Highway, Street and Parking Lot Lighting

Realizing the importance of installing surge protection devices

White Paper – March 2012

Sensitive ballasts and power supplies are critical to the functionality of most highway, street and parking lot lighting. Maintaining the life of these critical components requires surge protection. The information contained in this document is intended to highlight this fact and discuss the importance of developing a protection strategy when servicing or installing your outdoor lighting.

IMPORTANCE:

According to the Federal Highway Administration, the U.S. currently has just over four million center-line miles of roads, providing 8.58 million lane-miles for highway travel. These figures don't include all the parking lots, railways, and sidewalks with thousands of light poles/fixtures dotting the landscape in every municipality across the country. Every single one of them are susceptible to damage and/or destruction by power anomalies like lightning strikes and transient surges.

Ok, so what? A street light or several street lights are out and non-functioning, no big deal, right? Afterall, we've determined there are hundreds of thousands of street lights in use, so why add costs to a DOT project by purchasing and installing surge protective devices (SPDs)?

First, it would be prudent to understand the major advantages of fully working street lights including the fact that they prevent accidents and increase safety.[1] Lighted intersections and highway interchanges tend to have fewer crashes than unlit intersections and interchanges.[2] Studies have shown that darkness results in a large number of crashes and fatalities, especially those involving pedestrians; pedestrian fatalities are 3 to 6.75 times more likely in the dark than in daylight.[3] Street lighting has been found to reduce pedestrian crashes by approximately 50%.[4][5][6]

Second, these lights are usually mounted on some type of pole/post, a good distance above the ground, making them prime targets for lightning and transient activity.

A properly installed SPD for this application would significantly reduce maintenance and/or replacement costs, as well as liability incursions for both business owners and local, state and national governments, all the while providing a measure of safety to the general public.

CHANGES IN TECHNOLOGY:

As previously stated, the ballast is an critical part of the street light fixture, as it regulates the amount of current the light needs to illuminate, supplying the correct amount of power. ***(See Figure 1).***

The ballast, though a relatively inexpensive part, serves an important role in the overall anatomy of the street light fixture and because its sensitivity to power fluctuations, great care should be taken to prevent any damage to it.

There are two types of ballasts, both operate in the same basic manner, but with significant differences in regards to the overall benefits. The robust **magnetic ballast** has been an industry standard, but is gradually being phased out in favor of more energy efficient lighting using a **high frequency electronic ballast,** along with newer **LED, (light emitting diode)** technology.

But, as with any improvement, there are usually trade offs. Installing energy efficient components heightens the need for increased maintenance costs, which is why surge protection should be installed.

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Figure 1.
Anatomy of a Street Light

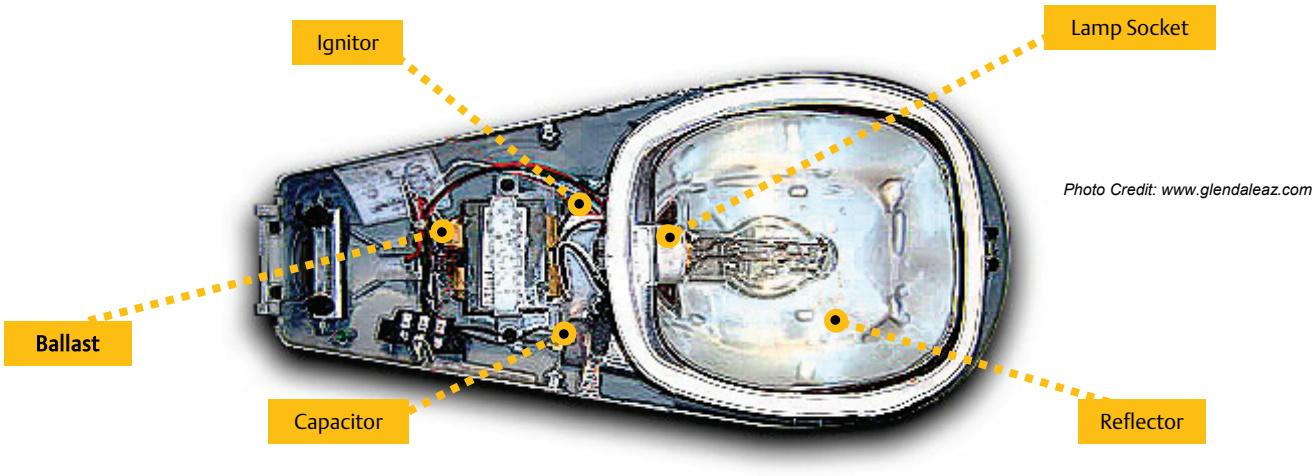
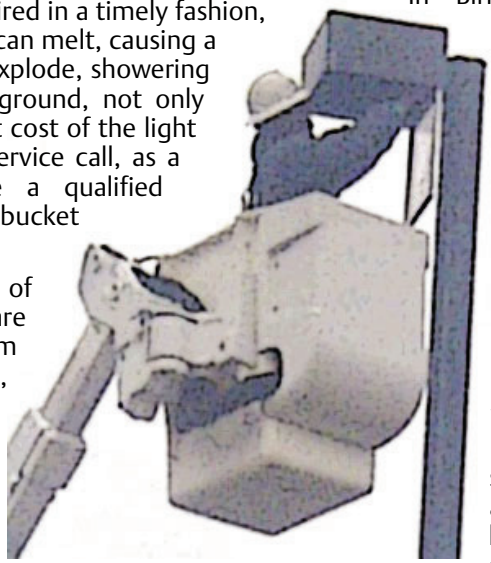


Photo Credit: www.glendaleaz.com

PROBLEM:

Surges are an everyday occurrence and can come from a host of different sources. We typically think of a lightning strike as the major culprit of equipment damage and though lightning CAN cause catastrophic damage in a single incident, over time, it's actually lower level transients that wreak havoc with sensitive electronic components, including ballasts and switch mode power supplies, (in LED lighting).

The breakdown of these electrical components may cause intermittent light distribution. If these malfunctions are not repaired in a timely fashion, parts can overheat, wires can melt, causing a fire or the fixture could explode, showering glass and debris to the ground, not only resulting in a replacement cost of the light itself, but an expensive service call, as a response would require a qualified electrician and an arial bucket truck.



Additional sources of transients to consider are those generated from utility grid switching, individual pieces of equipment (or loads), and traffic accidents. All of these sources are potentially damaging to unprotected equipment. This could mean street and parking lot lights, but it also includes the main source of power, the main electrical service supplying the equipment.

For street lights, the main AC power source could reside in a cabinet at an interchange or along the roadside. For a parking lot, the power source would be tied into the resident facility's main electrical service panel. Either way, whether it's the street light itself or the power feeding the light, all can be adversely affected by voltage transients and therefore need to be protected.

REAL LIFE PROBLEMS:

As mentioned before, studies have shown that intersection and highway darkness can result in a large number of crashes and fatalities. Damaged, non-functioning street lights could potentially have fatal consequences and be the critical difference between life and death situations, along with the fact that these dangerous conditions are a liability for businesses and municipalities who allow the conditions to exist.

Case Study:

In Birmingham, Alabama, residents filed numerous complaints with city officials about *some* of the 2,600 non-functioning streetlights on their local interstates, as well as *some* of the 1,100 street lights within the city limits, saying they're merely 'bird perches' by the side of the road. Birmingham officials earmarked $400,000 to repair and replace all the non-working street lights, as the local ALDOT division engineer called the situation a safety issue. [8]

Case Study:

We can all agree, inadequate or inoperable outdoor lighting can lead to serious pedestrian injuries. So when accidents happen, the question of liability surfaces. This generally comes down to a simple question, *'was there a reasonable effort to keep the premises safe?'* Namely, did the property owner (or municipality) know about a dangerous situation but fail to correct the problem in a reasonable time frame?

One case in particular is the *Clay Electric Cooperative, Inc. v. Johnson, 873 So. 2d 1182 (Fla. 2003),* which ruled in the favor of the plantiff.

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The accident occurred in the vicinity of an inoperative streetlight. In the lawsuit, the Supreme Court of Florida ruled that the Electric company had the responsibility to pedestrians to maintain the inoperative street light with reasonable care.[9]

This is one of many such cases that highlight the importance of paying attention to your outdoor lighting. There are many steps that can be taken to ensure some reasonable level of safety when it comes to lighting. Obviously, timely repairs should be considered, but one also needs to consider protecting the sensitive circuit *"upfront"* with an appropriately sized SPD.

PROBLEM SOLVED:

You can never solve a problem on the level on which it was created. — Albert Einstein

How true! Power quality issues were not always the source of frustration that many face today. With the advancement in micro-electronics and circuitry, sensitive technologies are merely targets and not the source of the problem. Surge protection is simply not given the importance to raise it *'above'* the level of technology it serves. One bright spot, IEEE recommends the standard for High Frequency Fluorescent Lamp Ballasts, ANSI C82.11-2002 which states, ***"Electronic high frequency ballasts are more susceptible to line transients than line frequency magnetic ballasts. Therefore, transient protection shall be included"***.

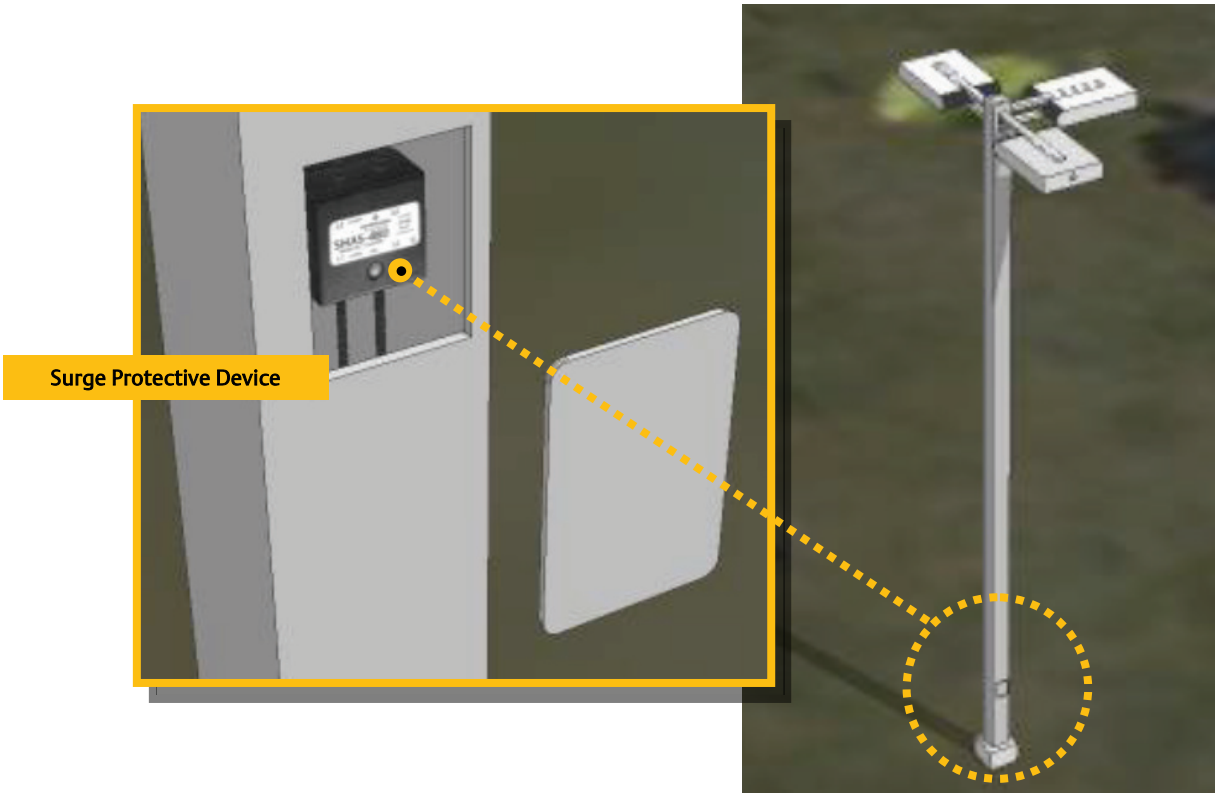
In addition to being a 'best practice', including a surge protection device into the base of the light pole fixture is relatively inexpensive and easy to install, ***(See Figure 2).***

So, whether it's Birmingham or another community/business in the US or abroad, installing or repairing expensive highway and parking lot light poles without including a surge protection device, is like closing and deadbolting the front door of your home or business, then going out and leaving the backdoor wide open. It simply doesn't make any sense and the decision is inviting trouble at the doorstep. Surge protection **is** the problem solving solution in reducing overall maintenance costs and improving safety.

"Electronic high frequency ballasts are more susceptible to line transients than line frequency magnetic ballasts. Therefore, transient protection shall be included".

—IEEE C82.11-2002

Figure 2.
Surge Protective Device installed at the base of a typical street light



Credits:

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