

# Testing time for lighting design

LED lighting has developed to the point where some think it will replace high-intensity discharge (HID) lamps in the medium term. Higher output fixtures are steadily coming out. For example, Acuity Brands, which produces the Holophane range of high mast lighting (HML) poles and fixtures, has just launched what it claims is "the first reliable high mast LED system," called Holophane HMAO LED, for new and retrofit applications. The fixtures are modular with three lumen packages using 7, 11 and 14 LED modules producing 22,049, 34,962 and 41,934 lumens respectively.

Comparatively speaking these are big LED fixtures, with the 14 module unit using 551W. They have prismatic glass optics with options for asymmetric or symmetric lenses to control light direction. Colour temperature options are 4000K and 5000K with a CRI (colour rendering index) of 65 minimum. The L70 life (the point at which light output falls to 70% of rated output) is rated at >100,000h at 25 degC, and the class I LED drivers are rated for 85,000h minimum. There are no fans and cooling is achieved through cold forged heat sinks.

Rob Drago, VP, value stream leader, infrastructure at Acuity, said the company has looked at lighting technology being developed, including light emitting plasma, and concluded that LEDs are the way of the future. The technology is now at the point where Acuity considers the HMAO LED series are suitable for poles up to 120ft high. The HMAO series are three times the cost of other options, but the energy and maintenance savings are significant. If the 100,000 hour life can be achieved, the fittings would last 25 years at a facility needing light 12 hours a day.

## Test data

Data from a test on a 120ft pole with 12 fixtures are presented in the table (p32). The 14 LED fixture produced an average of 3.2 foot-candles (fc) at the ground, compared with 3.02 fc for the existing high pressure sodium (HPS) fixtures using 1090W. While the HMAO LEDs produced as much light as the HPS fixture in the test, some terminals are looking for more light. The OSHA standard (29 CFR 1917.123) for marine terminal illumination requires an average of a minimum of 5 fc in working areas, or 53.8 lux.

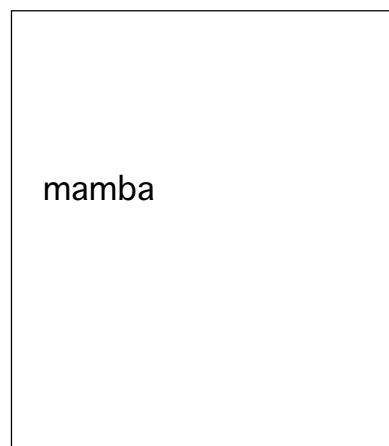
Drago said he has yet to see a terminal using HPS floodlights that actually achieves this standard, although it may be specified initially. As well as light level and consistency, fixtures also have to be designed to reduce light spill, and most customers want a full cut-off fixture. Achieving all the design criteria with existing pole infrastructure might not be possible no matter what fittings are chosen. In some cases, the poles are simply too far apart for what a terminal is trying to achieve, he added. Acuity now has six terminals testing Holophane HMAO fittings with 1-4 poles in each test.

## Global Tech upsizes

The HMAO range competes with US-based Global Tech LED's "off-the-shelf" LED retrofit kits. Global Tech president and co-founder Jeffrey Newman is bullish on LEDs: "Gaseous lamps are not going to be around for long, eventually every light in the world will be LED."

Newman said terminals' requirements vary considerably. One test system at a DP World

*DP World will use low-mounted LED street lights from Primalence at T3, Jebel Ali*



## LED lights offer energy and maintenance savings, but some terminals are staying with conventional HID fixtures

terminal in India is mounted on a 50m pole and designed for 12.5 lux at a 75m radius around the pole. There are 20 fixtures per pole with 10 in an outer ring tilted at 55 deg and 10 in an inner ring tilted at 39 deg. Initially Global Tech used 290W LED inserts, but had to increase this to 540W per fixtures to meet the lighting requirement.

Newman said light output from LEDs is increasing all the time, with the latest

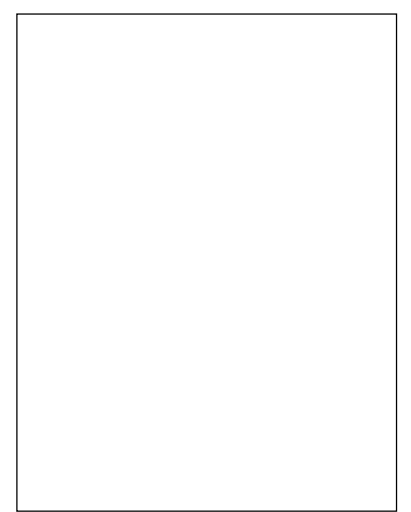
components from Phillips producing 25% more lumens per watt than the previous generation. Global Tech has been asked for 5 fc under the poles previously. "At the time we could only give them three, but now we can give them six."

## On site with CSX

CSX Intermodal Terminals began looking at LED lighting for high masts in

2011 and partnered with Aelux of Glenside, PA to test Global Tech retrofit kit. The test involved comparing four different configurations on existing poles in CSX's Orlando terminal: Metal Halide 750W; unaltered HPS 1000W; Global Tech LED HML Retrofit Kit; and a Green Spider Lighting Controller. A meter was set at the base of each pole and energy consumption was measured over a 4-day period.

"The Global Tech LED product performed better than the other options by a considerable margin," said Wilby Whitt, president, CSX Intermodal Terminals. CSX company normally requires 1fc at the rim of lighting for its terminals and achieves 5-10fc at the base, depending on the height of the poles. After testing, CSX retrofitted all 161 fittings on 23 100ft HML poles at its Jaxport intermodal fa-



*Holophane HML with new LED fittings*

*Automated stacking cranes at APMT Virginia converted to LED*

cility. "Employees at the Jacksonville terminal have expressed their pleasure at the quality of light and that visibility at night is much improved over the old HPS fixtures," said Whitt. "The LED fixtures have provided improved light needed to operate an intermodal facility safely."

With regard to power savings, CSX has achieved an average saving of 20% per month on the overall terminal energy consumption since the installation. It is also looking at other LED options and



its new terminal in Winter Haven, Florida (scheduled to open in May 2014) will be the first to use the Holophane HMAO-LED solution. The fixtures will be installed on 26 poles at a height of 70ft. The entrance and road gate

area will be illuminated with 40ft poles using Leotek LED fittings.

### Maths challenge

The key to getting more light from LEDs is to increase the number of LED modules and

drive more current through them. While some smaller LED lights for walkways or doors use 15W or less, the Holophane HML14 is a 550W fixture. That is greater than some prismatic CDM (ceramic discharge metal-halide) fixtures that can be used in the same application.

Prismalence of Sweden specialises in prismatic lenses to increase the range of a light source. International sales manager Daniel Björk said the company has been evaluating LED technology for seven years and has now launched its first LED product, an LED version of its Polaris fixture that uses the same optical lens as the CDM Polaris fixtures.

The Polaris LED is a relatively low power 38W unit that Prismalence has installed as auxiliary and door lights on RTG/RMG and STS crane applications. Using LEDs as the light source for bigger Prismalence lights is problematic because LEDs scale up by using multiple LED modules, and multiple modules are difficult to focus through a prismatic lens.

When it comes to HML, roadway lighting at lower heights and crane floodlights, Prismalence is, for now, staying with CDM technology, on the grounds of light quality and cost savings. Prismalence has seen LED fittings where the maximum to minimum light levels over an area covered by an LED fitting have been as extreme as 500 lux to 1 lux, which is not a good safe working environment. Poorly designed systems do not meet European safety standards and have turned some customers away from LEDs.

### Real savings

With regard to cost savings, the promise of LEDs, said Björk, is investing money in expensive fittings to save energy and maintenance costs long term. However, most of the calculations from LED suppliers compare LEDs with HPS light, which is "the cheapest, worst light around" with fixtures typically lasting 8,000 to 15,000 hours. Prismalence CMD fittings last around 30,000 hours and cost about one third of an LED fixture. More importantly, they use about the same amount of power (350kw) as LED floodlights, and less than the bigger units mentioned above. Paying three times as much for a fixture with a lifetime of less than double does not make sense, added Björk.

He stresses that Prismalence is not downplaying the benefits of

### Comparison of holophane LED and LPS. (Source: Acuity)

Luminaire Source	HPS C1HP	HML14 14 LEDs	HML11 11 LEDs	HML17 7 LEDs
Average fc	3.02	3.2	2.6	1.64
Maximum fc	4.16	4.1	3.2	2.0
Minimum fc	1.88	2.1	1.8	1.15
Avg/min	2.21	1.52:1	1.45:1	1.43:1
Max/min	1.61	1.95:1	1.78:1	1.74:1
Fc equivalent		100%	86%	54%
Wattage	1090	551	437	284

Note: Acuity provides the following explanation. Port application, 300ft x 425ft, 120ft pole height, 12 fixtures per pole, CH1P footcandle levels measured at job site. HML14 data based on lumen depreciation at 30,000 hours

LEDs just because LEDs are not a good fit with its optical lens technology. Over the last two years many customers have reevaluated Prismalence fittings compared to LEDs "and we have come out the winner every time." Prismalence is supplying yard lighting for T2 at DP World's facility in Jebel Ali and has won the order for all the lights at T3. This includes over 2000 fixtures for the yard lighting, 10 STS cranes and 25 automated RMGs. It is also supplying yard and STS lighting for DPW's Rotterdam World Gateway and London Gateway terminals.

At T3 Jebel Ali and RWG, DP World will not be installing HML over the yard blocks, opting instead for street lighting for vehicle roadways only, mounted at 4.5 and 5m respectively. At T3 the fixtures on these poles will be a new 50W LED streetlight fixture (with Prismatic lens) called Mamba. At London Gateway Prismalence is supplying its Stella 315W CDM fixtures on 30m masts. "By using our optics we could go down from 40m masts to 30m masts and maintain the same distances, which is a great saving," said Björk.

### Phoenix lands orders

Phoenix Products has won an order for LED fixtures on STS and ASC cranes for LBCT's Middle Harbor project. Phoenix will supply its ModCom LED floodlights, walkway and interior machinery house lights for all the new ZPMC cranes. The floodlights are 150 and 300W ModCom fixtures with customised optics, while the walkway lighting uses 18W fixtures and the machinery house Phoenix's RSL linear fixtures.

Phoenix maintains that LEDs have a significant advantage on ASCs deployed in perpendicular yard blocks. The cranes do not need lighting when operating in the block, but the interchange areas at the ends must be lit for remote controlled operations. LEDs can deliver "instant on" lighting with no warm up time, allowing

the terminal to shut LED lights off for up to 90% of night operations, depending on the terminal.

Pete Giugliano, VP, engineering for Global Container Terminals (GCT) said this is the main reason it specified Phoenix LEDs for the ASCs at its expansion project in New Jersey. Phoenix designed a configuration featuring 8 x 300W LED floodlights and only two of the floodlights will be on at night during unmanned operations, with the other six coming on when the crane is operated by the remote operator.

The Phoenix lighting configuration was tested on a very similar crane at APMT Virginia (where Giugliano was previously engineering director) in place of 14 400W metal halide floodlights. Light levels with the LEDs exceeded metal halides (although the metal halides had been in operation for some time) and the quality of light was improved. The LEDs are better for remote operation as the images "are more crisp than the same image illuminated with metal halide," added Giugliano. Phoenix will also be supplying LEDs to DP World for the ASCs at London Gateway.

Using LEDs reduces power consumption from 5600W to 2400W, but the ability to shut off six out of eight fixtures also has to be factored into the savings. With 20 ASCs, GCT expects to save US\$60,000/year in energy costs, based on 12 hours operating for two floodlights and two hours for the other six. In Virginia, VIT is pursuing grant funding to convert further cranes to LED lighting.

Phoenix continues to expand its range and has recently launched the Aries, a low-profile 16W LED floodlight designed to replace up to 500W quartz halogen fixtures on mobile equipment. Aries is designed for a variety of input voltages in both AC and DC and is built to marine ratings including IP67 and UL 1598A. Phoenix expects to have its first retrofits installed on straddle carriers soon. □

## Modern Terminals tests LEDs

Modern Terminals Ltd (MTL) in Hong Kong is taking its first steps with LED lights. Procurement and contract manager Leslie Lau said the capability of LEDs would be a significant advantage following MTL's E-RTG conversion project. The operator frequently moves E-RTGs between blocks under diesel power and the existing HID lights take 15 mins to come up again when an RTG is reconnected to the conductor bar after "crossing the street."

MTL has investigated using LED fixtures on its RTGs and been approached by over 16 suppliers over the past two years claiming to have suitable fixtures. It is now testing products from six suppliers for suitability in severe weather conditions and vibration environments. Lau said MTL could also use LED lights on STS cranes, but doubts they are suitable for lighting all the way down to the bottom of a vessel from a crane trolley, a distance of over 50m "given the products currently available in the market."

Other applications around the

terminal are being treated on a case by case basis. Lau said the gate canopy is suitable for LEDs as the fixtures are mounted at a height of 10m. High mast poles, however, will require further tests. MTL has 50m poles spaced over 50m apart and will be testing an LED system on one pole. It is also considering using the conductor rail infrastructure of its E-RTGs to install lower height LED street lights to light roadways where possible.

If the tests prove successful, MTL will install LED fixtures in stages, doing a pole or an area at a time and keeping existing fixtures as replacement spares where possible. Maximising energy efficiency is a key part of the company's environment policy, but so is conserving resources and minimising waste.

Old HID lamps are still a useful resource and they contain hazardous chemicals that must be disposed of properly. On balance, said Lau, it is greener to migrate gradually to lower energy lighting and use up all the existing light fittings rather than throw them away. □