When LED traffic signals hit the market more than a decade ago, this new technology represented a quantum leap forward in performance compared to incumbent technology. Not only did LEDs promise six or seven times the life span of incandescent bulbs, they also gave municipalities an opportunity to dramatically reduce energy consumption with a lower-wattage solution. This combination of maintenance and energy savings added up to a huge win for organizations looking to maximize return on investment for traffic signal upgrades.

Today, many of the LED signals installed by early adopters are coming due for replacement, and there are some areas that still have yet to adopt LED technology at all. But, how do you know when it’s time to replace or upgrade installed systems? And what should you look for in the latest technology? The newest integrated head LED signals can last up to 20 years, meaning most maintenance engineers and technicians may never have to touch them again for the duration of their career. But, not all LED signals are created equal, so it’s important to choose the right technology to suit your specific application.

Some municipalities have taken a rotational upgrade approach, replacing a certain number of existing signals annually beginning with the oldest signals first. Others still use the holdover approach from the days of incandescent bulbs, simply waiting until the LED or incandescent signal fails to replace it. However, the latter approach may pose a serious public safety risk. Even though LEDs are a much more reliable and durable option than incandescent bulbs, they are not fail proof. In fact, when LED signals age, they do not fail completely. Instead, they fade slowly, operating at progressively lower intensity, which can make them less visible from a distance, especially under direct, bright sunlight and in poor weather conditions like heavy rain, fog, and snow. This could create a hazardous situation if drivers and pedestrians are unable to clearly see the signal.

What causes LED signals to lose their luster?

There are several contributing factors, including:

- **Lens Degradation:** Virtually all LED signals are manufactured with UV-stabilized polycarbonate lenses treated with an abrasion resistant coating. Over time, the lens material may degrade, causing yellowing of the outer lens that can decrease the amount and quality of light that passes through. The extent of this degradation would vary greatly based on the length of time the signal has been installed, the geographic location and orientation of the signal. For example, older installations in south facing, sunny southern areas would be subjected to the worst UV exposure.

- **LED Degradation:** Of course, catastrophic failure of an LED traffic signal is easy to spot. Light output degradation, and the extent of the degra-
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dation, is a greater problem that’s also more difficult to diagnose. While newer high flux LEDs packaged specifically for traffic applications have improved this to some degree, even the latest models will degrade slowly over time, influenced by operating current, on-time and operating temperature. Under controlled conditions, an LED loses 30% to 50% of its initial intensity over 70,000 hours of operation; this loss can be affected by temperatures and other conditions over time, and most manufacturers factor this into designs to ensure the products comply with the stated intensity requirements through the typical 5 year warranty period. Finally, because LEDs are semiconductor devices, their performance is affected by temperature cycling. This occurs most significantly in areas with warm sunny days, where the LED experiences a high temperature from both operation and solar loading, followed by cool nights. When this occurs thousands of times over the life of a signal, the impact can range from significant light loss to catastrophic failure of the LED. The most advanced systems now last three times as long as the industry standard—15 years or more—thanks to newer LED systems, better thermal management and improved power supplies.

• Aging Power Supply: The power supply in any LED application is critical to life expectancy. Tasked with converting 120VAC into the proper drive current for the LED board, LED power supplies require specialized design to achieve optimal operation. Off-the-shelf power supplies that are not specifically designed for LED or traffic signal applications are prone to failure under the demands of this type of environment.

When should I replace my old LED traffic signal modules? Signals more than 7 years old are probably due for replacement. In its report, “Replacement Processes for Light Emitting Diode (LED) traffic signals, Project 20-01/Task 246,” the National Cooperative Highway Research Program (NCHRP) of the Trans-

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portation Research Board (TRB) found that it may actually be less costly long term to replace older LEDs in groups, versus spot replacement of older products on an as-needed basis.

For signals between 5 to 7 years old, the answer is not quite so simple. As previously discussed, there are many factors that affect the performance of an LED signal module, and these vary greatly from one installation to the next. Instead of using age as a determining factor, review each installation for the following conditions:

Are older LED installations as visible as newer LED installations in all weather conditions?
• Are older installations starting to fail at an increasing rate?
• What is the liability in leaving older product in operation if it fails?
• Are there any advantages of upgrading my older LEDs?

Advantages of Newer LED Traffic Signals
Based on recent industry developments, the answer to the last question is a resounding “Yes.” Since 2004, the Institute of Transportation Engineers (ITE) has released specifications exclusively for LED traffic products that consider all of the unique properties of LEDs and incorporated testing and performance requirements to ensure the overall safe performance of the products. Specifically, ITE has established photometric requirements for minimum sustained luminosity intensity over a 60 month life for LED signals.

In fact, the latest models to hit the market far surpass ITE life specifications to last longer and ensure a greater return on investment. Global LED supplier Dialight recently announced it is now offering the first ETL-certified integrated LED traffic signal that offers more than three-times the ITE minimum, backed by a 15-year full-performance warranty. Its integrated design offers simple replacement for existing LED signals with separate LED modules using existing wiring and mounting hardware. This both reduces the number of replacement parts municipalities must keep on-hand for signal maintenance, and eliminating the need for on-site assembly.

Consuming just 7 watts, the next-generation units use a fraction of the energy consumed by most common 30-watt systems in place, and the new models accommodate future conversion to DC power to leverage solar energy, without the need to replace the entire module.

Making the Switch
LEDs have experienced dramatic evolution over the past decade, resulting in substantial performance improvements and offering a better long-term value than their predecessors, even from just a few years ago. Replacing older LED products with today’s more advanced systems on a proactive basis can:
• Dramatically increase signal life and long-term equipment costs;
• Significantly lower maintenance demand and cost;
• Reduce energy consumption and associated carbon dioxide emissions;
• Improve signal uniformity and visibility over a longer time span; and
• Reduce emergency replacement needs.

Aside from these direct benefits, proactively replacing older, out of warranty, LED traffic signals with more modern, long-life performance technology can also significantly improve public safety for both drivers and pedestrians, and reduce the potential liability associated with the unexpected failure of older technology.