' *Environmental Science & Technology*, 46(5), 2529-2537, March 6, 2012, **DOI:** 10.1021/es203353q.

27. Coffelt, Don and Chris Hendrickson (2011) 'Case Study of Occupant Costs in Roof Management', ASCE J. of Architectural Engineering doi: 10.1061/(ASCE)AE.1943-5568.0000080.
28. Coffelt, Donald and Chris Hendrickson (2011), 'Carnegie Mellon University Facilities as an Educational Laboratory,' ASCE AEI 2011: Building integrated solutions, Proceedings of the AEI 2011 Conference, doi:10.1061/41168(399)5
29. Nagengast, Amy, Chris Hendrickson, and Deborah Lange (2011), Commuting from U.S. Brownfield and Greenfield Residential Development Neighborhoods, ASCE J. of Urban Planning and Development, 137(3), pp. 298-304.
30. Blackhurst, Michael, H. Scott Matthews, Aurora L. Sharrard, Chris T. Hendrickson, and Ines Lima Azevedo, (2011), 'Preparing US Community Greenhouse Gas Inventories for Climate Action Plans,' Environmental Research Letters, 6(3), p034003.
31. Blackhurst, M., Azevedo, I.L., Matthews, H.S., Hendrickson, C.T. (2011) "Designing building energy efficiency programs for greenhouse gas reductions". *Energy Policy*. 39(9), pp. 5269-5279.
32. Jiang, Mohan, Mike Griffin, Chris Hendrickson, Paulina Jaramillo, Jeanne VanBriesen and Aranya Venkatesh, (2011), 'Lifecycle Greenhouse Gas Emissions of Marcellus Shale Gas,' Environmental Research Letters, 6(3), . doi:10.1088/1748-9326/6/3/034014.
33. Apt, J., Chris T. Hendrickson, M. Granger Morgan, (2011) 'Lester Lave: Visionary Economist,' *Environ. Sci. Technol.*, 2011, 45 (13), pp 5457–5458, DOI: 10.1021/es201635e.
34. Hendrickson, Chris, Sue McNeil, Gang-Len Chang and Anil Agrawal, (2011), 'Conference Papers and Prior Publications,' Journal of Transportation Engineering, Oct. 2011, 137(10).
35. Amekudzi, Adjo and Chris Hendrickson, (2011) 'Special Issue on Transportation, the Environment, and Sustainability,' J. Transportation Eng. 137(6), 371 (2011); doi:10.1061/(ASCE)TE.1943-5436.0000262
36. Cagan, Jonathon, Chris Hendrickson, and Jeremy Michalek, (2011), 'Using Economic Input-Output Life Cycle Assessment to Guide Sustainable Design,' ASME International Design Engineering Technical Conference.
37. Traut, E., C. Hendrickson, E. Klampfl, Y. Liu and J.J. Michalek (2011) "Optimal design and allocation of electrified vehicles and dedicated charging infrastructure for minimum greenhouse gas emissions," *Proceedings of the NAS Transportation Research Board Annual Meeting*, January 23-27, Washington D.C.
38. Bilec, Melissa, Chris T. Hendrickson, Amy Landis and H. Scott Matthews, (2011), 'Updating the Benchmark Sustainable Engineering Education Report – Trends from 2005 to 2010' ASEE Conference Proceedings.
39. Mashayekh, Yeganeh, Paulina Jaramillo, Mikhail Chester, Chris T. Hendrickson and Chris L. Weber, (2011), 'Costs of Automobile Air Emissions in U.S. Metropolitan Areas,' Transportation Research Record, Vol. 2233, pp. 120-127, DOI 10.3141/2233-14.
40. Nealer, Rachael, Christopher L. Weber, Chris Hendrickson and H. Scott Matthews (2011), 'Modal Freight Transport Required for Production of US

- Goods and Services,' *Transportation Research Part E*, 47(4), 474-489, DOI: 10.1016/j.tre.2010.11.015.
41. Shiau, Ching-Shin Norman, Nikhil Kaushal, Chris T. Hendrickson, Scott B. Peterson, Jay F. Whitacre and Jeremy J. Michalek, (2010), 'Optimal Plug-in Hybrid Electric Vehicle Design and Allocation for Minimum Life Cycle Cost, Petroleum Consumption, and Greenhouse Gas Emissions,' *ASME Journal of Mechanical Design*, September 132.
  42. Marriott, Joe, H. Scott Matthews and Chris Hendrickson, (2010), 'Impact of Power Generation Mix on Life Cycle Assessment and Carbon Footprint Greenhouse Gas Results,' *Journal of Industrial Ecology*, 14(6), 919-928.
  43. Committee on Independent Scientific Review of Everglades Restoration Progress, (2010), 'Progress Toward Restoring the Everglades: The Third Biennial Review,' National Research Council, National Academies Press.
  44. Christopher L. Weber, Chris T. Hendrickson, H. Scott Matthews (2010), 'The Economic Input-Output Life Cycle Assessment (EIO-LCA) Model,' Chapter 10 in J. Murray and R. Wood, *Sustainability Practitioners Guide to Input-Output Analysis*, Common Ground Publishing, Urbana, Illinois.
  45. Blackhurst, Michael, Chris Hendrickson, and H. Scott Matthews (2010), 'Cost-Effectiveness of Green Roofs,' *ASCE J. of Architectural Engineering*. [http://dx.doi.org/10.1061/\(ASCE\)AE.1943-5568.0000022](http://dx.doi.org/10.1061/(ASCE)AE.1943-5568.0000022)
  46. Rehr, Amanda; Mitchell Small; H. Scott Matthews; and Chris Hendrickson, (2010), 'Economic Sources and Spatial Distribution of Airborne Chromium Risks in the United States,' *ES&T*, 44 (6), pp 2131–2137.
  47. Davidson, Cliff; Chris Hendrickson; Scott Matthews; Michael Bridges; David Allen; Cynthia Murphy; Brad Allenby; John Crittenden; and Sharon Austin, (2010), 'Preparing Future Engineers for the Challenge of the 21<sup>st</sup> Century: Sustainable Engineering,' *Journal of Cleaner Production*, 18(7), 698-701,
  48. Hendrickson, Chris; Deanna Matthews; Mary Ashe; Paulina Jaramillo and Francis McMichael, (2010), 'Reducing Environmental Burdens of Solid State Lighting Through End-of-Life Design,' *Environmental Research Letters* 5(1) doi: [10.1088/1748-9326/5/1/014016](https://doi.org/10.1088/1748-9326/5/1/014016)
  49. Blackhurst, Michael; Hendrickson, Chris; Sels i Vidal, Jordi, (2010), 'Direct and Indirect Water Withdrawals for US Industrial Sectors,' *ES&T*, 44 (6), pp 2126–2130.
  50. Coffelt, Donald P. and Chris T Hendrickson, (2010), 'Life Cycle Costs of Commercial Roof Systems,' *Journal of Architectural Engineering*, 16(1), 29-36, March..
  51. Coffelt, Donald P; Chris T Hendrickson; Sean T Healey, 2010, 'Inspection, Condition Assessment and Management Decisions for Commercial Roof Systems,' *ASCE J. of Architectural Engineering*, 16(3), 94-99.
  52. Shiau, Ching-Shin Norman, Jeremy J. Michalek, and Chris T. Hendrickson (2009), 'A Structural Analysis of Vehicle Design Responses to Corporate Average Fuel Economy Policy,' *Transportation Research Part A*.
  53. Ping Chen, Corinne Scown, H. Scott Matthews, James H. Garrett, Jr., and Chris Hendrickson, (2009), 'Managing Critical Infrastructure Interdependence through Economic Input-Output Methods,' *ASCE J. Infrastructure Systems*, 15(3), pp.

200-210

54. Wakeley, H., C. Hendrickson, M. Griffin, H.S. Matthews, (2009), 'Economic and Environmental Transportation Effects of Large-Scale Ethanol Production and Distribution in the United States,' ES&T 43(7), 2228-2223, DOI: [10.1021/es8015827](https://doi.org/10.1021/es8015827)
55. Committee on Independent Scientific Review of Everglades Restoration Progress, 'Progress Toward Restoring the Everglades: The Second Biennial Review,' National Research Council, National Academies Press, 2008.
56. Hendrickson, Chris, (2008), 'Petroleum Prices and Transportation Engineering,' ASCE Journal of Transportation Engineering, 134(9), 359-360.
57. Wakeley, Heather, Michael Griffin, Chris T. Hendrickson and H. Scott Matthews, (2008), 'Alternative Transportation Fuels: Distribution Infrastructure for Hydrogen and Ethanol in Iowa,' ASCE J. of Infra. Systems, 14(3); 262-271.
58. Matthews, H. Scott, Christopher Weber and Chris T. Hendrickson, (2008), 'The Importance of Carbon Footprint Estimation Boundaries,' ES&T 42(16), 5839-5842.
59. Cicas, Gyorgyi, Hendrickson, Chris T. and H. Scott Matthews, (2008), 'The Economic and Environmental Consequences of Reduced Air Transport Series in Pennsylvania: A Regional Input-Output Life Cycle Assessment Case Study', The Dynamics of Regions and Networks in Industrial Ecosystems, 2008.
60. Hendrickson, Chris T. (2007), 'Sustainable Impact Matrices for Infrastructure and Construction,' Proceedings of the ASCE Construction Research Congress.
61. Cicas Gyorgyi; Hendrickson Chris T.; Horvath Arpad; Matthews H. Scott, 'A Regional Version of a US Economic Input-Output Life-Cycle Assessment Model,' Int. J. Life Cycle Assessment, '12(6), 367-374, (2007).
62. Cliff Davidson, Cynthia Murphy, Sharon Austin, Chris Hendrickson, H. Scott Matthews, Eric Williams, M. Bridges, Braden Allenby, John Crittenden, Yongsheng Chen, David Allen. (2007) Adding Sustainability to the Engineer's Toolbox: A Challenge for Engineering Educators. Environmental Science & Technology, 41 (14), pp 4847-4849 DOI: 10.1021/es072578f
63. Committee on Independent Scientific Review of Everglades Restoration Progress, 'Progress Toward Restoring the Everglades: The First Biennial Review,' National Research Council, National Academies Press, 2007.
64. Christini, Gwen, Montgomery Watson Harza, Deanna H. Matthews, and Chris Hendrickson, 'A Comparison of Environmental Management Systems Components and Practices,' in *Strategic Sustainability: The State of the Art in Corporate Environmental Management Systems*, Greenleaf Publishing, Sheffield, UK, 2007.
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200. Hendrickson, C., D. Martinelli, and D. Rehak, "Hierarchical Rule-Based Activity Duration Estimation," ASCE Journal of Construction Engineering and Management, 113(2), pp. 288-301, June 1987.
201. Hendrickson, C., C. Zozaya-Gorostiza and S. McNeil, "Network Representation of Performance Analysis for Intersections," Transportation Research Record # 1283, pp. 176-188, Dec, 1990.
202. Hendrickson, C. "National Science Foundation Support for Civil Engineering Research," ASCE Journal of Professional Issues in Engineering, 113(2), pp. 130-138, April, 1987.
203. McNeil, S., C. Hendrickson and T. Rossi, "Impact Fee Assessment Using Highway Cost Allocation Methods," Transportation Research Record #1107, p. 73-80, 1988.
204. Skibniewski, M. and C. Hendrickson, "Economic Analysis of a Robotic Construction Sandblasting Process," Proc. TenthCIB Congress, International Council for Building Research, Studies and Documentation, Washington, D.C., 1986.
205. Hendrickson, C., A. Pasquale, W. Robinson and M. Rossi-Velasco, "Some Applications of Computer Aided Instruction," ASCE Journal of Engineering Issues, 112(2), June 1986.
206. Skibniewski, M., P. Derrington and C. Hendrickson, "Cost and Design Impacts of Robotic Construction Finishing Work," Proc. Intl. Joint Conf. on CAD and Robotics in Architecture and Construction, CRIRAM, Marseilles, France, June 1986.

207. Au, T. and C. Hendrickson, "Profit Measures for Construction Projects," ASCE Journal of Construction Engineering and Management, 112(2), 273-286, June, 1986.
208. Zozayza-Gorostiza, C. and C. Hendrickson, "An Expert System for Traffic Signal Setting Assistance," ASCE Journal of Transportation Engineering, 113(2), pg. 108-126, March, 1987.
209. Au, T., C. Hendrickson and A. Pasquale, "Introduction of Relational Databases within a Cost Estimating System," Transportation Research Record 1050, pp. 57-62, 1986.
210. Janson, B.N., S.P.T. Thint and C.T. Hendrickson, "Validation and Use of Equilibrium Network Assignment for Urban Highway Reconstruction Planning," Transportation Research A, 20A, February, 1986.
211. Ciarico, A., T. Adams and C. Hendrickson, "A Cost Estimating Module to Aid Integrated, Knowledge-Based Design," Proc. of the Sixth Conference on Computing in Civil Engineering, ASCE, Atlanta, GA, 1989.
212. Hendrickson, C. "A Note on Trends in Transit Commuting in the United States Relating to Employment in the Central Business District," Transportation Research A, 20A, 33-37, February 1986.
213. Hendrickson, C., B. Janson and M. Rossi-Velasco, "Applications and Potential of Microcomputer-Aided Instruction," Microcomputer Applications within the Urban Transportation Environment, ASCE, pp. 116-125, 1985.
214. Hendrickson, C., "Research in Transportation System Characteristics and Operations," Transportation Research, Vol. 19A(5/6), pp. 367-369, 1985.
215. Skibniewski, M.J. and C. Hendrickson, "Evaluation Method for Robotics Implementation: Application to Concrete Form Cleaning," Proc. Second Conference on Robotics in Construction, Carnegie-Mellon University, Pittsburgh, PA., 1985.
216. McGartland, M. and C. Hendrickson, "Expert Systems for Construction Project Monitoring," Journal of Construction Engineering and Management, ASCE, (111)3, 293-307, September 1985.
217. Hendrickson, C. and T. Au, "Private versus Public Ownership of Constructed Facilities," ASCE Journal of Engineering Management, (1)3, 119-131, July, 1985.
218. Au, T. and C. Hendrickson, "Education in Engineering Planning and Management," Proceedings of the ASCE Conference on Civil Engineering Education), Columbus, Ohio, 1985.
219. Hendrickson, C. and S. McNeil, "Estimation of Origin/Destination Matrices with Constrained Regression," Transportation Research Record 976, pp.25-32, 1985.
220. Hendrickson, C. and F. McMichael, "Controlling Contradictions Among Regulations: Comment," American Economic Review 75(4), pp. 876-877, Sept. 1985
221. Hendrickson, C. and S. McNeil, "A Note on Alternative Matrix Estimation Techniques," Transportation Research B, 19B(6), pp. 509-519, December, 1985.
222. McNeil, S. and C. Hendrickson, "A Regression Formulation of the Matrix Estimation Problem," Transportation Science, 19(3), pp. 278-292, Aug. 1985.

223. Rehak, D.E., Keriouz, W.T., Cendes, Z. and Hendrickson, C.T., "Evaluation of Alternative Finite Element System Architectures," *Computers and Structures*, 20(1-3), pp. 17-30, 1985.
224. Carey, M. and C. Hendrickson, "Bounds on Network Flow with Links Subject to Failure" *Networks* (14), pp. 439-456, 1984.
225. Hendrickson, C. and E. Plank, "The Flexibility of Departure Times for Work Trips," *Transportation Research* 18A(1), 25-36, 1984.
226. Hendrickson, C. and S. McNeil, "Matrix Entry Estimation Errors," *Proceedings of the Ninth International Symposium on Transportation and Traffic Flow*, Delft, The Netherlands: VNU Press, 1984.
227. Au, T. and C. Hendrickson, "Measuring the Overall Return of a Construction Project," *Proceedings of the Fourth International Symposium on the Organization and Management of Construction*, Waterloo, Ontario, Canada, 1984.
228. Hendrickson, C. and S. McNeil, "An Illustration of Allocated Costs for Turnpike Toll Design," *Transportation Quarterly*, 38, pp. 575-592, October 1984.
229. Hendrickson, C.T. and B.N. Janson, "A Common Network Flow Formulation to Several Civil Engineering Problems" *Civil Engineering Systems* 1(4), pp. 195-203, 1984.
230. Kocur, G. and C. Hendrickson, "A Model to Assess Cost and Fuel Savings from Ridesharing," *Transportation Research B*, 17B(4), pp. 305-318, 1983.
231. Hendrickson, C. and A. Kane, "Cost Allocation by Uniform Traffic Removal," *Transportation Research B*, 17B(4), pp. 265-274, 1983.
232. Hendrickson, C., "Financing Civil Works with User Fees," *Civil Engineering*, 53(2), February 1983.
233. Hendrickson, C., "Construction Project Management", *CIT Engineering News*, Carnegie-Mellon University, 1982.
234. DiPasquale, D. and C. Hendrickson, "Options for Financing a Regional Transit Authority," *Transportation Research Record #858*, 1982, pp. 29-35.
235. Hendrickson, C. and M. Wohl, "Efficient Prices for Roadways and Transit Service," *Transportation Quarterly*, July 1982.
236. Hendrickson, C., T. Dubyak, R. Carrier and R. Anderson, "Traveler Responses to Reconstruction of the Parkway East (I-376) in Pittsburgh, PA," *Transportation Research Record* 890, 1982 pp. 33-39.
237. McNeil, S. and C. Hendrickson, "A Statistical Model of Pavement Maintenance Expenditure," *Transportation Research Record #846*, 1982, pp. 71-76.
238. Kocur, G. and C. Hendrickson, "Design of Local Bus Service with Demand Equilibration," *Transportation Science* Vol. 16, No. 2, June 1982.
239. Pucher, J., C. Hendrickson and S. McNeil, "Socio-Economic Characteristics of Transit Riders: Some Recent Evidence," *Traffic Quarterly* 35(3), July 1981, 461-483.
240. Hendrickson, C., D. Nagin and E. Plank, "Characteristics of Travel Time and Dynamic User Equilibrium for Travel to Work," *Proceedings of the Eighth International Conference on Transportation and Traffic Theory*, Toronto: Univ. of Toronto Press, pp. 321-347, 1981.

241. Hendrickson, C., "Travel Time and Volume Relationships in Scheduled, Fixed-Route Public Transportation," *Transportation Research*, Vol. 15A, No. 2, pp. 173-182, March 1981.
242. Hendrickson, C. and G. Kocur, "Schedule Delay and Departure Time Decisions in a Deterministic Model," *Transportation Science*, Vol. 15, No. 1, pp. 62-77, February 1981.
243. Carey, M., C. Hendrickson and K. Siddharthan, "A Method for Estimation of Origin/Destination Trip Matrices," *Transportation Science*, Vol. 15, No. 1, pp. 32-49, February 1981.
244. Wohl, M. and C. Hendrickson, "Attribution of Roadway Costs to Vehicle Classes," *Proceedings of the Transportation Research Forum*, Vol. 21, October 1980, pp 223-229.
245. Hendrickson, C., I. Oppenheim and D. Kufert, "Water System Network Analysis Under Seismic Hazard," *Pressure Vessels and Piping Technology Conference*, San Francisco, CA, ASME Paper No. 80-C2/PVP-62, August 1980.
246. Hendrickson, C., I.J. Oppenheim and K. Siddharthan, "User Losses in Earthquake Damaged Roadway Networks," *Journal of the Technical Councils of ASCE*, Vol. 106, No. TC1, pp. 117-128, August 1980.
247. Wilson, N.M.H. and C. Hendrickson, "Performance Models of Flexibly Routed Transportation Services," *Transportation Research*, 14B (1/2), pp. 67-78, March/June, 1980.
248. Hendrickson, C. and J. Pucher, "Distribution of Costs: Who Pays the Public Costs of Urban Transportation?" *Proceedings of the ASCE Urban Transportation Financing Specialty Conference*, Bucknell University, pp. 81-99, 1979.
249. Hendrickson, C., "An Evaluation of Automated Dispatching for Flexibly Routed Paratransit Services," *Transportation Research Board Special Report #186*, pp. 56-62, 1979.
250. Hendrickson, C., "Review of 'Review and Compilation of Demand Forecasting Experiences: An Aggregation of Estimation Procedures,'" *Transportation Research* 12(432-434), 1978.
251. Daganzo, C.F., C. Hendrickson and N.M.H. Wilson, "An Approximate, Analytic Model of Many-to-One Demand Responsive Transportation Systems," *Proceedings of the Seventh International Conference on Transportation and Traffic Theory*, Kyoto, Japan, 1977.

#### SELECTED FUNDED RESEARCH PROJECTS

1. 'Alternative Fuels for Port Authority Buses,' Mellon Foundation, 2015-2016, \$ 100K.
2. 'Traffic21 Institute Support' Hillman Foundation, 2014-2018, \$ 2.5M
3. 'Assessment of Liquid Fuels from National Gas,' Fuel Freedom Foundation, 2014-2015.
4. 'Connected and Autonomous Vehicles Vision 2040,' PADOT, 2013-2014.
5. 'Technologies for Safe and Efficient Transportation,' (Faculty Associate), USDOT 2012-2014.

6. 'Congestion Management to Promote Environmental Sustainability,' (with P. Jaramillo), NSF 2010-2012.
7. 'Engineering and Life Cycle Assessment of Activated Recycled Glass-Based Concretes,' (with C. Weber), NSF 2010-2012.
8. 'Life Cycle and Carbon Footprinting Assessment for Brownfield Development.' US EPA 2008-2011.
9. 'Life Cycle Assessment of Solid State Lighting,' (Faculty Associate), US DOE 2009.
10. MUSES: Material Resources and Environmental Impacts for Transportation Fuels Infrastructure (with M. Griffin, L. Lave, S. Matthews, and J. Michalek), NSF 2006, \$ 1,500,000.
11. Workshop on Frontier Research Directions and International Collaborations in Sustainability Engineering, NSF, 2007, \$ 68,200.
12. Models of Energy Futures and NETL's Local/Regional Economic and Environmental Impact, (with D. Lange), NETL DOE, \$ 102,000.
13. MUSES: Tacking Heavy Metal Life Cycle Pathways with Input-Output Methods (with L. Lave, S. Matthews and M. Small), NSF, 2003, \$ 1,200,000.
14. Assessment Tool and Visualization for Regional Supply Chain Impacts (with S. Matthews), NSF/EPA, 2003, \$ 375,000.
15. Automated Archiving and Retrieval of Construction Site Photographs (with B. Akinci), PITA, \$ 37,308.
16. Analyzing Critical Infrastructure Dependencies: Security and Survivability Effects in the Service Sector (with J. Garrett), NSF, \$ 149,000.
17. "Exploiting Motor Vehicle Information for Social Benefit," NSF/DOT (with B. Akinci), 2002, \$ 100,000.
18. "Environmental Management Systems: Informing Organizational Decisions," EPA (with L. Lave), 2001-2003, \$ 350,000.
19. "Computer-Aided Hybrid Models for Environmental and Economic Life Cycle Assessment," EPA, (with A. Horvath and S. Matthews), 2001-2003, \$ 305,000.
20. "Life Cycle Product Information Systems for Scalable and Sustainable Enterprises," NSF, 2001, \$ 100,000.
21. "The Net Effect: Environmental Implications of E-Commerce," AT&T Foundation, 1999-2001, \$ 75,000.
22. "Life Cycle Assessment in the Service Industries," Lucent and National Science Foundation Industrial Ecology Fellowship (Co-PI with Arpad Horvath and Lester Lave), 1998-2000, \$ 100,000.
23. "Economic Input-Output for Life Cycle Assessment," Environmental Protection Agency and National Science Foundation Environmental Technology Program, 1998-99, \$ 290,000.
24. "Motivating Environmentally Conscious Products and Processes: The Role of Social Pricing and Full Cost Accounting," National Science Foundation, 1996-1999, Co-Principal Investigator with Noellete Conway-Schempf and Lester Lave. \$ 475,000.
25. "Environmental Life Cycle Analysis of Construction Materials," National Science Foundation, 1997-1999, Principal Investigator, \$ 250,000.

26. "Curriculum and Educational Materials for Environmentally Conscious, Green Products and Processes," National Science Foundation, \$ 250,000, 1997-2000.
27. "Life Cycle Assessment using Economic Input-Output Models," Department of Energy, 1996-1998, Co-Principal Investigator with Noelle Conroy-Schempf and Lester Lave. \$ 250,000.
28. "Informing the Product Designer About the Environmental Implications of Design Choices," National Science Foundation, 1993-96, Co-Principal Investigator with Linda Argote, Lester Lave and Francis McMichael.
29. "Evaluation of Owner-Contractor Organization Integration for Site Remediation Projects," Construction Industry Institute, 1993-94, Co-Principal Investigator with Dave Dzombak.
30. "Development of Software Standards for Advanced Transportation Control Systems," California Department of Transportation (with U. California at Irvine), 1991-1993.
31. "Investigation of an Automated Pavement Crack Filler," Strategic Highway Research Program, National Academy of Sciences, 1989-1991, Co-Principal Investigator with Sue McNeil.
32. "Design of Computer-Based Facilities Management System," Duquesne Light, 1989-1990, Co-Principal Investigator with Sue McNeil.
33. "Economic Optimization Module for Concrete Placement," Western Pennsylvania Advanced Technology Center and Digital Site Systems, 1987-1989.
34. "Prototype Integrated Design Environment," Carnegie-Mellon Engineering Design Research Center, 1986-1991, Co-Principal Investigator with S. Fenves and M. Maher.
35. "Research in Cognitive Excavation Automation," National Science Foundation, 1986-1988, Faculty Associate.
36. "Knowledge Based Expert Systems for Retaining Wall Rehabilitation Design and Cost Estimation," National Science Foundation, 1986-1988, Principal Investigator.
37. "Innovative Financial Strategies During Facility Construction," Urban Mass Transportation Administration, 1985-1986, Co-Principal Investigator with Tung Au.
38. "Knowledge Based Expert Systems Aids for Construction Project Planning," National Science Foundation, 1985-1987, Co-Principal Investigator with Daniel R. Rehak.
39. "Instructional Software for Construction Project Planning and Management," Mellon-Stuart Company, Inc., 1984-85, Principal Investigator.
40. "Investigation of an Optimization Method to Estimate, Update or Expand Matrices," National Science Foundation, 1982-84, Principal Investigator.
41. "User Response to Time of Day Variations in Transit Service Level and Reliability," Urban Mass Transportation Administration, 1980-81; Co-Principal Investigator with Daniel Nagin (1980-81); Principal Investigator (1981-82).
42. "Study of Alternative Transportation Strategies for the Parkway East (I-376-1(37)5) Reconstruction", Pennsylvania Department of Transportation (under sub-contract to GAI Consultants, Inc.), 1981-82, Principal Investigator.

43. "Equity in Transit Financing," Urban Mass Transportation Administration (under sub-contract to Rutgers University), 1980-81, Co-Principal Investigator with J. Pucher (Rutgers University).

#### EXAMPLE CONSULTING ASSIGNMENTS

- Pre Consultants, Life Cycle Assessment Review, 2012.
- Construction Industry Institute, 'Stochastic Scheduling,' 2010-2012.
- External Panel Review, Upper Ohio Navigation Study, US Army Corps of Engineers, 2007-2008.
- Program Assessments, SEI and NSF, 1996-2002.
- Construction Productivity Analysis, Michael Baker Corporation, 1996.
- Statistical Analysis of Task Productivity Differences, Statistical and Total Project Quality Control (Pittsburgh Corning Corporation, 1986-1989).
- Investment Financing Alternatives for the Pittsburgh Airport Expressway (GAI Consultants for Pennsylvania Department of Transportation, 1985).
- Investigation of Port Authority of Allegheny County Operating Efficiency (Pennsylvania House of Representatives, 1985).
- Cost Allocation for Rail Rate Setting (Connecticut Department of Transportation, 1984).
- Public Transportation Database and Decision Making Support (NOVA Consulting, 1982).
- Economic Impact of Rail Short Line Abandonment (CONSAD for US Rail Administration, 1981).

#### GRADUATE STUDENT THESIS SUPERVISION

##### Doctoral Students

1. Peck, Dana, 'Data-Driven Analyses and Implications in the Transportation World: A focus on Pennsylvania,' (2015) (co-advised with Scott Matthews and Paul Fischbeck).
2. Markolf, Samuel, 'Climate Change Decision Making at the Metropolitan Level: Current Estimates and Future Drivers of Greenhouse Gas Emissions in US Metropolitan Areas,' (2015) (co-advised with Ines Azevedo and Scott Matthews).
3. Tom, Michelle, 'Impacts of the Overweight and Obese on the US Food Supply and Transportation Systems,' (2015) (co-advised with Paul Fischbeck).
4. DiPietro, Gwen, 'Economic Value, Resiliency, and Efficiency of Inland Waterway Freight Transport in the Ohio River Basin,' 2014 (co-advised with Scott Matthews), (SAIC consulting).
5. Tamayo, Mili-Ann, 'Regional Greenhouse Gas Emission Effects of Electric Vehicles,' 2014 (co-advised with Scott Matthews and Jeremy Michalek), (Asst. Prof., Univ. of the Phillipines).
6. Hoesley, Rachel, 'Implication of Mobility, Population Shifts and Growth for Metropolitan Energy and Greenhouse Gas Emissions Planning,' 2014 (co-advised with Scott Matthews), (CMU Post-Doc).

7. Traut, Elizabeth, 'Life Cycle Cost and Environmental Implications of US Electric Vehicle and Charging Infrastructure Scenarios,' 2013, (co-advised with Jeremy Michalek), (CMU Post-Doc).
8. Jiang, Mohan, 'Integrating Water Use and Water Quality into Environmental Life Cycle Assessment,' 2013, (DOE Post-doc).
9. Mashayekh, Yeganeh, 'Land Use and Congestion Management Strategies to Promote Urban Environmental Sustainability,' 2013, (co-advised with Paulina Jaramillo), (U.Penn. Post-Doc).
10. Nagengast, Amy, 'Energy Performance Impacts from Competing Low-Slope Roofing Choices and Photovoltaic Technologies,' 2013, (co-advised with Scott Matthews), (Confluence Consulting).
11. Nealer, Rachel, 'Supporting Sustainable Transportation Decision-Making,' 2012, (co-advised with Scott Matthews), (US EPA)
12. Coffelt, Don, 'Roof Management Decision Making Improvement,' 2008. (VP, Facilities Management, Carnegie Mellon).
13. Healey (Wakeley), Heather, 'Alternative Transportation Fuels: Infrastructure Requirements and Environmental Impacts for Ethanol and Hydrogen,' 2008. TRC Energy Services.
14. Higgins, Cortney, "Quantifying and Assessing the Impacts of Heavy Metal Flows: Fate, Transport, and Impacts of Lead Use in U.S. Product Manufacturing.", 2007 (employed by CBO).
15. Hawkins, Troy, 'A Mixed Unit Model for Life Cycle Assessment,' PhD 2007 (Co-advised by Scott Matthews, US EPA).
16. Aguirre, Jose Luis, Technology Change and Environmental Management for Cement Manufacturing: The Cement Industry in the United States (2000-2050), 2005
17. Bergerson, Joule, Future Electricity Generation: An Economic and Environmental Life Cycle Perspective on Near-, Mid- and Long-Term Technology Options and Policy Implications, (Advisors: Chris Hendrickson and Lester Lave), 2005 (U. Calgary)
18. Cicas, Gyorgyi, 'Regional Economics Input-Output Analysis Based Life Cycle Assessment,' PhD 2005.
19. Ochoa Franco, Luis, "Life Cycle Assessment of Residential Buildings," PhD 2005, (employed by Universidad Michoacana, UMSNH, Mexico).
20. Reyna-Caamano, Ruth, "Comparing the Performance of Manufacturing Plants in Mexico and the United States," PhD 2002, (co-advised by Lester Lave, employed by ITESM, Monterrey, Mexico).
21. Januschkowitz, Antje, "Use of Enterprise Resource Planning Systems for Life Cycle Assessment and Product Stewardship," Ph.D. 2002, (employed by Robert Bosch GmBh).
22. Matthews, Deanna, "Assessment and Design of Industrial Environment Management Systems," Ph.D. 2001 (awarded the 2001 Carnegie Mellon William Cooper Award for the Best Dissertation in Management or Management Science) (CMU)

23. Juarez-Espinosa, Octavio Hector, "Development of User Centered Environmental Software Systems," Ph.D. 1999 (co-advised with James Garrett, Jr., employed by Carnegie Mellon, Robotics Institute)
24. Matthews, H. Scott, "External Air Pollution Costs of Industrial Production," Ph.D. 1999 (co-advised with Lester Lave) (CMU)
25. Klausner, Markus, "A Framework for Product Takeback Systems," Ph.D., 1998 (employed by Robert Bosch GmbH).
26. Horvath, Arpad, "Estimation of the Environmental Implications of Construction Materials and Designs using Life Cycle Assessment Techniques," Ph.D., 1997 (employed by U. CA Berkeley)
27. Cobas-Flores, E. Elisa, "Life Cycle Assessment Using Input-Output Analysis," Ph.D., 1996. (co-advised with Lester Lave, employed by ITESM, Monterrey, Mexico.)
28. Hussain, Mansur, "Constraint-Based Project Scheduling," Ph.D., 1993. (employed by Indonesian Ministry of Transport)
29. Bullock, Darcy, "A Model for Roadway Traffic Control Software," Ph.D., 1992. (employed by Purdue University)
30. Morse, David, "Communication in Automated Interactive Engineering Design," Ph.D. 1990 (employed by IBM)
31. Haas, Carl, "A Model of Pavement Surfaces", Ph.D., 1990 (employed by U. Waterloo)
32. Adams, Teresa, "RETAIN: An Integrated Knowledge Based System for Retaining Wall Rehabilitation Design", Ph.D., 1989 (employed by Univ. Wisconsin, Madison).
33. Zozaya-Gorostiza, Carlos, "Knowledge-Based Planning for Construction Projects," Ph.D., 1988 (employed by INAM, Mexico City).
34. Skibniewski, Miroslaw, "Engineering and Economic Analysis of Robotics Application Potential in Selected Construction Operations," Ph.D., 1986 (employed by University of Maryland)
35. McNeil, Sue, "Quadratic Matrix Entry Estimation Methods," Ph.D., 1983 (employed by U. Delaware)
36. Kocur, George, "Optimal Design of Urban Bus Systems with Demand Sensitive to Service Levels," Ph.D., 1981 (employed by MIT)

#### Master of Science Theses

1. Christini, Gwen, "Environmental Management Systems Case Studies," MS 2003 (employed by MWH).
2. Horney, Cheryl, "Integrating Environmental Costs in a Management Information System: A Full Cost Accounting Case Study of a Manufacturing Plant" MS 1998 (employed by Xerox Corporation).
3. Hart (now Matthews), Deanna, "Identification and Specification of Recycled Materials: A Case Study of Post-Consumer Carpets," MS, 1995. (employed by IBM)
4. Kameda, Hirofumi, "Assessment of Foreign Aid Development Projects," MS, 1995.

5. Horvath, Arpad, "Toxic Emissions Indices for Environmental Management," MS, 1995.
6. Tan, Kathleen, "A Concurrent Roadway Incident Detection System," MS, 1994.
7. Diaz-Calderon, Antonio, "A Comparison of Task Management Approaches," MS, 1993.
8. Raja, Gopal, "Systematic Micro-Routing of Recycling Trucks," MS, 1992.
9. Abdelshafi, Elsherbini, "Intelligent Interfaces for Engineering Interfaces," MS, 1992.
10. Yasu, Shigeru, "Risk Management for Construction Projects," MS, 1991.
11. Miller, Edward, "Implementing Computer Aided Constructability Critics," MS, 1990.
12. Wain, David, "Concrete Placement Cost Savings in Cold Weather Through Computer Simulation of Strength Development and Maturity," MS, 1990.
13. Ciarico, Anthony, "Cost Estimation of Retaining Wall Rehabilitation Options Using a Relational Database," MS, 1989
14. Phelan, Randall, "Computer Aided Concrete Placement Optimization," MS, 1989
15. Pico, Jose, "Integrated Database System for Site Construction Management," MS, 1989
16. Adachi, Yoshinori, "Performance Simulation of Construction Robots," MS, 1988
17. Romero-Lois, Humberto, "A Strategic Planning and Monitoring System for Machine Excavation Process," MS, 1988
18. Dudziak, William, "Improving Negotiation Skills with Game Simulation," MS, 1987
19. King, Michael, "Assessment of the Potential for Automation in the Design, Fabrication, and Erection of Steel-Frame Structures," MS, 1987
20. Miras, Hristos, "Robotic Drilling Implementation in Construction," MS, 1987
21. Streubel-Gutierrez, Christian, "An Expert System for Financial Status Analysis," MS, 1987
22. Thapa, Bhaskar, "Project Planning Under Uncertainty A Case Study of the Barun River Hydropower Project in Nepal," MS, 1987
23. Martinelli, David, "Project Finance During Construction," MS, 1986
24. Elinski, Edward, "External Impacts of Reconstruction and Rehabilitation Projects with Implications for Project Management," MS, 1985
25. Honda, Akira, "A Multiple Regression Model Incorporating Contingencies to Aid Bidding Strategy," MS, 1985
26. Pleskow, Mark, "Decision Analysis Under Uncertainty," MS, 1985
27. Rossi-Velasco, Mario, "An Experimental Application of Computer-Aided Instruction in Construction Project Management," MS, 1985
28. Kromer, Robert, "Interactive Activity Network Analysis Using a Personal Computer," MS, 1984
29. Thint, Selwin, "Study of Traffic Pattern Changes Using Network Equilibrium Assignment Model," MS, 1984
30. Vieceli, Angelo, "Construction Project Information," MS, 1984
31. McGartland, Martin, "Application of Knowledge Based Expert Systems to Construction Project Monitoring," MS, 1983

32. Pasquale, Angelo, "Construction Cost Estimation Using Relational Databases," MS, 1983
33. Skibniewski, Miroslaw, "Methods to Improve the Safety Performance of the US Construction Industry," MS, 1983
34. Dubyak, Thomas, "Application of the Direct Utility Assessment Technique to Analyze and Forecast the Demand for Transportation Services," MS, 1982
35. Plank, Edward, "An Investigation of Peak Period Mode Choice and Departure," MS, 1982
36. McNeil, Sue, "Three Statistical Models of Road Management Based on Turnpike Data," MS, 1981