



Photo by Jason Reed

IS ELMS The ANSWER?

Public Agencies Should Take a Hard Look at the Wave of New Control Systems for Street Lighting. Here Are Five Reasons Why.

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By Karl A. Burkett*

A recent avalanche of technical advances is bringing an array of new technologies to organizations that install, operate and maintain street lighting systems. If used smartly, these technologies have the potential to improve service quality, lower maintenance costs, increase productivity, protect the environment and conserve energy.

Electrical and Lighting Management Systems (ELMS) is the term applied to the hardware related to these new control and communications technologies. ELMS usually consist of a fixture controller, a field data logger to gather information from several luminaires and a central control center. The municipalities' Master Lighting Plan (MLP) is the procedure for implementing ELMS. The MLP articulates the theory of operation of an entire city or region with respect to outdoor lighting systems. The MLP may also include maintenance procedures and outdoor lighting ordinances or codes.

What are the compelling reasons that warrant installation of ELMS and adoption of an MLP? What follows are five key issues that public agencies responsible for street lighting may face that can be addressed by these new innovative controls.

1. Electrical Safety. Electrical safety is a primary concern for outdoor lighting systems with underground electrical circuits. These systems are often installed in sidewalks and other areas open to public ac-

cess. Outdoor electrical circuits are subject to water, weather, rodents and insects. Lighting systems installed by government agencies will typically be in service for 20 or 30 years. In addition, these systems are rarely monitored closely. Typically, maintenance personnel learn of problems in one of three ways: reported or observed lamp outages involving a number of light poles; from a citizen or maintenance person reporting that they received a shock; or, more times than we want to know, by someone actually getting electrocuted.

ELMS can improve this situation through ground-fault monitoring. Monitoring for ground-fault current will alert maintenance personnel much earlier of potential problems than current practices. Ground faults can be thought of as electricity leaking out of the wires. It may occur a little, a lot, or, ideally, not at all. Ground faults will typically first become evident in wet weather. Maintenance personnel do not usually perform their work in wet conditions and will not likely observe the condition until the circuit breaker trips. Ground faults that trip circuit

breakers are very severe, (i.e., a lot of leakage occurs). Tripped circuit breakers, however, are often the first indication of ground fault trouble for the maintenance person. Early and definite indication of ground faults is thus a very valuable, although difficult to quantify, benefit of ELMS. Future developments may include ground fault trips or arc-fault indication and trips.

2. Light Pollution/Light Trespass. For outdoor lighting engineers, light pollution and light trespass are the issues of our time. We are no longer, or should no longer be, locked into the "more and more light" mindset of the past 40 or 50 years. Now is the time to shake ourselves out of this rut.

Traffic engineers over the years have been quick to realize that lighting improves traffic safety. Research supports this notion. In addition, we can all recognize through our own driving experience that street lighting is beneficial. The problem is that we now have so much lighting that our cities are glowing and our maintenance costs are soaring.

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The improved safety we like; it's the glowing and soaring we don't like.

The tide for more and more lighting has clearly turned. A new approach is demanded by the public, as evidenced by the many cities, counties and states that have adopted—or are considering—lighting regulations, codes or ordinances. Further evidence is seen in the many people, organizations, magazines and web sites that promote less light, better lighting and dark skies. The value of both nighttime lighting and dark skies is highly subjective. And plenty of room should be allowed for local tastes. I doubt that the City of Las Vegas will turn off many lights, but my home town of Lubbock, TX, well, I think they may have some candidates.

In Texas, ELMS will help meet the requirements of Texas Health and Safety Code, Chapter 425, "Regulation of Certain Outdoor Lighting." Among other things, this Texas law requires that "for outdoor lighting installed, replaced, maintained or operated using state funds, full consideration be given to energy conservation, reducing glare, minimizing light pollution, and preserving the natural night environment. This includes reducing overall energy costs and resources used and may involve the use of lower wattage lights and timer switches."

ELMS provides the ability to turn lights off or dim lights late at night meeting the requirement for timer switches.

3. Cost Issues and Energy Savings. Guidelines have been in place for many years that help government officials decide when lighting provides sufficient benefit to justify its cost. The best known guidelines are those of the American Association of State Highway and Transportation Officials (AASHTO). These guidelines make recommendations, called "warrants," for when September/October 2005

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the addition of lighting is worth the money. It does not recommend that lighting be installed if the situation meets the warrants; only that it would be worth it from a fiscal standpoint. The warrants are based on four main conditions. These are

- known accident locations,
- motorist decision-making locations such as intersections or entrance/exit ramps,
- locations where glare sources or veiling glare conditions are located in close proximity to the roadway, and
- traffic volume.

Our paradox is to balance safety and environment. From a fiscal standpoint, we cannot light every roadway. From an environmental standpoint, we don't want to. Our goal is to obtain the greatest safety improvement with the resources that we have, while also being aware of the value of the natural nighttime environment. Personally, I would like the lights on when I drive, and off when I'm home. I think most everyone would like that. So why don't we do it? Or at least do it for most of the people most of the time?

The solution is to think "regionally."

We can lower the cost of operation by turning fixtures off, or by dimming fixtures. The result would be more luminaires on more streets and highways, and by extension a greater degree of improved traffic safety. In other words, we can have more lighted streets and highways, with lights that operate only when a lot of people are driving and are turned off the rest of the time. Who says we can't have our cake and eat it too (I never have been able to figure out what that meant anyway)?

Such an operating scheme is possible with individual luminaire controls. Some luminaires, such as those at intersections and ramp terminals, should operate all night. Others, midblock and between interchanges on freeways, may be turned out, which could lead to 25 percent to 50 percent of street lighting being turned off in the late night hours.

This makes engineering sense, because one of the main reasons to light roadways is high traffic volume, and traffic volume diminishes in the late hours of the night. Thus, our need for lighting changes throughout the night. Previously, sophisticated controls were not available at reasonable costs in order to address this changing need. Now, they are.

Additional common sense dimming and on/off curfews can be implemented for central business districts that often have much more lighting than is needed for driving and for security. One reason for additional lighting is to attract retail customers. Certainly this type of lighting can be dimmed or turned off when the retail establishments close. Park lighting, monument lighting, landscape lighting, highway weigh station lighting, some parking lot lighting and numerous other types of lighting can also be turned off when not in use.

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There is a mindset that holds that once a light pole is installed, the light must be burning all night long. That mindset, stemming from tort liability, I believe is misapplied concerning street lighting. From a practical standpoint, street lighting is not required. It is certainly beneficial for nighttime visibility, but not "required." Headlamps provide the "required" lighting. Nighttime drivers commonly drive with headlamps only. This should be the position of all street lighting owners and designers. And the municipality's MLP should clearly state this position.

All totaled, dimming and curfews will potentially save 20 percent or more system-wide in electricity use. By implementing the dimming and curfew schedules mentioned above, overall energy usage is less and safety is greater. During the initial implementation stages, savings may be applied to expanding the lighting system and to the cost of the controls.

4. Contract Management /Maintenance.

The trend for many government functions is to reduce employees and to privatize. ELMS provides reliable lighting system operational condition information that may be used as a basis for payments to contractors. In this scenario, satisfactory operational condition would be defined as maintaining lighting systems operational at or above a certain percentage, say 96 percent. This will allow contracts to be bid on a monthly or annual lump sum basis. The agency savings will be realized in the reduced manpower required to manage a lump sum contract and the ease of monitoring the number of lights operating correctly.

The maintenance contractor will also have access to the data. The contractor can perform remote trouble-shooting and will be able to confidently dispatch the type of service

technician qualifications needed to accomplish the maintenance required, i.e. send out a master electrician or send out a lamp changing crew; and will have an advance idea of what the problem is; thus, the contractor is able to provide his service for a lower cost. Ultimately, this cost savings will be realized by the system owner through lower bid prices for maintenance.

5. Homeland Security. Homeland security improvements, like electrical safety improvements, are difficult to quantify. Various government agencies must each weigh their relative risks. Security managers frequently recommend increased lighting as one method for increasing the perceived "security presence" and thus providing deterrence. Lighting systems installed for this purpose are fine, and can provide the desired deterrence. However, it is likely that the lighting need not burn 100 percent all night every night, but perhaps only when a high threat level exists. Also, if a direct threat is received at night, it may be advisable to turn off the lights at a particular facility so as to not "light up" the target and provide guidance to the terrorist. The ability to turn "all lights on" or "all lights off" in particular geographic areas will also be a benefit to law enforcement for threats other than those posed by terrorists.

Around the Bend

ELMS is the next logical step...technologically, environmentally and practically. Already, some lighting laws and ordinances provide for the implementation of controls, as do some city and DOT policies. In addition, the National Transportation Communications for ITS Protocol (NTCIP) has almost completed the standard for ELMS, and AASHTO is updating its Informational Guide for Roadway Lighting. The new guide will include ELMS/MLP provisions. Meanwhile, IESNA's Roadway Lighting Committee is considering ELMS provisions in its documents. Finally, pilot projects

are underway in Texas, Los Angeles, Canada, Europe and elsewhere.

Everything is getting smart these days, including fixtures. Why ELMS? Because we need it. Everyone benefits.



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at Karl A. Burkett and Associates, Austin, TX. He is recently retired from the Texas Department of Transportation and has 30 years experience in lighting and electrical projects. Mr. Burkett is past chair of the AASHTO Task Force for Roadway Lighting and is a member of the Roadway Lighting Committee of IESNA. He was co-chairman of the International Technology Exchange Program's European Road Lighting Technologies scan tour from which many of these ELMS/MLP ideas stemmed.

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