



Illuminating
ENGINEERING SOCIETY

ANSI/IES RP-1-12

American National Standard Practice for Office Lighting



Currently in preview, click buy full version



**Recommended Practice for
Office Lighting**

Publication of this Design Guide
has been approved by IES.
Suggestions for revisions
should be directed to IES.

Prepared by:
**The Office Lighting Committee of the
Illuminating Engineering Society of North America**

Copyright 2012 by the Illuminating Engineering Society of North America.

Approved by the IES Board of Directors, December 10, 2012, as a Transaction of the Illuminating Engineering Society of North America.

Approved by the American National Standards Institute as an American National Standard, April 22, 2013.

All rights reserved. No part of this publication may be reproduced in any form, in any electronic retrieval system or otherwise, without prior written permission of the IES.

Published by the Illuminating Engineering Society of North America, 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 Rita Harrold, Director Educational and Technical Development, at the above address for verification and correction. The IES welcomes and urges feedback and comments.

Printed in the United States of America.

ISBN # 978-0-87995-262-4.

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.

Prepared by the IES Office Lighting Committee

W. Dau - Chair

G. Woodall - Chair

R. Altman*
T. Carlins
J. Coventry
N. De La Rosa*
N. Florence**
M. Fogarty*
P. Franck*
L. Gammon
J. Jewell**
M. Hartley*

O. Howlett*
R. Hughes*
J. Lee*
C. McSpadden*
G. Newsham
F. Oberkircher*
T. Peak*
D. Peifer*
A. Reyes*
C. Samuelson*

J. Schwartz*
Z. Suchara*
R. Walter
W. Warren
L. Wilson
J. Zulak*

*Advisory Members
**Honorary Members

Currently in preview, click buy full version

Contents

1.0	Introduction	1
2.0	Summary of Recommendations	1
2.1	Illuminance Target Value System	2
2.1.1	Recommended Illuminances at Design Time	2
2.1.2	Recommended Illuminances at Occupancy Time	2
2.1.3	Localized Tasks	2
2.1.4	Area Tasks	2
2.1.5	Tasks at Uncertain Locations Over a Large Area	3
2.1.6	Multiple Tasks	3
2.1.7	Visual Age of Occupants	3
2.1.8	Illuminance Ratios in Large Areas	3
2.1.9	Target Light Levels	3
2.2	Application of Luminance Targets for Office Lighting	3
2.2.1	Room Surface Luminance	5
2.2.2	Luminance Ratio Limits	5
2.2.3	Glare	5
2.2.3.1	Visual Comfort Probability	5
2.2.3.2	Overhead Glare	5
2.2.4	Direct Lighting	5
2.2.5	Indirect Lighting	5
2.2.6	Direct/Indirect Lighting	5
3.0	Desirable Luminous Conditions	6
3.1	Lighting Quality	6
3.1.1	Lighting and Organizational Productivity	6
3.2	Illuminance	6
3.2.1	What is Illuminance?	6
3.2.2	Measurements	7
3.2.3	Quantity of Illumination	7
3.2.4	Individual Preference	7
3.2.5	Uniformity	7
3.3	Luminance	7
3.3.1	What is Luminance?	7
3.3.2	Frightness and Adaptation	8
3.3.3	Room Surface Luminances	8
3.3.4	Luminance-Ratio Limits	8
3.3.5	Luminance Variability	8
3.3.6	Directing Attention	8
3.4	Glare	8
3.4.1	Discomfort From Glare	9
3.4.1.1	Visual Comfort Probability (VCP)	9
3.4.1.2	Overhead Glare	10
3.4.2	Glare causing Disability and Veiling Reflections	10
3.4.2.1	Direct Lighting	10
3.4.2.2	Indirect Lighting	11
3.4.2.3	Direct/Indirect Lighting	13

3.5	Color	13
3.5.1	Light Source Color	13
3.5.1.1	Chromaticity (Correlated Color Temperature, or CCT)	13
3.5.1.2	Color Rendering Index (or CRI)	13
3.6	Modeling	14
3.7	Windows and Daylight	14
4.0	Means and Methods – Design Basics	15
4.1	Architectural and Interior Design Issues	15
4.1.1	Lighting Design Process	15
4.1.1.1	Project Analysis	15
4.1.1.2	Establishing Qualitative Objectives	15
4.1.1.3	Establishing Quantitative Objectives	16
4.1.1.4	Lighting Design and Implementation	17
4.1.1.5	Communicating the Design	17
4.1.2	Appearance of Space and Luminaires	17
4.1.3	Impact of Daylight Design on Architecture and Interior Design	17
4.1.4	Material Selection and Coordination	17
4.2	Electric Light Sources	18
4.2.1	Luminous Efficacy	18
4.2.2	Incandescent (and Other Filament Source Types)	18
4.2.3	Fluorescent	18
4.2.4	HID	19
4.2.5	LED/OLED	19
4.3	Daylight	21
4.3.1	Sunlight and Sky Light	21
4.3.2	Daylight Integration and Controls	21
4.4	Luminaires	22
4.4.1	Lighting System Efficiency	22
4.4.1.1	Luminaire Types	22
4.4.1.2	Optical Systems	22
4.4.1.3	Thermal Performance	22
4.4.1.4	Luminaire Efficacy Rating	23
4.4.2	Luminaire Types	23
4.4.2.1	Types by Application	23
4.4.2.2	Luminaire Considerations	23
4.4.2.3	Ambient Lighting Types	24
4.4.2.4	Direct Lighting	24
4.4.2.4.1	Diffusers	25
4.4.2.4.2	Lenses	25
4.4.2.4.3	"Reflected Direct" Luminaires	25
4.4.2.4.4	Parabolic Louvers	26
4.4.2.5	Indirect Lighting	26
4.4.2.6	Direct/Indirect Lighting	28
4.4.2.7	Furniture-based Task Lighting	30
4.4.2.8	Accent Lighting	31
4.4.2.9	Daylight Luminaires	32

4.5	Ballasts, Transformers, and Power Supplies	32
4.5.1	Ballasts	32
4.5.2	Transformers	33
4.5.3	Power Supplies	33
4.6	Maintenance	33
4.6.1	End User Responsibility – Maintenance	33
4.6.2	General Considerations	33
4.6.3	Lighting Maintenance Plan	33
4.6.4	Pre-Installation Maintenance	34
5.0	Energy Efficiency, Sustainability and Controls	34
5.1	Energy Codes and Recommendations	34
5.1.1	Concepts	35
5.1.2	Key Sources of Codes and Guidelines	35
5.2	The Cost of Energy	35
5.3	Efficient Sources and Systems	35
5.4	Controls	35
5.4.1	Switching and Dimming	36
5.4.2	Manual Controls	36
5.4.2.1	Preset Scene Controls	36
5.4.3	Automatic Controls	36
5.4.3.1	Time Clock	36
5.4.3.2	Occupancy/Vacancy Sensors	36
5.4.3.3	Daylight Harvesting	37
5.4.3.4	Demand Responsive Buildings	38
5.4.4	Fluorescent Lamp Switching	38
5.4.5	HID Lamp Switching	38
5.5	Product Selection for Recycling	38
5.6	Safe Disposal	38
5.7	Energy Management Checklist	38
6.0	Design Issues for Specific Areas	40
6.1	Open-Plan Offices	40
6.1.1	VDT Considerations	40
6.1.2	General Considerations	40
6.1.3	Flexibility	41
6.1.4	Viewfinding	41
6.2	Private Offices	41
6.3	Conference and Meeting Rooms	42
6.4	Videoconference Rooms	42
6.5	Graphic Production and Drafting Rooms	43
6.5.1	Shadows and Reflected Glare	43
6.5.2	Supplementary Lighting	43
6.6	File Rooms and Libraries	43
6.7	Restrooms	44

6.8 Public Areas	44
6.8.1 Entrance Lobbies	44
6.8.2 Reception Areas	44
6.8.3 Corridors	45
6.8.4 Elevator/Escalator Lobbies	45
6.8.5 Elevators	45
6.8.6 Stairways	45
6.9 Atria	46
6.10 Support Spaces	46
6.10.1 Break Rooms	46
6.10.2 Copy Rooms	46
6.11 Lighting for Plants (Vegetation)	47
6.11.1 Light Sources	47
6.11.2 Commercial Application	47
6.12 Emergency Lighting	47
6.12.1 Systems in Use	47
6.12.2 Emergency Egress Lighting	47
6.12.2.1 Exit Marking	48
6.12.2.2 Emergency Egress Lighting	48
6.13 Building Exterior	48
6.13.1 Pedestrian Access	48
6.13.2 Vehicular Access	49
6.13.3 Exterior Spaces	49
6.13.4 Building Identity	49
6.13.5 Light Trespass And Light Pollution	49
7.0 Interactions with other building performance issues	50
7.1 Thermal Energy Effects	50
7.2 Other Aspects of the Indoor Environment	50
Annex A: Lighting Calculation & Design Issues	50
A.1 Lighting Calculations	50
A.1.1 Material Surface Properties	51
A.1.2 Photometry	51
A.1.3 Adjustment Factors	51
A.1.3.1 Non-recoverable Factors	51
A.1.3.2 Recoverable Factors	51
Annex B: Lighting Calculation & Design Issues	53
B.1 Application Illuminance Recommendations - Introduction	53
Annex C: Glossary	68
Endnotes	90

1.0 INTRODUCTION

For many people, the office is the environment where they spend the majority of their waking adult lives. The expectation is that the time spent in the office will be useful and productive, and that the physical environment will be healthy.

The design of the office greatly influences how well the space meets the needs of the workers and their organization. Lighting is a critical element of the design that may enhance or degrade the work experience and affect the well-being of the workers. Beyond supporting worker performance, lighting may also affect the bottom line of the organization by making the best use possible of materials and electricity.

Describing and defining the office can be a challenge. There is no standard for how workers are organized and divided into groups. There are common tasks shared by many employees and some tasks that are performed by a limited few. Even the common tasks evolve and change over time. Earlier generations have worked mostly on paper, reading and writing with pens and pencils. Often this meant much time scrutinizing low contrast, poor quality visual information. More recently, self-luminous computer-based tasks entered the work place, first as a specialized task that required unique consideration and accommodations. Over time, and with considerable evolution of the hardware and much greater user familiarity, computer-based tasks have become the ubiquitous, primary basis of office work.

Just as the tasks have changed, so have office layouts and design expectations. Fewer and fewer companies isolate their workers in individual small spaces that require considerable work and investment to change and reconfigure. In parallel with the change to office layouts, technology has made it possible for workers to be flexible in where and when they work. An office workstation may still be a wooden desk enclosed by four walls, but it may also be a flat surface supported by demountable partitions, or even a window table in the corner of the company cafeteria or a coffee bar.

People can be extremely inventive and flexible in finding places to work and adapting both their habits and their environment to suit the situation and their needs. Some will demand daylight, for views and connection to the outdoors, and will gladly suffer the glare of direct sunlight. Some will demand near black-out conditions to maximize the sharpness and clarity of images on their graphic displays.

Energy codes and similar programs to maximize energy efficiency have an increasing influence on office lighting design, prescribing ever lower allowances for lighting system power draw. The result is that greater attention may be required to determine how and where electric lighting is applied to maximize its effectiveness and preserve lighting quality. Greater environmental awareness heightens the desire to maximize the benefits, both psychological and economical, of daylight integration with architectural design and electric lighting systems.

New technology has changed lighting with the introduction of new light sources and control techniques. Ceramic metal halide lamps and LEDs are viable alternatives to incandescent lamps. Fluorescent lamps offer improved color appearance and greater luminous efficiency. Ballast designs for fluorescent lamps allow better control for both switching and dimming applications. Control systems allow for integration of occupancy sensors, photosensors for daylight harvesting, personal controls and demand response/load shedding, along with preset scene selections to automate and simplify the user interface with the lighting system. New manufacturing processes have eliminated or greatly reduced the use of toxic materials. Recycling efforts have increased, affecting both the material content of lighting products and their eventual reuse.

This recommended practice has been substantially reorganized and reworked from earlier editions to address these issues in the changing office environment. By maintaining a focus on lighting quality and human visual performance, and using the available technology, lighting practitioners can light the workplace more effectively. Their careful attention to the details, and willingness to work with and educate other members of the design team (architects, engineers, interior designers, owners and users), will ensure the best possible use of available resources in design solutions that are cost effective, environmentally sustainable, and that yield higher workplace satisfaction and consequently enhanced organizational productivity.

2.0 SUMMARY OF RECOMMENDATIONS

The following is a summary of the definitive recommendations made in this recommended practice. The summary is provided as a convenient reference, but it is not a substitute for reading the complete recommended practice and careful consideration of all factors relevant to a specific lighting situation.