**1. General Outdoor Lighting Guides, Standards and Recommended Practices**

The resources below provide detailed information about guides, standards and recommended practices that specifiers should consult when designing, replacing or upgrading outdoor lighting. All links are up-to-date as of January 2020.

ANSI, ASHRAE, & IES. (2019). 90.1-2019 Energy Standard for Buildings Except Low-Rise Residential Buildings. Retrieved from <https://ashrae.iwrapper.com/ViewOnline/Standard_90.1-2019> This standard is referenced by the building codes in many states. The standard includes sections that cover exterior lighting.

ANSI, ASHRAE, IES, & USGBC. (2017). ANSI/ASHRAE/IES/USGBC Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings. Retrieved from <https://ashrae.iwrapper.com/ViewOnline/Standard_189.1-2017> Standard 189.1 provides sustainability guidance for designing, building, and operating high-performance green buildings, including exterior lighting requirements for reducing light pollution and energy use. This standard provides baseline requirements that align with LEED prerequisites.

ASSIST. (2011). ASSIST recommends… Recommendations for Evaluating Street and Roadway Luminaires. Retrieved from <http://www.lrc.rpi.edu/programs/solidstate/assist/recommends/parkinglot.asp> This report provides guidance about LED parking lot lighting. A recommendation is made for using Luminaire System Application Efficacy (LSAE) to evaluate the lighting system. An online calculator is provided that performs all of the calculations for LSAE using either standard IES files or an IES file uploaded by the user.

Bullough, J. D. (2012). New Lighting Technologies and Roadway Lighting: An Informational Brochure (pp. 1–6). Retrieved from <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-10-14_RoadwayLighting-InformationalBrochure.pdf> This brochure provides an introduction to technologies and techniques for roadway lighting. It also provides a list of resources for more in-depth information.

Bullough, J. D., & Radetsky, L. (2014). Sustainable Roadway Lighting Seminar. Troy, New York. Retrieved from [http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Transportation/Sustainable Roadway-Lighting-Seminars.pdf](http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Transportation/Sustainable%20Roadway-Lighting-Seminars.pdf) This report is a summary of material presented at a series of seminars presented by Rensselaer's Lighting Research Center to engineers and others from the New York State Department of Transportation, municipalities, utilities, and engineering firms. The topics include roadway lighting basics, roadway lighting technologies, visibility and safety, economics and benefit/cost analyses, and new approaches to roadway lighting including ecoluminance, pedestrian crosswalk lighting, mesopic vision and brightness appearance.

Federal Highway Administration. (2018). Web-Based Training for FHWA Roadway Lighting Workshop. Retrieved from <https://safety.fhwa.dot.gov/roadway_dept/night_visib/roadway_lighting_workshop/> To help transportation agencies make decisions about appropriate roadway lighting, FHWA has developed several online educational modules and accompanying workbooks. Modules address roadway lighting design, light source considerations, and special topics.

Illuminating Engineering Society. (2018). IES RP-8-18: Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting. Retrieved from <https://www.techstreet.com/standards/ies-rp-8-18?product_id=2035855> This document provides recommendations for designing new lighting systems for roadways and parking facilities. Recommendations include lighting for adequate visibility, enhancing of personal safety and security, optimizing energy use, and minimizing maintenance.

Leslie, R and Rodgers, P. (1996). The outdoor lighting pattern book. New York: McGraw-Hill. Retrieved from <http://www.lrc.rpi.edu/publicationdetails.asp?id=100> This book presents many lighting patterns for typical outdoor residential, commercial, institutional, industrial, and public spaces, including walkways and areas adjoining apartment houses, alleys, quick-stop shopping, pedestrian malls, city business districts, office parks, parking garages, loading docks, school yards, playgrounds, public parks, and waterfront walks. Although it was written before LED products were available, the lighting design recommendations are still appropriate.

Lutkevich, P et al. (2020). Solid-State Roadway Lighting Design Guide, Volume 1: Guidance. Transportation Research Board. Retrieved from <https://www.nap.edu/catalog/25678/solid-state-roadway-lighting-design-guide-volume-1-guidance> This document provides guidance to agencies planning to use solid-state lighting for streets and highways.

Lutkevich, P et al. (2020). Solid-State Roadway Lighting Design Guide, Volume 2: Research Overview. Transportation Research Board. Retrieved from <https://www.nap.edu/catalog/25679/solid-state-roadway-lighting-design-guide-volume-2-research-overview> This document summarizes research activities undertaken to develop guidelines for LED roadway lighting systems.

Maine State Planning Office. Promoting Quality Outdoor Lighting in Your Community. Retrieved from <http://www.maine.gov/dacf/municipalplanning/docs/lightingmanual.pdf> This bulletin discusses the impacts of outdoor lighting, the qualities of outdoor lighting to consider, and means of implementing outdoor lighting standards. The document provides concise, actionable recommendations for policy makers.

Massachusetts Metropolitan Area Planning Council. (2013). Buy Back Streetlights from Utility. Retrieved from <http://www.mapc.org/wp-content/uploads/2017/09/Buy-Back-Streetlights-from-Utility.pdf> This document provides a strategy for municipalities to purchase back streetlights from its utility. The authors say that 30-60% of street lighting costs can be saved just by purchasing streetlights from utilities.

Massachusetts Metropolitan Area Planning Council. (2013). Retrofit Streetlights with LEDs. Retrieved from <https://www.mapc.org/wp-content/uploads/2017/09/Retrofit-Streetlights-with-LEDs.pdf> This guide provides insight and guidance into the planning process of switching exterior lighting installations to LED technologies. The guide discusses how to develop a scope of work, lighting design, fixture selection, project implementation, procurement, and financing.

Moyer, J. L. (2013). The Landscape Lighting Book: Third Edition. Wiley. Retrieved from <http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118073827.html> This book is a comprehensive guide to landscape lighting design. According to the publisher, it covers lighting practices, materials including LED products, design applications, preparing lighting drawings, technical specifications, mesopic vision, and lighting controls.

New York State Energy Research and Development Authority. (2002). NYSERDA How-to Guide to Effective Energy-Efficient Street Lighting (p. 1-32). Retrieved from <http://www.lrc.rpi.edu/programs/transportation/pdf/how-to-officials.pdf> This is a guide to the effective implementation of outdoor street lighting with energy efficiency and application efficacy in mind. The two sections of the guide explain what the benefits of energy-efficient and effective outdoor lighting are, and the process that should be followed to define the project design goals and limitations as well as to communicate these principles with design professionals, vendors and city officials and residents.

U.S. Department of Energy, Federal Energy Management Program (FEMP), Lawrence Berkeley National Laboratory, & California Lighting Technology Center. (2010). Exterior Lighting Guide. Retrieved from <http://cltc.ucdavis.edu/sites/default/files/files/publication/2010_DOE_FEMP_Exterior_Lighting_Guide.pdf> A comprehensive guide for specifying lighting technologies for outdoor applications. Pertinent information is given regarding possible energy savings through the use of more efficient lamps as well as superior control strategies, as well as improved maintenance and quality of light.