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LIGHTING DESIGN + APPLICATION

Chasing Away The Dark

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In late 2007, Dual-Lite supplied three Trident Series three-phase 20KVA central lighting inverters to Chase Field, home of the Arizona Diamondbacks Major League Baseball team. The central lighting inverters were part of an order secured by Hubbell Lighting, Inc. for a major Chase Field renovation project. The inverters were installed as emergency power supplies for 80 Sports Liter Solutions 1,500 watt metal halide fixtures designated on the renovation plan as "emergency lighting fixtures."

LD+A featured this renovation project in the May 2008 issue as a sidebar to an article on lighting design trends for sports lighting and roadway lighting by J. Devlin Armstrong, P.E. The sidebar is reprinted here with permission.

tion after construction, we paid particular attention to the quality of the light as well as the quantity. The opinions of the installations were overwhelmingly positive and the use of this MH-HPS mix became the standard layout for our firm. We did increase the quantity of HPS vs. MH to 30 percent HPS/70 percent MH and up to as high as 40 percent HPS/60 percent MH, and judged the higher ratios to provide even better lighting results.

One project–a set of six tennis courts for the Seattle Parks Department with a full-cutoff optical system–even pushed the mix ratio of HPS and MH to 50/50. We heard about the results of this project before it could even be tested. A landscape architect who lived nearby and regularly walked through that park welcomed the dramatic reduction in off-site glare and the excellent color rendition.

Another project, the Key Arena Light Ring, came to a different result. Included in that project was the temporary lighting of a practice gymnasium for the Seattle SuperSonics basketball team. This practice court was illuminated to over 200 footcandles to mimic the type of lighted environment the players would normally see. This required a large number of luminaires and it was fairly easy to mix the light sources; the mix works well whenever more than one luminaire is used to light the same area. When the Key Arena was completed, the Sonics moved to a new, nearby facility and contracted directly with an electrical contractor to move the luminaires over to the new gymnasium. Unfortunately, during the move, the contractor installed several of the MH luminaries in one area and several of the HPS luminaries in another area. The light did not mix and the result was disappointing.

An example of luminaire mixes used for sports lighting in the 1980s. Note only two high-pressure sodium luminaires in a 12-luminaire bank.

As more full-cutoff optical systems for baseball, football, soccer and similar sports fields have been designed over the years using the mix of HPS and MH, there's been a minor change in the ratio of the mix. As the systems age, the light depreciation from the MH lamp is much greater than from the HPS lamp. The illumination slowly shifted to become richer in the golden portion of the spectrum rather than the complete warm white that we saw when the project was installed. The slight shift in color over time was not a problem for the users or owners, but was an important part of the learning curve for our design team. As a result, we have settled on a 5/3, 4/2, 3/2 mix of MH/HPS for banks of eight, six and five luminaires.

Chasing

With Chase Field's retractable roof—not to mention its desert location—rain delays aren't much of a concern for the Arizona Diamondbacks. While a power outage is just as unlikely to disrupt the game, stadium operators now have a system in place to provide emergency illumination—just in case.

Stadium officials upgraded Chase Field's lighting system—including its security lighting—after they learned that replacement parts for the stadium's re-strike HID fixtures would no longer be produced. If the lights were to go out, a capacity crowd of 49,033 would suddenly find itself in the dark for up to 15 minutes. In the remote event of a power outage, the stadium operations team wanted to ensure that it could quickly shift from normal source illumination to emergency back-up generation in five seconds or less.

Engineers evaluated a number of alternatives (including a UPS system and a fly wheel system) before selecting a central lighting inverter system (from Dual-Lite a Hubbell Lighting, Inc. brand) to be used in the new emergency 1,500-W metal halide HID fixtures specified. "In addition to being cost effective, the central light inverter system enabled us to standardize our sports lighting," says Marshall Cheever, assistant director of engineering at Chase Field. "We were able to dispose

ROADWAY TO STREETSCAPE

Mixed lamp lighting is also feasible for street lighting projects. High-mast lighting is quite common on many of our freeways. It normally consists of several luminaires on each tall lighting pole. Sometimes HPS

Away the Dark

of many obsolete fixtures, and most importantly, we would not go dark."

To illuminate the playing field and intentionally provide overthrow lighting into the stands for safety, the engineering team standardized on 1,500-W metal halide fixtures (from Sports Liter Solutions, a Hubbell brand). There are seven banks of fixtures (totaling 87) in each of the four corners of the stadium, and 180 fixtures in each of the two main outfield banks of lighting. Of these, 80 are emergency fixtures: 60 in the corner banks (15 fixtures in each of the four corners), plus 20 within the two main banks (10 fixtures in each bank). Together, these 80 fixtures provide sufficient illumination to allow spectators to exit the ballpark safely during an emergency.

Three, 3-phase, 20 KVA central lighting inverters supply the emergency power for these fixtures. Strategically positioned near electrical panels, two of the inverters are located on the facility's mechanical level, while the third is on the stadium's upper concourse. The central lighting inverters constantly monitor the incoming power supply to the connected loads. As long as normal utility-supplied power is available, the central lighting inverters remain in a standby mode with batteries fully charged, ready to respond to an emergency. If the utility line is disturbed or interrupted, the central lighting inverters would automatically supply emergency "inverted" power (derived from DC batteries and converted to AC power) to all connected loads.

Since the central lighting inverters supply the exact same power to the load as the utility does, there is no drop in the electrical current needed to operate the load. Every load connected to the inverters is maintained at its required power level. This is especially important at Chase Field because of its use of high-intensity discharge lamps; a very minor power interruption can cause fixtures to "wink out." Due to the nature of HID lamps, they must cool down before they can re-strike an arc, and that process takes up to 15 minutes. With the inverter system now in place, that process is expected to take milliseconds.

Chase Field, home of the Arizona Diamondbacks baseball team, recently updated its lighting and security lighting systems with central lighting inverters and 1,500-W metal halide fixtures.

equipment is used and other times MH equipment. There are now several high-mast lighting projects in the Puget Sound area that utilize a mix of light sources. One of the current issues in roadway lighting is the desirability for better color rendition. While I know of no research that has been done on the mix of light sources, I would expect the mix to provide better visibility than either source alone, making it a viable lighting system whenever it can be used.

In addition, lighting in Central Business Districts is usually at a higher level to provide pedestrian safety, comfort and good color rendition. This might also be an appropriate application for the mixing of lamp sources.

The bottom line: Designers should be aware of this under-utilized technique, but should not force a solution that doesn't fit the project.

This article is based on the author's presentation at the 2007 IESNA Street and Area Lighting conference.

About the Author: J. Delvin Armstrong, P.E., Member IESNA (1967), is a licensed professional electrical engineer and has recently retired as president and principal of Armstrong Engineers Inc., a consulting electrical engineering firm. He has specialized in outdoor illumination projects for the past 37 years of his career, and has been the Engineer-of-Record on over 800 illumination projects in the Pacific Northwest. He engineered the illumination system for Seattle's Kingdome, the original home of the Seattle Seahawks and the Seattle Mariners major league sports teams. In 1995, he engineered the new illumination system for the Key Arena, temporary home of the Seattle Supersonics. He is a member of the IESNA Roadway Lighting Committee and past chairman of the Sports Lighting committee.

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