

# Understanding TM-21 in Relation to Specifying Luminaires Reported vs. Calculated

A multitude of data points are published by luminaire manufacturers that address the maintenance or useful life of LEDs at a prescribed light output. Those data points are labeled Reported or Calculated, reflecting the nomenclature of the EPA, but are also assigned creative designations such as Projected, Theoretical, Minimum Lifetime or even Survivorship. This makes it difficult for specifiers or building owners to objectively compare options in order to select the best product for each application. This article endeavors to explain the difference between Reported and Calculated values, the limitations set by the EPA, and how L70 and L90 data relates to real-life applications.

## **Industry issue**

LEDs, similar to other light sources, see their output diminish over time. However, given the significantly longer life of LEDs and the absence of visible signs indicating their decreasing performance, it can be more complex to accurately measure and communicate light output over time.

To help address this issue, the Illuminating Engineering Society of North American (IESNA) and the Environmental Protection Agency (EPA) have put in place standards for reporting the useful lifetime of an LED package: LM-80<sup>1</sup> and TM-21<sup>2</sup>. LM-80 is a set of standards defining how LED components can be tested to determine their performance over time. TM-21 outlines a standard calculation method to predict future lumen depreciation using LM-80 data. These standards ensure consistent reporting from LED manufacturers, enabling lighting professionals to make sound decisions when specifying luminaires.

## **Reported Maintenance**

IESNA standards limit the projection of useful lifetime for an LED package to 6 times the LM-80 test period. That test period is typically 10,000 hours, on occasion up to 12,000 hours, which translates to a maximum useful lifetime projection of lumen depreciation at 60,000 or 72,000 hours. Therefore, the Reported Maintenance data published is often L70 or 70% at >60,000 hours. This signifies that the LEDs will still emit at least 70% of their initial light output after 60,000 hours of operation.

## **IES and EPA regulations**

The IES does not recognize projections beyond 6 times the test period as stated in the IES TM-21 Addendum B: "Due to the statistical uncertainty stated in Annex D, the calculated result in hours beyond reported projection limit set in Section 5.2.5 does not have any practical or meaningful value." Section 5.2.5 states: "Luminous flux values must not be projected beyond 6 times the total test duration." The IES also states a lack of confidence in data beyond 5 years due to outlying factors such has component failures.

## **What does this mean?**

Assuming that a given lighting system operates 12 hours/day, 5 days/week, this would translate into 3,120 hours yearly, making 60,000 hours equivalent to 19+ years.

Based on those numbers, the useful life of LEDs will far exceed the remodel cycle for many applications. In addition, the efficiency of LED technology is continuously improving and technology upgrades are occurring on average every 6-8 months. This means that the LEDs used today are less efficient than those that will be used in a few months or years.

## **Equivalent Useful Lifetime Expressed in Years**

Durations	12hrs x 5 days/week	18hrs x 6 days/week	24hrs x 7 days/week
10,000 hours	3.2 years	1.8 years	1.1 years
60,000 hours	19.2 years	10.7 years	6.8 years
200,000 hours	64.1 years	35.6 years	22.8 years

## **Why is Calculated Maintenance published?**

Previous versions of the EPA TM-21 calculator allowed the extrapolation of lumen maintenance beyond 6 times the LM-80 test period. Legacy information can still be found on manufacturers' product data. Also, some manufacturers publish L70 or L90 values without specifying if they relate to Reported or Calculated data, which if greater than 72,000 hours are unlikely to be supported by the IES. Some luminaire manufacturers, including Focal Point, may consider it necessary to publish both Reported and Calculated Maintenance in order to provide a reference point for comparison with competitors.

## **Comparing Data Points**

When specifying luminaires, it is key to understand the difference between Reported and Calculated Lumen Maintenance data, and how they relate to the projected life of the space. It is mistakenly understood that a luminaire with Calculated Maintenance data reported at 100,000 or 200,000 hours is superior to one with Reported Maintenance at 60,000 hours. Those data points are not equivalent and should not be compared when selecting one luminaire over another.

## **References**

- <sup>1</sup> Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules by Illuminating Engineering Society
- <sup>2</sup> Projecting Long Term Lumen Maintenance of LED Lighting Source by Illuminating Engineering Society
- <sup>2</sup> Addendum B for TM-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources by Illuminating Engineering Society