LEDucation®

Designers Light Forum

Community Friendly Lighting 101

Bob Parks

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives

At the end of the this course, participants will be able to:

1. Understand best practices for public lighting design that include improved visibility, visual comfort, and community outreach.
2. Explore ways to minimize the negative impact of public lighting on communities by minimizing glare, light trespass and skyglow.
3. Discover how innovative optical design, controls and proper spectrum can reduce the negative impact of public lighting on communities, human health and the environment.
4. Review examples of LED public lighting upgrades that have embraced the principles of community friendly lighting design.

Community Friendly Lighting 101

Bob Parks, LC, CLC, MIES
Executive Director
Smart Outdoor Lighting Alliance

What is Community Friendly Lighting?

- Best practices for outdoor lighting design
- Public outreach and engagement
- Quality over quantity
- Enhanced visibility using research & vision science
- Pedestrian focused to enhance safety
- Visual comfort (Appropriate CCT & quality fixture design)
- Reduced glare, light trespass and skyglow
- Utilizing controls to maximize efficiency
- Minimize negative ecological impact

Community Lighting Certification (CLC)

- First outdoor lighting specific certification
- Recognizes advanced knowledge of Community Friendly Lighting Design Principles
- Designed to help municipal, utility, planner, manufacturer, & contractor staff understand and implement Community Friendly Lighting
- SOLA will provide live & web based training and webinars
- 120 question written test required (80% Score)
- Continuing education requirement
- Renewal every three years

Lighting Quality

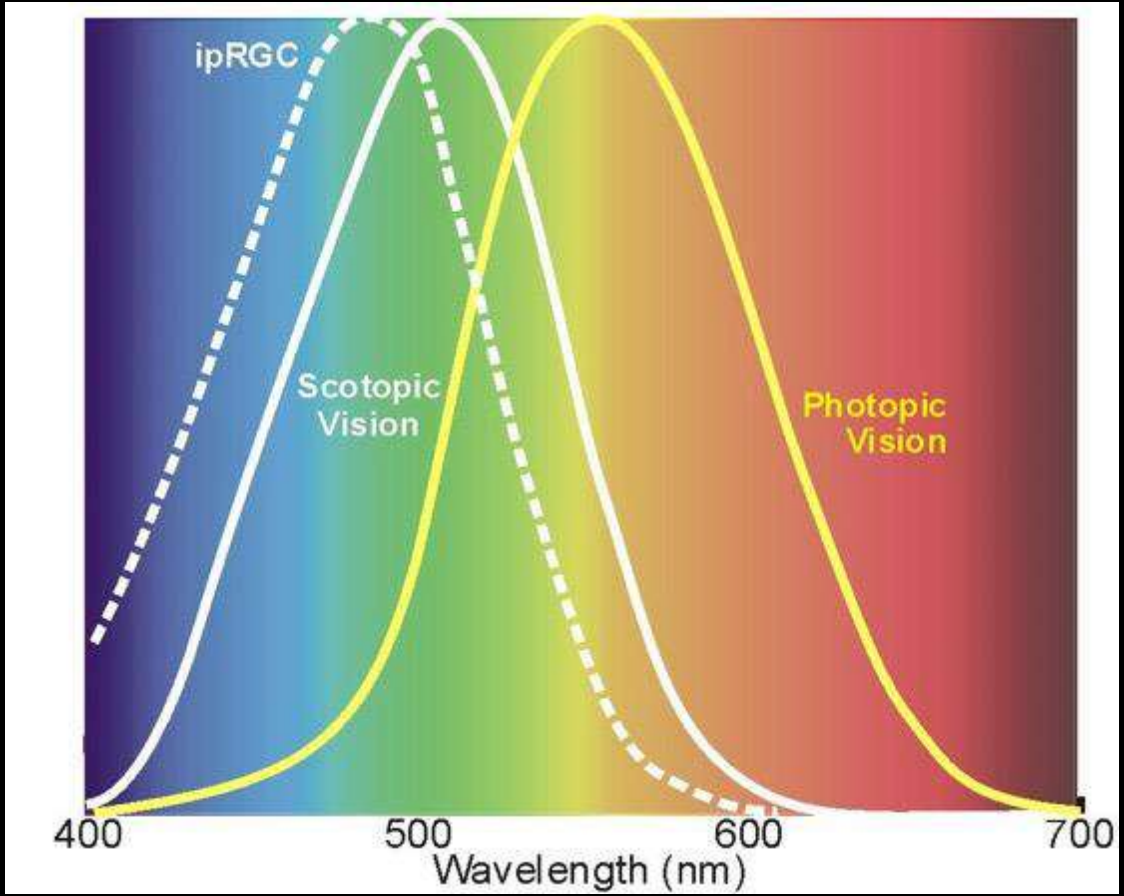
- Why has it been missing in public lighting?
- Too much emphasis on low cost and quantity
- Quality is difficult to define/eye of the beholder
- Standards stress luminance & uniformity
- Increased luminance doesn't always improve visibility, but
- Cities often choose higher luminance levels for "safety" and to avoid litigation
- City & utility staff responsible often lack lighting design training and/or experience


STOP

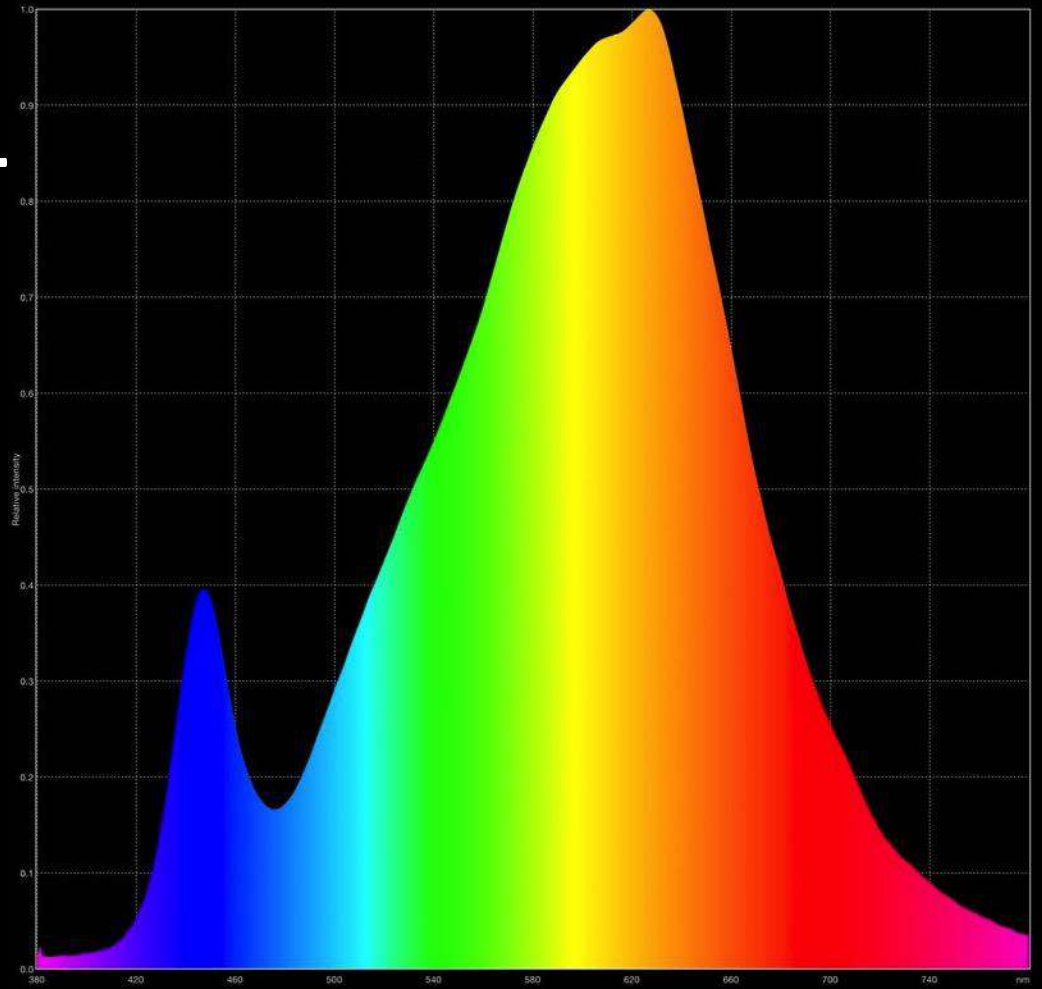

5904
STOP

Lighting Color

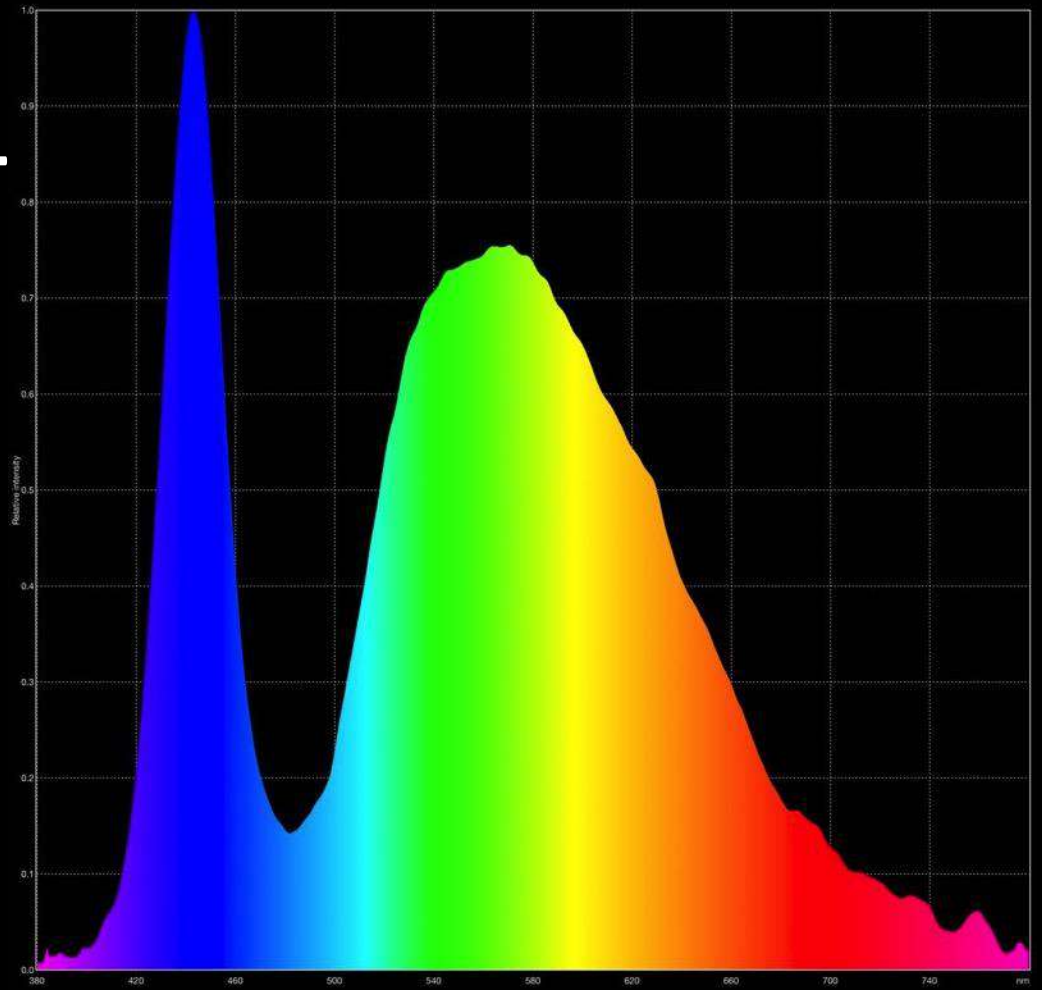
- Color is a community preference that should be assessed
- Warmer color temperature may help preserve neighborhood character and ambiance
- High CCT increases the perception of glare & light trespass, skyglow, & ecological disruption
- Energy savings is not an excuse for high CCT


ipRGC
Scotopic Vision
Photopic Vision
400
500
600
700
Wavelength (nm)

3000K CCT


Relative Intensity
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
380
420
460
500
540
580
620
660
700
740
nm

5000K CCT


1.0
0.9
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Relative intensity
380
420
460
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580
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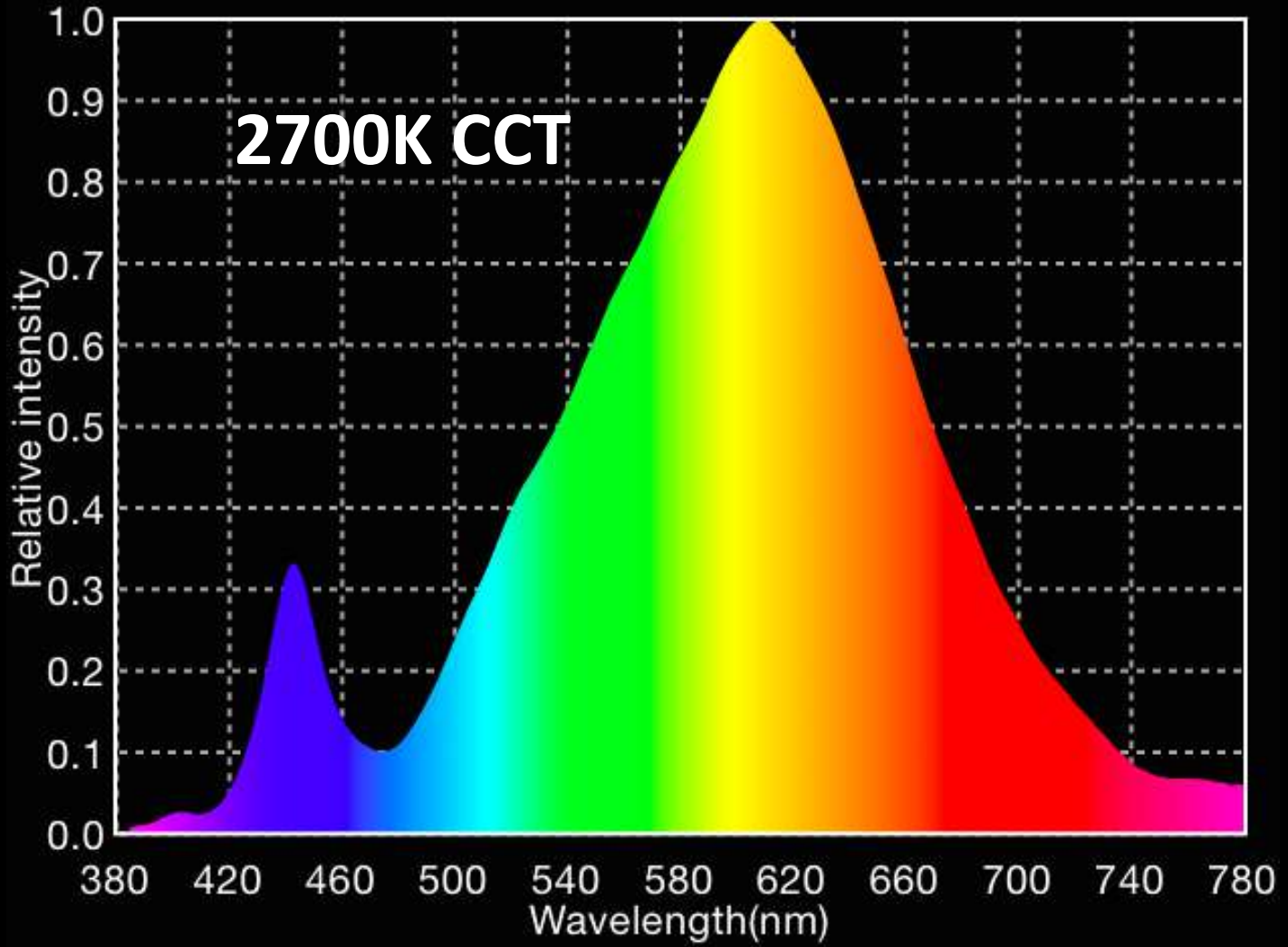
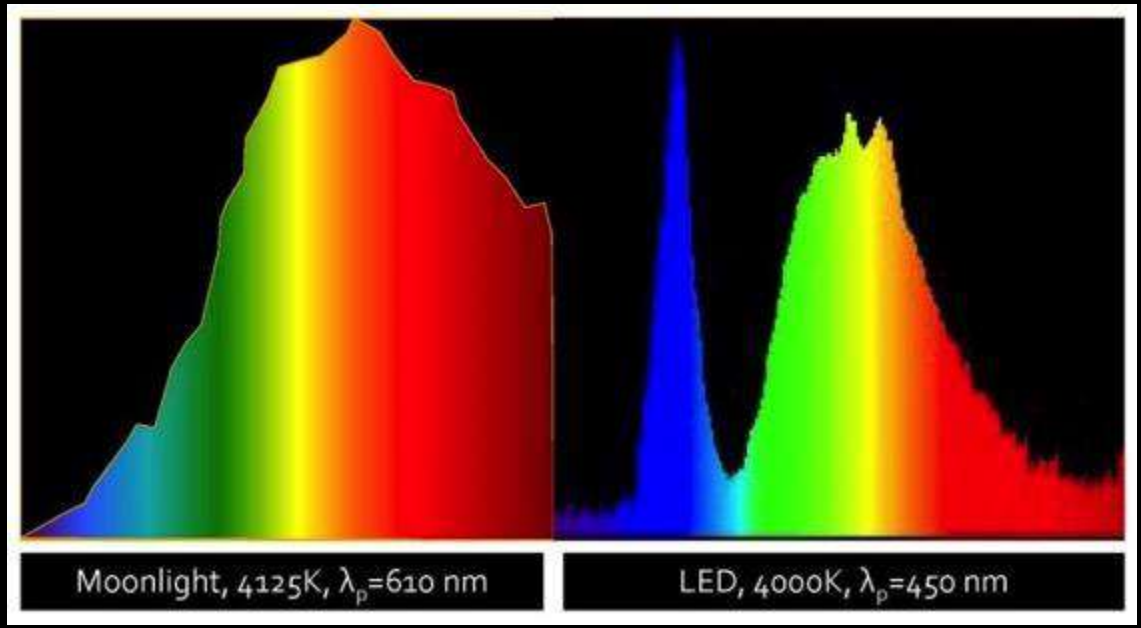
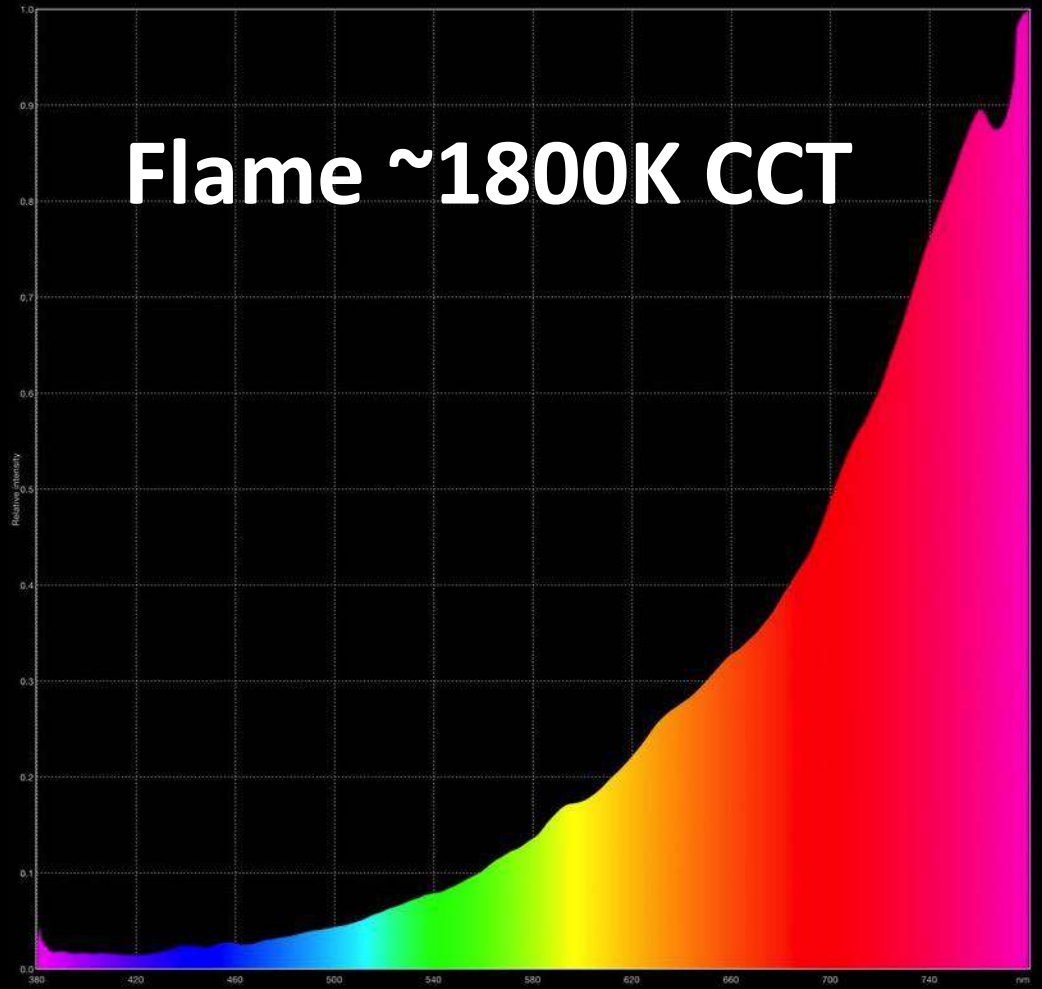
660
700
740
nm


2700K CCT
Relative intensity
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
380
420
460
500
540
580
620
660
700
740
780
Wavelength(nm)

Why 4000K CCT isn’t the same as moonlight



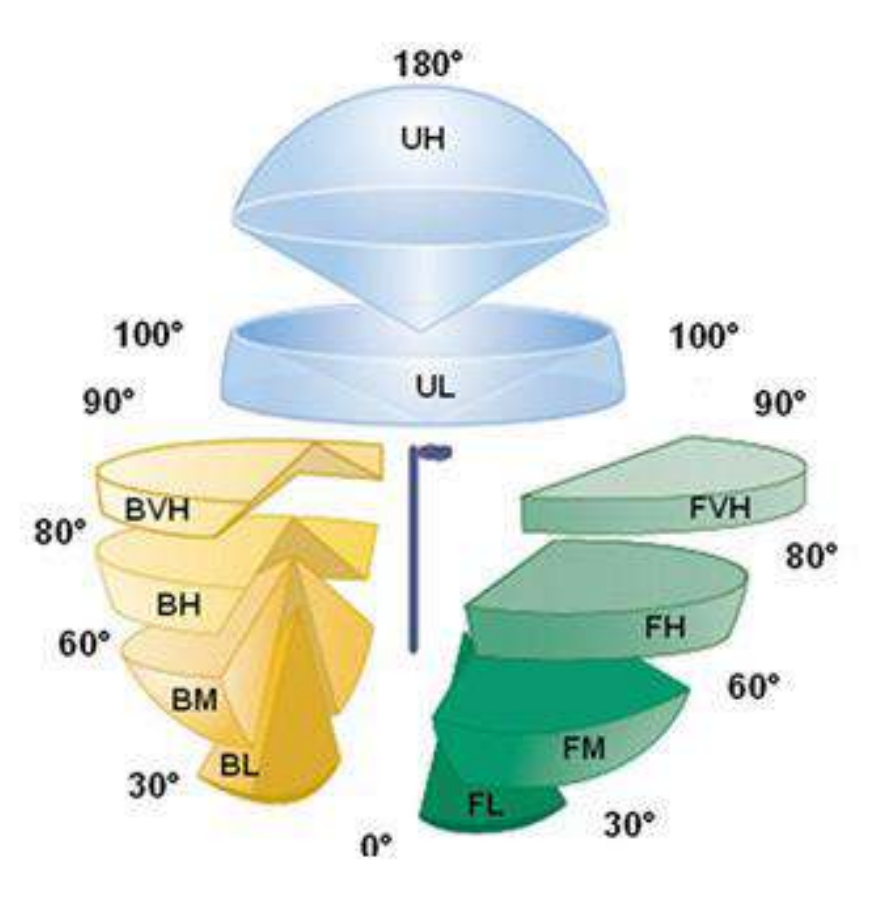
Typical streetlight is 100X brighter than moonlight


Flame ~1800K CCT
Relative Intensity
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
380
420
460
500
540
580
620
660
700
740
nm

Lighting Levels

- Luminance in excess of the RP-8 minimums is unwarranted and wasteful using LED
- Increased lighting levels do not necessarily increase visibility
- Higher lighting levels do not reduce crime
- Over-lighting high crime areas stigmatizes neighborhoods

IES TM-15-11 BUG Rating



Visual Comfort

- Using appropriate BUG rated fixture reduces adverse impact and improves visual comfort
- Uniformity doesn’t trump glare/light trespass
- Point source LED without diffusion reduces visual comfort, especially for pedestrians
  - Plenty of fixtures with improved visual comfort available now

Improved Visual Comfort

Improved Visual Comfort

Community Lighting Choices

- Controls
  - Not installing controls now is short sighted
  - Dimming to RP-8-14 can save 50% more energy/$$$
  - Constant lumen output saves ~15% alone while increasing fixture lifespan
  - Payback period <= to that of fixtures alone
  - Adding later increases labor costs
  - Options include local/non-networked, centralized management, wired, & wireless

“Real” Efficacy

- A fixture design that wastes 30% energy and CO_2 before LED, still wastes 30% after retrofit
- Real efficacy measures how much light reaches the intended target/task area (TER & FTE)
- There are good decorative post tops available
- Poorly shielded fixtures are not a smart choice
- They are “gas” guzzlers that we simply can’t justify going forward

Consequences of Poor Quality Lighting Design

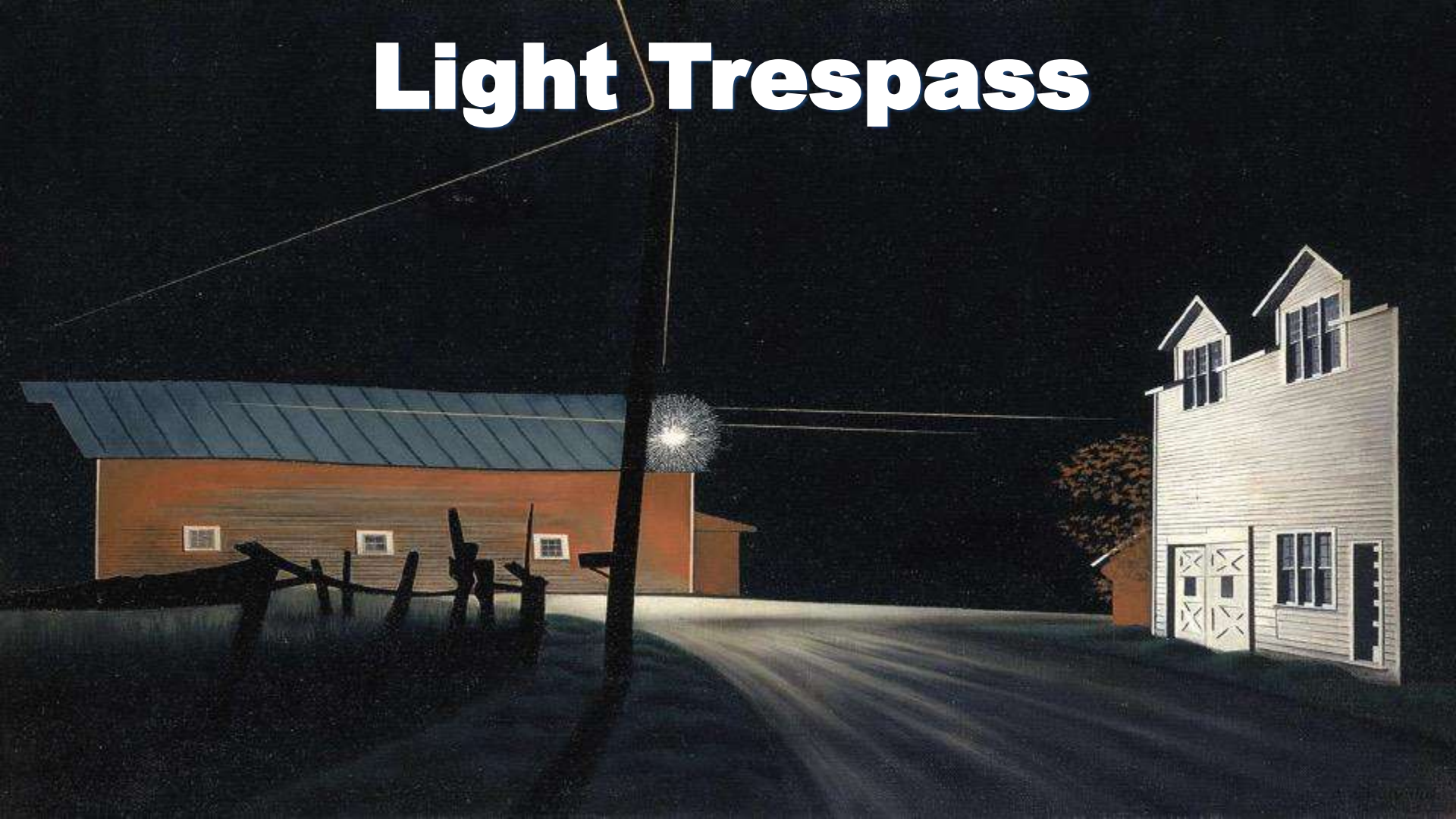
- Glare
- Light Trespass
- Sky Glow
- Negative Ecological Impact
- Circadian Disruption

Glare

Glare

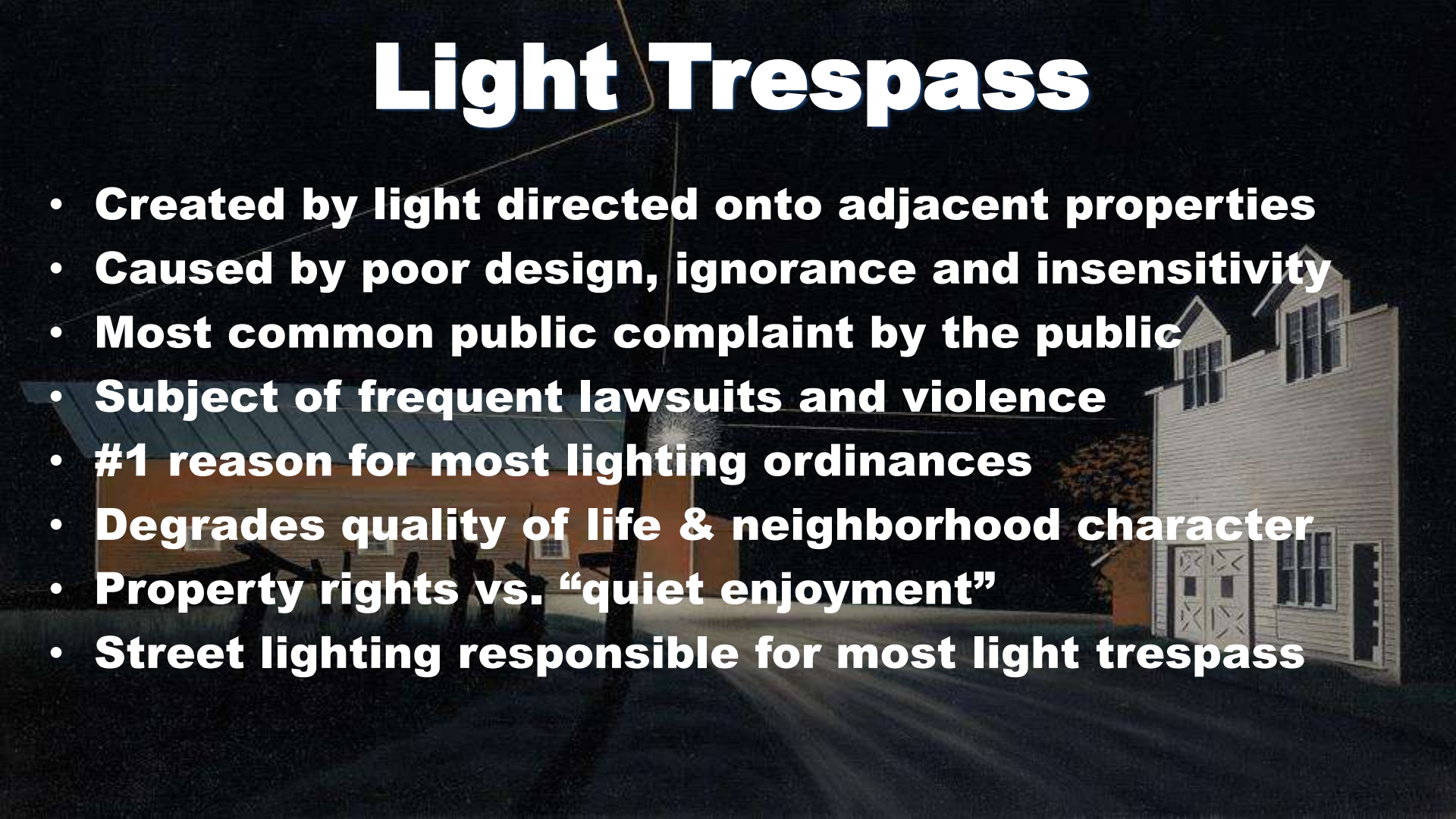
- Caused by light directed into eyes, not the target area
- IES defines light range of 60 – 90 degrees of nadir
- Defined as discomfort or disability
- Dramatically degrades visibility
- Requires increased overall lighting levels to compensate
- Often the byproduct of pursuing uniformity
- Always the result of poor lighting design decisions
- Disproportionately impacts seniors due to the physiology of the aging eye

Light Trespass



Light Trespass

- Created by light directed onto adjacent properties
- Caused by poor design, ignorance and insensitivity
- Most common public complaint by the public
- Subject of frequent lawsuits and violence
- #1 reason for most lighting ordinances
- Degrades quality of life & neighborhood character
- Property rights vs. “quiet enjoyment”
- Street lighting responsible for most light trespass



Sky Glow

Sky Glow

- The increase in night sky brightness
- Impacts astronomy, ecology and karma
- Produced by the scattering of light with moisture and particulate in the atmosphere
- Light +/- 10 degrees of horizon causes most
- Uplight and reflected light also contribute
- White LED can cause 300% or more sky glow than HPS

Impact of Light at Night

- Profound changes in all species:
  - Feeding
  - Predation
  - Reproduction
  - Migration
  - Survival

Vision and Visibility

Positive Luminance Contrast

Negative Luminance Contrast

Chrominance Contrast

Uniformity

Uniformity

Public Outreach

- DOTs need to engage experts for planning
- Pilot test all options: fixtures/CCT/controls
- Solicit public preferences with surveys/tours
- Use professionals to create “neutral” questions
- Engage broad demographic sampling
- Use social media, web and print advertising, and mail to engage widest population diversity
- Hold frequent town hall public meetings
- Base final design decisions on the data results

Community Friendly Lighting Goals

- Lighting quality over quantity
- Maximize visual comfort
- Preserve community ambiance & character
- Engage public to develop consensus-based community friendly lighting standards
- Embrace pedestrian centric lighting design
- Understand and minimize ecological impact

Community Friendly Lighting Best Practices

- Choose fixtures with improved visual comfort
- Smart controls to maximize savings/flexibility
- Vary lighting intensity to match traffic volume
- Use BUG 0-1 to reduce glare, uplight, & light trespass
- Find CFL certified fixtures and devices on the SOLA website: SOLA.Lighting/CFLcertified

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This concludes The American Institute of Architects Continuing Education Systems Course

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Thank you, Questions?

Bob Parks, LC, MIES
Smart Outdoor Lighting Alliance

(bparks@sola.lighting)
www.sola.lighting