THE IESNA LIGHTING HANDBOOK

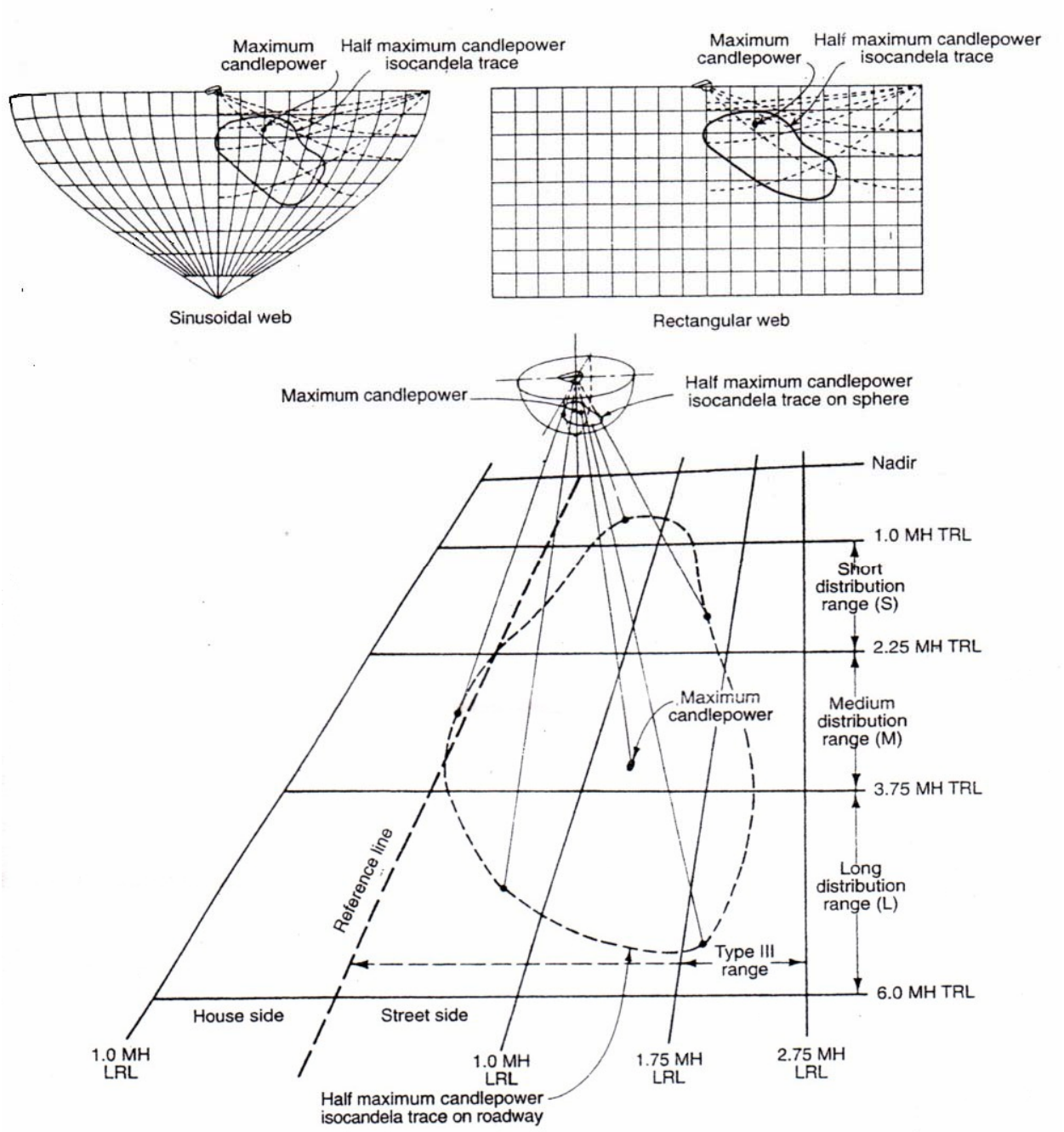

Figure 22-7. Diagram showing projection of maximum candlepower and half-maximum candlepower isocandela trace from a luminaries having a Type III-Medium distribution, on the imaginary sphere and the roadway. Sinusoidal web and rectangular web representation of sphere are also shown with maximum candlepower and half-maximum candlepower isocandela trace**.**

Full Cutoff - A luminaire light distribution where zero candela intensity occurs at an angle of 90˚ above nadir, and all greater angles from nadir. Additionally, the candela per 1000 lamp lumens does not numerically exceed 100 (10%) at an angle 80 above nadir. This applies to all lateral angles around the luminaries.

Cutoff - A luminaire light distribution is designated as cutoff when the intensity per 1000 lamp lumens does not numerically exceed 25 (2.5%) at an angle of 90˚ above nadir (horizontal), and 100 (10%) at a vertical angle of 80˚ above nadir. This applies to any lateral angle around the luminaire. (In some cases the cutoff distribution may meet the requirements of the semi cutoff distribution)

Semi cutoff - A luminaire light distribution is designated as semicutoff when the intensity per 1000 lamp lumens does not numerically exceed 50 (5%) at an angle of 90˚ above nadir (horizontally), and 200 (20%) at a vertical angle of 80˚ above nadir. This applies to any lateral angle around the lumainaire. (In some cases the semicutoff distribution may meet the requirements of the noncutoff distribution.)

Noncutoff - This is the category in which there is no intensity limitation in the zone above maximum intensity.

Variations. With the variations in roadway width, type of surface, luminaire mounting height, and spacing found in actual practice, there are a large number of ideal lateral distributions. For practical applications, however, a few types of lateral distribution patterns may be preferable to many complex arrangements. This simplification of distribution types is more easily understood, and consequently there is greater assurance of proper installation and more reliable maintenance. When luminaries are tilted upward, the angle of street side light distribution is raised. Features such as cutoff or width classification may be changed appreciably. When the tilt is planned, the output of the luminaire should be measured and the light distribution classified in the position in which it will be installed.

Type I, II, III and IV lateral light distributions can vary across transverse roadway lines (except for the line that includes the maximum intensity) so as to provide adequate coverage of the rectangular roadway area involved. The width of the lateral angle of distribution required to adequately cover a typical width of roadway varies with the vertical angle or length of distribution as shown by the TRL. For a TRL at 4.5 MH, the lateral angle of distribution for roadway coverage is obviously narrower than that required for a TRL at 3.0 MH or 2.0 MH.

Luminaire Selection

Luminaire light distribution classification helps to determine the optical and economical suitability of a luminaire for lighting a particular roadway from the proposed mounting height and location. A wide selection of light distribution systems is available.

Simply because a luminaire is assigned a particular classification, there is no assurance that it produces the recommended quantity and quality of lighting for all roadway configurations and

mountings shown in Fig 22-4. The relative amount and control of light in areas other than the cone of maximum intensity are equally important in producing good visibility in the final system but are not considered in the classification system.

Lighting Design

The lighting system of a specific road section should accommodate the visual needs of night traffic (vehicular and pedestrian) and to be expressed in terms clearly understandable by lighting designers, traffic engineers and highway administrators.

The visual environmental needs along the roadway can be described in terms of pavement illuminance and luminance, uniformity, and direct glare produced by the system light sources. Figure 22-8a provides recommended luminance design requirements and uniformity. It also specifies the relationship between the average luminance L_{avg}, which is the average of all of the luminance values calculated for the section of roadway under consideration, and the veiling luminance L_v, which is defined later in this chapter,

The visual needs along the roadway can also be satisfied by the use of illuminance criteria. Figure 22-8b provides the recommended illuminance design requirements, considering the differences in roadway reflectance characteristics. The designer should not expect the lighting systems designed under the two sets of criteria to provide identical results.

The design of a roadway lighting system involves consideration of visibility, economics, aesthetics, safety, and environmental conditions, as well as appropriate material and equipment. The design process follows these major steps:

1. Determination of roadway classification and adjacent area classification along the specific road section to be lighted. There are three types of area classification commercial, intermediate, and residential. If the pavement classification is unknown, use the R3 values of Figure 22-8.]