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ENGINEERING SOCIETY

ANSI/IES RP-22-11

## Tunnel Lighting



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## 1.0 INTRODUCTION

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This Standard Practice has the objective of providing information to assist engineers and designers in determining lighting needs, recommending solutions, and evaluating resulting visibility at vehicular tunnel approaches and interiors. This Practice is intended also for use by administrators charged with the responsibility of providing a safe visual environment within a tunnel both day and night.

The Standard Practice deals entirely with lighting and associated systems and does not give advice on construction practice. It is neither intended as, nor does it establish a legal standard for tunnel lighting systems. Its purpose is to provide recommended practices for designing new tunnel lighting systems and it is not intended to be applied to existing lighting systems until such systems are redesigned. It has been prepared to advance the art, science, and practice of illumination as it pertains to tunnel lighting in North America.

Treatment of tunnel portals, wall and ceiling surfaces, and selection of lighting equipment, as well as light sources, maintenance and lighting economics are also reviewed and assessed. However, special requirements for pedestrians are not addressed in this document. For pedestrian and underpass lighting refer to ANSI/IESNA RP-8, *American National Standard Practice for Roadway Lighting*.<sup>1</sup>

The emphasis on providing electric or daylighting in vehicular tunnels enables a motorist to maintain speed and safely navigate. The basic design criteria for tunnel lighting are outlined in **Section 6.0**. Tunnels may require considerably different treatment of the threshold zone luminance value depending on variables such as geographic orientation, geometric design, traffic volume, travel speed, service levels, light sources used, and modes of light application. The lighting designer, therefore, should consider the factors which affect the visibility conditions as outlined in **Sections 3.0, 4.0, 5.0, 7.0, and 8.0**.

### 1.1 What is New in RP 22-2011

The present Practice has evolved from earlier documents, and considers the latest research, international standards, experience, and equipment technology including:

- Revision of the transition curve.
- Wall illumination height change from 3 m to 2 m and from luminance to illuminance.
- New calculation and field measurement grid.

- Black Window Method has been removed for further evaluation.
- Expansion of **Table 1**, SSSD to include slope distances.
- **Annex C** - Calculation of Tunnel Wall Luminance Using Bi-Directional Reflectance Factors (BRDF) for Typical Materials Used for Tunnel Walls.

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## 2.0 DEFINITION OF TERMS

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### 2.1 Definition of a Tunnel

A tunnel is defined as a structure over a roadway, which restricts the normal daytime illumination of a roadway section such that the driver's visibility is substantially diminished. Tunnel cover roadways and produce a shadow that limits the ability of the driver to see objects or obstructions within the tunnel.

### 2.2 Divided and Undivided Tunnels.

A structure which consists of two separate enclosures, each designated to accommodate one direction of traffic flow, is considered to be a divided tunnel.

A structure which consists of a common enclosure to accommodate the traffic flow in both directions is considered an undivided tunnel.

### 2.3 Underpasses.

Structures considered to be underpasses are those in which the length and physical configuration of the structure do not substantially limit the drivers' ability to see objects ahead. No supplemental daytime lighting is required for underpasses or structures less than 25 m (80 ft) in length. The zero percent values in **Table 2** show when supplemental daytime lighting is not required.

For nighttime illumination underpasses can also be classified as short or long. Short underpasses can generally be lighted with conventional street and roadway luminaires and placements. When the lighting levels and uniformity on the roadway provided by the conventional roadway lighting system are affected by the structure, then the underpass can be classified as long and will require additional lighting. When pedestrian lanes or sidewalks are included as part of an underpass then pedestrian lighting should be considered. Lighting levels should be as recommended in ANSI/IESNA RP-8, *American National Standard Practice for Roadway Lighting*.<sup>1</sup>