

Insights into Outdoor Lighting

Presentation to the County of Lanark

By Robert Dick, P.Eng., FRASC¹

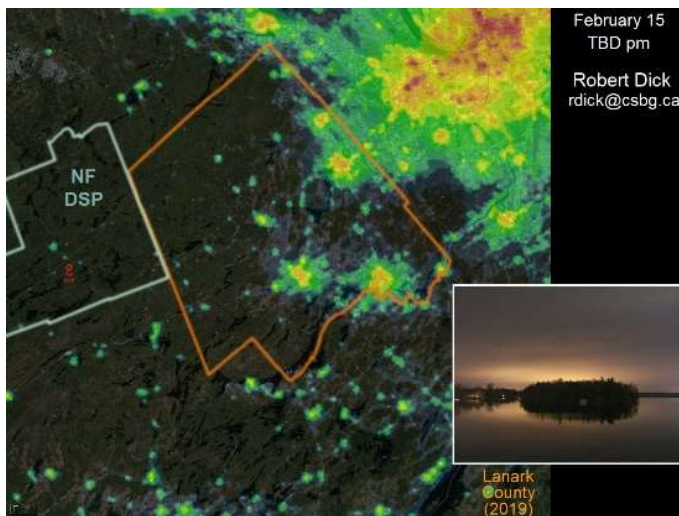
rdick@csbg.ca

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"We speak on the topic of artificial outdoor lighting, and specifically the negative impacts of improper lighting (e.g., on human health, biodiversity, public safety, and values/aesthetics such as dark skies) and options for municipalities when making future outdoor artificial lighting decisions."

Good evening. I'm Robert Dick. For 20 years I've been studying outdoor lighting and its impact on the night ecology: how it affects animals, our physical and mental health and our ability to see at night.

For 1½ centuries we've taken outdoor lighting for granted. But a watershed occurred 20-years ago with the first clear link between Artificial (Anthropogenic) Light at Night and human health - specifically cancer. Artificial light is now linked to cancer², obesity, diabetes, stress, anxiety³, violent behaviour⁴, sensitivities to infection and disease and the infirmities of aging like dementia.



¹ Mr. Dick received his graduate degree in mechanical engineering in 1981 and worked in the commercial electronics, avionics and spacecraft industries. He has taught physics and engineering at the University of Ottawa and Carleton Universities, as well as courses on astronomy at Algonquin College in Ottawa. He is the President of CSbG Inc. He researched and authored the Guidelines for Outdoor Lighting (GOL) that were subsequently adopted by Parks Canada and the International Dark Sky Association, and adapted for the US National Park Service. He developed the Dark-sky Preserve (DSP) Program for the Royal Astronomical Society of Canada (RASC) and its lighting protocol that is based on the GOL. He also manages the Canadian Dark-Sky Preserve Program for the RASC. Mr. Dick has promoted the use of scotobiology in the development of urban lighting policies, and written articles on scotobiology and urban lighting policies in engineering and urban planning journals. He has performed lighting studies of municipalities and protected areas. He developed the CSbG design for the *CSbG-EcoLights* to be fully compliant to the IDA, RASC, Parks Canada and USNPS GOLs.

² Article: <https://www.sciencedaily.com/releases/2014/07/140725080408.htm>

³ Article: <http://www.physorg.com/news/2010-11-night-brain-linked-depression.html>

⁴ Article: <https://mhanational.org/blog/how-blue-light-affects-mental-health>

1) My first take-away for you is that most of what we have learned about the problems with artificial lighting are fairly recent - leading to the need to change Historical Best Practices.

We know that lighting provides safety and security - but like most things the benefits only come if used in moderation. We've long surpassed the levels that provide these benefits and we're now installing lighting that does more harm than additional good.

Light pollution has various definitions but they centre on the over use and miss use of light. Although usually associated with large cities, these images of the landscape show that light is installed wherever there are people – even around isolated homes in the country. And just like air and water pollution, light respects no boundaries.

Cities have an extensive tax base to pay for the installation, maintenance and power for outdoor lighting. Although rural governments don't have this luxury, they tend to adopt policies that were developed for more affluent communities. This diverts resources away from other needs.

Some towns are trying to control the spread of improper artificial lighting. For example, Mississippi Mills has a light pollution bylaw. The town now uses only ½ the light per capita of neighbouring Perth.

Now let's consider the citizens of Lanark County. Why are they here? For many people, both those born and raised here and those who have come from away, they like the rural life: the quiet, the open space, the fresh air.... And their health may also benefit from the rural lifestyle. We must question if we are preserving these aspects of life in Lanark County, or are inadvertently changing them for the worse.

CITIZENS - Your Customers

WANT - quiet, open space, clean air, wildlife

NEED - safety, security, low taxes

STRATEGY

Minimize installed infrastructure (capital, maintenance)

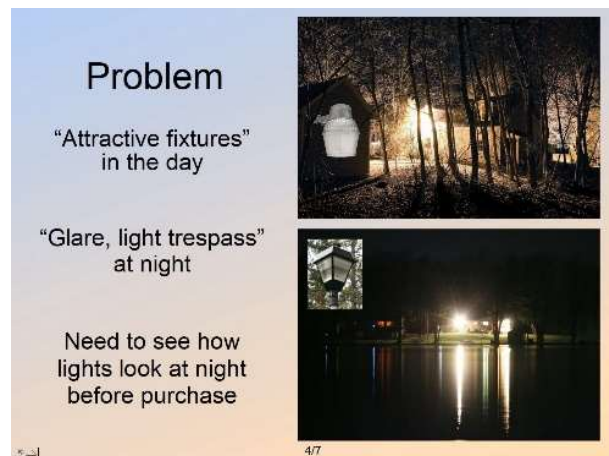
Maximize public services, preserve/protect environment



Artificial lighting can improve security as long as there is constant surveillance. It can help the homeowner or police inspect a property, but not if the lamp is set to shine in their eyes, or creates those dark shadows where you can't see, and where those ne'er-do-well might hide. Artificial lighting can provide safety. But what is lit also attracts attention and nurtures curiosity - leading to those un-wanted visitors.

We create these problems when we choose a light. Light fixtures aren't chosen on the basis of the visibility they're meant to provide. The decision is usually based on their daytime appearance in attractive promotional literature. Buyers are usually not familiar with the important photometrics of the lights they purchase.

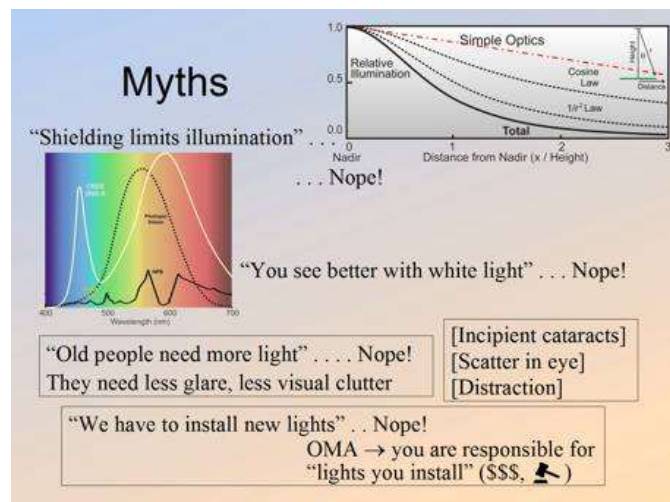
The glare and poor light distributions of "nice looking" fixtures undermine our visibility at night. And since lights are selected and installed during the day, many night hazards are left in the dark. Lights can *reduce* the safety and security that they should provide if indeed they are capable of doing it.



2) So, my second take away is to not base your purchase on the appearance in a sales brochure. Get a sample, install it and see what it really looks like "at night".

As Councillors, you will be hearing from a lot of "advisors". There are a number of "lighting myths". You may have already heard some of these, but you should be aware that they are indeed "myths", and should not be allowed to obscure the facts.

Does white light improve visibility? Nope.
 Does shielding limit illumination? Nope.
 Do seniors need more light? Nope.
 Do lights limit your liability? Nope.
 Doesn't everyone want more light? Nope.
 Surely our supplier knows best? Nope.
 Light is not a pollutant: Nope



A single unshielded light at night contaminates about 1 km² and wastes 80% of its light and energy. A bare light at a crossroads causes so much glare that it will limit visibility down the road, and can be seen from orbit. The blue that makes light look white exacerbates the glare and it undermines the health of animals - changing their behaviour everywhere within eye-shot. Foraging animals shy away from light for safety, and predators approach it looking for their prey from the shadows.

Even the light of the full Moon affects biology. However, in contrast to streetlights, each month there is a 3-week dark-time for animals to recover.

3) Now comes my third take away. We must not be gluttons. We should use artificial lighting carefully and sparingly. We must accept that, like all additions to the environment such as sewage and chemicals, – artificial lighting disrupts the environment.

There are two familiar instruments that can reduce the impact of artificial lighting, while providing sufficient light for outdoor activity. A policy plots where you want to go – what kind of lifestyle your citizens want, but it is not legally binding. A Bylaw is legally binding, but it tends to entrench current practice. But regardless, the local government should lead by example.

4) My fourth take-away for you is to critically review your written and unwritten policies regarding outdoor lighting such that they preserve what the people want.

What do I mean by “critically review”? Obviously, Lanark County is NOT Ottawa, so you should take a local point of view. You can’t solve crime with money and built infrastructure. It takes people, not technology. Lighting puts property on display throughout the night. But some of the people around after dark may be ne’er-do-wells. Also, it’s been shown that light doesn’t reduce crime – it just makes some people feel safe, leaving municipalities out of pocket at the cost of \$1,000+ on a pole, a luminaire and installed power lines.

Lighting technology can come to the rescue. The Illumination Engineering Society has recommendations for how bright to light roadway and other lighting projects but not about shielding and colour. Industry best practices pre-date our current understanding of the impact of light on the environment and human health.

However, some of their recommendations are close to the ecological and health thresholds. Shielding and avoiding the intense glare from white light, can actually improve visibility – even at lower brightness levels - saving electricity. These will help you preserve the rural nature of Lanark County. They make a significant difference. So, we can have our cake and eat it too by doing the following.

Policy or Bylaw

- Policy - Provides guidance – “no teeth”
 - What you want
 - (political document – periodic review)
- Bylaw - Specific Requirements “enforceable”
 - What you have
 - (legal document – change is difficult)

Illumination Engineering Society (IES.org)

- Recommends industry urban standards
(Brightness of Illumination)
- Rural landscape more sensitive to glare
(Sparse lighting)
- Public more sensitive to light trespass
(Natural landscape)
- Shielding, colour not specified
(Reduce glare, light trespass)
- Shielding cuts Glare and LT (less nuisance)
- Amber reduces impact of Glare (more visibility)

The Difference

- Shield - reduce glare and light trespass
- Schedule - dim/off after active hours
- Amber - reduces glare sensitivity [W-B]
- Brightness - use lower limit of range
- Passive - reflective markers or surfaces

a) Direct the light down to the area that needs to be illuminated. How?

Shield the light to keep the illumination local, and mount the fixture “level” (not toe-up). Light that shines off road, off path, off property is worst than a waste. It contaminates, and it affects your neighbour’s enjoyment of their property and the ecosystem.

b) Only use light when it’s needed. How?

Use timers to limit the light to the active-part of the evening, and to turn them off when visitors are not invited. This should include municipal buildings and retail outlets. Or if it serves as a security light, use motion detectors. A light that pops on is much more of an attention-getter than a constant light. If the traffic is local, dim them to 1/2 or 1/4 brightness when the traffic subsides. You’ll save electricity, but the chief benefit is reducing the nuisance of glare and light trespass, and the contamination of the countryside.

c) Use light that has the least biological impact. What’s that?

Blue is bad, so remove it. (White light – Blue = Amber). So, on a building, use amber BugLights. On roadways keep your amber HPS lamps, or use the new amber LED luminaires.

d) Don’t over-light. Too many lights, and ones that are too bright, create glare that undermines visibility by blinding our eyes and creating dark shadows. What can you do?

Use luminaires with good optics. A NEMA yard light scatters light in all directions but it can only illuminate out to about 1½ mounting heights before its glare overwhelms visibility into the periphery and visibility down rural road. It is a hazard. Good optics can expand this area from 1½ to 3X, while preventing the blinding glare.

e) How about not using light. How?

Use some of the techniques from long ago that are now being used again in some parks such as those operated by Parks Canada. Don’t pave a path with black asphalt use reflective crushed stone. Use "passive signage" rather than illuminated signs. Retro-reflective paint is expensive, but it's still a lot cheaper than running power to poles and installing luminaires. (Car headlights are bright enough!) If a business has a glaring sign, require them to change it – FOR THE SAFETY OF YOUR CITIZENS. Don't let a glaring light remain, and don't compound the glare with more light.

Are “good lights” more expensive? Yes, but if you can halve the number of lights along the road, or the number of lights used in perimeter lighting, the system cost will be much less. The difference in cost between a cheap and the extra cost of a good light fixture is just the cost in time of the crew’s “coffee break”. Remember, the main cost is in the pole, its footing, the wiring and labour - not the luminaire.



5) My fifth take-away is that the devil is in the details. But following these suggestions will avoid a lot of arguments from citizens.

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Take-Aways

Passive signage versus active lighting
Shield against glare, light trespass
Amber light not white light

Thank you for Listening

Canadian Guidelines for Outdoor Lighting
http://rasc.ca/sites/default/files/RASC-GOL_2018_1.pdf

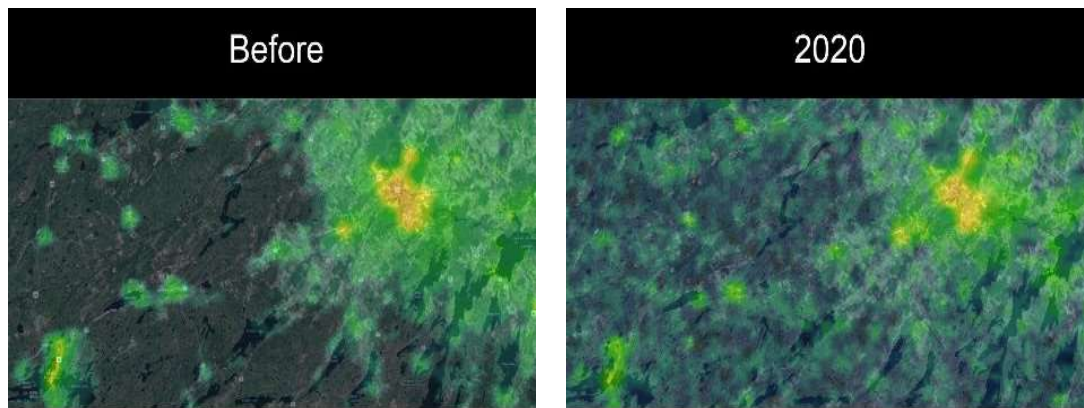
Robert Dick
 rdick@csbg.ca
 1-800-278-2032

Perth from 11 km
 Pop. 6,000
 Tay Valley ~5,700

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And, they will reduce the time municipal staff may spend on answering questions or responding to complaints. This will save more than the cost of a better light fixture.

Of course, it begins with the municipality setting the example and encouraging others to follow.



If you have any further questions in the future for specific artificial lighting projects, feel free to contact me again.

Robert Dick, 1-800-278-2032, 613-283-0362 (cell), rdick@csbg.ca
PO Box 79, Rideau Ferry, ON K0G 1W0