

OAAA Lighting Comparison Guidelines

Comparison of luminance standards between NEMA TS-4 for LED signs used in traffic and the OAAA's brightness standards for digital billboards

Background

The National Electrical Manufacturers Association (NEMA) publishes over 500 standards, application guides, and technical papers. It is NEMA's belief that standards play a vital part in the design, production, and distribution of products destined for both national and international commerce: *"Sound technical standards benefit the user, as well as the manufacturer, by improving safety, bringing about economies in product, eliminating misunderstandings between manufacturer and purchaser, and assisting the purchaser in selecting and obtaining the proper product for his particular need."*

Abstract

The OAAA's recommended lighting criteria for LED digital displays are in compliance with the NEMA lighting standards for dynamic message signs.

Comparison Analysis

The National Electrical Manufacturers Association (NEMA) has defined the predominant standards governing the use of dynamic message signs in North America. NEMA standards are the guiding principles used on city and state right of way highway signs throughout North America. The reference document containing all of NEMA's findings and recommendations is NEMA TS-4 2005.

NEMA TS-4 quantifies brightness luminance on dynamic message signs in terms of cd/m^2 (candela per square-meter) or nits. These standards define minimum and maximum brightness levels for daylight and night time ambient illuminance levels. Table 5-9 from NEMA Standards publication TS-4 2005 identifies the values of luminance intensity for Light Emitting Diode (LED) signs displaying all white light during various times of the day (Lux levels from 40,000 to 4).

Table 5-9
LUMINANCE INTENSITY LIMITS IN CD/M^2 FOR ON-AXIS (0° HORIZONTAL, 0° VERTICAL)
TEST ANGLES – FOR WHITE

Sign illuminance (lx) (Tolerance = $\pm 10\%$)	Light Emitting @ Full Connected Power		Light Emitting @ Reserve Power		Reflective	Hybrid	
	Min	Max	Min	Max	Min	Min	Max
40,000	12400	62000	6200	NA	7500	7500	NA
4000	2200	11000	1100	NA	750	750	NA
400	600	3000	300	NA	75	365	NA
40	250	1250	200	1250	NA	250	2500
≤ 4	75	375	60	375	NA	75	750

NA = Not Applicable

NEMA TS-4 Luminance Levels for White Light

From the above table, we can read that the maximum luminance level allowed for Outdoor digital displays is 62,000 nits when outside illuminance levels are 40,000 lux. This 40,000 lux level could only occur during the middle of a very bright, sunny day. The 62,000 nit luminance level allowed by the standard is quite high. LED digital billboards operated by most OAAA members have a maximum brightness near 7,500 to 10,000 nits. As a result, The OAAA recommended lighting criteria are well within the Daylight NEMA TS-4 Standards.

During the middle of the night when Lux levels are at 4 or less, the maximum NEMA luminance levels allowed for digital displays are 375 nits. Again this luminance level is greater than the limits recommended by the OAAA. The maximum nighttime brightness suggested by the OAAA digital signage lighting standard is 300 to 342 nits. Thus, the OAAA recommended lighting criteria are within the Nighttime NEMA TS-4 Standards.

The OAAA recommended brightness criteria for digital billboards is as follows:

- Light produced by a digital billboard should not exceed 0.3 Foot-candles over ambient light levels. (0.3 foot candles is equivalent to 3.23 Lux)
- The distance (D) to measure foot-candles intensity for the various sized digital displays and the expected luminance level is listed in the table below:

Expected Luminance Levels

Billboard Dimensions (ft.)	D ft.	Luminance (Candela/sq Mtr.)
11 x 22	150	300
10.5 x 36	200	342
14 x 48	250	300
20 x 60	350	330

Conclusion

The luminance levels recommended by this OAAA standard are always below the maximum luminance levels listed in the NEMA TS-4 2005 standard.

Consequently, the OAAA recommended lighting standards are in complete compliance with the NEMA TS-4 standards for dynamic message signs.