

To: Council Members, Mayor Prussing
CC: Bill Gray, Director of Public Works

From: Charlie Smyth

RE: Lighting RFP motion that is still before us

6/8/2008 – 7/9/08

I would like to bring to your attention some changes in lighting standards that we were not made aware of by our lighting consultant. These changes have a major impact on how we go about the Campus area Lighting RFP and in implementing any lighting ordinance changes. I describe some ideas on how we might move forward and then present the background information that I've been gathering this past month.

Since our Tuesday, May 27 Council meeting, I've submitted a number of questions and ideas to Bill Gray though some of what is contained in this memo may supersede those. I also shared the 4 pages of concerns with Eva Sweeney, a University of Illinois F&S (Facilities and Services) engineer and lighting designer (and one of two people locally with the LC certification). I had previously shared this document with Jack Dempsey, the head of F&S. Ms. Sweeney also has LEED certification and it is my understanding that she has been asked to evaluate the RFP. We have also confirmed that the University is following LEED Silver on multimillion dollar projects. This previous document was also shared with the campus Environmental Council and other interested individuals.

We also had follow up questions answered by Jim Benya, our pro bono consultant who was presenting papers on the new standard at the recent LightFair 2008 conference. Please note that Jim Benya is a major superstar in the lighting field. John Richards, another pro bono consultant is also well known.

One thing we understand better now is that in some situations cutoff lighting can save energy over full-cutoff. We already know that the switch to full cutoff/cutoff can save substantially on energy but allowing the extra light in the 80 to 90 degree range allows for wider pole separation and the use of fewer lights. The downside (in addition to the extra glare) is that to get the extra light in the 80 to 90-degree area, cutoff lighting can waste some light sending it above 90 degrees. However, fully shielded lighting has no restrictions on the 80 to 90 degree range and doesn't send any light above 90 degrees and so that would be preferable to cutoff (and indeed, IDA certifies both full-cutoff and fully shielded light fixtures as dark-sky friendly). Further, Mr. Benya suggests that we simply use one of the "better" cutoff style lights that have minimal uplight (eg. 1% of total luminaire flux in Lighting Zone 3 with no more than 200 Watts HID).

The new standard, IESNA TM-15-47 described below supersedes IESNA Full Cutoff/Cutoff language and creates zones of lighting. Gary Cziko summarizes this new standard as “So it seems that we want no light in the Up Low (UL) and Up High (UH) zones and limited light in the Forward Very High (FVH) and Forward High (FH), with Forward High allowing wider pole placement at the cost of more glare. They give an example of a tear drop luminaire that has only 0.2% uplight and only 0.7% light in the 80 to 90 degree range. So this suggests we can get nice luminaires with minimum glare and uplight. But we have to control the overall illumination.”

So, what does all this mean? Besides proper lighting design being somewhat complicated, the real issues are related to over lighting and light fixture design. Our policy allowing Full cutoff and Cutoff type fixtures is not far off but should be adjusted for the new terminology. As Gary (and Jim Benya below) mention, **there are some nice fixtures that meet these new standards as long as illumination levels aren't overly bright. Excess light is wasted energy and continues to be a major factor and a reason why we need to be very careful to match a design to the types of areas we are trying to light. I think that if we keep in mind the draft IDA / IESNA Model Outdoor Lighting Ordinance that is under development we will be well on our way to a better policy. Further, I would encourage us via the Sustainability Commission to follow the development of this model ordinance and use it as guidance to change our own ordinances so that we can have our own 21st century Lighting Policy.**

I continue to support the motion sent to council (see memo of 5/29) which states as follows (in black) but which I would encourage amendment to the indicated language (in blue italics):

Motion

Council directs staff to develop an RFP that leads to a master plan design for lighting using IDA *approved* full cutoff, *cutoff*, or shielded fixtures *per the new Luminaire Classification System (IESNA TM-15-07) that minimizes backlight, uplight, and glare for the appropriate AASHTO lighting zones within the campus district*, and that meets LEED lighting standards and technical requirements for energy efficiency and light pollution controls for the Urbana portion of the campus district. This plan and related equipment specifications will be done by someone with LC certification and who has experience developing LEED Certified lighting projects. The plan would include suggested hardware, and manufacturers to be solicited, with specs to meet the design that would then be solicited.

Background

In response to a follow up questions about AASHTO illumination levels to Jim Benya about how to best develop a city lighting policy, he responded as follows:

From: "Jim Benya" <jbenya@benyalighting.com>
Date: Wed, 28 May 2008 14:38:45 -0700

Please remember that the primary cause of light pollution is overlighting, not the cut off issue. That's why the AASHTO selections are critical.

As for full cut off, remember that the terms cut off and full cut off are deprecated and no longer approved by IESNA. What we (IDA) want is luminaires that have very little or no direct uplight, but full cut off is not absolutely required. Cut off will often do, depending on the photometric specifications.

Keep up the good effort.

James R Benya, PE, FIES, FIALD, LC

Gary had also asked Mr. Benya a follow up on the AASHTO recommendations and he clarified as follows:

Jim:

Two quick questions for you, if I may:

2008/5/28 Jim Benya <jbenya@benyalighting.com>:

Gary: But IDA currently approves only IESNA full cutoff and fully shielded fixtures (see below) while mentioning the possibility of expanding approval to other types of fixtures. But we need to specify fixtures now. **Do you think it would be overly restrictive to use only IDA approved fixtures that are full cutoff or fully shielded, or fixtures with photometrics that indicate they are full cutoff or fully shielded?**

JB: At the moment, IDA approves only Illuminating Engineering Society of North America (IESNA) full cutoff and fully shielded fixtures. In the near future the program will expand to allow approval of some fixtures in other cutoff classifications that satisfy additional criteria, such as sensible wattages, minimal lumens/candela in the glare zone (75-90 degrees), and tight optical designs that minimize light trespass. (From <http://data.nextrionet.com/site/idsa/fixture-seal-of-approval-package.pdf>)

To add to this, Mr. Benya provided the following comments to me:

From: "Jim Benya" <jbenya@benyalighting.com>
To: "Charlie Smyth" <csmyth@sbcglobal.net>
Cc: "Gary Cziko" <g-cziko@illinois.edu>, <amyando@gmail.com>
Subject: RE: thanks!
Date: Thu, 29 May 2008 08:46:38 -0700

About AASHTO

AASHTO standards are developed from IESNA standards, and many of the standards committee personnel are members of both organizations. AASHTO's standards vary

according to roadway type (residential, collector, etc.), pavement type (R1=concrete, R2=asphalt with 60% gravel aggregate, etc.) and adjacent neighborhood (residential, intermediate and commercial). It appears from the photos that the major streets in campustown are concrete R1 and using this will lead to the AASHTO recommendations I suggested. If in fact a different pavement is used, higher values may be needed.

Moreover, there did not appear to any differentiation between commercial and intermediate in this "master plan" and intermediate light levels are 25% less than commercial, another overlighting issue. From the information presented, I believe that there remains a significant opportunity to reduce the amount of lighting while continuing to meet applicable standards.

About Cut off

The old IESNA cut off system (full cut off, etc.) is now deprecated by TM-15-07 which establishes a better and more complete system. From the standpoint of glare, the 80-90 degree zone (just below horizontal) is most critical and needs to be limited to approximately the definition of full cut off. The 90-110 degree zone produces the most severe sky glow and needs significant restriction. However, a really good luminaire can have a tiny bit of uplight including the 90-110 zone due to a clear lens or even the top of a pole just below the light. FCO purists eliminate this potentially superior group of luminaires, many of traditional style, due to this meaningless photometric anomaly.

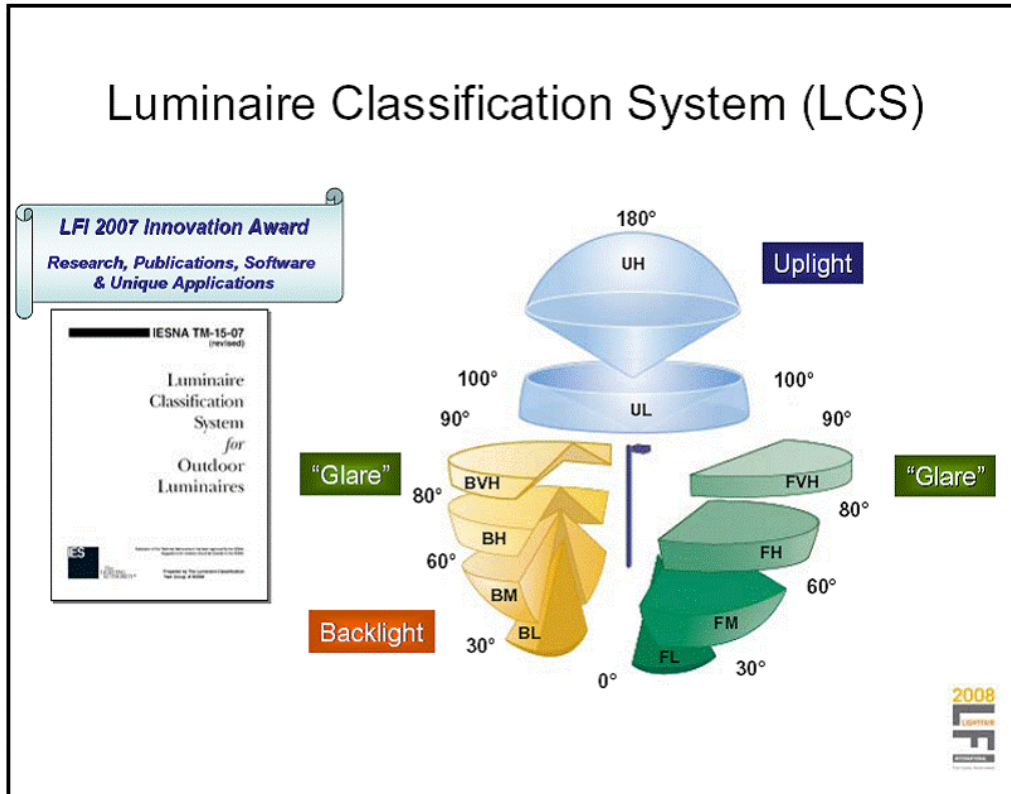
Therefore, a better photometric rating system should be used based on TM-15 and local objectives (the "BUG" system, that I will be presenting today at LightFair, is just such a system. Backlight Uplight Glare).

James R Benya, PE, FIES, FIALD, LC

One thing I did at this point was look up the new IESNA standards for outdoor lighting effective 28 January 2007 (why didn't this change get brought up to us by Tom Burtness?). These are described in an IESNA technical bulletin, TM-15-07. I will skip the details except to say that light distribution is now described for 3 major zones broken down into 10 secondary zones of lighting (see <http://www.agi32.com/kb/index.php?article=858> for a good general description). As described on one site: "The new Technical Memorandum bears the name TM-15-07 Luminaire Classification System for Outdoor Luminaires. According to this new classification system, the words Full Cutoff, Cutoff, Semicutoff and Noncutoff are not used anymore and are replaced by percentages of lamp lumens in different zones. The words Type I, Type II, Type III, Type IV and Type V and Short, Medium, Long are still used to qualify the transversal and longitudinal distributions respectively. You can order the new Technical Memorandum from IESNA if you want additional information regarding this new classification system." (<http://www.spectralux.ca/notice6.htm>)

Mr. Benya provided the following slide describing this new system and his proposed BUG system of classification based on this standard (see reference below):

Luminaire Classification System (LCS)



"The BUG system employs the TM-15 system and sets limits to the number of lumens per photometric zone, according to lighting zone. It is called BUG because the three ratings (Backlight, Uplight and Glare) each are a composite rating considering the applicable photometric zones for each. For Backlight, the zones are BL, BM, and BH; for Glare, the zones are FH, FVH, BH, and BVH; for uplight, the zones are UL and UH. A look-up table of consensus values for each photometric zone determines the lighting zone rating. This system replaces the obsolete "Full CutOff", "CutOff", etc. system."

Mr. Benya's web site has links to his talk from this year's LightFair 2008 Conference (May 29, 2008). He also presented a 2 day class on his book. The slides related to each talk, "A New Day for Outdoor Lighting" and "Lighting Design Basics" can be found at:

<http://www.benyalighting.com/LFI%202008%20-%20A%20New%20Day%20for%20Outdoor%20Lighting.pdf>

and

<http://www.benyalighting.com/2008%20Lighting%20Design%20Basics.pdf>.

When I shared an earlier draft of this memo with Mr. Benya he provided these comments on the revised motion:

From: "Jim Benya" <jbenya@benyalighting.com>
To: "Charlie Smyth" <csmlyth@sbcglobal.net>

Subject: RE: lighting policy for Urbana
Date: Mon, 7 Jul 2008 07:40:04 -0700

I recommend that you set a limit on less than 1 percent uplight of total luminaire flux. This will be close to BUG compliance for lighting zone 3 using a lamp of less than 200 watts HID. Such allows tremendous flexibility among various luminaire companies and products. Backlight should be limited using "house side shielding" whenever adjacent to living quarters.

I further recommend that you insist on the strict interpretation of AASHTO lighting levels to prevent overlighting.

Many cities have poles with separate pedestrian lights, often mounted lower on the pole, for the sidewalk. This is an option for districts with wide sidewalks and little opportunity for building mounted lighting.

If these are studied and employed carefully, you will get a decent roadway lighting system suitable for mixed commercial and intermediate districts. If moved into wholly residential areas, the lighting system may need to change to address much lower light levels.

In conclusion, I think that if we follow Mr. Benya's recommendations, we could have a very effective lighting policy where the first application will be in the campus district. I believe that we can provide Urbana and University students a model effective, safe, and pedestrian friendly night time environment that also saves energy.