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IES RP-20-14
REVISED

Lighting for Parking Facilities



IES RP-20-14 Revised

Lighting for Parking Facilities

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

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Prepared by:
The Subcommittee on Off-Roadway Facilities
of the IES Roadway Lighting Committee

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J. DaCosta*	H. Kashani	J. McCormick**	A. Silbiger	

RP-20 is dedicated to Paul C. Box.

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This edition (published November 21, 2016) incorporates editorial Errata found in IES RP-20-14. The list of corrected items is as follows:

- 1. Foreword, Part I Paragraph 9, parenthetical note added*
- 2. Foreword, Part I Paragraph 9, new notes added*
- 3. Table 2, Avg: Min values and category deleted*
- 4. Table 2, New notes f, g, h, i added.*
- 5. Table 4, Avg: Min values and category deleted*
- 6. Table 4, new notes f, g, h added*
- 7. Annex B Section B1.0, delete "...average or at a point"*
- 8. Annex B Section B6.0 Determinations of Average Illuminance for a Parking Lot, deleted entirely, including Figure B2 captions and all text in between.*
- 9. Annex B Section B7.2 Isolux Diagram, paragraph 5 deleted.*
- 10. Annex B Section B7.2 last paragraph, delete last sentence "This is the value to compare..."*
- 11. Annex B Section B8.0 Uniformity Ratios, delete paragraph 9, "If the designer is using average illuminance..."*
- 12. Delete Figure B5 and caption*

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FOREWORD

The following is a summary history on the evolution of this document (RP-20). It describes the progress leading to the current RP-20.

A *Recommended Practice of Outdoor Parking Area Lighting* was prepared in 1960 by an IESNA Committee.¹ This document specified as a basic value 11 lux (1 fc)** average maintained horizontal illuminance, with a 4:1 or better average/minimum uniformity ratio [minimum point illuminance \geq 2.5 lux (0.25 fc)]. A doubling of these values was recommended at parking area entrances and exits.

In 1974, the IESNA Roadway Lighting Committee produced recommendations for lighting safety rest areas along limited access highways.² A value of 11 lux (1 fc) was specified for major activity sections, with a 3:1 or better average to minimum uniformity. For lower activity zones (picnic areas, shelters), a 5 lux (0.5 fc) illuminance and a 6:1 uniformity were recommended. These values were carried forward to the *IESNA Lighting Handbook*, Eighth Edition³ and correspond to minimum illuminance values of 0.8 to 3.3 lux (0.08 to 0.33 fc).

In 1984, a new IESNA Recommended Practice, IES RP-20-84, *Lighting for Parking Facilities* was published.⁴ This document contained separate recommendations for lots and garages. Values were based on average illuminance for vehicle-use-only areas of lots and for all areas of garages. For general parking and pedestrian areas of lots, the recommendations were for minimum illuminance values of 2 to 10 lux (0.2 to 1 fc). Maximum average-to-minimum uniformity ratios of 4:1 were specified in most applications, producing average illuminance values of up to 40 lux (4 fc) when designed to this ratio. Differences in assumed levels of activity for various land uses formed the basis for setting the range in recommended minimum illuminance values. This version of RP-20 also added vertical illuminance recommendations, which were as important as the horizontal values, measured at 1.5 meters (5 ft) above the pavement (for facial recognition).

IES RP-20-84 was not based upon surveys or field measurements of existing parking facilities; it was based on state-of-the-art prevailing practice. Subsequent to its publication, reports surfaced of field measurements finding significantly lower levels in typical uses. A sampling survey of cities in 1991 found only one-fifth to be applying the IES RP-20-84 document in checking construction plans for private parking facilities, which constituted the vast majority of lots and garages.

The IESNA document dealing with airport parking areas (IESNA RP-17-87) was prepared as a guide for the application of fixed outdoor lighting in and around the airport environment with respect to the airport's special requirements. These requirements included:

- Height restrictions such as obstructions affecting navigable airspace as defined by the governing civil aviation authorities
- The ability to distinguish color of light for visual cues
- Restriction of light trespass that might interfere with visibility for of Air Traffic Control Tower (ATCT) controllers or pilots.

The *Recommended Building Code Provisions for Open Parking Structures*⁸, published by the National Parking Association in 1987, specified 65 lux (6.0 fc) average at 75 cm (30 in.) above the floor, with a maximum uniformity ratio of 3:1. An earlier publication, *Parking in the City Center*, commissioned by the Automobile Manufacturers Association, recommended 33 to 54 lux (3.3 to 5.4 fc) in garage parking areas.

The IES RP-20-84 publication was revised in 1998 based on field surveys of actual illumination found in existing parking facilities. *Rather than specify an average illuminance criterion, a minimum illuminance criterion was established.* The minimum basic requirement in parking lots was 2 lux (0.2 fc), with a minimum of 5 lux (0.5 fc) where enhanced security was an issue. The uniformity ratio was then redefined in terms of a maximum to minimum ratio of less than 20:1 rather than an average to minimum ratio, as the eye was thought to adapt to the brightest pavement (i.e., paved surface) in the field of view, not the average light level. The maximum to minimum uniformity ratio was limited in order to allow one to see into the darkest areas from the brightest areas. The uniformity ratio for enhanced security was 15:1.

This Max/Min ratio was chosen for two reasons:

- 1) The better-quality HID luminaires (generally with horizontal lamps) were able to achieve these results (as are today's LED luminaires). Desiring a "best practice" approach to this document, a consensus was achieved.

** Within the general notes of *The Lighting Handbook*, 10th ed. (IES 2011), for each Illuminance Recommendation Table, note C specifies that "Footcandle conversions of any values cited in this table should be made at 1 fc = 10 lx."

- 2) A uniformity ratio that is higher than approximately 15:1 will result in the perception that the minimum levels will look dark. This was the consensus view, aimed at achieving "best practice." Further research is required to determine a more accurate limit.

For parking garages, the recommended minimum was 10 lux (1.0 fc) on the pavement with a maximum to minimum uniformity ratio of less than 10:1. The vertical illuminance criterion at 1.5 meters (5 ft) above the pavement was a minimum of 50 percent of the recommended horizontal illuminance on the pavement.

In 2000 the Urban Land Institute published the *Guidelines for Parking Facility Location and Design*, following the IES RP-20-98 recommendations. The 1992 Institute of Transportation Engineers Traffic Engineering Handbook⁶ publication followed the IES RP-20-84 recommendations for parking garages.

IES RP-33-14, *Lighting for Exterior Environments* provides recommendations for lighting outdoor areas other than parking lots and roadways. The reader is encouraged to research local ordinances concerning lighting, as well as the *Joint IES-IDA MLO-2011 Model Lighting Ordinance (MLO)* – Table A.

The IES publication G-1-16, *Security Lighting Guidelines for People, Property, and Critical Infrastructure* recommends an average of 30 lux (3 fc) on the pavement in open parking lots where security is an issue. Sidewalks, footpaths and grounds around open parking lots are recommended to be illuminated to an average of 60 lux (6 fc). The average to minimum uniformity ratio in each instance is 4:1. In parking garages, the recommended average illuminance is 60 lux (6 fc) on the pavement where security is an issue. Where people gather such as at elevators and stairs, illuminance is recommended to be an average of 100 lux (10 fc) in a 9-meter (30-ft) radius from the center of the gathering point. The average to minimum uniformity ratio is recommended to not exceed 4:1. Lighting should allow safe movement and easy detection of other people out to a distance of at least 9 meters (30 ft).

Since publication of the last edition of IES RP-20 there has been increased emphasis on energy conservation and light trespass. This update to IES RP-20-98 expands on those issues. It is coordinated with the writing of the *IES Lighting Handbook*, 10th Edition and includes many sub-areas of parking facilities that previously had not been addressed, including payment transaction areas, passenger drop-off areas, corners and turning areas. Additionally, there are many new recommendations for vertical illuminance in parking garages. Following practices in ANSI/IES RP-8-14, *Roadway Lighting*, this



Figure 1 – Typical garage elevator lobby.

(Photo provided by LSI Industries Inc.)

new update recognizes differences in reflectance between concrete (R1) surfaces and asphalt (R3) surfaces. These practices led to a visibility-based system of recommended lighting levels. Calculations of visibility, based upon reflectance and contrast between important surfaces (pavement compared to wheel stops and curbs), has caused the illuminance recommendations to be higher in some conditions.

Age differences are also discussed, in **Section 4.9** (in relation to the *IES Lighting Handbook*, 10th Edition, Chapter 4, Section 4.12.2 Basis).

Lighting Zones are also discussed in this document for the first time. Lighting Zones describe the area surrounding a parking facility, and indicate lower light levels in the parking facility when the Lighting Zone itself has less dependence on fixed lighting. There does come a point at which lower light levels do not allow adequate visibility of important objects in a parking facility. Thus it became necessary to recommend the asymptotic minimum light levels for Lighting Zone 3 and continue the same levels as the Lighting Zones become lower and more rural. Starting out with a recommendation at Lighting Zone 1 and then increasing illuminance recommendations in zones 2, 3, and 4 could not be supported.

1.0 INTRODUCTION

Roadway Lighting Committee studies for the orderly passage of motorists and pedestrians have formed the basis of vehicular and pedestrian illuminance recommendations on public roadways. Parking facilities are an extension of the roadway system and include open surface parking lots and multi-level parking garages.