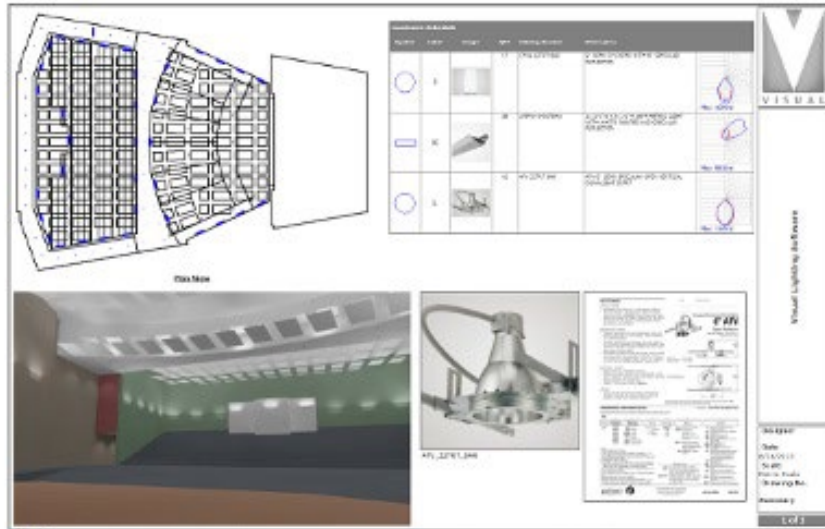


A Specifying Engineer's Viewpoint on Photometric Modeling

Catherine Hollenshead, P.E., Lighting Assistant Dept. Leader with Estes, McClure & Associates, talks about lighting analysis.



Let's start with a question: What are the most meaningful calculations that you perform during project design? As Electrical Engineers, we tend to focus on the electrical power distribution, right? We are calculating the branch circuit loads, sizing branch circuits, feeders, panelboards and transformers, voltage drop, branch AIC and a list of other associated calculations like these. We understand these calculations. After all, this is what we learned in college. But if your responsibilities are like mine, then you are also the “lighting designer” on your project. *How are you supposed to do that?* How do you know what type of lighting to put in a space? Which luminaire(s) do you use and how much light needs to be in that space anyway? The architect or interior designer may prefer a certain lighting type or luminaire style(s), but they are going to rely on you to determine (and meet) the light level needed in a space. For this, you will need to perform photometric calculations of the lighting layout within the space.

So where do you find the required or recommended lights levels for interior and exterior spaces? There are many places where you may need to look. The IBC and NFPA 101 require specific light levels and uniformity for both general lighting and emergency lighting in the means of egress. The AHJ may specify required light levels for exterior building entrances, walkways, parking lots and at the property line. The IES Lighting Handbook provides recommendations for interior and exterior light levels, and uniformity, for various building spaces. These recommendations are based on the space type, the task performed in the space, the age of the occupants in the space, etc. The building owner may even specify light levels that need to be met in certain space types. Knowing the necessary light level(s) and uniformity for your project is crucial to begin your lighting design.

When should you perform photometric calculations? If you are new to lighting design, then you should perform photometric calculations for each space. To help get a visual of what certain light levels actually look like, use a light meter to measure the horizontal and vertical light levels in the spaces around your office or home. It is important to take your measurements at the correct height, which is usually at the task height. The task height is usually either standing (around 42" AFF), sitting (30" AFF) or at the floor (0" AFF). You can use photometric calculations to create office standards - or "rules of thumb" - for luminaire spacing, based on your typical luminaire type, distribution and light output. These office standards are essential to streamline your design time. Photometric calculations are especially important for open spaces where the light level requirements change throughout the space. For example, in a library you have the book stacks, study areas, circulation desk and computer areas. Each one of these space types has specific light level and uniformity requirements and it is up to us to make sure that each is met and maintained. Always perform photometric calculations when you are using luminaires that you haven't used in a previous design.

Why should you perform photometric calculations? One of our duties as engineers is to sign and seal our drawings. By sealing our drawings, we are stating that we meet the required codes to ensure public safety. The public is depending on us to provide the appropriate light levels in each space for both general and emergency lighting. Historically, engineers tend to over light spaces. But more light is not always best. You can have too much light in a space and unintentionally cause occupant discomfort. The same can be said for underlighting a space. Performing photometric calculations can also help you balance light levels with the Lighting Power Density (LPD) required by the adopted energy codes.

What are some tips for getting accurate results? Reflectances, reflectances, reflectances! It is absolutely critical that you have the correct ceiling, wall and floor reflectances in your modeling software. If your reflectances are modeled higher than what they actually will be, then you are artificially inflating the light levels in the space. On the flip side, if your reflectances are modeled lower, then you are calculating lower light levels in the space. Secondly, create templates in your photometric calculation software with your standard IES files and Light Loss Factors (LLF) for typical space types. This will save you from entering this information into the software for each project. Also, model your spaces accurately. Different ceiling types like a gabled ceiling or barrel vault will have a big impact on your light levels as opposed to a flat ceiling. Odd-shaped rooms with lots of corners will impact luminaire spacing. Most software has what I call a "quick and dirty" method where you input the length, width and height of the space, the IES file you want to use and the desired light level. This method has its place and can be a time-saver for you, but it is not good to use for unique and challenging spaces.

As you can see, there are lots of things to be aware of and to consider when performing photometric calculations. Hopefully, you will learn to enjoy lighting and performing these calculations, like I have. This is a part of your job where you can have more

creative freedom. Of course, there are rules and best practices to follow, but your imagination is the limit. Go for it!

Ms. Hollenshead obtained her B.S. in Electrical Engineering from the University of Texas at Tyler in 2004. She began her engineering career with EMA in 2004. Ms. Hollenshead is highly proficient in the use of AutoCAD, Revit, AGI32 and Microsoft Office. Some of her daily responsibilities include preparing complete electrical specifications, electrical power and lighting drawings, coordinating with architects, other engineering disciplines and utility providers, and educating the firm on innovative lighting trends. Ms. Hollenshead's unwavering passion for lighting, along with her extensive knowledge in electrical design has recently earned her the title of Lighting Specialist at EMA.

