

David M. Keith

Established and maintains an independent consulting company working on illumination and photonic projects including design, research, product development and education, demonstrating skills in integrating multiple technical disciplines, and introducing innovative approaches to illumination issues.

CORE COMPETENCIES

- Technical Expert in Illumination
- Conceptually Creative
- Technical Writing Skills
- Mathematics & Programming Skills
- Experience in Lighting Design and Specification
- Trained in Architecture and Construction
- Experience in Research and Development
- Excels in Teaching and Communicating

PROFESSIONAL EXPERIENCE HIGHLIGHTS

MARSHALL DESIGN, INC.

SINCE 1992

Principal and founder, provides all technical work including these significant activities:

INSTRUCTOR, LIGHTING FUNDAMENTALS COURSE, IES ROCKY MOUNTAIN SECTION (DENVER) SINCE 1994

Instructor for *Lighting Fundamentals*, continuing education for lighting professionals and others interested in illumination, presenting the fundamentals and applications in lighting, including vision, sources, surfaces, calculations, design process and objectives, and codes.

LIGHTING ORDINANCE CONSULTING SERVICES, CITY OF CENTENNIAL, COLORADO 2011

With funding from an EECB grant, developed an ordinance that promotes energy-efficient exterior lighting, with standards for lighting quality and reasonable limits on obtrusive lighting.

RESEARCH WITH NOAA'S NGDC ON LIGHT SOURCE SPECTRA 2009 - 2010

Provided expertise in development of a publically-available library of spectral power distributions of exterior light sources, including measurement and data analysis, and contributed to two publications (Sensors 2010 and JEnvMan 2011).

CONSULTANT WITH ADA TECH – TRACE DETECTION TECHNOLOGIES PROGRAM 2008 - 2009

Provided expertise in investigation and development of photonic amplifier for trace explosive detection system, using the measurement and characterization of photonic stimuli.

INSTRUCTOR, COLLEGE OF ENGINEERING, UNIVERSITY OF COLORADO AT BOULDER 2008

Instructor for *Luminous Radiative Transfer* (ARE 4560) for senior undergraduates in the illumination program, presenting the fundamentals of the mathematics of radiative transfer and applications in illumination, including indirect lighting, skylighting and daylighting.

INSTRUCTOR, INTERIOR DESIGN PROGRAM, ROCKY MOUNTAIN COLLEGE OF ART AND DESIGN 2005 - 2007

Instructor for *Lighting Layout and Design* (ID 3970) for undergraduates in the interior design program, introducing the art, science and craft of interior illumination, using a broad range of tools and techniques from sketches and mock-ups to plans, working with catalogues, cut sheets and photometric reports, and including calculations, code issues, energy and environmental issues and the specification of lamps, luminaires and controls.

LIGHTING ORDINANCE CONSULTING SERVICES, CITY OF ARVADA, COLORADO 2005-2007

Leader of team developing an ordinance for exterior lighting. Met with staff and the community, organized a city-wide survey of outdoor lighting and associated educational lighting tours, supervised the ordinance development and presented the resulting document at public meetings. It was adopted unanimously by the City Council and remains in effect as

of 2011. Also provided site inspection and plan review services, including documenting the application of the ordinance provisions.

LIGHTING RESEARCH, OCCUPANCY CONTROLS, LAWRENCE BERKELEY NATIONAL LABORATORY 1999-2001

Research into applied engineering, concerning the prediction of interior lighting systems' energy use, peak demand and economics, when integrated with occupancy-responsive lighting controls installed in individual offices distributed across a corporate campus.

LIGHTING RESEARCH, ROADWAY LIGHTING OPTIMIZATION 1997-2001

Innovative research into applied engineering, concerning optimization of roadway lighting systems' performance in terms of energy use and uplight (light pollution) including the development of custom illumination software.

UTILITY DEMAND-SIDE-MANAGEMENT CONSULTANT 1994-1998

Lighting consultant for Public Service Co of Colorado on DSM projects, including DSM program development as well as project evaluation and inspection for utility rebate programs.

LIGHTING RESEARCH, ADVANCED LIGHTING SYSTEMS, ELECTRIC POWER RESEARCH INSTITUTE 1992-1994

Applied engineering research concerning the prediction of interior lighting systems' performance in terms of energy use, peak demand and economics, when integrated with advanced lighting controls responding to daylight illumination.

LIGHTING DESIGN CONSULTING SERVICES SINCE 1992

Lighting design consultant for a wide range of projects including The Bluebird Theater (1993), numerous high density residential facilities and neighborhoods, E-470 roadway and maintenance facilities (1996-2000), Boulder County Courthouse Plaza (2000), improvements to SH119 (2001) and West Main Street of Frisco, CO (2008).

CLANTON ENGINEERING, INC. 1985 - 1992

Lighting designer working on award-winning projects including interior offices, interstate interchanges, residences, industrial and research facilities, and even public monuments.

EDUCATION BACKGROUND

University of Colorado at Boulder Master of Science in Civil Engineering

- Advanced studies in illumination, energy, mathematics and human psychophysical perception, graduated in 1997
- Thesis concerning occupancy-sensor controls based on one year of data collected at a Boulder office facility, led to a paper published in *Journal of the IES*, Winter 1999

University of Colorado at Boulder Bachelor of Science in Architectural Engineering

- Specialized in architectural energy and illumination, graduated in 1985
- Graduated at the top of the class for Civil, Architectural and Environmental Engineering
- E.I.T. registration in Colorado, #13560, June 1985

PROFESSIONAL SOCIETY

- Fellow, Illuminating Engineering Society of North America (IES), honored in 2002
- Member, Illuminating Engineering Society of North America, since 1983
- Member, IES Educational Review Council, 2007-2010

- Member, IES Technical Review Council, 2003-2006
- Member, IES Board of Fellows, 2003-2006 and 2009-2011
- Member, IES Roadway Lighting Committee, since 1987: member of Energy Management, Fundamentals & Education, Research & Visibility and Standard Practice subcommittees
- Regional Vice-president for Intermountain Region (1997-1999), Section president (1995-1997) and Board of Managers (through 2011) for Rocky Mountain Section in Denver
- Section Education Chairman (1995 – 2010) and instructor for Lighting Fundamentals (ED-100 and FoL) and Intermediate Lighting (ED-150) courses held in Denver since 1994

TECHNICAL PUBLICATIONS

- "Limiting the impact of light pollution on human health, environment and stellar visibility", F. Falchi, P. Cinzano, C. Elvidge, D. Keith & A. Hiam, Journal of Environmental Management, October 2011.
- "Spectral Identification of Lighting Type and Character", C. Elvidge, D. Keith, B. Tuttle & K. Baugh, Sensors 2010.
- "Sources and Surfaces – Evaluating Spectral Distribution Interactions Using Roadway Signage", J. Knox & D. Keith, Illuminating Engineering Society of North America (IESNA) Roadway Lighting Committee Meeting, April 2004.
- "Sources, Surfaces and Eyes – Calculation Procedures Incorporating Spectral Distribution Information", J. Knox & D. Keith, IESNA Annual Conference Proceedings, August 2003.
- "Sources' Spectra, Roadway Surfaces and the Potential for Uplight Scattering", D. Keith & J. Knox, International Dark-Sky Annual Conference, March 2003 & IESNA Roadway Lighting Committee Meeting, March 2003.
- "Correlations of Roadway UUD Values to UPD, Uplight and Classification", D. Keith, IESNA Annual Conference Proceedings, August 2002 & Journal of the IES, v32n1 Winter 2003.
- "Evaluating Lighting System Components Through Comparison of Roadway UPD Values", D. Keith, IESNA Annual Conference Proceedings, August 2002 & Journal of the IES, v32n1 Winter 2003.
- "Unit Power Density Evaluation of Roadway Lighting Systems", D. Keith, IESNA Annual Conference Proceedings, August 2001 & Journal of the IES, v31n2 Summer 2002.
- "Energy Savings Achievable with Lighting Controls in Commercial Buildings", F. Rubinstein and D. Keith, IESNA Annual Conference Proceedings, August 2001.
- "Roadway Lighting Design for the Optimization of UPD, STV and Uplight", D. Keith, IESNA Annual Conference Proceedings, August 1999 & Journal of the IES, v29n2 Summer 2000.
- IESNA ED-100.8, "Lighting Applications for Exterior Environments", S. Gray (1993), revised for the second edition by D. Keith, IESNA Lighting Fundamentals Course ED-100, 1999.
- "Simplified Prediction Tool for Peak Occupancy Rate in Office Buildings", D. Keith & M. Krarti, IESNA Annual Conference Proceedings, August 1998 & Journal of the IES, v28n1 Winter 1999.

- “Predicting the Performance of Controlled Lighting Systems”, S. Stannard, D. Keith & K. Johnson, IESNA Annual Conference Proceedings, August 1996 & Journal of the IES, v26n1 Winter 1997.

RECENT TECHNICAL PRESENTATIONS

- IES Street and Area Lighting Conference, Philadelphia, PA, 2009: *What We Do Know Can Hurt Us*
- LUCI (Lighting Urban Community International) International Conference, San Luis Potosí, Mexico, 2008: *Urban Light Now – and Decades From Now*
- IES Street and Area Lighting Conference, Denver, CO, 2008: *MORE & less*
- CORM (Council on Optical Radiation Measurement) Annual Conference, Montreal, Canada, 2008: with C. Lughinbuhl and J. Knox, *Lamp Spectrum and Light Pollution: the other side of yellow light* (presented by R. Gibbons)
- IES Street and Area Lighting Conference, Seattle, WA, 2007: *White May Not Be Right*
- IES Centennial Regional Conference, Denver, CO, 2006: *Light and Health at the Start of the 21st Century*
- IES Street and Area Lighting Conference, San Antonio, TX, 2004: *The Spectra of Choices in the Choice of Spectrum*

EXPERT TESTIMONY

- 2016
Cather v. 2015 Market LLC, ViewHouse Corporation et. al.
District Court, City & County of Denver, CO, Case Number: 2014CV33175

Park v. Outback Steakhouse et al.,
18th Judicial District Court, Arapahoe County, CO, Case Number: 14CV33301
- 2010
Koinzan v. Highlands Ranch Community Association & Xcel,
Douglas County District Court, Castle Rock, CO, Case Number: 08CV58

Reynolds v. Cascade Village Theater, Inc.,
Eagle County District Court, Eagle, CO, Case Number: 09 CV 66858
- 2006
B. J. Bedwell v. Moses-Gardner, LLC, High Street Company & W.D. Gardner,
El Paso County District Court, Colorado Springs, CO, Case Number: 05CV4630
- 2005
Estate of Zhang v. City of Golden & Xcel,
Jefferson County District Court, Golden, CO, Case Number: 2002CV2189
- 2004
Pedge v. Goff et al.,
Boulder County District Court, Boulder, CO, Case Number: 2000CV1098

CONTACT INFORMATION

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