

NEIL ABERCROMBIE
GOVERNOR

RICHARD C. LIM
INTERIM DIRECTOR

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

No. 1 Capitol District Building, 250 South Hotel Street, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Web site: www.hawaii.gov/dbedt

Telephone:
Fax:

(808) 586-2355
(808) 586-2377

Statement of
RICHARD C. LIM
Interim Director

Department of Business, Economic Development & Tourism
before the

HOUSE COMMITTEE ON TRANSPORTATION

Monday, February 7, 2011

9:00 a.m.

State Capitol, Conference Room 309

in consideration of

HB 1473

RELATING TO HIGHWAYS.

Chair Souki, Vice Chair Ichiyama, and members of the Committee. The department supports the intent of HB 1473 to minimize glare and light pollution in Hawaii's night skies.

Our department convened a Starlight Reserve Committee in July of 2010 to study the impacts of nighttime light pollution statewide and provide recommendations for a Starlight Reserve Strategy that would address these issues. The chairman of this committee, Dr. Richard Wainscoat, is providing testimony today on SB 1473, and we defer to the recommendations in his testimony with regard to this measure, with the additional request that care be taken to ensure that this bill does not weaken existing county ordinances that mandate full shielding of lighting on highways.

Thank you for the opportunity to testify on this bill.

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU

850 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

PETER B. CARLISLE
MAYOR



COLLINS D LAM, P.E.
DIRECTOR

LORITA M. KAHIKINA, P.E.
DEPUTY DIRECTOR

February 4, 2011

The Honorable Joseph Souki, Chair
and Members
Transportation Committee
State Capitol
Honolulu, Hawaii 96813

Dear Chair Souki and Members:

Subject: House Bill No. 1473, Relating to Highways

The Department of Design and Construction (DDC) supports the intent of HB1473 and respectfully offers the following comments to improve the practicality of implementing the bill:

1. Section (b) (2) should be revised to read, "Existing and legally installed, prior to January 1, 2012; provided that any lighting fixture exempt under this subsection that subsequently becomes inoperable shall be replaced with a fully shielded or partially shielded lighting fixture that provides the minimum or better illumination as recommended by the Illuminating Engineering Society of North America (IES). If such fixture is not available for the existing light pole spacing, a non-complying fixture that meets the IES illumination design criteria shall be allowed." At some locations, fully and partially shielded lighting fixtures may not be capable of providing the IES standard of illumination with the existing light pole spacing. Replacement of existing light poles with more closely spaced light poles in order to satisfy both the illumination and shielding requirements due to an inoperable fixture would be impractical and prohibitively expensive.
2. We recommend the terms "fully shielded" and "partially shielded" be revised to "full-cutoff" and "semi-cutoff" respectively for consistency with the terminology defined in the IES street illumination standards, which are used by the City (excerpt attached).

Thank you for the opportunity to testify.

Very truly yours,

Handwritten signature of Collins D. Lam in black ink.

Collins D. Lam, P.E.
Director

CDL:WB:hm

RP-8-00
Reaffirmed
2005

Roadway Lighting

IES

The
LIGHTING
AUTHORITY



Upward light from a luminaire or lighting system must be evaluated. Such light generally adds to sky glow and wastes energy. Unless it is desirable in an urban area, it should be minimized.

2.4.2 Luminaire Cutoff Classifications. Luminaire distribution (see Figure 1) is described by the following terms:

Full Cutoff: A luminaire light distribution where zero candela intensity occurs at or above an angle of 90° above nadir. Additionally the candela per 1000 lamp lumens does not numerically

exceed 100 (10 percent) at or above a vertical angle of 80° above nadir. This applies to all lateral angles around the luminaire.

Cutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 25 (2.5 percent) at or above an angle of 90° above nadir, and 100 (10 percent) at or above a vertical angle 80° above nadir. This applies to all lateral angles around the luminaire.

Semicutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not

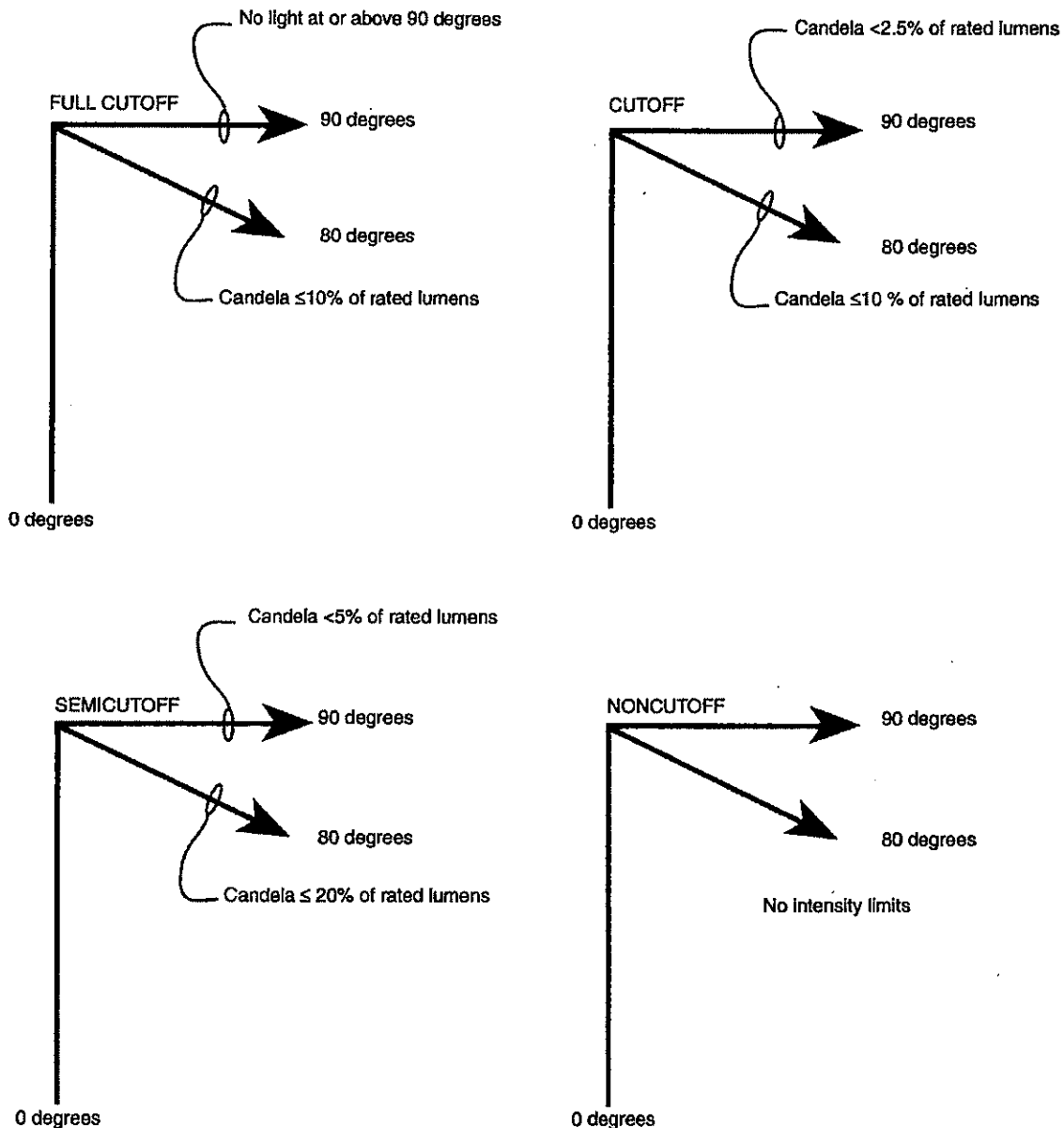


Figure 1. Four different cutoff classifications.

numerically exceed 50 (5 percent) at or above an angle of 90° above nadir, and 200 (20 percent) at or above a vertical angle 80° above nadir. This applies to all lateral angles around the luminaire.

Noncutoff: A luminaire light distribution where there is no candela limitation in the zone above maximum candela.

3.0 DESIGN CRITERIA

This Standard Practice includes three different criteria for use in continuous roadway lighting design. These are illuminance, luminance, and STV. The designer should be familiar with all of these criteria in order to decide which one best addresses the needs of the particular project. Calculation procedures and additional information about these methods are included in the **Annexes**. Consideration should also be given to glare and sky-glow issues stated in **Section 4.6**. For issues about light trespass see IESNA TM-10, *IESNA Technical Memorandum Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting*.

The recommended design values, as well as the uniformity ratios as shown in **Tables 2, 3, and 4**, represent the lowest maintained values for the kinds of roadways and walkways in various areas. Numerous installations have been made at higher values. Furthermore, the design values can be made using different combinations of luminaire light distribution, lamp sizes, mounting heights, spacings, and transverse locations. These figures do not represent *initial* readings, but the lowest *in-service* values of systems designed with the proper light loss factor. When design values for continuous roadway lighting vary due to changes in the road or area classification no special transitions are necessary.

This document follows the guidelines of IESNA LM-67-94, *Calculation Procedures and Specification of Criteria for Lighting Calculations*.

3.1 Illuminance Criteria

The illuminance method of roadway lighting design determines the amount of light incident on the roadway surface from the roadway lighting system. Because the amount of light seen by the driver is the portion that reflects from the pavement towards the driver, and because different pavements exhibit varied reflectance characteristics, different illuminance levels are needed for each type. The illuminance criteria gives recommendations for average maintained lux for various road and area classifications depending on the pavement

type used. The recommended illuminance values and the uniformity ratio are in **Table 2**. Veiling Luminance Ratios, derived from the luminance calculation method, must also be determined to avoid a lighting system that produces disability glare. (See **Table 2**.)

3.2 Luminance Criteria

The luminance method of roadway lighting design determines how "bright" the road is by determining the amount of light reflected from the pavement in the direction of the driver. The luminance criteria is stated in terms of pavement luminance, luminance uniformity, and disability veiling glare produced by the lighting system. **Table 3** provides the recommended luminance design requirements, uniformity and the relationship between average luminance (L_{avg}) and the veiling luminance (L_v).

3.3 Small Target Visibility (STV) Criteria

The STV method of design determines the visibility level of an array of targets on the roadway considering the following factors:

- (a) The luminance of the targets
- (b) The luminance of the immediate background
- (c) The adaptation level of the adjacent surroundings
- (d) The disability glare

The weighted average of the visibility level of these targets results in the STV. The values of STV are included in **Table 4** as well as uniformity ratios and luminance requirements for mitigating the effect on approaching headlights. The veiling luminance ratio component is included in the STV calculation methodology.

3.4 High Mast Lighting

Ordinarily, conventional lighting along streets and highways involve mounting heights of 15 meters (49.2 ft.) or less. Poles of 20 meters (65.6 ft.) or greater height have been utilized in several situations:

- Large parking lots - such as regional shopping centers, and stadiums
- Interchanges and complex intersections in both urban and rural areas and tangent sections with more than six lanes

Opinions differ on whether light levels can be lower when high mast lighting is used, compared with the use of conventional poles of 15 meters (49.2 ft.) or less. Typically, the surround conditions are more uniform with the high mast design and, seeing is easier. Prior editions of ANSI/IESNA RP-8 have allowed lower



UNIVERSITY OF HAWAII SYSTEM

Legislative Testimony

Written Testimony Presented Before the
House Committee on Transportation
Monday, February 7, 2011 at 9:00 a.m.

by

Virginia S. Hinshaw, Chancellor

and

Richard J. Wainscoat

Astronomer

University of Hawai'i at Mānoa

And

Chair

Light Pollution Working Group

International Astronomical Union — Commission 50

HB 1473 RELATING TO HIGHWAYS

Chair Souki, and members of the Committees. My name is Richard Wainscoat and I am here to offer testimony on behalf of the University of Hawai'i at Mānoa. The University supports the intent of this bill to reduce glare and reduce light pollution, but believes that it should be strengthened by removing the option of partially shielded lighting and extended to include all roadway lighting.

Mauna Kea on the island of Hawai'i, and Haleakalā on the island of Maui, are two of the best astronomy sites in the world. Dark night skies are essential for these observatories to continue to operate. However, increasing urban lighting is threatening the dark night skies over these observatories. Light pollution extends well beyond county boundaries; lights from Oahu have a major and growing impact on Haleakala. Statewide legislation is needed to protect the observatories.

Full shielding of lights is one of the most important techniques for protecting astronomical observatories. Light emitted from partially shielded fixtures at small angles above the horizontal travels enormous distances through the atmosphere, and is a major contributor to light pollution — it increases sky glow at remote locations, making it difficult or impossible to see faint objects. Fully shielded light fixtures emit no light above the horizontal, and therefore have much less impact on remote locations.

Full shielding also reduces glare, which is a very important safety factor, particularly for older drivers, and greatly reduces the impact of nighttime lighting on endangered species.

The University recommends that care be taken to ensure that this bill does not weaken the existing state laws that require the state department of transportation to follow county lighting ordinances. County lighting ordinances in the Counties of Hawai'i and Maui already require full shielding of all roadway lighting. All highway lighting is already fully shielded on the island of Kaua'i because of the endangered birds.

The University recommends that the committee remove the option of partially shielded highway lighting. The state Department of Transportation is already using fully shielded lights on all new highway lighting, and the improvement in the quality of the lighting in the sections where fully shielded lighting is used is remarkable. The definition of "partially shielded" lighting in the bill allows an excessive amount of up light, which is higher than most typical partially shielded lights presently being used in Hawaii.

Finally, the University would like the committee to clarify the intent of this law by making it clear whether the law applies only to lighting on state and county highways, or whether it applies to lighting on all roadways. If possible, the University would like this law extended to apply to all new nighttime roadway lighting. Poor roadway lighting is presently a major contributor to the light pollution that we experience on Haleakala and Mauna Kea. Improperly shielded roadway lighting causes unnecessary energy loss and, because of its glare, is less safe than fully shielded roadway lighting.

A dark night sky has tremendous value to all citizens—not just astronomers. The residents of Honolulu have lost their ability to see the Milky Way, and only about the 20 brightest stars can be seen in the sky from central Honolulu. From a dark location, you can see 2,000 stars. Poor lighting that is directly lighting the night sky is wasting a tremendous amount of energy and money. Human health problems, including breast cancer, have now been linked to light at night. Endangered species such as turtles and birds are confused by lights at night—properly shielded lighting mitigates this problem.

Thank you for your support of our program and for the opportunity to present this testimony.

Testimony Related to
House Bill 1473
RELATING TO HIGHWAYS
Presented before the
House Committee on Transportation
The Twenty-Sixth Legislature
February 7, 2010
by
Richard J. Wainscoat
Chair
Starlight Reserve Committee

Chair Souki, and members of the Committees. My name is Richard Wainscoat and I am here today to submit this testimony in my capacity as Chair of the Hawaii Starlight Reserve Committee. I support the intent of this bill to reduce glare and reduce light pollution, but believe that it should be strengthened and clarified.

The Starlight Reserve Committee was established by the 2009 legislature. It held its first meeting in July 2010, and has met on four occasions. The Committee received extensive input from regarding the lighting situation on Kauai that is affected endangered birds, including the Newell's shearwater, and heard presentations from representatives of the US Fish and Wildlife Service and NOAA regarding endangered species and lighting. The US Fish and Wildlife Service representatives indicated that they were hoping for statewide legislation to regulate outdoor lighting, because the endangered species problems (including birds and turtles) are not isolated to Kauai, but are present on all the Hawaiian Islands. The principal method presently being employed on Kauai is to use proper (full) shielding and, short of turning lights off (which was done for the recreational facilities on Kauai), full shielding of lights is the best method presently known to protect endangered birds.

Full shielding of lights is also the best technique for protecting the astronomical sites on the islands of Hawaii and Maui, which presently suffer from unnecessary light pollution. Full shielding also reduces glare, which is a very important safety factor, particularly for older drivers.

I recommend that care be taken to ensure that this bill does not weaken the existing state laws that require the state department of transportation to follow county lighting ordinances. County

Testimony Related to House Bill 1473
House Committee on Transportation
February 7, 2007
Page 2

lighting ordinances in the Counties of Hawaii and Maui already require full shielding of all roadway lighting. All highway lighting is already fully shielded on the island of Kauai because of the endangered birds.

I also recommend that the committee remove the option of partially shielded highway lighting. The state Department of Transportation is already using fully shielded lights on all new highway lighting, and the improvement in the lighting in those sections where fully shielded lighting is used is remarkable.

Finally, I would like the committee to clarify the intent of this law by making it clear whether the law applies only to lighting on state and county highways, or whether it applies to lighting on all roadways.