LED: Lightsavers

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TORONTO – CALEDON PARKING LOT TRIAL: FINAL REPORT

Background:
LightSavers is a project of the Toronto Atmospheric Fund (TAF), in affiliation with The Climate Group, and is supported by the Ontario Power Authority and Natural Resources Canada. The LightSavers project aims to accelerate deployment of advanced lighting technologies — Light Emitting Diodes (LEDs) and smart controls — in order to reduce energy use and greenhouse gas emissions.

The first phase of the LightSavers project focuses on pilot testing advanced lighting technologies in real world applications. Pilot projects were hosted by municipalities and public sector organizations across the Greater Toronto Area. TAF coordinates ongoing monitoring and evaluation of pilot projects.

Evaluation and monitoring services provided by Gerry Cornwell of Cornwell Lighting.

For more information on the LightSavers project, see **www.lightsavers.ca**.

For more information contact:
Bryan Purcell
Program Manager
bpurcell@tafund.org
416-393-6358

Disclaimer: Mention of any firm or commercial product, device, measurement instrument or specific lighting engineers/consultants in this document does not represent an endorsement by TAF or the Town of Caledon. This report summarizes data collected on site at this specific pilot site and is not intended to predict the performance of the same or other products on other sites.

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1.0 Executive Summary

This is a final report on the Town of Caledon's LightSavers Pilot Project. The project involved replacement of nine Metal Halide (MH) area lights with new LED area lights manufactured by three manufacturers: Elumen, Relume and Ruud. The purpose of the project was to evaluate whether the LED area lights could be a viable and energy efficient alternative to the conventional MH area lights commonly deployed for parking lot illumination across North America. Specific factors considered in this report include illuminance, uniformity, average illuminance over time, temperature sensitivity, energy consumption, and economic performance. The pilot location is a parking lot adjoining the Town of Caledon Municipal Building.

Data was collected over a thirteen-month period beginning in November 2009. The key findings are summarized below:

- Two of the three LED products increased average illuminance on the lot by as much as 51%
- Two of the three LED products improved Illuminance uniformity to much better than the IES design recommendations
- Measured depreciation in average illuminance over the 13 month test period ranged from 0% to 7%
- Energy consumption was reduced by between 58% and 69%
- The high price of the LED fixtures, combined with the high cost of installation, resulted in a relatively long payback period. However, LED luminaire prices are falling relatively quickly, and it is expected that similar projects will be economically viable in the near term future (2012).

2.0 Project Overview

2.1 Site Description

The pilot site is a parking lot located adjacent to the Town of Caledon municipal building (see Figure 1 below). Test fixtures were selected on the perimeter of the parking lot to minimize the interference from adjacent luminaires. Since the municipal building is located next to a sports field, there is no apparent external light trespass.

For reference, the Illuminating Engineering Society of North America Lighting Handbook, Ninth Edition, *Recommended Maintained Illuminance Values for Parking Lots*, was used (see Appendix A). This parking lot is classified as Enhanced Security as this is a public building. Minimum maintained illuminance is 5 lux (lx). Recommended Maximum/Minimum value is 15:1.

Existing area lighting fixtures are Gardco CR20 4XL (Type 4 distribution) MH using 175 Watt, 347 Volt electromagnetic ballasts and conventional photocell controllers. See Appendix C for product details.

2.2 Test Products

This pilot evaluated three different LED luminaries produced by different manufacturers. The manufacturer specifications for each luminaire are in Appendix C. The table below illustrates some of the basic specifications for each fixture.

One major difference between the products tested in this trial is that the Elumen product uses a dynamic driver that adjusts the drive current, and power consumption, in response to time and temperature. According to product specifications, power consumption is reduced by 3% for every 10ºC decrease in temperature, and will gradually increase by up to 30% over the lifetime of the fixture to compensate for LED aging. Therefore, at end of life the fixture may be using up to 90 watts of power.

Figure 1: Town of Caledon Site Photograph

Table 1: Fixture Specifications

Manufacturer	Model	Power	Lumen Output	Efficacy (LpW)[1]	Colour Temp[2]
Elumen	LEDSLSE66C3	69W[3]	4900	71	5000K
Relume	R4800 Cobra	71.78W	3349	46.7	5600K
RUUD	X-AL-1-2-80-C	93W	6842	73.5	6000K

[1] Lumens per Watt
[2] In degrees Kelvin; product specifications are ±500K
[3] This product's power use changes over time (see Appendix B for details). This is rated initial power use at 15 degrees Celsius.

3.0 Performance Assessment Methodology

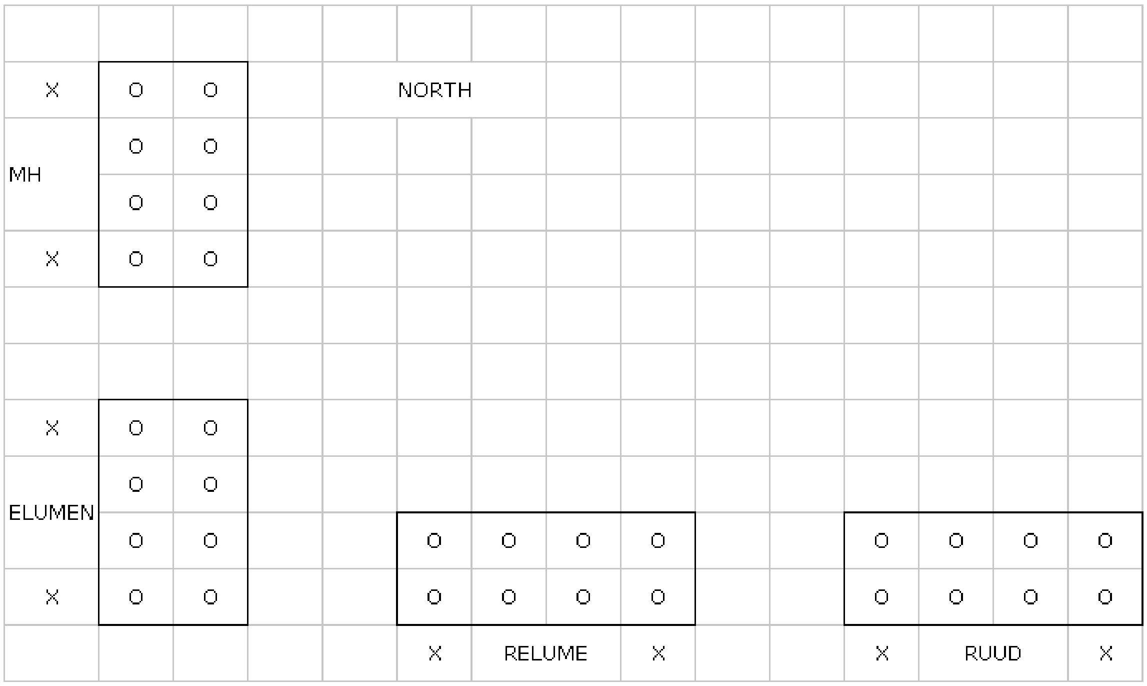
This pilot project was evaluated using the LightSavers Monitoring and Evaluation Protocol, developed by TAF in collaboration with the Ontario Centre for Environmental Technology Assessment (OCETA). The full protocol is available at www.lightsavers.ca.

Prior to any measurements, a section of the existing MH area lights were re-lamped with new lamps, and these were operated for approximately 100 hours to allow the lamps to achieve rated output. Power and illuminance readings were taken with the MH area lights in order to establish a baseline for comparison to the new LED fixtures.

Following the baseline measurements, the new LED fixtures were installed and operated for approximately 100 hours prior to any measurements. Initial measurements of both power and illuminance were taken on November 10, 2009. Further illuminance measurements were taken on a randomized date approximately twice per month. All measurements were taken at least one hour after sunset. Temperature and atmospheric conditions were recorded at the time of measurement.

A measurement grid was designed and marked on the parking lot to ensure consistency of measurement points. It is to be noted that the measurement grid used does not follow IES recommended practice, which would require more data points and vertical illuminance measurements. However, the values are real and the purpose of the measurements, to compare the relative illuminance in different areas over time, has been served. Figure 2 below provides a rough approximation of the measurement grid (not to scale).

Figure 2: Caledon Measurement Grid



The letter 'X' denotes a fixture, while the letter 'O' denotes a measurement point. The measurement points are located in the centre of one driving lane and one parking row. There are eight measurement points in each test area. Perimeter locations near curbs were avoided to simplify data collection during winter months. It should be noted that the pole spacing varied slightly across the four test areas. Readers should therefore be cautious in making absolute comparisons between the four products.

Data was collected on site for a 13 month period commencing in November, 2009, using a Cooke cal-LIGHT 400F light meter. Since the quantity of raw data at this site is extensive, the summary data charts are appended to this document. See Appendix D

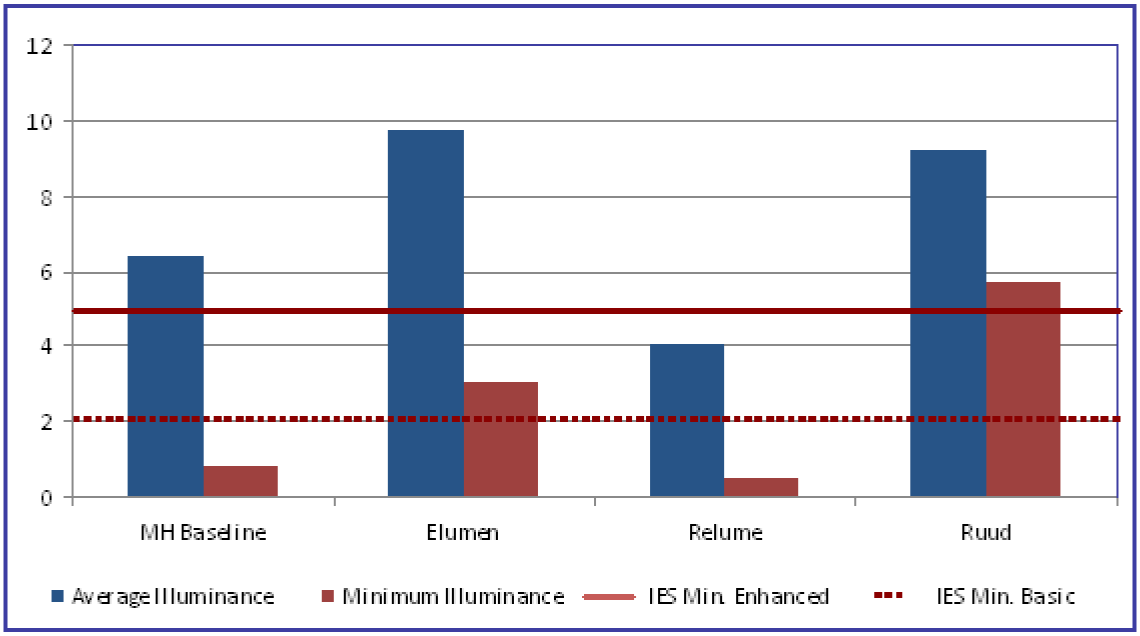
4.0 Results

4.1 Illuminance

The average and minimum illuminance values after 12 months for each of the four test areas are graphed below (Figure 3). The IES design recommendation for both basic and enhanced security parking lots is shown for reference.

The average illuminance measured with the baseline (re-lamped) MH fixtures was 6.4 lx. The minimum illuminance measured was 0.8 lx, which indicates that the existing baseline design does not meet the IESNA recommended minimums for either basic or enhanced security parking lots (see Appendix A for details). Average illuminance in the LED test areas ranged from 9.7 lx to 4 lx, with minimums ranging from 5.7 lx to 0.5 lx.

Figure 3: Average and Minimum Illuminance after 12 Months



As the chart above illustrates, two of the three LED products substantially improved both the minimum and the average illuminance values on site in comparison to the baseline design. Only one of the LED products met the IES recommended minimum for enhanced security parking lots, while two products met the benchmark for basic parking lots. However, it should be noted that the manufacturers were not asked specifically to provide a product which would meet the IESNA recommendations, but rather to provide a product that was substantially equivalent to the baseline MH fixtures which were being replaced.

4.2 Uniformity

Uniformity of illuminance levels is critical for human vision since the eye is so sensitive to contrast. The IESNA recommendation is a maximum to minimum uniformity ratio of 15:1 or better for enhanced security parking lots, and 20:1 for basic. The uniformity of the LED parking lot lights varies considerably from product to product. The baseline MH area light and the Relume area exhibited unacceptable measured Max:Min values. The Elumen test area was well within IESNA recommendations, indicating good uniformity. The Ruud product in particular achieved excellent uniformity of light distribution.

Table 2: Max:Min Values after 12 Months

Product	Max:Min after 12 Months
Base MH fixtures	20.4:1
Elumen LED fixtures	7.6:1
Relume LED fixtures	23.2:1
Ruud LED fixtures	2.5:1

4.3 Colour Temperature

Colour temperature readings were taken during two different illuminance measurement sessions, approximately 9 months apart in order to detect any colour shift over time and verify that the colour of the light source was within manufacturer specifications. The data is illustrated below in Table 3.

Table 3: Colour Temperature

Product	Measured CCT March 22, 2010	Measured CCT Dec 29, 2010	Manufacturer Specifications
Elumen LED fixtures	4937K	5000K	5000K (±500K)
Relume LED fixtures	5716K	5600K	5600K (±500K)
Ruud LED fixtures	5690K	5800K	6000K (±500K)

All of the colour temperature observations were within manufacturer specifications. The differences in values between the two measurement sessions were all less than 2%, which is less than the range of measurement error.

4.4 Average Illuminance Over Time

Uncertainty over the useful lifetime of LED luminaires is one of the key barriers to widespread adoption of the technology. Therefore one of the objectives of the LightSavers pilots is to monitor average illuminance over time for LED's in real site conditions. Unlike conventional lighting technologies, LED light sources generally do not burn out but rather gradually decline in lumen output. End-of-life for LED luminaires can vary based on site specific requirements, but is generally considered to be the point when lumen output has declined to 70% of the original value (referred to as L70).

Manufacturer estimates for the useful life (L70) of the products in this trial ranged from 70,000 hours to 105,000 hours of operation, corresponding to between 16-24 years in this application. However, many independent experts recommend a more conservative estimate of 50K hours, or just under 12 years, given the lack of long-term performance data. If the manufacturer estimated lifespans are accurate, source lumen depreciation should be less than 2.5% over the course of this pilot.

Note that the data collected is Illuminance on the pavement, not source lumens. Other factors than lumen depreciation will contribute to variations in horizontal illuminance such as ambient temperatures, stray light from other sources, and build up of dirt (dirt depreciation) on the luminaires. Additionally, portable light meters such as those used in this study are only accurate to ±5%.

The data are illustrated and discussed below for the baseline MH fixtures as well as each of the LED test fixtures.

Figure 4: Metal Halide Average Illuminance Over 12 Months

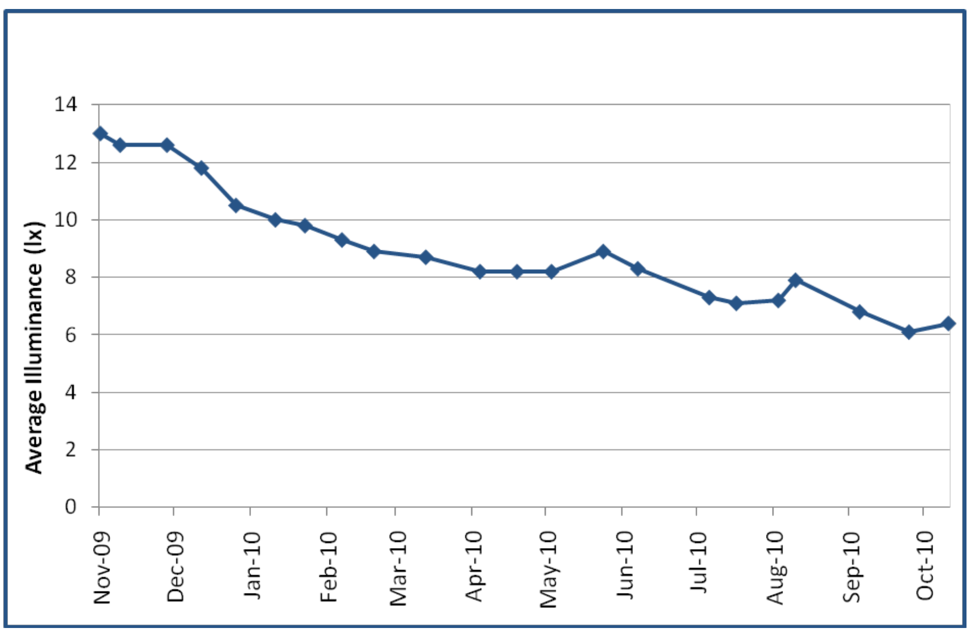


Figure 4 above illustrates the average illuminance levels measured on site for the baseline MH lighting system over 12 months. Conventional Metal Halide lamps experience very high depreciation over time, and this is accelerated with outdoor fixtures due to dirt collecting on the luminaire and its optical system, as well as other environmental factors. In this case, the average illuminance levels ranged from a high of 13lx to a low of 6.1lx, a variance of 54%. There was a clear and consistent downward trend, with a 51% reduction in illuminance values over 12 months. This is exceptionally high, even for a MH lamp. At the time of the final illuminance reading on December 29, 2010, the metal halide fixtures had failed entirely. The rapid depreciation observed in these fixtures very likely indicates an underlying problem with the metal halide luminaries.

Figure 5: Elumen LED Average Illuminance Over 13 Months

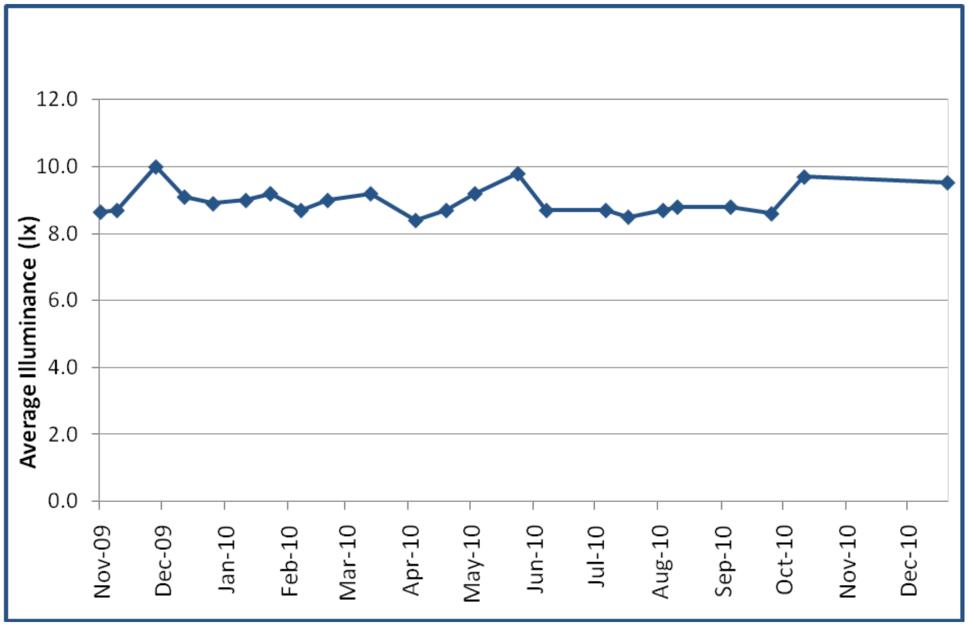


Figure 5, above, illustrates the average illuminance levels measured on site over 13 months for the Elumen LED luminaires. Average illuminance values recorded ranged from a high of 10lx to a low of 8.4lx, a variation of 16%. However, there was no clear downward trend, and the final measurement was actually 10% higher than the first measurement. So while variation in average illuminance was greater than expected, there is no evidence of depreciation of the light source. It should be noted that this product uses a dynamic driver which adjusts the drive current in response to time and temperature to minimize lumen depreciation (see the product specifications in Appendix C for further details).

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Figure 6: Relume LED Average Illuminance Over 13 Months

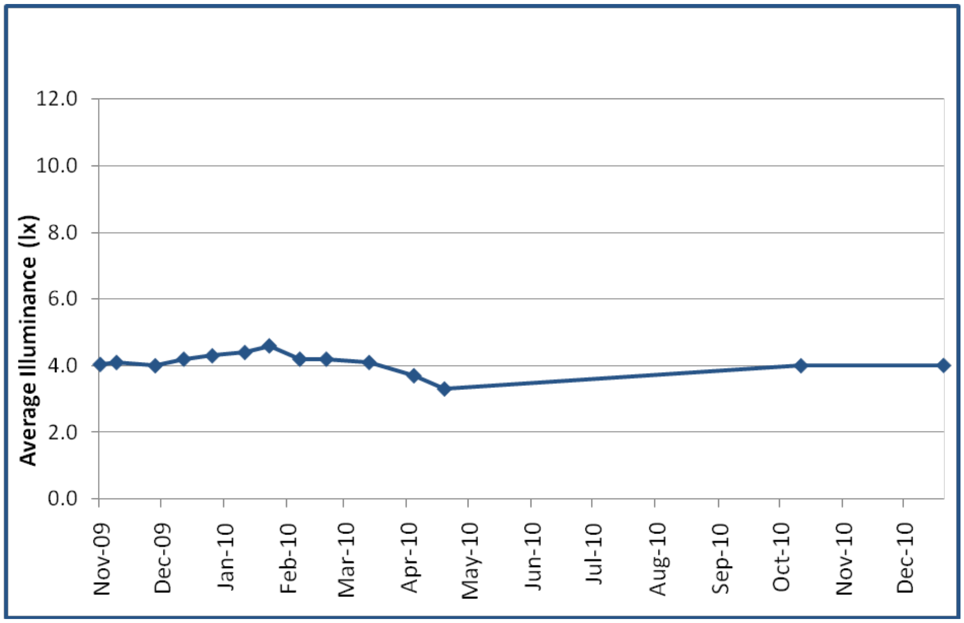


Figure 6, above, illustrates the average Illuminance levels measured on site over 13 months for the Relume LED luminaires. Average illuminance values recorded ranged from a high of 4.6 to a low of 3.7, a variance of approximately 20%. However, there was no clear downward trend; the values observed on the first and last measurement dates were very nearly the same, at 4.04lx and 4.01lx respectively. So while variation in average illuminance levels was greater than anticipated, there is no evidence of significant depreciation of the light source. It should be noted that measurements were not taken in this pilot area between May and October of 2010, because the leaves of adjacent deciduous trees appeared to be interfering in the light levels.

Figure 7: Ruud LED Average Illuminance over 13 Months

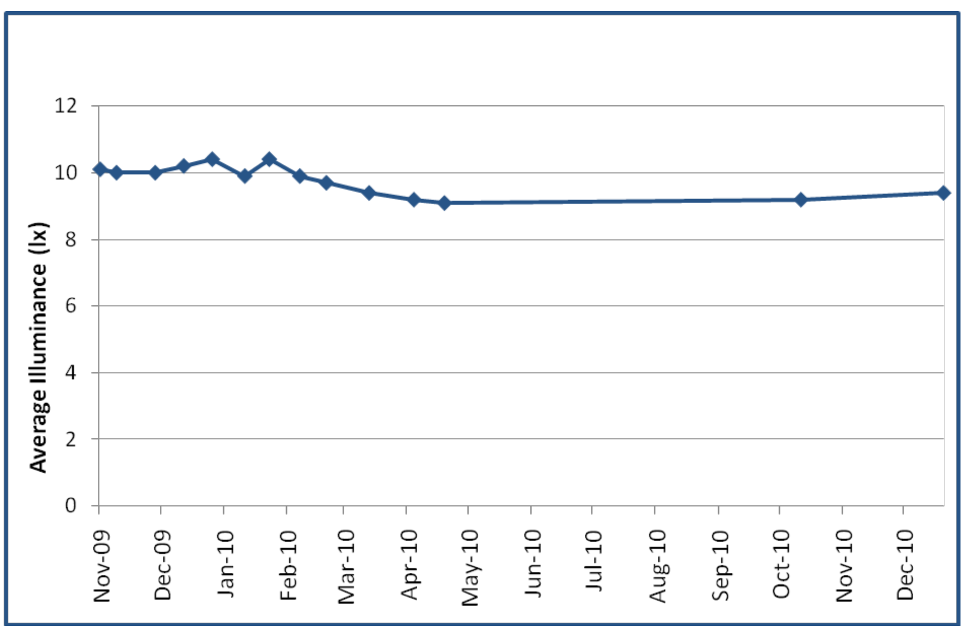


Figure 7, above, illustrates the average illuminance levels measured on site over 13 months for the Ruud LED luminaires. Average illuminance values recorded ranged from a high of 10.4 to a low of 9.2, a variance of approximately 12%. There was a slight downward trend, with the final measurement being approximately 7% below the initial reading. Based on the manufacturer estimated lifespan, we would expect source lumen depreciation to be less than 2.5% over 13 months. Dirt depreciation could be expected to account for an additional 1-5 percentage points. The remaining variation may be accounted for by any combination of: ambient temperature effects (see section 4.5 below); measurement error/inaccuracy; and/or faster than expected depreciation of the light sources.

It should be noted that measurements were not recorded in this pilot area between May and October of 2010, due to problems with the adjacent parking lot lights which appeared to be interfering with illuminance readings.

Table 4, below, summarizes the changes and variability in average illuminance for each of the three LED products as well as the baseline MH luminaires

Table 4: Average Illuminance, variability and % change over 13 months

Product	Total variance in avg. illuminance	% change, first to last measurement
Baseline MH	54%	-51%
LED - Elumen	16%	+10%
LED – Relume	20%	-0.7%
LED – Ruud	12%	-7%

4.5 Temperature Sensitivity

Another goal of on-site measurement is to track any sensitivity of the light source to climate, in particular temperature. LEDs are known to be sensitive to ambient temperature, with higher termperatures leading to lower light output and vice versa. Temperature data is collected at LightSavers sites using digital thermometers (Omega HH308) and checked against the nearest Environment Canada site.

Figures 8-11, below, illustrate the average illuminance and ambient temperature for the LED fixtures for each measurement session, organized from coldest to warmest. The readings are organized from coldest to warmest in order to illustrate any observed correlation.

Figure 8: MH Average Illuminance and Temperature

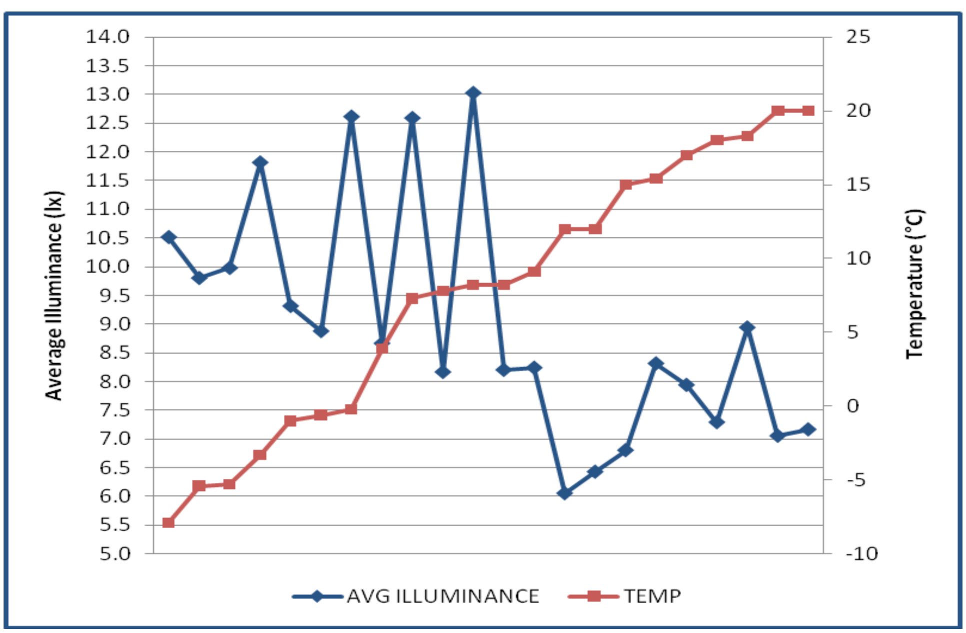


Figure 8, above, illustrates the illuminance and temperature data for the MH luminaires. MH technology is not known to be sensitive to ambient temperatures. The chart illustrates a strong, inverse correlation between temperature and average illuminance[4]. However this is probably due to the fact that the initial measurements were taken in the fall and winter of 2009, while most of the later measurements were taken in warmer weather. In other words, the correlation between illuminance and temperature is probably largely a function of the correlation between hours installed and ambient temperature.

Figure 9: Elumen LED Average Illuminance and Temperature

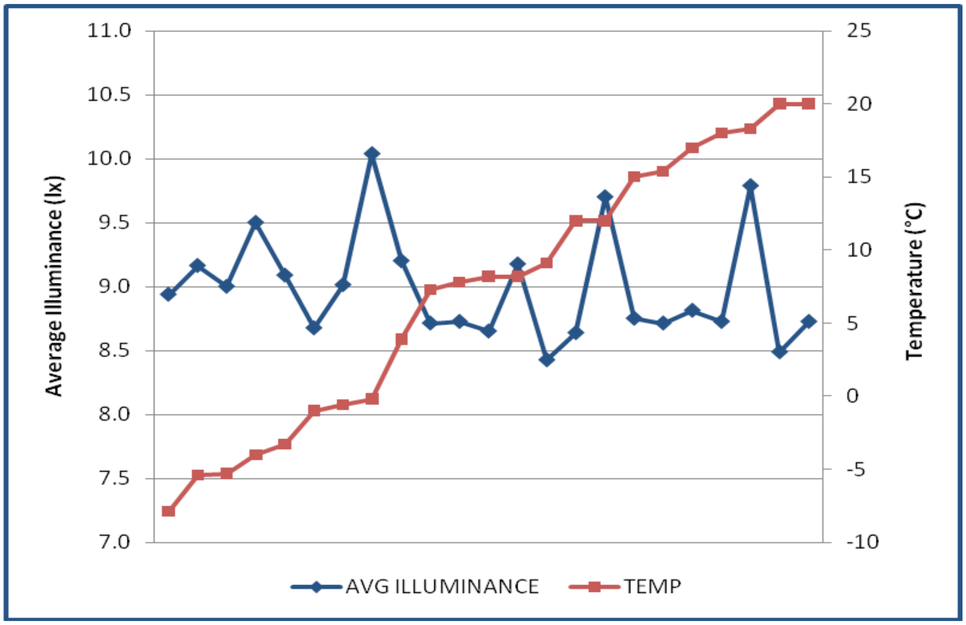
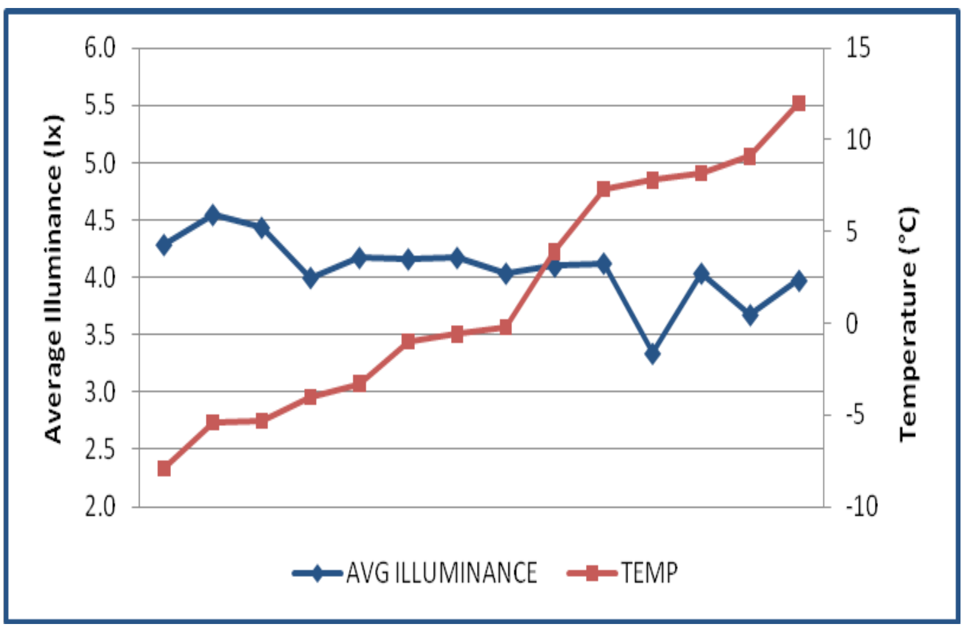


Figure 9, above, illustrates the average illuminance and ambient temperature data for the Elumen LED fixtures. There is a slight, inverse correlation between temperature and average illuminance[5]. It should be noted that this luminaire uses a dynamic driver which reduces power consumption as temperatures fall, and vice versa, in order to minimize the influence of temperature on light output. It would appear that this approach has largely compensated for the impact of ambient temperature across a 28 degree celsius range of conditions.

Figure 10: Relume LED Average Illuminance and Temperature



4 R2=-0.59

5 R2 -0.28

Figure 10, above, illustrates the average illuminance and ambient temperature data for the Relume LED fixtures. The data suggest an inverse correlation between temperature and average illuminance[6]. This suggests that ambient temperature effects may explain a signfiicant proportion of the observed variabiltiy in illuminance levels.

Figure 11: Ruud LED Average Illuminance and Temperature

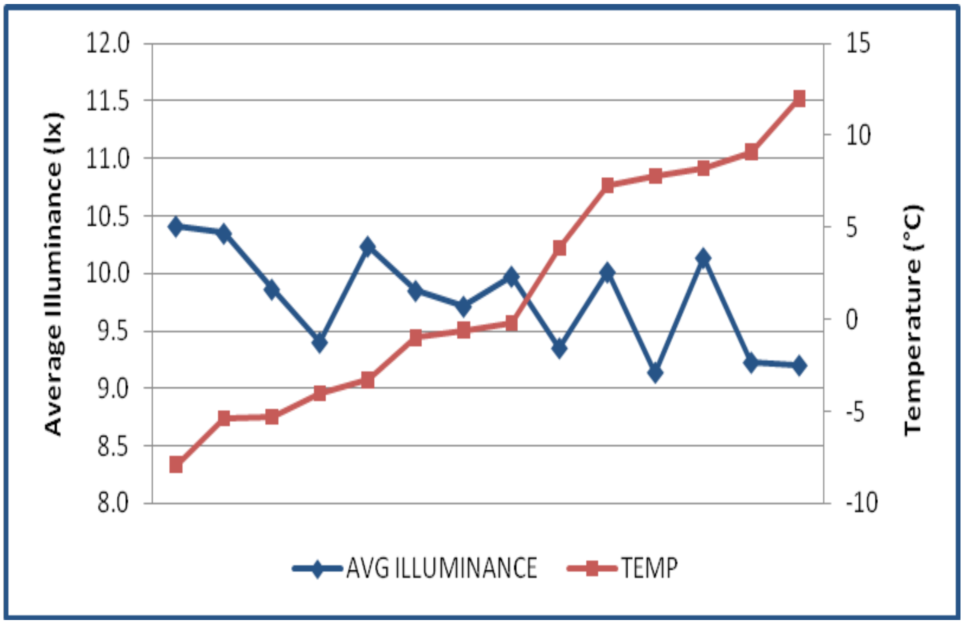


Figure 11, above, illustrates the average illuminance and ambient temperature data for the Ruud LED fixtures. The data suggest an inverse relationship between temperature and illuminance[7]. This suggests that ambient temperature effects may explain a significant proportion of the observed variability in average illuminance.

4.6 Power & Energy

Table 5: Power Measured on Site

Product	Average Current	Power (calculated)
Baseline MH fixtures	0.63 @ 347V	218 W
Ruud LED fixtures	0.77 @ 120V	92 W
Relume LED fixtures	0.58 @ 120V	70 W
Elumen LED fixtures	0.56 @ 120V	67 W[8]

At this site, the existing power for the parking lot lighting is 347 Volt, and this is fairly common in Canada, particularly in larger municipal and office buildings. Very few manufacturers had 347V drivers available when this pilot was installed. On this project, transformers were installed to convert from 347V to 120V at each fixture. The readings were taken after the transformer to get the 'true' comparison with the base fixture. Therefore, the power used by the transformer is not included in these values. All of the manufacturers in this trial now have 347V divers available for their products.

6 R^2 = -0.67

7 R^2 = -0.61

8 Note that the Elumen fixture is designed to increase the drive current over time to compensate for lumen depreciation. As a result, power consumption will increase gradually over time.

Table 6: Calculated Savings

Product	Power Savings	Percent Savings
RUUD LED fixtures	218 W – 92 W = 126 W	58%
Relume LED fixtures	218 W – 70 W = 148 W	68%
Elumen LED fixtures	218 W – 67 W = 151 W	69%

All of the LED fixtures achieved significant energy savings, ranging from 58% to 69% in comparison to the baseline MH fixtures. It should be noted that while the Elumen fixtures achieved the highest initial savings, this product's electricity use is designed to increase gradually over its lifetime from the initial 67W to up to ~87W. The power use of the other products is expected to be relatively stable over time.

4.7 Economic Performance

The economic performance of the LED luminaires was assessed under two scenarios. The first is an early replacement scenario, where the costs and benefits of installing the LED fixtures are compared against leaving the existing MH fixtures installed, over a twenty year period. This scenario assumes that the MH fixtures would last for an additional twenty years with only replacement of minor components (in this case that would be unlikely).

The second scenario is an end of life or new construction scenario, where the costs/benefits of the LED fixtures are compared against the costs of purchasing new MH fixtures assumed to be equivalent to those already installed at the site. This scenario assumes that the lights need to be replaced within the near term future, and could also be extrapolated to new construction situations where project managers are faced with a choice between similar MH and LED fixtures.

The installed cost of the LED fixtures ranged from $1349 to $1772 per fixture. It should be noted that these prices included the cost of installing transformers at each fixture to convert from 347V to 120V (see section 4.5 for details). The assumed installed cost of a new MH luminaire is $325.

Estimated savings in maintenance costs were also factored into the analysis. Assumed maintenance costs for the baseline MH fixtures was $41/annum, based on actual maintenance costs logged at this facility over the past three years, including parts and labour. The assumed maintenance for the LED fixtures was $5/annum, which represents estimated cost of cleaning each LED luminaire every five years to counteract dirt depreciation.

The results of each scenario are illustrated 7 and 8 below (on a per-fixture basis).

Table 7: Economic Performance for Early Replacement Scenario (per fixture)

Fixture	Cost	Annual Energy Savings*	Avg. Annual Maintenance Savings	Simple Payback**	20 Year Return on Investment
Elumen[9]	$1,349	$50	$36	14.2 Years	47%
Relume	$1,772	$49	$36	17.3 Years	18%
RUUD	$1,651	$41	$36	17.9 Years	15%

* At $0.075/kWh
** Assuming 3.5% annual inflation in energy prices

9 It was assumed that the energy consumption of the Elumen fixture would increase by 1% per annum.

Table 8: Economic Performance for End of Life or New Construction Scenario (per fixture)

Fixture	Incremental Cost	Annual Energy Savings*	Avg. Annual Maintenance Savings	Simple Payback**	Total Cost of Ownership (20 years)**
Elumen	$1,024	$50	$36	11 Years	$2304
Relume	$1,447	$49	$36	14.7 Years	$2522
Ruud	$1,326	$41	$36	14.9 Years	$2606
MH	N/A	N/A	N/A	N/A	$3160

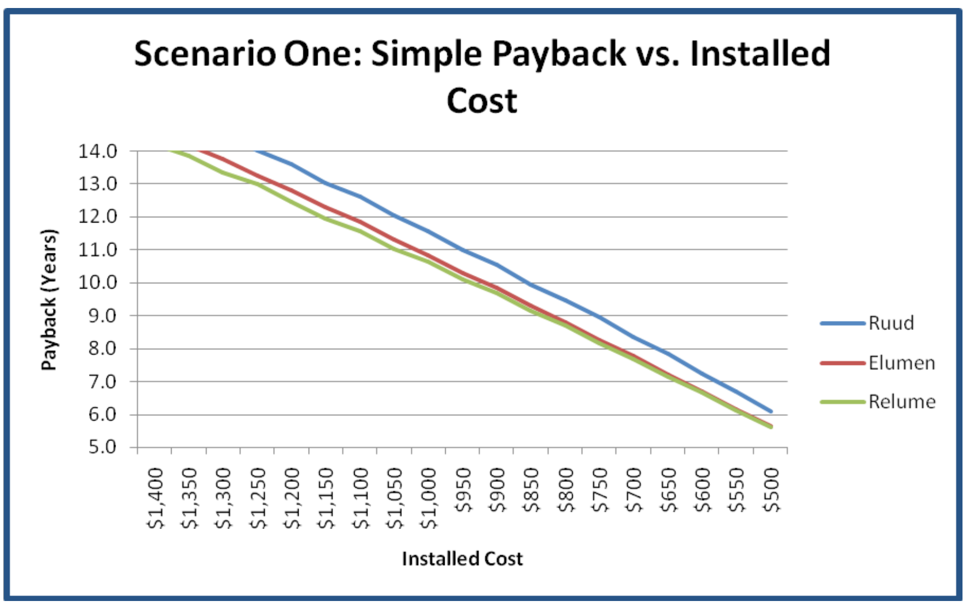
* At $0.075/kWh
** Assuming 3.5% annual inflation in energy prices

The paybacks under the early replacement scenario are relatively long, although within the manufacturer estimated lifetimes. Under the end of life or new construction scenario, all three LED fixtures offer a considerably lower Total Cost of Ownership over 20 years. However, realizing this benefit depends on the products meeting or exceeding the manufacturer claimed lifetimes.

It must be noted that the actual costs incurred in this pilot project are not representative of what the costs would be on future installations. First, the price of LED luminaires is falling relatively rapidly. Second, a larger purchase order may have resulted in a lower price point. And finally, many LED fixtures are now available with a 347V driver, which would reduce the installed cost significantly.

Figure 12 below illustrates the economic performance of the LED luminaires under a variety of potential cost scenarios.

Figure 12: Simple Payback vs. Cost



As the chart above illustrates, in order to bring the payback below 10 years in an early replacement scenario, the installed cost of the LED luminaires would need to fall below $1000 per fixture, approximately 30-40% below the costs observed in this pilot installation. According to US Department of Energy estimates[10], the price of LED fixtures is expected to fall by approximately 22% per annum, indicating that these price points may be achievable in 2011 (these fixtures were purchased in 2009).

5.0 Conclusions

This project has successfully demonstrated that LED area lighting technology can be used to replace conventional MH technology at considerable energy savings. Most of the test products were able to achieve industry standard illuminance levels with the existing pole heights and spacing.

Uniformity may vary depending on the luminaire selected. In this case, two of the three products which were tested were able to improve on the uniformity of the baseline MH fixtures.

Long-term monitoring of illuminance levels offers conditional support for the long-lifetime claims for LED products. Two of the three products showed insignificant depreciation in average illuminance over 13 months. In one case, depreciation in average illuminance was significant but the difference between the expected depreciation rate and the observed depreciation rate is still within the range of measurement error. Temperature sensitivity is present but not excessive.

Two of the three tested products were able to increase the average illuminance on site, while all three products decreased power consumption by a minimum of 58%. This saving is partly attributable to the differences between MH and LED source technology, but a large portion is attributable to the photometric inefficiency of the baseline MH luminaires at this site.

The lack of 347V drivers for many LED area lighting fixtures represents a significant barrier to wide-spread implementation of similar projects. 347V power is quite common in large commercial, industrial, and institutional facilities, and these are expected to be the early adopters for this technology. Installation of transformers to convert the existing power supply to 120V imposed significant additional project costs in this case, which undermined the business case for the project. Many LED fixtures are now available with 347V drivers.

From an economic perspective, the payback and return on investment observed in this pilot project are probably not sufficient to justify immediate large-scale investment in similar LED upgrade projects. However, with ongoing reductions in the cost of LED fixtures, and improvements in performance, similar projects should reach economic viability in the near-term future (2012).

[10] Solid-State Lighting research and Development: Manufacturing Roadmap, July 2010. US Department of Energy.

Appendix A: IESNA Outdoor Parking Lot Illuminance Recommendations

	Basic	Enhanced Security
Min Horizontal Illuminance	2 lx, 0.2 fc	5 lx, 0.5 fc
Uniformity ratio (max-min)	20:1	15:1
Min Vertical Illuminance	1 lx, 0.1 fc	2.5 lx, 0.25 fc

PARKING LOT LIGHTING

Appendix B: Summary Data Chart

LIGHTSAVERS CALEDON SUMMARY DATA

	1	2	3	4	5	6	7	8	AVERAGE	MAX:MIN	AVG:MIN	% LLD
#1 BASE												
10 Nov, 09	35.5	12.0	7.2	16.3	20.8	6.1	2.9	3.4	13.0	12.2	4.5	
18 Nov, 09	34.4	10.8	7.0	16.0	20.6	6.0	2.7	3.2	12.6	12.7	4.7	3.4%
7 Dec, 09	33.4	13.0	5.6	16.0	19.5	5.7	2.7	5.0	12.6	12.4	4.7	3.2%
21 Dec, 09	31.9	9.8	6.6	16.1	19.0	5.5	2.5	3.1	11.8	12.8	4.7	9.3%
4 Jan, 10	29.0	9.1	6.0	12.5	17.3	4.9	2.3	3.0	10.5	12.6	4.6	19.3%
20 Jan, 10	27.5	8.4	5.6	11.9	16.9	4.5	2.3	2.7	10.0	12.0	4.3	23.4%
1 Feb, 10	27.7	8.4	6.0	11.1	15.8	4.5	2.3	2.6	9.8	12.0	4.3	24.8%
16-Feb-10	27.2	7.5	6.1	10.1	14.2	4.5	2.3	2.6	9.3	11.8	4.0	28.5%
1 Mar, 10	25.2	4.4	7.8	10.8	13.6	4.4	2.2	2.6	8.9	11.5	4.0	31.9%
22 Mar, 10	24.7	4.5	7.2	10.4	13.5	4.5	2.1	2.4	8.7	11.8	4.1	33.5%
13 Apr, 10	24.5	4.4	6.1	10.0	13.0	4.0	2.0	1.9	8.2	12.9	4.3	36.8%
28 Apr, 10	23.5	4.4	7.0	9.8	12.6	3.9	2.0	2.1	8.2	11.8	4.1	37.3%
12 May, 10	23.5	4.4	6.9	9.7	12.9	3.2	2.6	2.4	8.2	9.8	3.4	37.0%
2 Jun, 10	24.6	5.4	7.4	10.4	12.7	4.8	2.6	3.6	8.9	9.5	3.4	31.4%
16 Jun, 10	21.1	4.8	6.9	10.2	13.5	4.1	2.9	3.0	8.3	7.3	2.9	36.2%
15 Jul, 10	19.9	3.7	6.6	9.6	10.5	3.9	1.7	2.4	7.3	11.7	4.3	44.0%
26 Jul, 10	19.7	3.1	6.4	8.9	10.6	3.8	1.6	2.3	7.1	12.3	4.4	45.9%
12-Aug-10	19.0	3.1	6.4	9.2	11.0	4.7	2.4	1.5	7.2	12.7	4.8	45.0%
19-Aug-10	19.4	8.2	6.0	9.7	11.2	4.8	2.5	1.7	7.9	11.4	4.7	39.1%
14-Sep-10	19.0	3.7	6.0	8.5	10.6	3.1	1.6	1.9	6.8	11.9	4.3	47.8%
04-Oct-10	17.0	3.1	5.3	7.8	9.3	2.6	1.3	2.0	6.1	13.1	4.7	53.6%
20-Oct-10	16.3	3.8	4.8	7.6	9.6	5.2	0.8	3.3	6.4	20.4	8.0	50.7%
29-Dec-10	NO READING - LIGHTS OFF											
#2 ELUMEN												
10 Nov, 09	10.1	18.0	20.4	10.0	2.1	2.4	2.1	4.1	8.7	9.7	4.1	
18 Nov, 09	10.8	17.7	20.9	9.9	2.1	1.8	2.3	4.2	8.7	11.6	4.8	-0.7%
7 Dec, 09	10.9	20.8	25.3	12.8	2.2	1.7	2.2	4.4	10.0	14.9	5.9	-16.0%
21 Dec, 09	11.2	18.3	21.5	10.7	2.3	1.8	2.4	4.5	9.1	11.9	5.0	-5.1%
4 Jan, 10	11.0	18.0	21.2	10.6	2.3	1.9	2.4	4.1	8.9	11.2	4.7	-3.3%
20 Jan, 10	11.0	18.4	21.3	10.0	2.2	1.3	2.1	5.7	9.0	16.4	6.9	-4.0%
1 Feb, 10	11.5	18.6	21.0	10.1	2.5	1.5	2.6	5.5	9.2	14.0	6.1	-5.9%
16-Feb-10	11.0	18.5	20.1	10.0	2.0	1.4	2.3	4.1	8.7	14.4	6.2	-0.3%
1 Mar, 10	11.2	18.2	21.5	11.0	2.2	1.3	2.4	4.3	9.0	16.5	6.9	-4.2%
22 Mar, 10	10.9	17.7	21.6	12.4	2.3	1.7	2.4	4.6	9.2	12.7	5.4	-6.4%
13 Apr, 10	10.7	17.7	19.4	10.0	1.9	1.5	1.9	4.3	8.4	12.9	5.6	2.6%
28 Apr, 10	10.8	17.7	21.0	10.0	2.0	1.3	2.0	5.0	8.7	16.2	6.7	-0.9%
12 May, 10	11.6	18.1	21.7	10.6	2.2	1.7	2.3	5.2	9.2	12.8	5.4	-6.1%
2 Jun, 10	11.4	17.6	20.7	10.7	7.4	2.9	2.2	5.4	9.8	9.4	4.4	-13.2%
16 Jun, 10	10.9	17.9	20.6	10.0	2.3	2.2	2.7	3.1	8.7	9.4	4.0	-0.7%
15 Jul, 10	10.5	17.2	20.4	9.7	2.5	1.7	2.8	5.0	8.7	12.0	5.1	-0.9%
26 Jul, 10	10.3	17.3	20.2	9.2	2.3	1.6	2.1	4.9	8.5	12.6	5.3	1.9%
12-Aug-10	10.5	16.3	19.9	10.3	2.4	1.6	3.3	5.5	8.7	12.4	5.5	-0.9%
19-Aug-10	10.6	16.4	20.2	10.4	2.7	1.4	3.3	5.5	8.8	14.4	6.3	-1.9%
14-Sep-10	10.3	17.1	20.1	10.0	2.6	1.8	2.8	5.3	8.8	11.2	4.9	-1.2%
04-Oct-10	10.5	16.7	20.6	10.2	2.4	2.4	1.5	4.8	8.6	13.7	5.8	0.1%
20-Oct-10	10.5	18.9	22.7	10.7	3.5	3	3.1	5.2	9.7	7.6	3.2	-12.1%
29-Dec-10	11	18	21	15.3	2.4	1.6	2.3	4.6	9.5	13.1	6.0	-10.1%
#3 RELUME												
10 Nov, 09	12.3	4.5	3.6	7.5	0.9	1.3	1.1	1.1	4.0	13.7	4.5	
18 Nov, 09	12.0	4.5	3.6	8.5	1.0	1.5	0.9	1.0	4.1	13.3	4.6	-2.2%
7 Dec, 09	12.9	5.0	3.6	7.0	0.9	1.0	1.3	0.6	4.0	21.5	6.7	0.0%
21 Dec, 09	13.1	4.8	3.8	6.9	1.0	1.2	1.6	1.0	4.2	13.1	4.2	-3.4%
4 Jan, 10	13.0	4.8	3.6	8.5	1.0	1.2	1.1	1.1	4.3	13.0	4.3	-6.2%
20 Jan, 10	13.2	4.8	3.7	9.2	1.0	1.2	1.4	1.0	4.4	13.2	4.4	-9.9%
1 Feb, 10	13.3	4.8	3.8	9.5	1.2	1.3	1.5	1.0	4.6	13.3	4.6	-12.7%
16-Feb-10	13.1	4.7	3.5	8.0	1.0	1.0	1.3	0.7	4.2	18.7	5.9	-3.1%
1 Mar, 10	13.0	4.8	3.5	8.2	0.9	1.1	1.2	0.7	4.2	18.6	6.0	-3.4%
22 Mar, 10	12.5	4.6	3.5	8.4	0.8	1.0	1.3	0.7	4.1	17.9	5.9	-1.5%
13 Apr, 10	12.8	4.2	3.2	6.0	0.9	0.7	1.0	0.6	3.7	21.3	6.1	9.0%

28 Apr, 10	12.4	4.6	3.3	2.7	0.9	1.0	1.1	0.7	3.3	17.7	4.8	17.3%
12 May, 10	13.0	4.6	3.3	0.1	0.7	0.7	1.9	1.2	3.2	130.0	31.9	21.1%
2 Jun, 10	13.3	4.7	3.1	0.2	0.8	0.7	1.7	1.4	3.2	66.5	16.2	19.8%
16 Jun, 10	13.5	4.7	3.2	0.3	0.9	0.9	1.8	1.5	3.4	45.0	11.2	17.0%
15 Jul, 10	12.3	4.0	1.6	0.1	0.9	1.1	0.5	0.4	2.6	123.0	26.1	35.3%
26 Jul, 10	12.2	4.0	1.4	0.1	1.0	1.0	0.5	0.4	2.6	122.0	25.8	36.2%
12-Aug-10	12.8	5.2	1.4	0.2	1.4	1.7	0.9	0.7	3.0	64.0	15.2	24.8%
19-Aug-10	11.6	4.3	3.9	0.9	2.0	3.5	2.3	0.1	3.6	116.0	35.8	11.5%
14-Sep-10	11.5	4.6	2.1	0.1	1.5	0.7	0.7	0.1	2.7	115.0	26.6	34.1%
04-Oct-10	11.4	4.8	1.4	0.1	1.6	1.2	1.5	1.2	2.9	114.0	29.0	28.2%
20-Oct-10	11.6	4.4	5.4	3.8	2.0	0.5	1.2	2.9	4.0	23.2	8.0	1.5%
29-Dec-10	11.9	4.4	3.0	5.6	1.0	1.0	1.2	4.0	4.0	11.9	4.0	0.6%
#4 RUUD												
10 Nov, 09	14.5	11.0	12.4	11.4	8.7	8.0	5.4	9.7	10.1	2.7	1.9	
18 Nov, 09	15.1	9.9	11.5	12.2	9.2	7.6	5.5	9.1	10.0	2.7	1.8	1.2%
7 Dec, 09	12.1	10.9	12.4	14.8	8.4	7.0	5.8	8.4	10.0	2.6	1.7	1.6%
21 Dec, 09	12.0	11.2	12.7	15.5	8.6	7.5	5.6	8.8	10.2	2.8	1.8	-1.0%
4 Jan, 10	12.5	11.3	13.0	15.8	8.9	7.7	5.6	8.5	10.4	2.8	1.9	-2.7%
20 Jan, 10	12.0	10.0	12.4	14.8	8.5	7.3	5.5	8.4	9.9	2.7	1.8	2.7%
1 Feb, 10	12.2	11.0	13.4	15.9	8.5	7.6	5.6	8.6	10.4	2.8	1.8	-2.1%
16-Feb-10	12.1	10.2	11.6	16.0	8.3	7.1	5.2	8.3	9.9	3.1	1.9	2.8%
1 Mar, 10	11.5	10.2	12.6	15.0	8.3	7.1	5.0	8.0	9.7	3.0	1.9	4.2%
22 Mar, 10	11.7	10.3	11.0	15.0	7.6	6.6	5.0	7.6	9.4	3.0	1.9	7.8%
13 Apr, 10	11.1	9.9	11.5	14.6	6.9	8.0	4.6	7.2	9.2	3.2	2.0	9.0%
28 Apr, 10	11.0	9.9	11.8	14.6	6.9	7.1	4.8	7.0	9.1	3.0	1.9	9.9%
12 May, 10	11.6	9.3	11.6	14.2	6.6	6.5	4.6	6.9	8.9	3.1	1.9	12.1%
2 Jun, 10	11.4	8.5	12.0	14.7	6.8	6.7	5.0	7.2	9.0	2.9	1.8	10.9%
16 Jun, 10	11.8	11.2	11.2	14.4	6.0	6.5	4.2	6.8	9.0	3.4	2.1	11.1%
15 Jul, 10	10.9	9.2	11.6	14.2	3.5	3.8	3.2	6.6	7.9	4.4	2.5	22.3%
26 Jul, 10	10.7	9.7	11.0	13.7	3.5	3.7	3.1	6.4	7.7	4.4	2.5	23.8%
12-Aug-10	10.9	7.0	11.6	13.4	3.8	3.2	3.2	5.3	7.3	4.2	2.3	28.0%
19-Aug-10	10.8	8.5	11.6	13.5	4.6	5.2	3.0	6.2	7.9	4.5	2.6	21.8%
14-Sep-10	10.9	7.7	11.3	13.6	4.0	3.7	3.0	5.9	7.5	4.5	2.5	25.9%
04-Oct-10	10.7	9.0	12.2	13.7	3.6	4.0	3.4	6.0	7.8	4.0	2.3	22.8%
20-Oct-10	11.3	9.0	11.7	14.1	7.3	8.4	6.1	5.7	9.2	2.5	1.6	9.2%
29-Dec-10	12.0	10.3	12.2	15.3	7.3	7.0	5.1	6.0	9.4	3.0	1.8	7.3%
TEMP												
10 Nov, 09	8.2											
18 Nov, 09	7.3											
7 Dec, 09	-0.2											
21 Dec, 09	-3.3											
4 Jan, 10	-7.9											
20 Jan, 10	-5.3											
1 Feb, 10	-5.4											
16-Feb-10	-1.0											
1 Mar, 10	-0.6											
22 Mar, 10	3.9											
13 Apr, 10	9.1											
28 Apr, 10	7.8											
12 May, 10	8.2											
2 Jun, 10	18.3											
16 Jun, 10	15.4											
15 Jul, 10	18.0	+										
26 Jul, 10	20.0	+										
12-Aug-10	20.0	+										
19-Aug-10	17.0	+										
14-Sep-10	15.0											
04-Oct-10	12.0											
20-Oct-10	12.0											
29-Dec-10	-4.0											

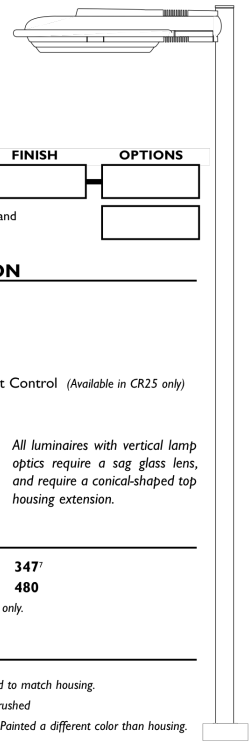
Baseline MH Luminaires

Job:
Type:
Notes:

Circa

CR20 and CR25 Area Luminaires

The Gardco Circa product line is a low profile, curvilinear cutoff luminaire utilizing CosmoPolis™ or MasterColor® Elite high performance ceramic metal halide electronic systems and suitable for other high intensity discharge lamps and systems. The housings are one-piece, die cast aluminum and mount directly to a pole, mast arm or wall without the need of a separate support arm. The shallow, rounded form produces extremely low effective projected areas for superior wind loading capability. Luminaires accept nine interchangeable, rotatable precision segmented optical systems which provide sharp cutoff of glare and light trespass. Flat glass lens luminaires provide full cutoff performance. Sag lens luminaires provide cutoff performance.



PREFIX	MOUNTING	DISTRIBUTION	WATTAGE	VOLTAGE	RING	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

CR20 Small Circa 20"

CR25 Large Circa 25"

Standard arm, without any RPA (Round Pole Adapter), mounts to round poles from 3.85" to 4.5" O.D.

MOUNTING

1	Single Pole Mount
2	Twin Pole Mount at 180°
2@90	Twin Pole Mount at 90°
3	3-way Pole Mount at 90°
3@120°	3-way Pole Mount at 120°
4	4-way Pole Mount
W	Wall Mount, Recessed J-Box
WS	Wall Mount, Surface Conduit

DISTRIBUTION

Horizontal Lamp

1[9]	Type I
2XL	Type II
3XL	Type III
4XL	Type IV
BLC[9]	Backlight Control *(Available in CR25 only)*
5H[9]	Type V

Vertical Lamp

2XLV[5]	Type II
3XLV[5]	Type III
4XLV[5]	Type IV
5V[5]	Type V

All luminaires with vertical lamp optics require a sag glass lens, and require a conical-shaped top housing extension.

WATTAGE

	CR20	CR25	
Pulse Start MH Magnetic Ballast	**100MH** **150MH** **175PSMH**[4] Ⓔ **200MH**[2,4] Ⓔ	**250PSMH** Ⓔ **250PS90**** Ⓔ **320PSMH**[3] Ⓔ **350PSMH**[3] Ⓔ **400PSMH**[3] Ⓔ	**450PSMH**[4,5] Ⓔ **750PSMH**[5] **775PSMH**[4,5] **875PSMH**[5]
CosmoPolis™ Electronic System See Notes 11, 12, 13	**60CMPE** **90CMPE** **140CMPE**	**140CMPE**	
MasterColor® Elite Electronic System See Notes 10, 12, 13		**210MCE-3K** Ⓔ **210MCE-4K** Ⓔ	**315MCE-3K** Ⓔ **315MCE-4K** Ⓔ
Pulse Start MH Electronic Ballast		**250PSE**[10] Ⓔ	**320PSE**[3,10] Ⓔ
*Standard MH Magnetic Ballast**	**175MH*** **250MH***[1,6,7]	**250MH***[7]	**400MH***[3]
High Pressure Sodium Magnetic Ballast	**100HPS** **150HPS**	**250HPS** **400HPS**	**750HPS**[5]
Low Pressure Sodium Magnetic Ballast	**18LPS**		

** 175MH, 250MH and 400MH not available for sale in the United States.*

*** 250PS90 includes a 90% efficient magnetic PSMH ballast, meeting the requirements of California Title 20, effective 1/1/2010.*

Ⓔ *Wattages marked with Circle "E" meet federal energy efficiency standards applicable to 150 watt through 500 watt metal halide luminaires only.*

VOLTAGE

120	**240**	**347**[7]
208	**277**	**480**

200-277 *CMPE, MCE and PSE types only.*

RING

AR[8]	Aluminum Ring *Painted to match housing.*
SR	Stainless Steel Ring *Brushed*
OR[8]	Optional Color Ring *Painted a different color than housing.*
LR	Less Ring

1. Horizontal lamp optics only.
2. Not available in 480V.
3. Requires E28/BT28 lamp.
4. Vertical lamp optics only.
5. Supplied with sag glass lens only.
6. Type 1 and Type 5H utilize E-28 lamp. Types 2XL, 3XL and 4XL require the E-18 lamp.
7. 250MH with 347V is not available with QS, QST, Q924 or QT924 options.
8. (AR) Ring supplied same color as housing standard. For optional color ring (OR), specify finish or RAL. Ex. OR-BLP or OR-RAL-7024
9. Type 1, Type BLC and Type 5H are not available above 400 watts.
10. 200 - 277V only. Not available with QS, QST, Q924 or QT924 options.
11. 120V or 200 - 277V only. Not available with QS, QST, Q924 or QT924 options.
12. CosmoPolis™ and MasterColor® Elite systems supplied with lamp.
13. "-3K" suffix specifies a 3000°K lamp and "-4K" suffix specifies a 4000°K lamp.

1611 Clovis Barker Road, San Marcos, TX 78666
(800) 227-0758 (512) 753-1000 FAX: (512) 753-7855 sitelighting.com

79115-117/1010

PHILIPS GARDCO

ORDERING

Luminaire	*Serie*	*Color*	*Power*	*LED*	*Mounting**	*Photocell Receptacle*	*Wing Angle*	*POWER SUPPLY*
LED-SL	SE	__	66	C3	DM	__	__	__

G= GREY
B= BRONZE
K= BLACK

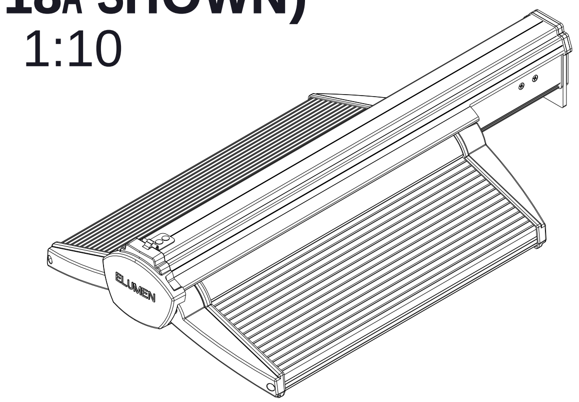
C3 = WHITE 5000K TYPE II OR III DEPENDING ON WING ANGLE

N= NONE
R = YES

6= 22.5 Á- 7.5X MH
5= 18.0Á- 7 X MH
4= 13.5Á- 6 X MH
3= 9.0Á- 5 X MH
2= 4.5Á- 4.5 X MH
1= 0.0Á- 4 X MH
MH= MOUNTING HEIGHT

A= 150Wmax 85-300 Vac
AM= 150Wmax 85-300 Vac WITH MIDNIGHT DIMMING 50% FROM 11h30pm

LUMINAIRE DETAIL (WING ANGLE 18Á SHOWN)
SCALE 1:10

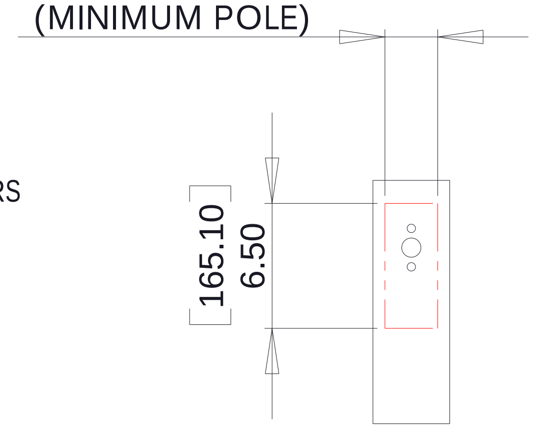


LUMINAIRE SPECIFICATIONS:

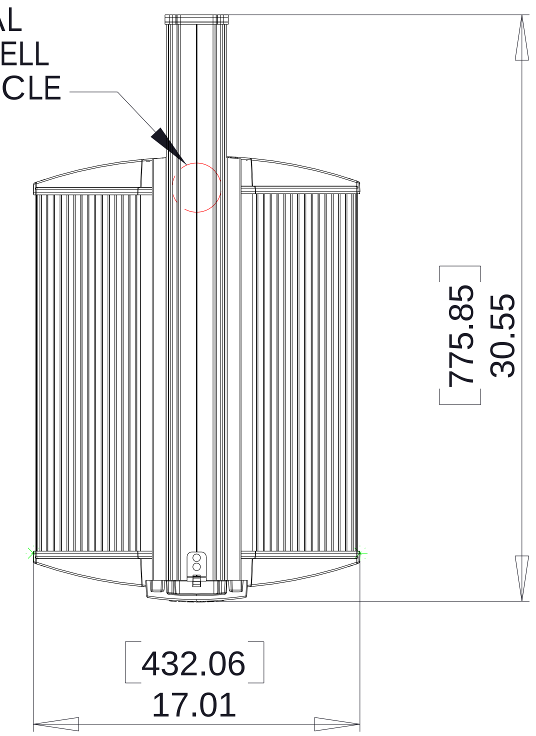
- INPUT: 85-300 Vac 50-60Hz, AUTO SENSING
- OPTIAC POWER CONVERSATION:
  EFFICIENCY 95% W/ POWER FACTOR OF 0.96 TO 0.99
  TOTAL HARMONIC DISTORTION <10%
- TEMPERATURE & AGE COMPENSATION FOR UNIFORM PHOTOMETRIC OVER THE LIFE OF THE FIXTURE 100,000 HRS AT 15ÁC (20 YRS)
- LIGHT LOSS FACTOR (LLF): 0.95
- OPTIONAL: - MIDNIGHT DIMMING
  - ROUND POLE ADAPTER (POLE 3"- 4" O.D)
- PAINTED DIE-CAST & EXTRUDED ALUMINIUM
-INITIAL CONSUMPTION AT 15ÁC *: 69 W

* CONSUMPTION REDUCES 3% FOR EVERY 10ÁC OF TEMPERATURE DECREASE. POWER WILL GRADUALLY INCREASE UP TO 30% TO COMPENSATE FOR LED AGING.

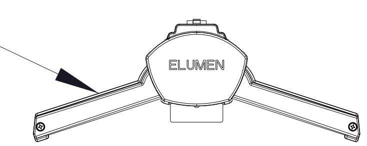
- NICHIA 5mm, LIGHTING GRADE LOW POWER LEDs
- CLEAR ACRYLIC HIGH IMPACT LENS
- 5000K COLOR TEMPERATURE (CCT)
- 82 COLOR RENDERING INDEX (CRI)
- OPERATING TEMPERATURE RANGE -45ÁC TO +45ÁC
- 5 YEAR LIMITED WARRANTY (PRORATED)
- IP66 RATED
- CSA C22.2 NO. 250.0-08, UL1598 FOR WET AREAS
- ROHS COMPLIANT
- EPA: 1.25 SQ. FT.
- Weight: 18.5 lbs (8.4 kg)



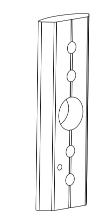
DIRECT MOUNT BRACKET OUTLINE



WING ANGLE IS AJUSTABLE FOR REQUIRED SPACING (0Á - 22.5Á)

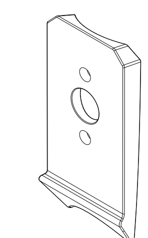


BACKPLATE

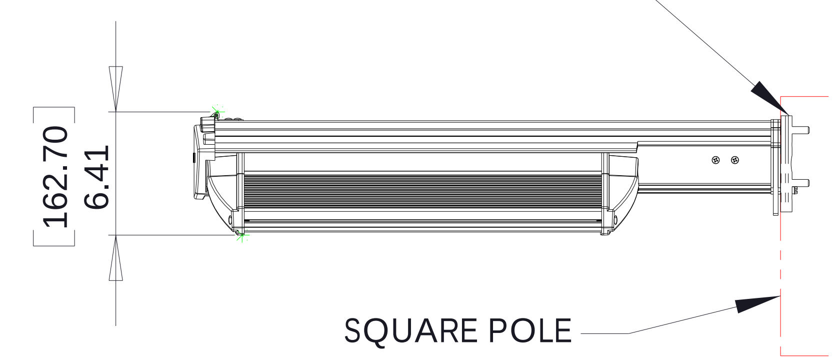


USE FOR SQUARE AND ROUND POLE

*ORDERING MOUNTING:
DR



ROUND POLE ADAPTOR (POLE ∅ 3" TO 5")



WING ANGLE	LUMENS	UPLIGHT % LUMEN	TYPE	DISTRIBUTION
0	4902	0.00%	2	SHORT
4.5	4925	0.02%	2	SHORT
9	4978	0.10%	2	SHORT
13.5	4919	0.10%	2	SHORT
18	4859	0.20%	3	MEDIUM
22.5	4714	0.20%	3	MEDIUM

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES, WITHIN [ ] ARE IN MILLIMETERS

NOTICE:
THIS DRAWING IS FOR REFERENCE ONLY. CHECK FOR LATEST REVISION PRIOR TO ORDERING

	NAME
DRAWN	MAP
CHECKED	CdeV
ENG APPR.	
MFG APPR.	
Q.A.	

COMMENTS:
THIRD ANGLE PROJECTION

ELUMEN R£SEAUX D'£CLAIRAGE
1155 Ren®-L®vesque Ouest
Suite 2500
Montr®al, QC
H3B 2K4

Courriel: info@elumen.ca
Tel: 514-876-1010
Fax: 514-876-1010

elumen
LIGHTING NETWORKS

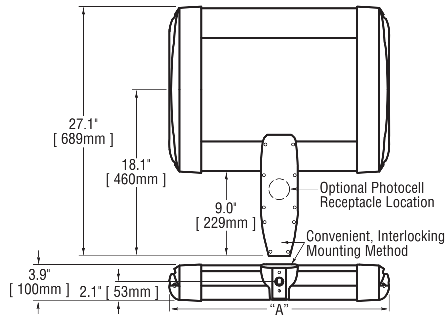
SIZE **B**
DWG. NO.
LED LIGHT 66W DIRECT MOUNT

SHEET 1 OF 1

X-AL SERIES — THE EDGE™ LED Area Light – Type II Medium

Catalog #: X - AL - 1 -   -   - C -   -   -   -

Reset



# of LEDs	Dim. "A"
20	11.75"
40	11.75"
60	13.75"
80	15.75"
100	17.75"
120	19.75"
140	21.75"
160	23.75"
180	25.75"
200	27.75"
220	29.75"
240	31.75"

Notes:

Product	Family	Mounting	Optic	# of LEDs (x 10)	LED Series	Voltage	Color Options	Factory-Installed Options
X	**AL** Area Light	**1**[1] Direct Arm	☐ **2**[2] Type II ☐ **G**[3] Type II w/ BLS	☐ **02** ☐ **04** ☐ **06** ☐ **08** ☐ **10** ☐ **12** ☐ **14** ☐ **16** ☐ **18** ☐ **20** ☐ **22** ☐ **24**	**C**	☐ **U** Universal 120–277V ☐ **V** Universal 347–480V ☐ **1** 120V ☐ **4** 240V ☐ **2** 277V ☐ **6** 347V	☐ **S** Silver ☐ **T** Black ☐ **Z** Bronze ☐ **B** Platinum Bronze ☐ **W** White	Please type additional options in manually on the lines provided above. ☐ **7** 4300K Color Temperature[4] ☐ **C** 525mA Drive Current[5,6] ☐ **CL** Two-Level (0/525 w/ integrated sensor control)[7,8] ☐ **F** Fuse[9] ☐ **G** Hi/Low (175/350/525, dual circuit input)[7,8,10] ☐ **K** Two-Level (175/525 w/ integrated sensor control)[7,8] ☐ **L** Two-Level (0/350 w/ integrated sensor control)[8] ☐ **P** Photocell[11-14] ☐ **R** NEMA Photocell Receptacle[13-16] ☐ **Y** 0–10V Dimming[18,19]

Footnotes

1. Direct mounting arm for use with 3–6" square or round pole
2. IESNA Type II Medium distribution
3. IESNA Type II Medium distribution with backlight control
4. Color temperature per fixture; minimum 70 CRI
5. Driver operates at 525mA instead of the standard 350mA providing a higher lumen output and a shorter life
6. Available on fixtures with 20–120 LEDs
7. Available on 120–277V fixtures with 20–120 LEDs and 347–480V fixtures with 40–120 LEDs
8. Refer to multi-level spec sheet for more information
9. Not available with K, L, or CL options when V voltage is selected
10. Sensor not included
11. Not available with G option when V voltage is selected
12. Must specify voltage other than U or V
13. Not available with L or CL options
14. Not available with K option when V voltage is selected
15. 100 LED maximum when used with K option
16. Not available with G option
17. Control by others
18. Please consult factory for availability

LED PERFORMANCE SPECS

# of LEDs	Initial Delivered Lumens – Type II Medium @ 6000K	B	U	G	Initial Delivered Lumens – Type II Medium w/ Backlight Control @ 6000K	B	U	G	Initial Delivered Lumens – Type II Medium @ 4300K	B	U	G	Initial Delivered Lumens – Type II Medium w/ Backlight Control @ 4300K	B	U	G	System Watts 120–277V	Total Current @ 120V	Total Current @ 230V	Total Current @ 277V	System Watts 347–480V[1]	Total Current @ 347V	Total Current @ 480V	L_{70} Hours[2] @ 25° C (77° F)
		Rating[3]				Rating[3]				Rating[3]				Rating[3]										
350mA (Standard) Fixture Operating at 25° C (77° F)																								
20	1,711 (02)	1	1	1	1,278 (02)	0	1	1	1,500 (02)	1	1	1	1,121 (02)	0	1	1	25	0.23	0.11	0.10	30	0.10	0.15	105,000
40	3,421 (04)	1	1	1	2,556 (04)	0	1	1	3,001 (04)	1	1	1	2,242 (04)	0	1	1	49	0.41	0.23	0.20	55	0.16	0.16	105,000
60	5,132 (06)	2	2	1	3,833 (06)	1	1	1	4,501 (06)	1	1	1	3,362 (06)	1	1	1	71	0.60	0.32	0.28	77	0.22	0.20	105,000
80	6,842 (08)	2	2	2	5,111 (08)	1	2	1	6,002 (08)	2	2	2	4,483 (08)	1	2	1	93	0.78	0.41	0.35	99	0.29	0.23	105,000
100	8,553 (10)	2	2	2	6,389 (10)	1	2	2	7,502 (10)	2	2	2	5,604 (10)	1	2	1	116	0.98	0.52	0.43	123	0.35	0.28	105,000
120	10,263 (12)	2	3	2	7,667 (12)	1	2	2	9,002 (12)	2	2	2	6,725 (12)	1	2	2	139	1.17	0.61	0.52	146	0.42	0.33	105,000
140	11,974 (14)	3	3	3	8,944 (14)	1	3	2	10,503 (14)	2	3	2	7,845 (14)	1	3	2	164	1.39	0.74	0.63	172	0.50	0.37	105,000
160	13,685 (16)	3	3	3	10,222 (16)	1	3	2	12,003 (16)	3	3	3	8,966 (16)	1	3	2	186	1.58	0.83	0.71	195	0.56	0.41	105,000
180	15,395 (18)	3	3	3	11,500 (18)	1	3	2	13,503 (18)	3	3	3	10,087 (18)	1	3	2	211	1.77	0.93	0.79	220	0.63	0.47	105,000
200	17,106 (20)	3	3	3	12,778 (20)	1	3	2	15,004 (20)	3	3	3	11,208 (20)	1	3	2	233	1.97	1.03	0.87	243	0.70	0.51	105,000
220	18,816 (22)	3	3	3	14,056 (22)	2	3	2	16,504 (22)	3	3	3	12,328 (22)	1	3	2	256	2.16	1.13	0.95	267	0.77	0.56	105,000
240	20,527 (24)	3	3	3	15,333 (24)	2	3	2	18,005 (24)	3	3	3	13,449 (24)	1	3	2	279	2.35	1.23	1.03	291	0.84	0.61	105,000
525mA Fixture Operating at 25° C (77° F)																								
20	2,224 (02)	1	1	1	1,661 (02)	0	1	1	1,950 (02)	1	1	1	1,457 (02)	0	1	1	37	0.31	0.18	0.17	43	0.13	0.15	61,000
40	4,448 (04)	1	1	1	3,322 (04)	1	1	1	3,901 (04)	1	1	1	2,914 (04)	0	1	1	69	0.58	0.31	0.27	75	0.22	0.19	61,000
60	6,671 (06)	2	2	2	4,983 (06)	1	2	1	5,851 (06)	2	2	2	4,371 (06)	1	2	1	110	0.92	0.49	0.41	116	0.33	0.27	61,000
80	8,895 (08)	2	2	2	6,644 (08)	1	2	2	7,802 (08)	2	2	2	5,828 (08)	1	2	2	138	1.16	0.62	0.54	145	0.42	0.32	61,000
100	11,119 (10)	3	3	3	8,306 (10)	1	3	2	9,752 (10)	2	2	2	7,285 (10)	1	2	2	177	1.49	0.79	0.68	186	0.53	0.40	61,000
120	13,343 (12)	3	3	3	9,967 (12)	1	3	2	11,703 (12)	3	3	3	8,742 (12)	1	3	2	217	1.82	0.96	0.81	226	0.65	0.48	61,000

1. Utilizes magnetic step-down transformer
2. For recommended lumen depreciation data see TD-13
3. For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit www.iesna.org/PDF/Erratas/TM-15-07BugRatingsAddendum.pdf

General Description

Slim, low profile design minimizes wind load requirements. Fixture sides are rugged cast aluminum with integral, weather-tight LED driver compartments and high performance aluminum heatsinks. Convenient, interlocking mounting method. Mounting housing is rugged die cast aluminum and mounts to 3 – 6" square or round pole. Fixture is secured by two (2) 5/16-18 UNC bolts spaced on 2" centers. Includes leaf/debris guard. Five year limited warranty on fixture.

Electrical

Modular design accommodates varied lighting output from high power, white, 6000K (+/- 500K per full fixture), minimum 70 CRI, long life LED sources. 120–277V 50/60 Hz, Class 1 LED drivers are standard. 347–480V 50/60 Hz driver is optional. LED drivers have power factor >90% and THD <20% of full load. Units provided with integral 9kV surge suppression protection standard. Integral weather-tight electrical box with terminal strip for easy power hook-up. Surge protection tested in accordance with IEEE C62.41.2 and ANSI standard 62.41.2.

Testing & Compliance

UL listed in the U.S. and Canada for wet locations. Consult factory for CE Certified products. RoHS compliant. International Dark-Sky Association approved.

Finish

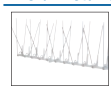
Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable silver powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Bronze, black, white and platinum bronze powder topcoats are also available. The finish is covered by our 10 year limited warranty.

Fixture and finish are endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117.

Patents

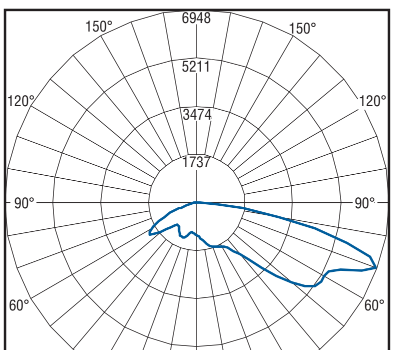
U.S. and international patents granted and pending. BetaLED is a division of Ruud Lighting, Inc. For a listing of Ruud Lighting, Inc. patents, visit www.uspto.gov.

Field-Installed Accessories



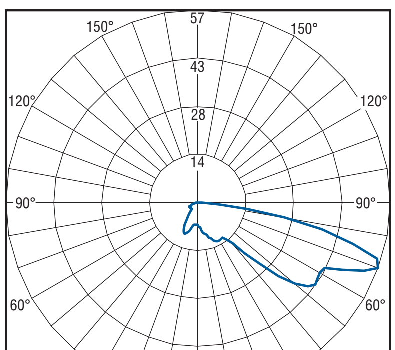
Bird Spikes
☐ XA-BRDSPK

Photometrics



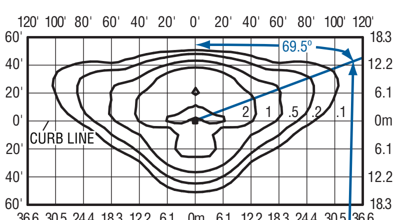
Candlepower Trace: Vertical plane through horizontal angle of maximum candlepower.

Independent Testing Laboratories certified test. Report No. ITL63821 . Candlepower trace of 6000K, 120 LED Type II Medium area luminaire with 10,355 initial delivered lumens operating at 350 mA. **All published luminaire photometric testing performed to IESNA LM-79-08 standards.**



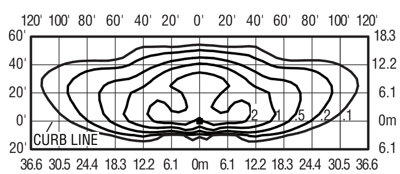
Candlepower Trace: Vertical plane through horizontal angle of maximum candlepower.

PRELIMINARY
Candlepower trace of Type II Medium LED luminaire with backlight control.



Position of vertical plane of maximum candlepower.

Isofootcandle plot of 6000K, 120 LED Type II Medium area luminaire at 25' A.F.G. Luminaire with 10,263 initial delivered lumens operating at 350mA. Initial FC at grade.



PRELIMINARY
Isofootcandle plot of 6000K, 120 LED Type II Medium area luminaire with backlight control at 25' A.F.G. Luminaire with 7,667 initial delivered lumens operating at 350mA. Initial FC at grade.

THE EDGE™ EPA & Weight Calculations

# of LEDs	Approximate Weight 120-277V[1]	Single	2@ 180º	2@ 90º	3@ 90	4@ 90º
Fixed Arm Mount						
20	21.0 lbs.	0.60	1.20	0.87	1.47	1.75
40	23.7 lbs.	0.60	1.20	0.87	1.47	1.75
60	27.0 lbs.	0.60	1.20	0.92	1.51	1.83
80	28.1 lbs.	0.60	1.20	0.96	1.55	1.91
100	32.3 lbs.	0.60	1.20	1.00	1.60	2.00
120	33.5 lbs.	0.60	1.20	1.04	1.64	2.08
140	36.9 lbs.	0.60	1.20	1.08	1.68	2.16
160	41.4 lbs.	0.60	1.20	1.12	1.72	2.24
180	42.1 lbs.	0.60	1.20	n/a[2]	n/a[2]	n/a[2]
200	43.3 lbs.	0.61	1.21	n/a[2]	n/a[2]	n/a[2]
220	46.6 lbs.	0.65	1.29	n/a[2]	n/a[2]	n/a[2]
240	47.8 lbs.	0.69	1.38	n/a[2]	n/a[2]	n/a[2]

1. Add 5 lbs. for transformer in 347-480V fixtures
2. For applications requiring 180 or more LEDs at 90 degrees refer to the DL mount version of our spec sheet.

LTL LUMINAIRE TESTING LABORATORY, INC.

SUSTAINING MEMBER of the IESNA

905 Harrison Street · Allentown, PA 18103 · 610-770-1044 · Fax 610-770-8912 · www.LuminaireTesting.com

LTL NUMBER: 12844 DATE: 03-17-2008

PREPARED FOR: RELUME TECHNOLOGIES

CATALOG NUMBER: R4800 COBRA 796-4201

LUMINAIRE: EXTRUDED ALUMINUM HOUSING WITH MOLDED ACRYLIC END AND TOP CAPS, FORMED BLACK ENAMEL AND SPECULAR ALUMINUM REFLECTORS, CLEAR ACRYLIC ENCLOSURES.

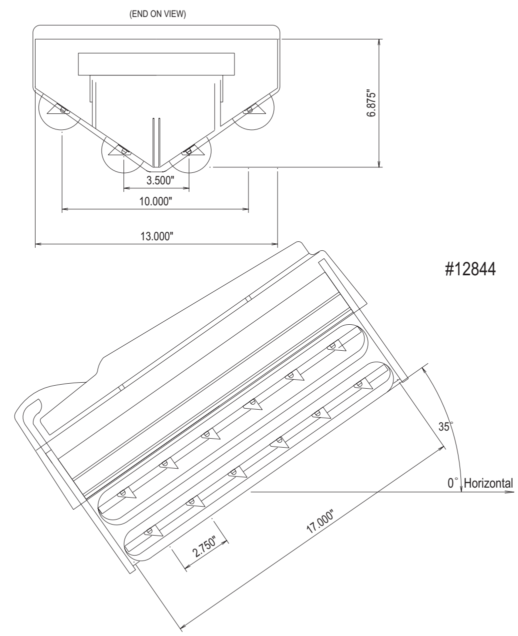
LAMP: 24 WHITE LEDS

LED DRIVER: ONE ADVANCE LEDINTA0024V41FO

ELECTRICAL VALUES: 120.0VAC, 0.6010A, 71.78W

LUMINAIRE EFFICACY: 46.7 LUMENS/WATT

NOTE: THIS TEST WAS PERFORMED USING THE CALIBRATED PHOTODETECTOR METHOD OF ABSOLUTE PHOTOMETRY.*



IES CLASSIFICATION: **TYPE III**

LONGITUDINAL CLASSIFICATION: **SHORT**

CUTOFF CLASSIFICATION: **CUTOFF****

**CUTOFF DESIGNATION IS NOT DEFINED FOR ABSOLUTE PHOTOMETRIC TESTS. THIS CUTOFF RATING IS BASED ON THE MAXIMUM CANDELA READING PER LUMINAIRE RATED AT 1000 LUMENS.

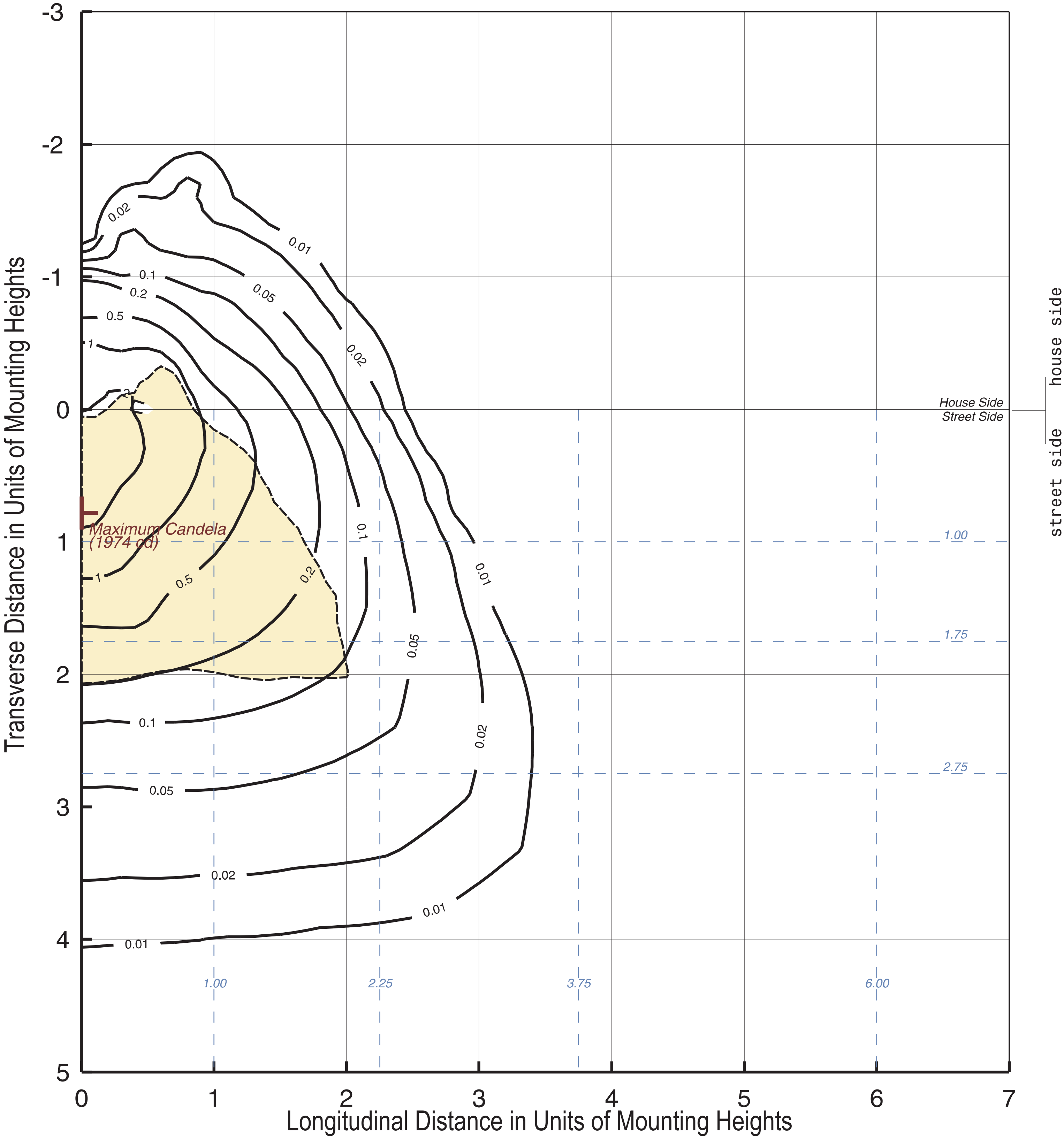
FLUX DISTRIBUTION

LUMENS	DOWNWARD	UPWARD	TOTALS
HOUSE SIDE	798.54	0.00	798.54
STREET SIDE	2551.34	0.00	2551.34
TOTALS	3349.88	0.00	3349.88

*DATA WAS ACQUIRED USING THE CALIBRATED PHOTODETECTOR METHOD OF ABSOLUTE PHOTOMETRY. A UDT MODEL #211 PHOTODETECTOR AND UDT MODEL #S370 OPTOMETER COMBINATION WERE USED AS A STANDARD. A SPECTRAL MISMATCH CORRECTION FACTOR WAS EMPLOYED BASED ON THE SPECTRAL RESPONSIVITY OF THE PHOTODETECTOR AND THE SPECTRAL POWER DISTRIBUTION OF THE TEST SUBJECT.

Approved By: MG

ISOFOOTCANDLE LINES OF HORIZONTAL ILLUMINATION
VALUES BASED ON 20.00 FOOT MOUNTING HEIGHT



PROJECTION OF HALF-MAX CANDELA CONTOUR

LTL LUMINAIRE TESTING LABORATORY, INC.

SUSTAINING MEMBER of the IESNA

905 Harrison Street · Allentown, PA 18103 · 610-770-1044 · Fax 610-770-8912 · www.LuminaireTesting.com

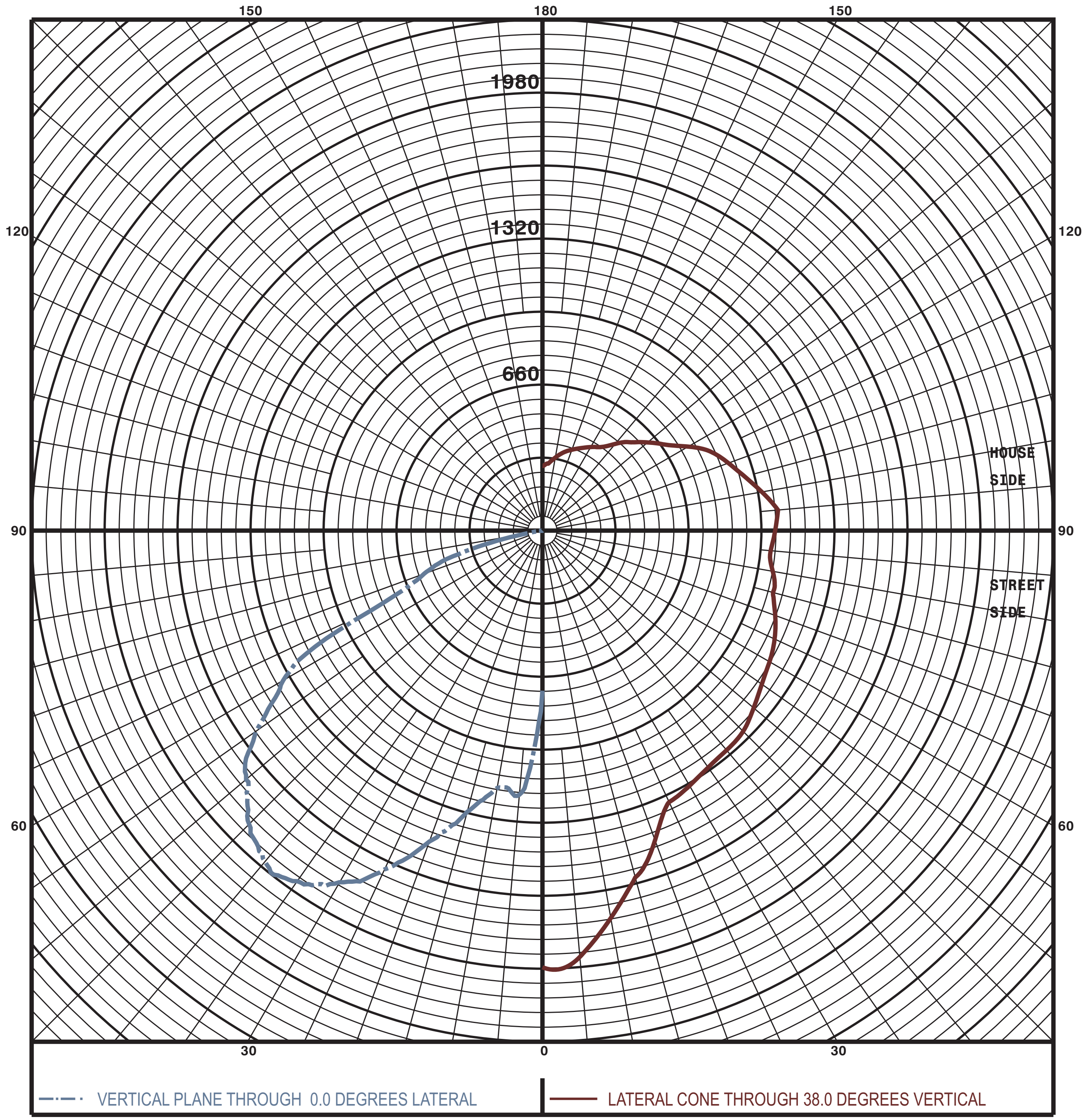
CANDELA DISTRIBUTION

	0	5	15	25	35	45	55	65	75	85	90
180	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0
87.5	3	3	6	6	11	5	0	0	0	0	0
85	13	14	18	20	30	17	6	0	0	0	0
82.5	32	32	45	50	59	41	9	9	5	0	0
80	85	78	95	110	205	228	32	12	11	9	8
77.5	216	208	232	294	459	486	208	18	6	14	14
75	365	352	402	525	699	756	435	78	14	18	20
72.5	492	492	569	691	806	918	620	261	45	21	17
70	570	572	660	774	916	1011	838	447	171	36	30
67.5	653	645	746	889	1016	1067	969	631	331	133	80
65	860	851	897	999	1075	1073	1020	811	480	258	181
62.5	1206	1208	1159	1085	1099	1081	1078	919	655	394	288
60	1355	1375	1499	1174	1138	1093	1079	968	797	528	399
57.5	1451	1467	1606	1193	1167	1125	1069	993	876	661	521
55	1581	1608	1576	1220	1186	1155	1085	1051	930	744	619
52.5	1689	1700	1586	1277	1217	1161	1079	1090	978	808	679
50	1750	1781	1599	1286	1238	1168	1109	1099	1023	848	719
47.5	1811	1816	1620	1312	1254	1188	1119	1093	1073	877	786
45	1876	1884	1615	1319	1271	1203	1159	1087	1087	931	823
40	1953	1934	1617	1365	1309	1263	1189	1158	1063	1046	1013
38	1974	1934	1623	1354	1307	1283	1211	1159	1079	1036	1052
35	1934	1911	1585	1351	1324	1303	1224	1141	1102	1026	1042
30	1836	1830	1517	1348	1322	1279	1230	1155	1075	1022	989
25	1688	1686	1449	1309	1274	1250	1203	1152	1073	1010	966
20	1495	1490	1339	1224	1189	1171	1159	1103	1084	1026	978
15	1316	1292	1203	1123	1109	1066	1066	1097	1106	1055	1029
10	1180	1162	1159	1105	1060	1031	1046	1048	1023	996	990
5	1199	1196	1147	1106	1058	1031	998	969	937	885	857
0	723	723	723	723	723	723	723	723	723	723	723

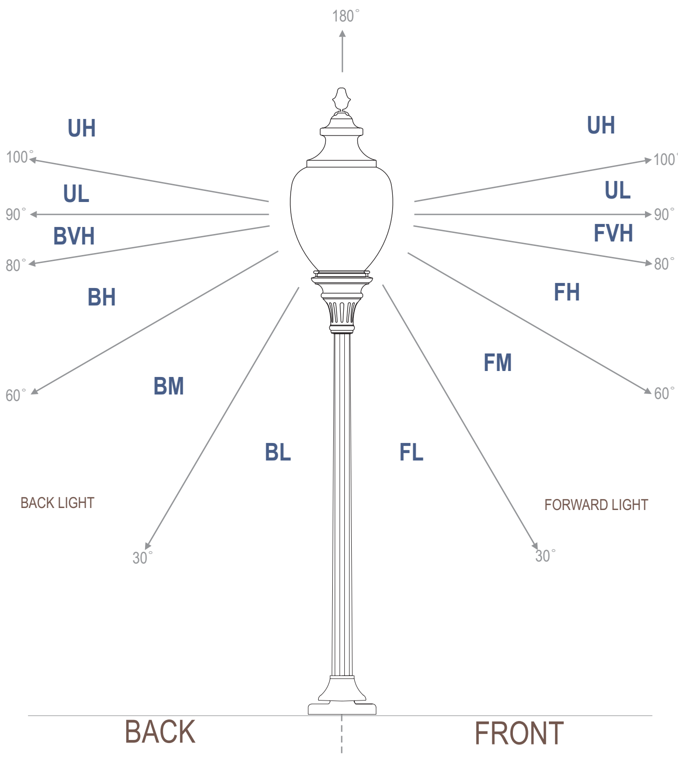
CANDELA DISTRIBUTION

	95	105	115	125	135	145	155	165	175	180
180	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0
87.5	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0
82.5	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0
77.5	5	0	0	0	0	0	0	0	0	0
75	18	5	0	0	0	0	0	0	0	0
72.5	27	8	6	2	2	8	0	0	0	0
70	39	21	8	6	5	23	5	0	0	0
67.5	63	48	26	20	23	33	24	0	0	0
65	125	78	53	39	32	33	56	0	0	0
62.5	214	146	104	78	60	45	97	18	0	0
60	300	192	146	109	80	65	72	45	5	0
57.5	405	254	189	151	112	75	71	71	9	0
55	495	320	242	190	149	101	71	107	20	0
52.5	554	368	261	216	165	115	94	107	15	12
50	608	377	267	229	190	143	115	82	39	21
47.5	651	432	303	260	226	195	146	94	92	91
45	697	472	377	337	296	258	189	148	187	190
40	933	746	670	563	486	415	343	368	288	290
38	1069	946	842	678	565	460	412	367	305	293
35	1250	1209	1054	836	661	539	468	392	344	347
30	1113	1173	1016	820	670	565	472	462	468	471
25	962	1034	981	815	709	613	581	583	628	625
20	957	1007	980	857	780	747	708	726	729	734
15	1007	995	943	877	845	814	788	780	774	767
10	959	886	808	768	752	756	750	741	771	749
5	832	770	699	654	639	620	617	619	623	625
0	723	723	723	723	723	723	723	723	723	723

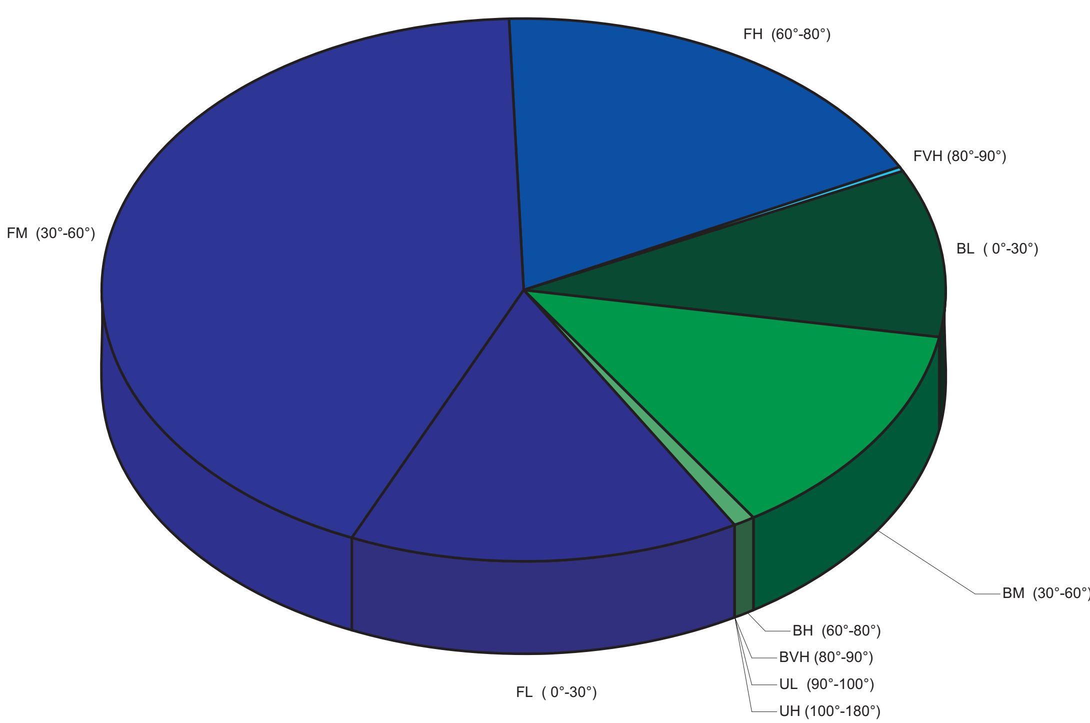
MAXIMUM PLANE AND CONE PLOTS OF CANDELA



FLUX DISTRIBUTION TABLE BASED ON THE IESNA LUMINAIRE CLASSIFICATION SYSTEM



ZONE	FLUX: LUMINAIRE LUMENS	FLUX: % OF LUMINAIRE LUMENS
FORWARD LIGHT	2551	76.2
FL (0°-30°)	503	15
FM (30°-60°)	1438	42.9
FH (60°-80°)	599	17.9
FVH (80°-90°)	11	0.3
BACK LIGHT	799	23.8
BL (0°-30°)	335	10
BM (30°-60°)	435	13
BH (60°-80°)	29	0.9
BVH (80°-90°)	0	0
UPLIGHT	0	0
UL (90°-100°)	0	0
UH (100°-180°)	0	0
TRAPPED LIGHT	NA	NA



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