ANSI/IES RP-8-22

Illuminating ENGINEERING SOCIETY

RECOMMENDED PRACTICE: LIGHTING ROADWAY AND PARKING FACILITIES

Approved American National Standard ANSI

www.ies.org

ANSI/IES RP-8-22

RECOMMENDED PRACTICE: LIGHTING ROADWAY AND PARKING FACILITIES

AN AMERICAN NATIONAL STANDARD

Publication of this Recommended Practice has been approved by the IES.
Suggestions for revisions should be directed to IES.

Prepared by:
The Roadway Lighting Committee

Approved by the IES Standards Committee, July 11, 2022 as a Transaction of the Illuminating Engineering Society.

Approved by the American National Standards Institute as an American National Standard, September 16, 202

Published by the Illuminating Engineering Society, 120 Wall Street, New York, New York 10005

IES Standards and Guides are developed through committee consensus and produced by the IES Office in New York. Careful attention is given to style and accuracy. If any errors are noted in this document, please forward them to the Director of Standards, at standards@ies.org or the above address, for verification and correction. The IES welcomes and urges feedback and comments.

Printed in the United States of America.

ISBN 978-0-87995-452-9

DISCLAIMER

IES publications are developed through the consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on lighting recommendations. While the IES administers the process and establishes policies and procedures to promote fairness in the development of consensus, it makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

The IES disclaims liability for any injury to persons or property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

In issuing and making this document available, the IES is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the IES undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The IES has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the IES list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or statement of compliance with the requirements of this document shall not be attributable to the IES and is solely the responsibility of the certifier or maker of the statement.

AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether that person has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation to any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Prepared by the Roadway Lighting Committee

Joseph D. Marsh, *Chair*
Mark Seppelt, *Vice Chair*
Geoff Thiesse, *Secretary*

Members

M. Aitkenhead
C. K. Andersen
L. A. Asselin
R. Bhagavathula
J. T. Brown
M. Bucci
G. Chelvanayagam
J. Cheung
N. E. Clanton
S. Coyle
N. Dittman
M. A. Dudas
K. Fitzmaurice
J. Frazer
R. S. Jones
J. J. Juzwiak
R. W. Kauffman
S. N. Lansford
R. Larivee
O. Letamendi
D. S. McLean
K. Molloy
M. N. Maltezos
E. H. Morel
R. Rainer
J. Robinson
A. D. Silbiger
W. A. Smelser
M. Smolyansky
R. Stemprok
U. Thurairajah
S. A. Wentworth
R. W. Yeager

Advisory Members

K. Aiken
R. Benekohal
R. D. Clear
C. Donkin
A. L. Duma
R. R. Ebbert
C. Falkowski
J. S. Farsatis
J. Faught
R. Gibbons
D. R. Howard
G. Hyde
J. Jiao
K. S. Kang
D. M. Keith
M. T. Kelly
R. Kent
E. J. Kramer
A. M. Kuczkowski
A.-M. E. Lemieux
D. Lenasi
C. J. Leone
M. Letourneau
P. Lutkevich
L. E. Nutley
D. R. Monahan
U. Padmanath
D. Passariello
M. R. Pearse
J. S. Petty
L. C. Radetsky
T. Ross
P. P. Sabau
P. Strasser
M. Tedesco
M.-A. Vachon
J. T. Weaver
E. S. Yao
S. Zarling

CONTENTS

Chapter 3: Calculations

Chapter 10: Highways and Interchanges

Chapter 11: Street Lighting

Chapter 18: Roadway Sign Lighting

Chapter 19: Temporary and Work Zone Lighting

Annexes

Glossary

Introduction to This Recommended Practice

This Recommended Practice is a compilation of lighting design techniques and criteria, all offered for quality roadway lighting solutions. Each chapter should not be taken in isolation but used as a whole for quality lighting design for roadways and other environments where vehicles are present, such as tunnels, intersections, and parking lots.

A lighting designer will often simplify the design criteria to lighting level and uniformity. However, impacts on visual quality go beyond these simple criteria and encompass minimizing glare and providing spectral contrast on pedestrians, hazards, and other vehicles. All design criteria are important in order to achieve these goals:

1. Improve motorist visual quality
2. Provide quality light and increased contrast for seeing hazards
3. Illuminate conflict areas
4. Minimize environmental impacts of light at night
5. Employ lighting systems that are easily maintained and minimize energy use

This document was prepared with the objective of providing lighting design guidance for most kinds of roadway and roadway-related applications. The recommendations contained in this document, however, may not reflect specific local factors or situations that are not typical and require special treatment. The contents of this Standard are based upon consensus of roadway lighting experts. It has no legislative authority unless adopted by an authority having jurisdiction. This Recommended Practice is not intended to establish a basis for civil liability.

This document is intended to be a single source of reference for roadway lighting; however, additional documents such as electric codes, transportation design guides and other codes and standards are often required design references.

History of the Document

This Recommended Practice is a compilation by the IES staff and the Roadway Lighting Committee's Special Task Group of efforts from several lighting organizations and authorities and was first published in 2018. This document updates the 2018 version.

The majority of the topics covered are from 12 previously separate roadway lighting documents of the Illuminating Engineering Society, along with the Transportation Association of Canada (TAC) *Guide for the Design of Roadway Lighting,* and the TAC *Roadway Lighting Efficiency & Power Reduction Guide*. During the review and compilation, the Roadway Lighting Committee revisited practices on design, installation and maintenance methods of roadway lighting systems. The team incorporated new or revised methodologies, design concepts and procedures, and included advancements in international research on lighting concepts.

In preparing this document the team sourced standards from around the world and applied the most applicable proven practices. It is important to note that new innovative design methods and products are being developed and will affect the future of roadway lighting. Some of these new design concepts and products are touched on in this document. Because much change is anticipated in the roadway design and technology, it is the responsibility of lighting designers and administrators to stay current with new technologies and concepts.

How to Use This Recommended Practice

This Recommended Practice may be used as a basis for the design and installation of roadway lighting and associated systems. This can be accomplished by selecting the appropriate sections and following the recommended procedures, including applying the recommended criteria. The document presents criteria that are recommendations derived through an American National Standards Institute (ANSI) consensus process. It may also be used as a basis for understanding roadway lighting design, as well as the underlying theories and criteria for reviewing designs.

Fundamental information upon which roadway lighting designs are based is provided in *Part 1 – Fundamentals*. This includes information on lighting theory, calculations, obtrusive light, the design process, system components, standards and codes, the use of computer software in roadway lighting design, and maintenance and operations.

Part 2 – Design applies the principles and information presented in Part 1 to specific circumstances that may benefit from roadway lighting. Lighted facilities may include roadways, interchanges, intersections, tunnels, and toll plazas. Off-roadway facilities are also included, such as pedestrian and bicycle pathways that are adjacent to the right of way, weigh scales, rest areas, and roadway signs.

Each chapter of *Part 2 – Design* is related to a particular type of roadway application and is arranged in a consistent fashion to allow the reader to easily assimilate new material. Design examples and, where applicable, step-by-step narratives are presented to assist the reader in understanding the design process.

In addition to the Table of Contents at the beginning of this document, each chapter has its own Table of Contents.

The annexes at the end of the document contain supplemental information of interest to lighting professionals.

A **Glossary** of roadway-related lighting terms follows the annexes.

References are provided at the end of each chapter and annex as applicable.

Part 1 – Fundamentals

Introduction to Roadway Lighting

Chapter 1

CONTENTS

Introduction to Roadway Lighting Chapter 1

Driving at night is a necessity in our modern, 24-hour society. As a result, roadway lighting has also become a modern reality. The main purpose for lighting roadways and other transportation related facilities is to provide an enhanced visual environment for people to safely use the road system during hours of darkness. An enhanced visual environment reduces motor vehicle collisions and provides a safer environment for pedestrians, cyclists, and drivers.[1,2,3] In providing some knowledge of what lies ahead on the road, lighting also provides a level of psychological comfort for those using roadways.

1.1 Why Light?

Collision statistics gathered throughout North America show that more than 50% of fatal collisions happen during nighttime hours. Even though an estimated 25% of travel takes place during these hours, the fatality rate is three times higher than during daytime hours. Properly designed roadway lighting aids in improving visibility of roadway features and helps the road user locate objects on the roadway as well as other vehicles, pedestrians, and cyclists. This results in increased safety for all.[2]

There is a consensus of statistics indicating that roadway lighting substantially decreases nighttime collision rates. Most important, the number of fatalities is reduced. Pedestrian fatalities account for approximately one quarter of all roadway related fatalities; hence, lighting of urban areas with large numbers of pedestrians is also important.[4,5]

Lighting of roadways and other transportation facilities may have a number of benefits not directly related to driving. These include:

- **Personal security:** Although there is some controversy over whether lighting improves security, there is no question that individuals feel more secure when walking, cycling or driving in a well-lighted area. Though some studies have shown that adding luminaires or increasing light levels can reduce crime in a given area, the actual long-term benefits and community-wide impacts are unknown.[6] By creating a safe feeling, lighting may draw people into an area, and increased pedestrian circulation will typically improve security. Social and economic factors of a given area, as well as police presence, will also have impacts on personal security. *Note:* For non-right-of-way areas where security is of particular concern, the reader is referred to *IES G-1-22, Guide for Security Lighting for People, Property, and Critical Infrastructure*.
- **Economics:** Lighting may draw people into a commercial area by providing increased visibility of businesses and a sense of personal security, and may thereby lead to an increase in commerce. Decorative lighting can be used for the economic revitalization of an area by contributing to a "sense of place" or by supporting a community architectural or urban design theme. *Note:* The benefits listed above may not necessarily apply to residential roads where there is little or no pedestrian activity during the hours of darkness.
- **Aesthetics:** Lighting may draw attention to architecture and other aesthetic features such as streetscapes, monuments, or parks. These features can enhance the nighttime use of facilities and improve the experience of roadway users at adjacent locations.

This Recommended Practice is intended to recommend proper techniques to allow motorists, pedestrians and cyclists within the right of way to benefit from the value of lighting. If designed or installed improperly, the benefits of lighting may be reduced. Improper pole heights may lead to excessive spill light on adjacent properties. Poles placed within the clear zone without breakaway bases may pose safety concerns. Over-lighting may reduce visibility while consuming excessive amounts of energy.

1.2 Human Factors

The human factors associated with lighting, including