

CLANTON & ASSOCIATES



# Town of Vienna, VA - Lighting Ordinance

# Clanton & Associates Project Team



**Dane Sanders**  
Principal & CEO



**Justin Sternberg**  
Project Manager



**Rick Utting**  
Outdoor Lighting  
Advisor



**Kate McBride**  
Project Planner



**Kaiti Phelan**  
Technical Lead

# Project Scope & Presentation

## Project Scope

### Included in Scope:

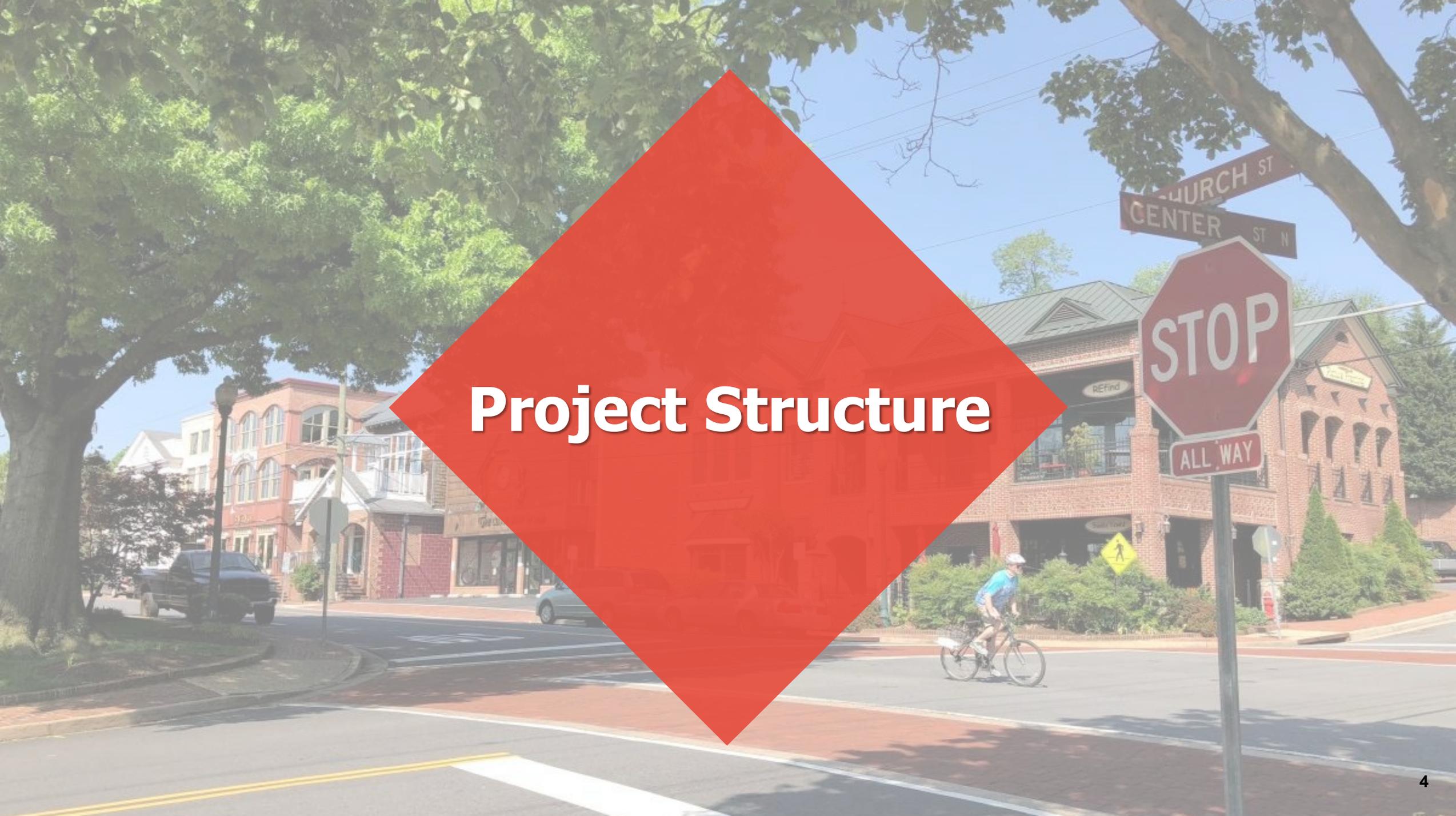
- Privately Owned Lighting
- City Owned/Non-ROW Lighting
- Façade Lighting
- Temporary Lighting

### Excluded from Scope:

- Street & Pedestrian Lighting in the Public ROW

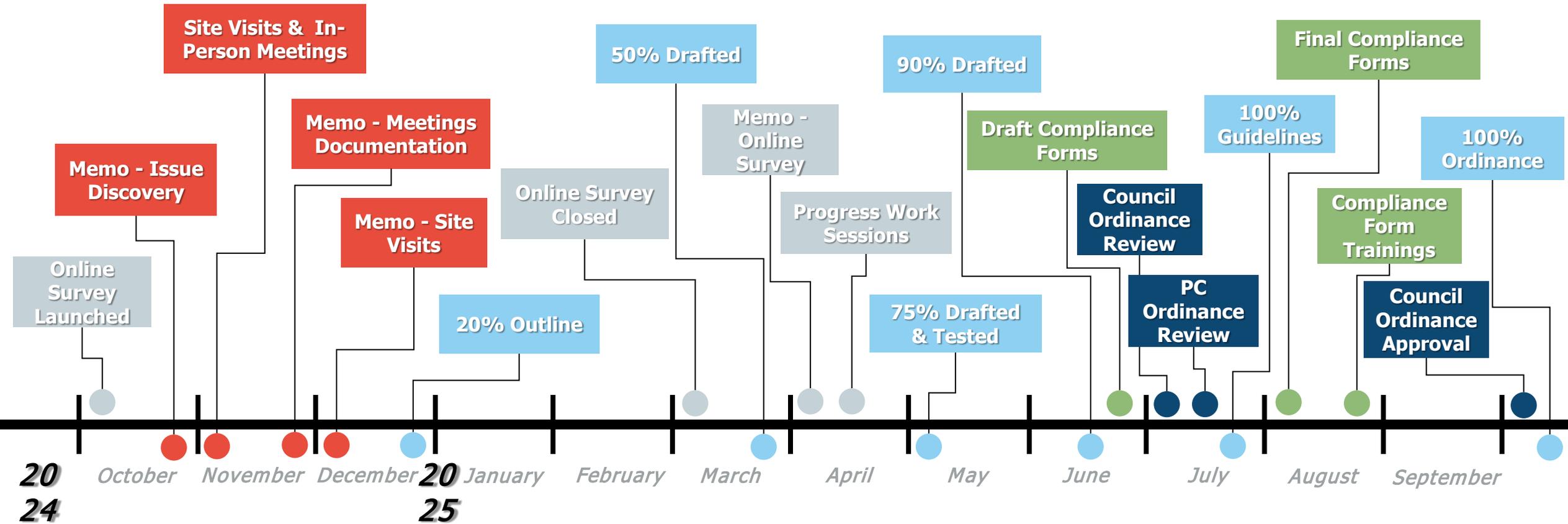
## Topics

- Project Structure & Schedule
- Lighting 101
- Impacts of Light Pollution
- Community Survey Results
- Role of Lighting Standards & Criteria

A photograph of a street intersection with a large red diamond overlay in the center. The overlay contains the text "Project Structure" in white. The background shows a brick building with a "STOP" sign and "ALL WAY" sign. Street signs for "CHURCH ST" and "CENTER ST N" are visible. A cyclist is riding across the street, and a car is parked on the left. The scene is set in a sunny, urban environment with trees and a clear blue sky.

# Project Structure

# Town of Vienna Outdoor Lighting Regulations & Guidelines Project Schedule



# Project Stages

## Project Initiation & Assessment

- Review of existing lighting standards
- Site visits to review existing night lighting conditions at 4 sites
- Memo of existing site lighting conditions



## Community Outreach & Engagement

- Lighting 101 Presentations
- Online Lighting Preferences & Nighttime Behaviors Survey
- Memo of survey findings



# Project Stages

## Lighting Ordinance Updates

- Updated language for all land use zones
- Currently around 50% complete
- 75% Draft by mid-May
- Anticipated for Council vote in October



## Lighting Design Guidelines

- Design guidance for buildings & illuminated signs
- Identifying quality luminaires for multiple architectural styles
- 50% Completed



# Project Stages

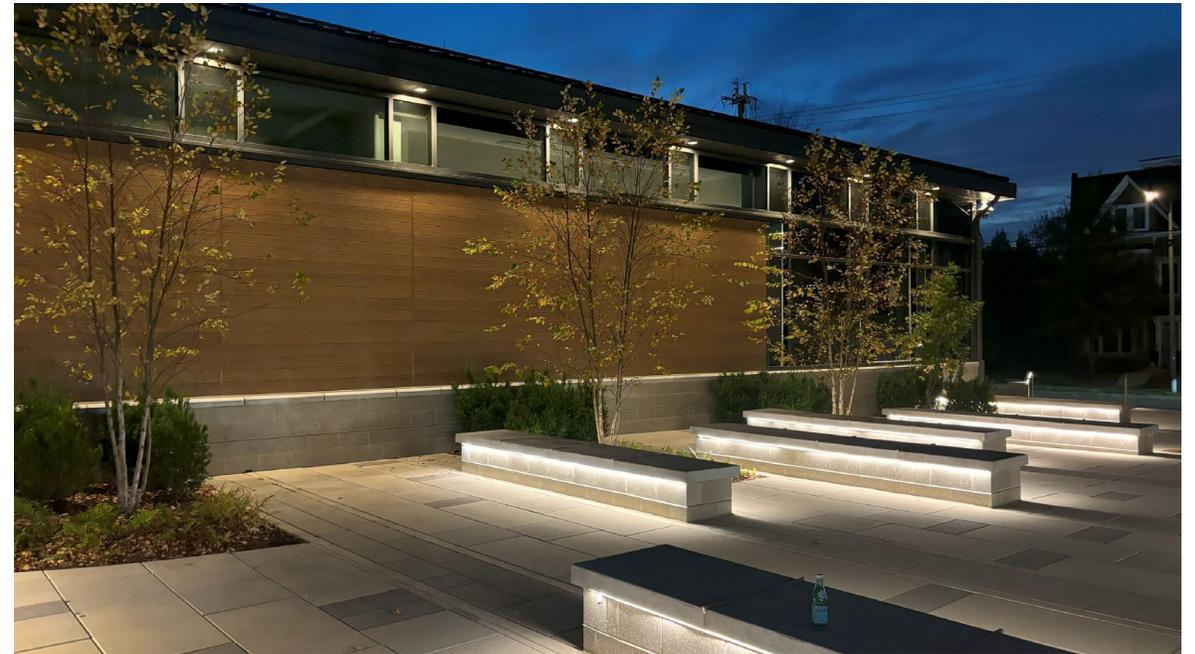
## Lighting Compliance Forms

- Tool to assist with lighting compliance
- Drafting in May 2025
- Virtual training for staff



## Public Hearings & Final Steps

- Ordinance draft provided to Council and PC by July for comment
- Guidelines Draft provided to BAR in June
- Final approvals in October



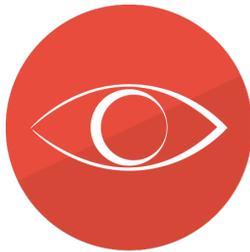
A photograph of a street intersection with a large red diamond overlay in the center. The overlay contains the text "Lighting 101" in white. The background shows a brick building with a "STOP" sign and "ALL WAY" sign. Street signs for "CHURCH ST" and "CENTER ST N" are visible. A cyclist is riding across the street, and a car is parked on the left. The scene is set in a sunny, urban environment with trees and a clear blue sky.

# Lighting 101

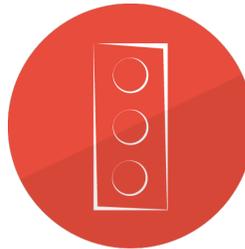
# Why do we light?



Outdoor lighting is only for the benefit of people. It has no other purpose. It is only beneficial when people are there to use it.



Visibility



Traffic Safety



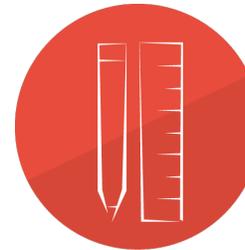
Late Night Activity



Safety & Security



Transit Accessibility



Design Aesthetics

# Lighting Metrics: Illuminance vs Luminance

Lumens = Total Light Output

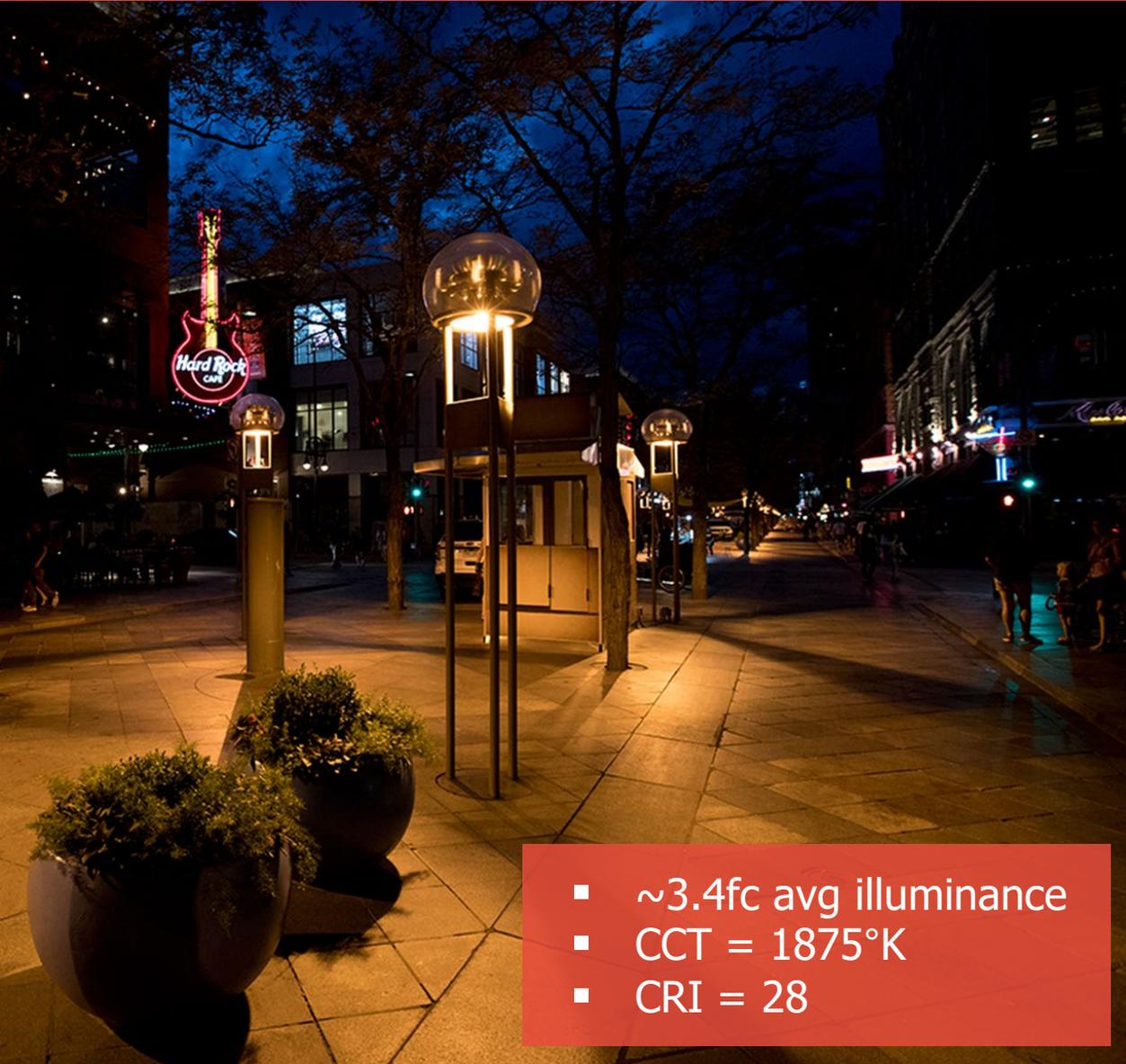
Vertical Illuminance = On People, Buildings, Walls

Illuminance = amount of light on a surface, such as the ground or a pedestrian (FC or lumens per sq. ft.)

Luminance = what we actually see at night, or the amount of light returned from a surface to the eye ( $\text{cd}/\text{m}^2$ )



# 16<sup>th</sup> Street Mall – Denver, CO



- ~3.4fc avg illuminance
- CCT = 1875°K
- CRI = 28



- ~1.1fc avg illuminance
- CCT = 3100°K
- CRI = 83

# YOU

*At some point you may come back to read this line or maybe not.*

# WILL READ THIS FIRST.

## And then you will read this line next.

You will go back to read this body copy if you want to know more. It takes the most effort to read because it has a lot of text in a small font in a light weight with tight line spacing. Many people will skip paragraphs like this unless if they aren't engaged right away. This is why it's important to draw attention to your message using visual hierarchy.

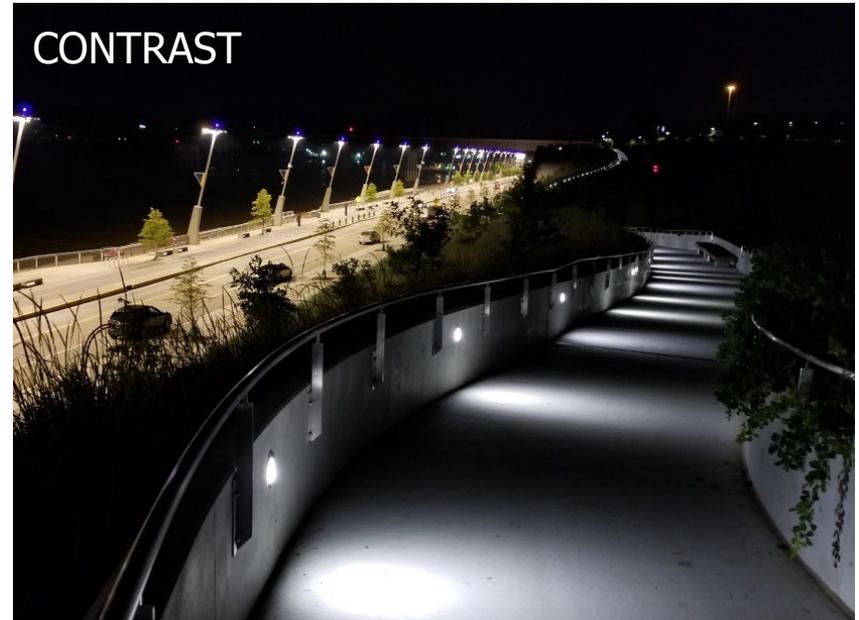
**You'll probably  
read this before  
the paragraph.**

# Perceiving Lighting

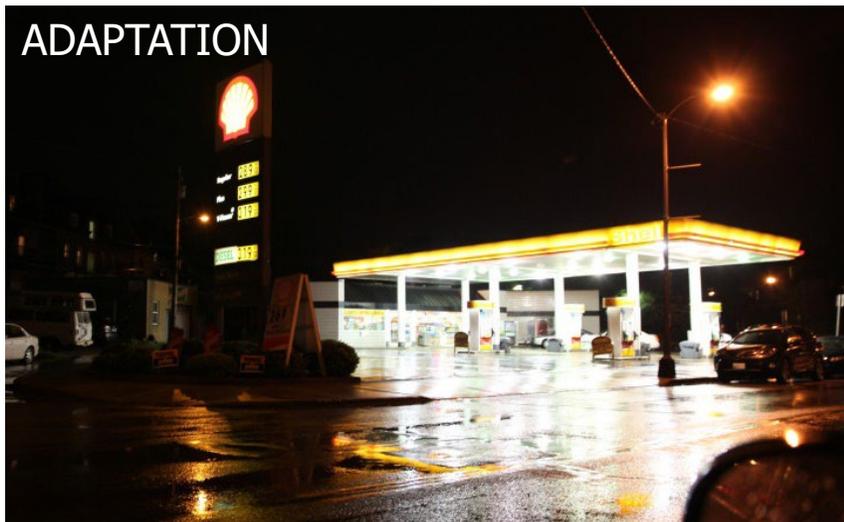
GLARE



CONTRAST



ADAPTATION



SPECTRUM



# Glare - Visibility

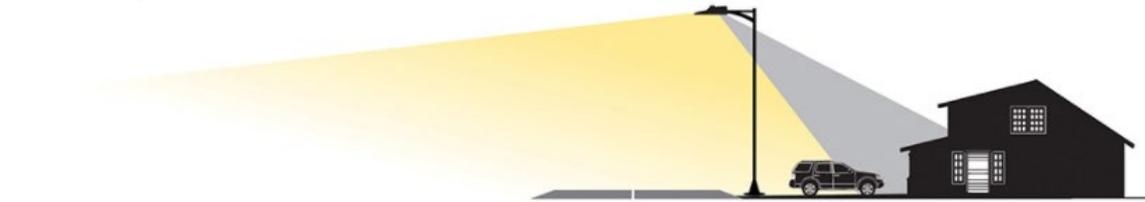
High glare reduces our ability to see and perceive contrast.



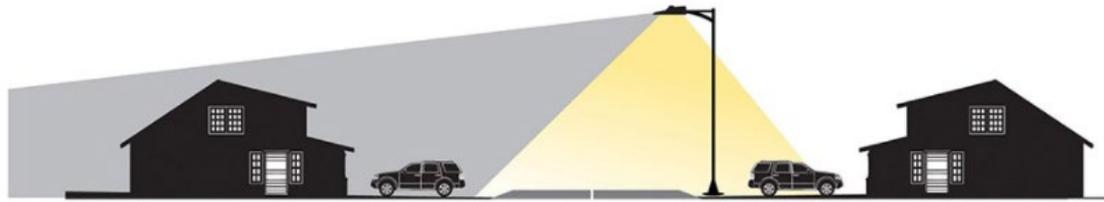
The absence of glare prevents unwanted adaptation and significantly improves the visual experience.



# Glare - Light Trespass



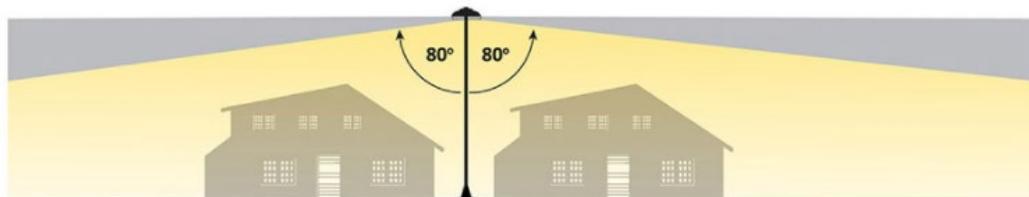
HOUSE-SIDE SHIELD



FRONT-SIDE SHIELD



CUL-DE-SAC SHIELD



GLARE CUT-OFF SHIELD

This is unwanted, "stray" light from nearby luminaires.

It's affected by:

- Light Distribution Selection
- Light Trespass Calculations
- Appropriate Light Level
- Shielding
- High-End Tuning
- Adaptive Dimming

# Adaptation - Light Level

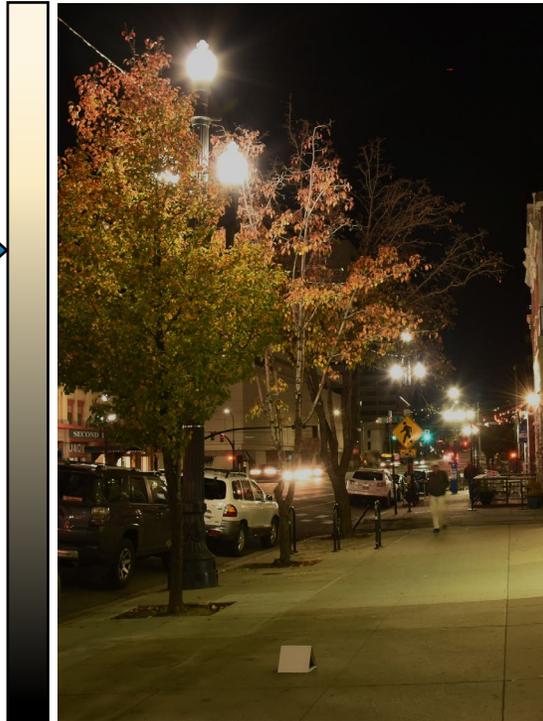
Things look darker here because it's brighter there.



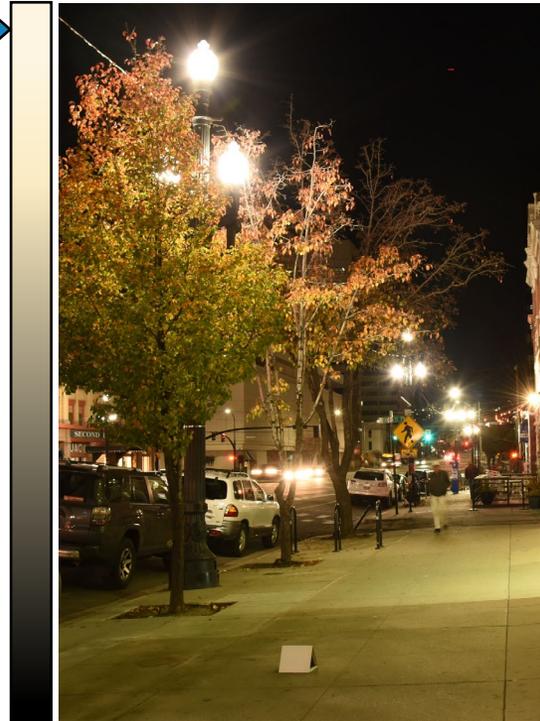
# Adaptation – Dimming



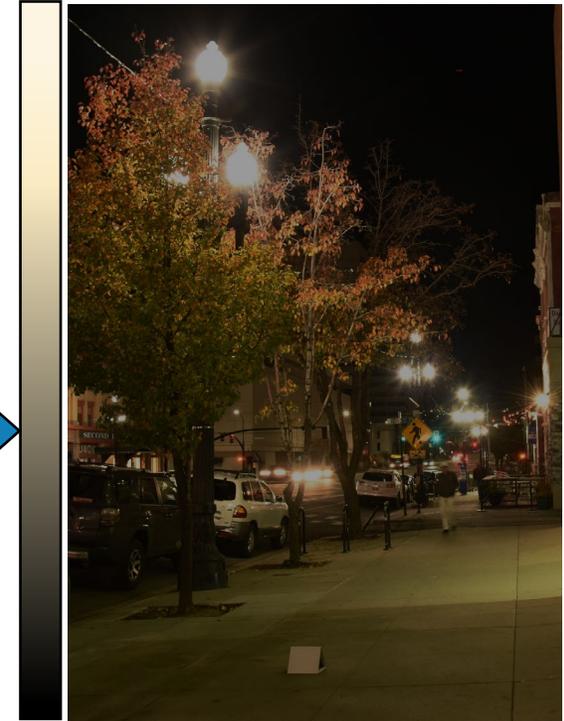
**Dusk to 10pm**  
Light to Criteria



**10pm to 12am**  
Reduce Pedestrian  
Criteria



**Weekends**  
**12am to 2am**  
Light to Criteria



**2am to Dawn**  
Reduce to Low Ped  
Criteria

# Contrast - Positive vs Negative

CONTRAST

# Contrast - Uniformity

Excessive uniformity of lighting can reduce contrast to the point where objects can seem to vanish.

Appropriate uniformity maintains contrast and allows small objects in the road to be seen.



# Spectrum: Correlated Color Temperature (CCT)



These temperatures are measured in degrees Kelvin (K).

# Spectrum: Correlated Color Temperature (CCT)



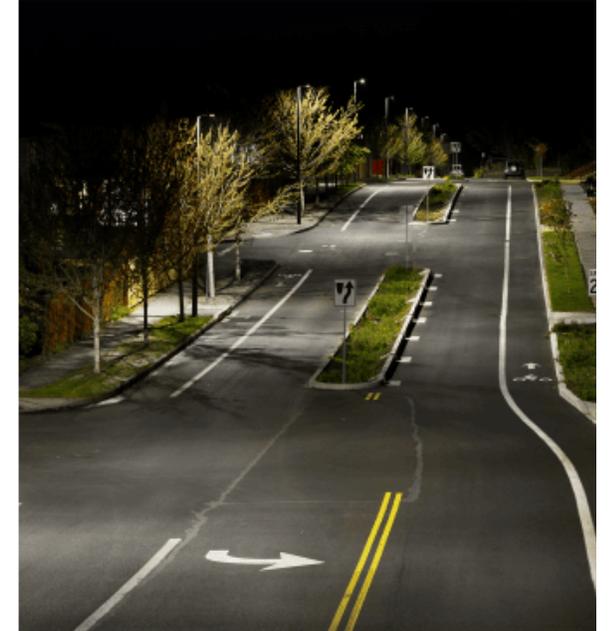
CCT = 2200K  
Warm Amber



CCT = 2700K  
Warm White



CCT = 3000K  
Neutral White



CCT = 4000K  
Cool White

# Spectrum: Color Rendering Index (CRI)

- C.R.I. is how well an artificial light can reproduce colors for human vision
- Light sources with the same Color Temperature (CCT) can have significant differences in wavelength composition
- Higher C.R.I. improves visual contrast without increasing light temperature or lumens

CRI: 40



CRI: 60



CRI: 80



# Spectrum: Color Rendering Index (CRI)

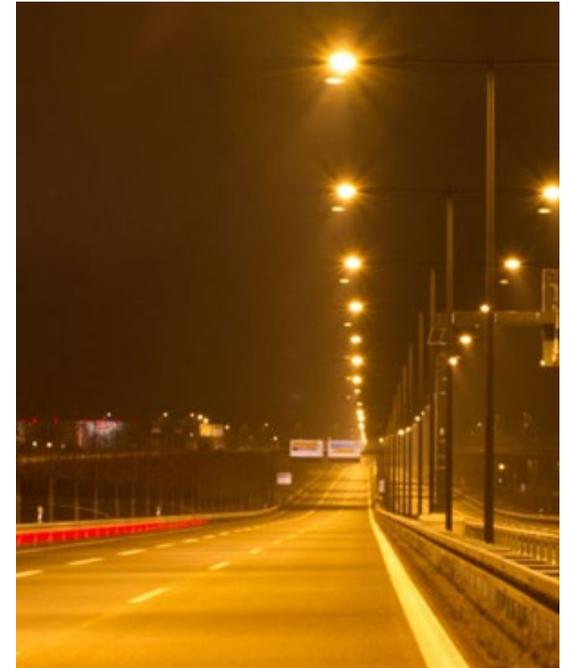
LED Lighting



Typical CRI: 70



HPS Lighting



Typical CRI: 35

A photograph of a street intersection in a town. In the foreground, a large red diamond shape is overlaid on the image, containing the text "Light Pollution" in white. The background shows a street intersection with a brick building on the right, a stop sign, and a cyclist. The street signs above the stop sign read "CHURCH ST" and "CENTER ST N". The building has a sign that says "REFind". A cyclist in a blue shirt is riding across the intersection. A black pickup truck is parked on the left side of the street. The scene is set against a clear blue sky with green trees.

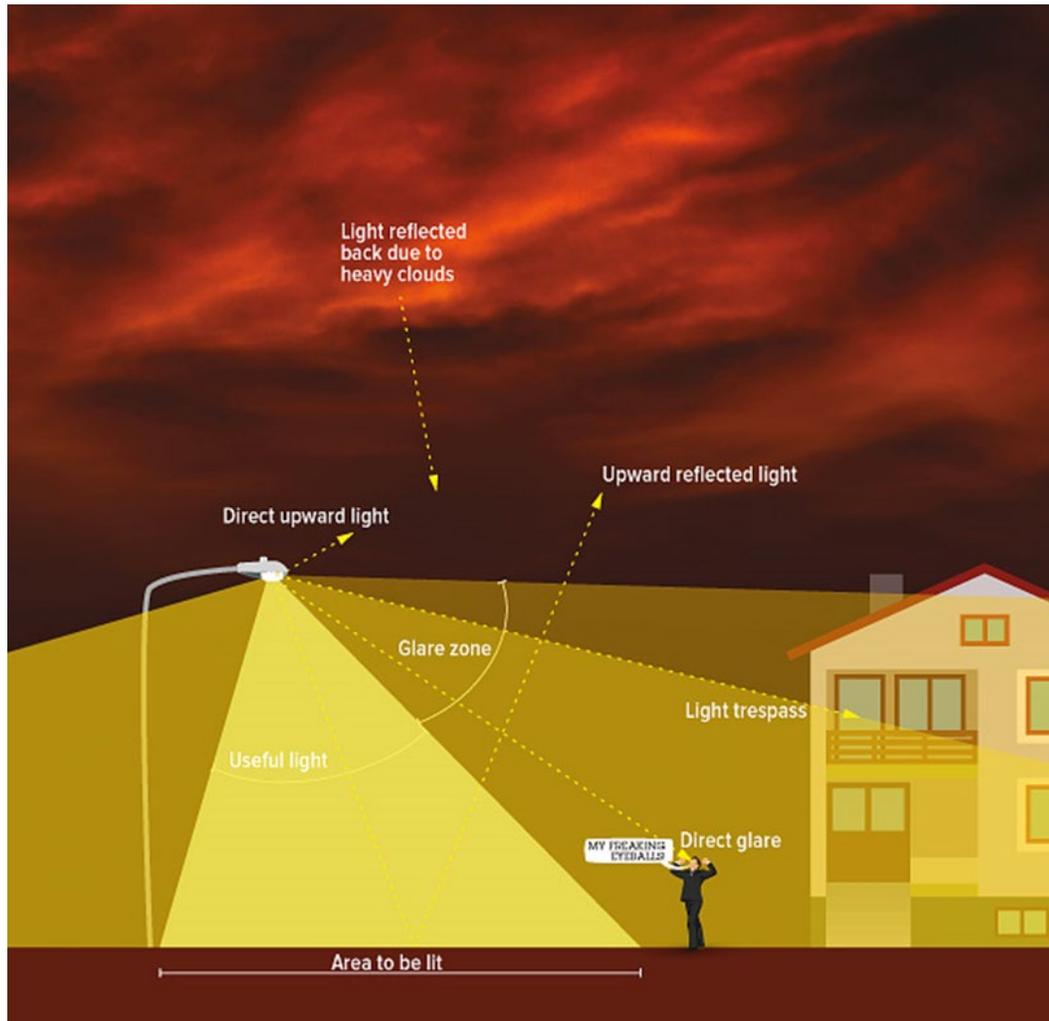
# Light Pollution

# Light Pollution & Cities

- Providing lighting at night is a significant amount of municipal energy budgets
- Yet around 30% of that lighting is wasted
- Light pollution is going up 10% annually, not down



# Types of Light Pollution



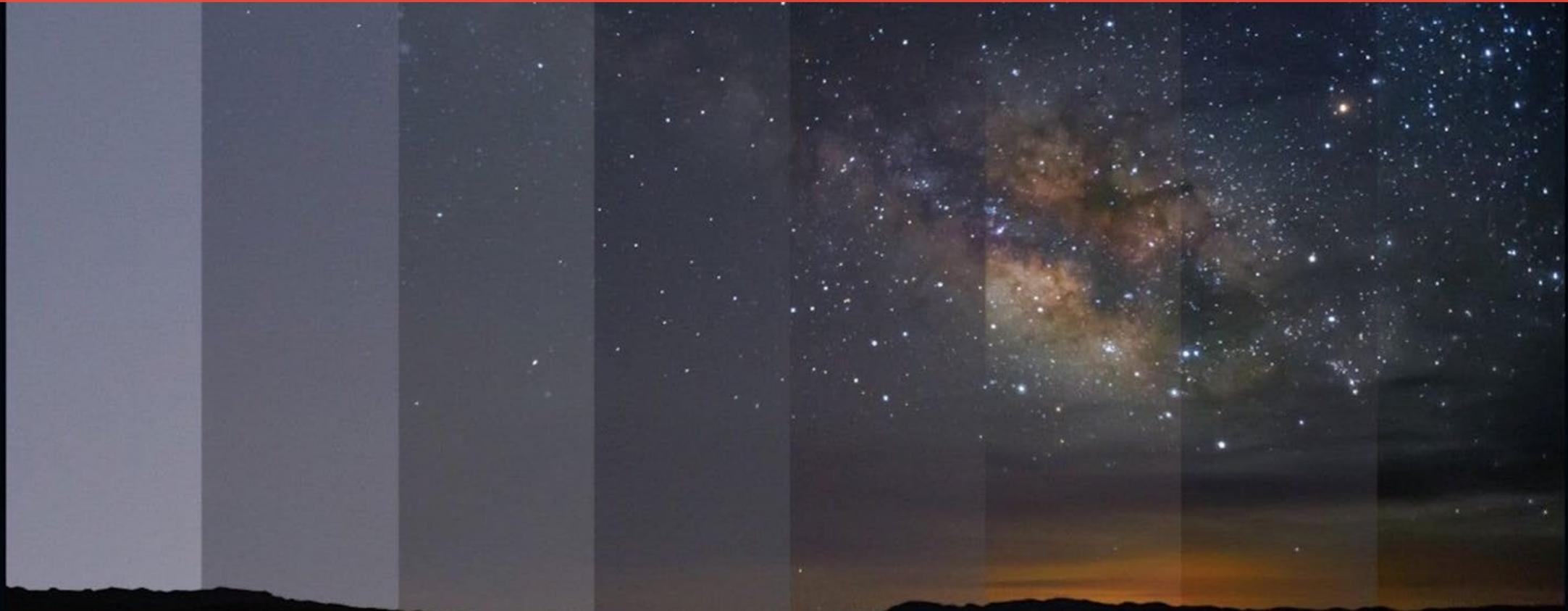
Types:

- Glare
- Light Trespass
- Sky Glow

Can be minimized by:

- Directional lighting
- Full cut-off or shielded luminaires
- Curfews

# Bortle Scale



8/9  
City/Inner  
City Sky

7  
City/  
Suburbia  
Transition

6  
Bright  
Suburban  
Sky

5  
Suburban  
Sky

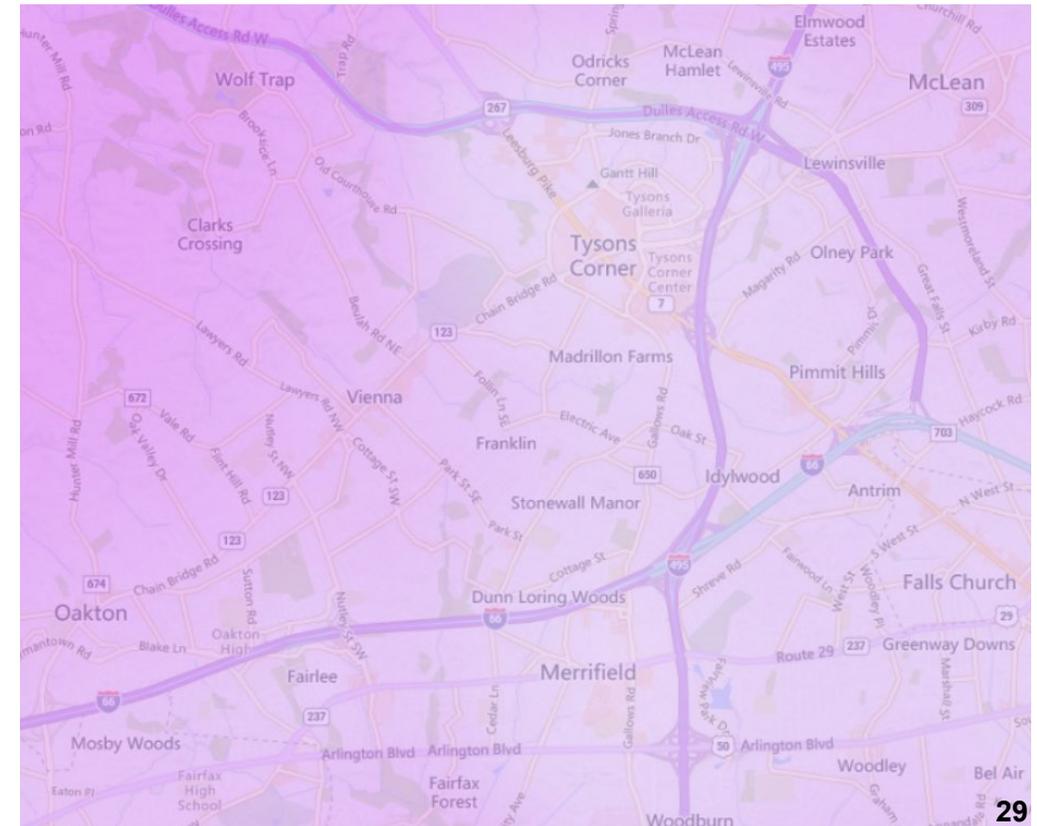
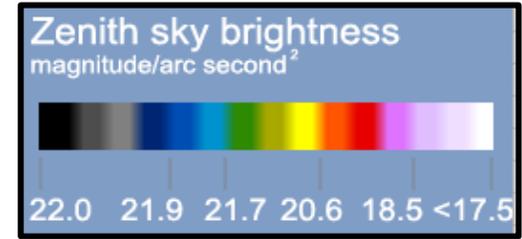
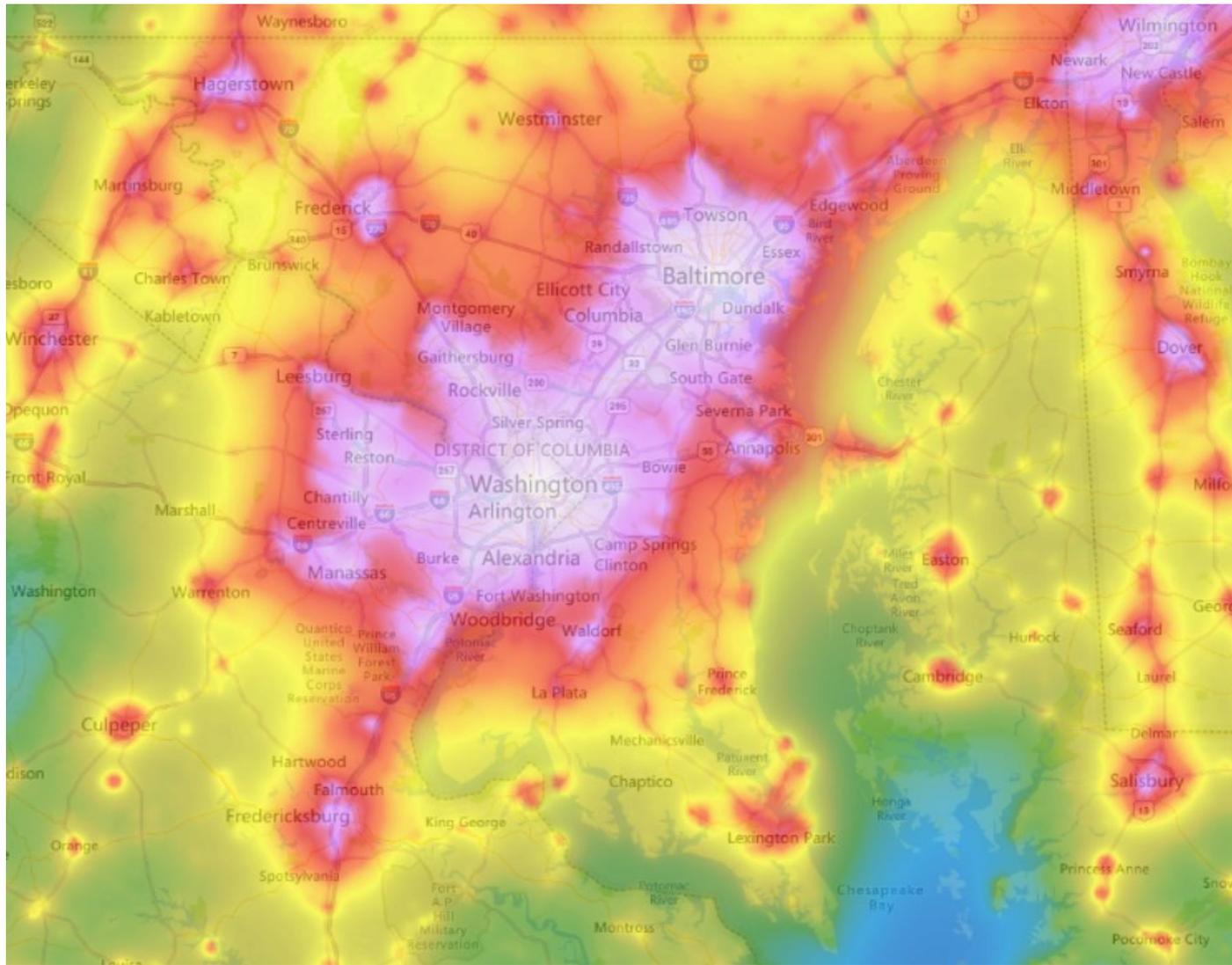
4  
Suburban/Rural  
Transition

3  
Rural Sky

2  
Dark-Sky  
Site

1  
Excellent  
Dark-Sky  
Site

# Regional Light Pollution



# Quality Lighting Systems



Focusing on human perception helps guide a quality lighting design that better supports people & the environment than focusing only on amounts of lighting.



Light Trespass



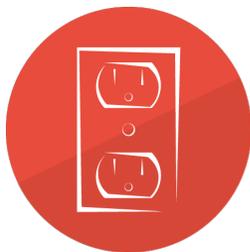
Streamline Maintenance



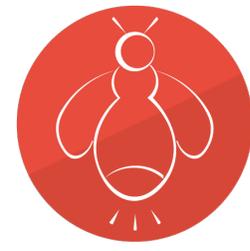
Light Pollution



Health & Wellbeing



Energy Conservation



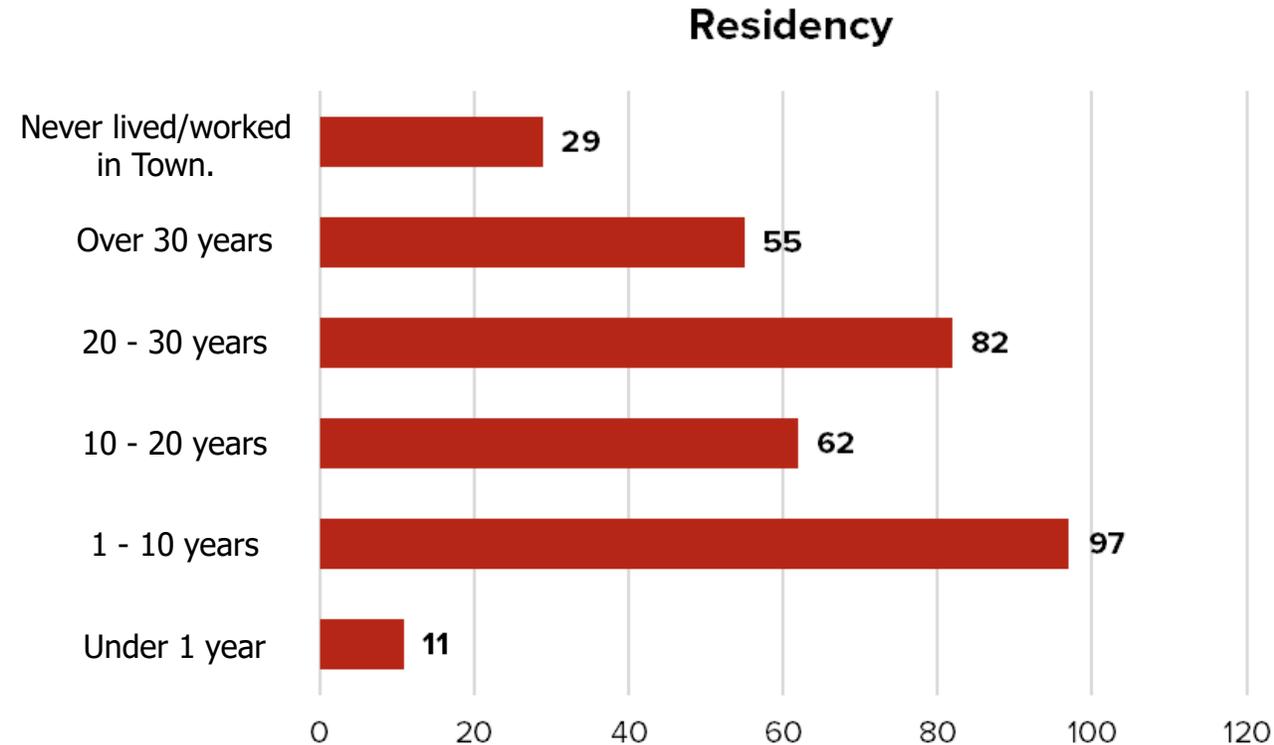
Wildlife Protection

A photograph of a street intersection in a town. In the foreground, a large red diamond shape is overlaid on the image, containing the text "Community Survey Results" in white, bold, sans-serif font. The background shows a street intersection with a brick building on the right, a stop sign, and a cyclist. The street signs above the stop sign read "CHURCH ST" and "CENTER ST N". A black pickup truck is parked on the left side of the street. A cyclist in a blue shirt and white helmet is riding across the intersection. The scene is set on a sunny day with green trees and a clear blue sky.

# Community Survey Results

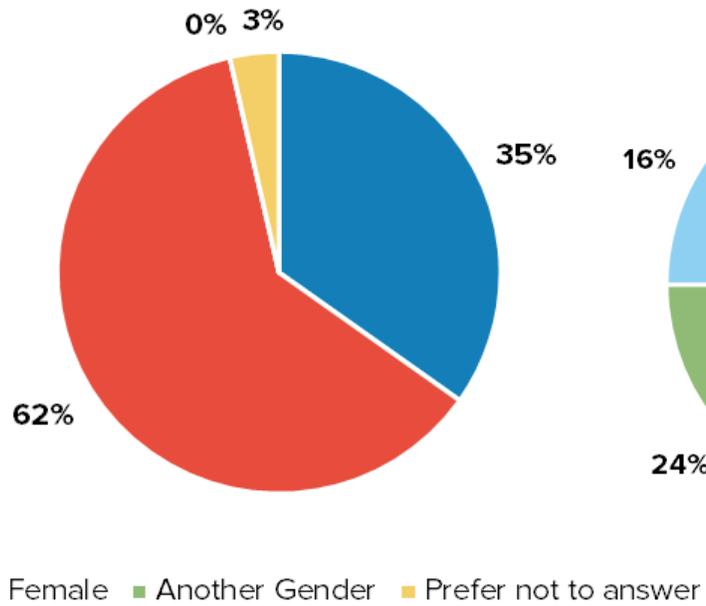
# Lighting Preferences & Nighttime Behaviors Survey

- Open from Mid-October 2024 through Mid-March 2025
- 25 Questions on demographics, lighting, and nighttime behavior patterns
- 336 Responses Analyzed
- 799 Unique Free Responses Analyzed

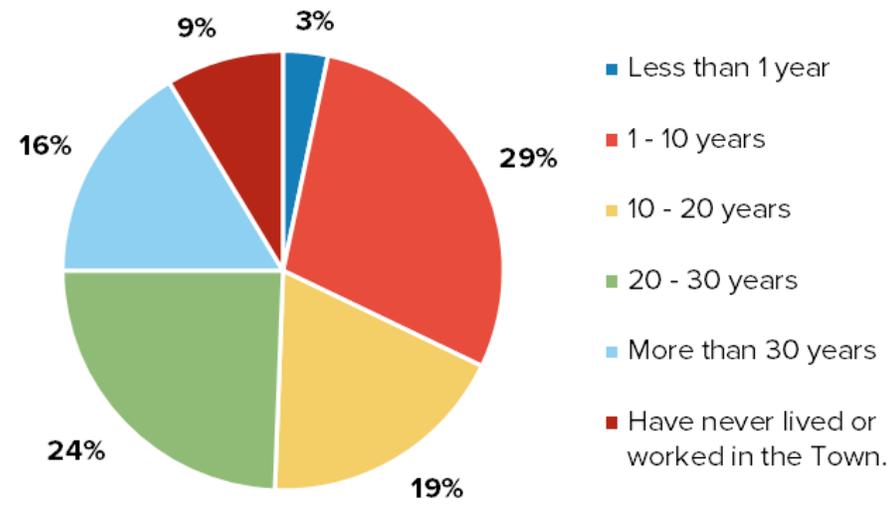


# Demographics

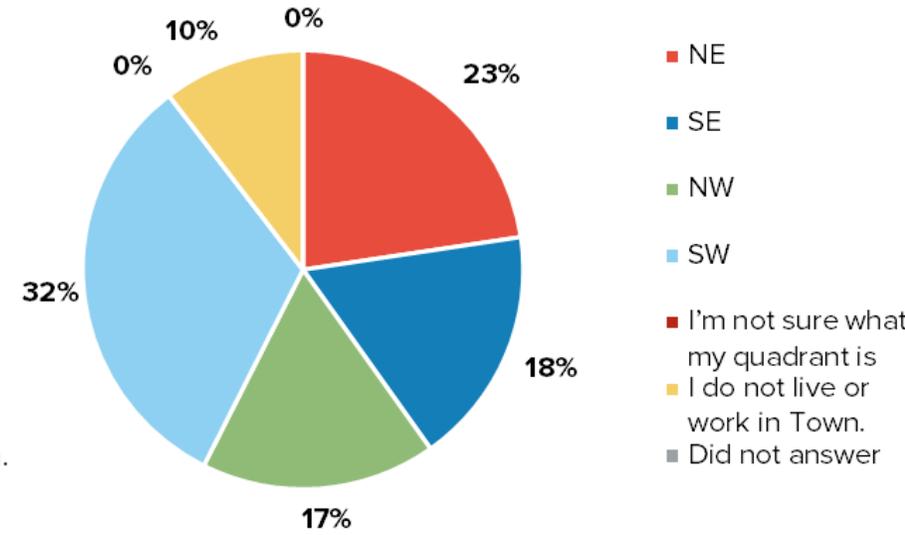
### Gender Distribution



### Length of Residency

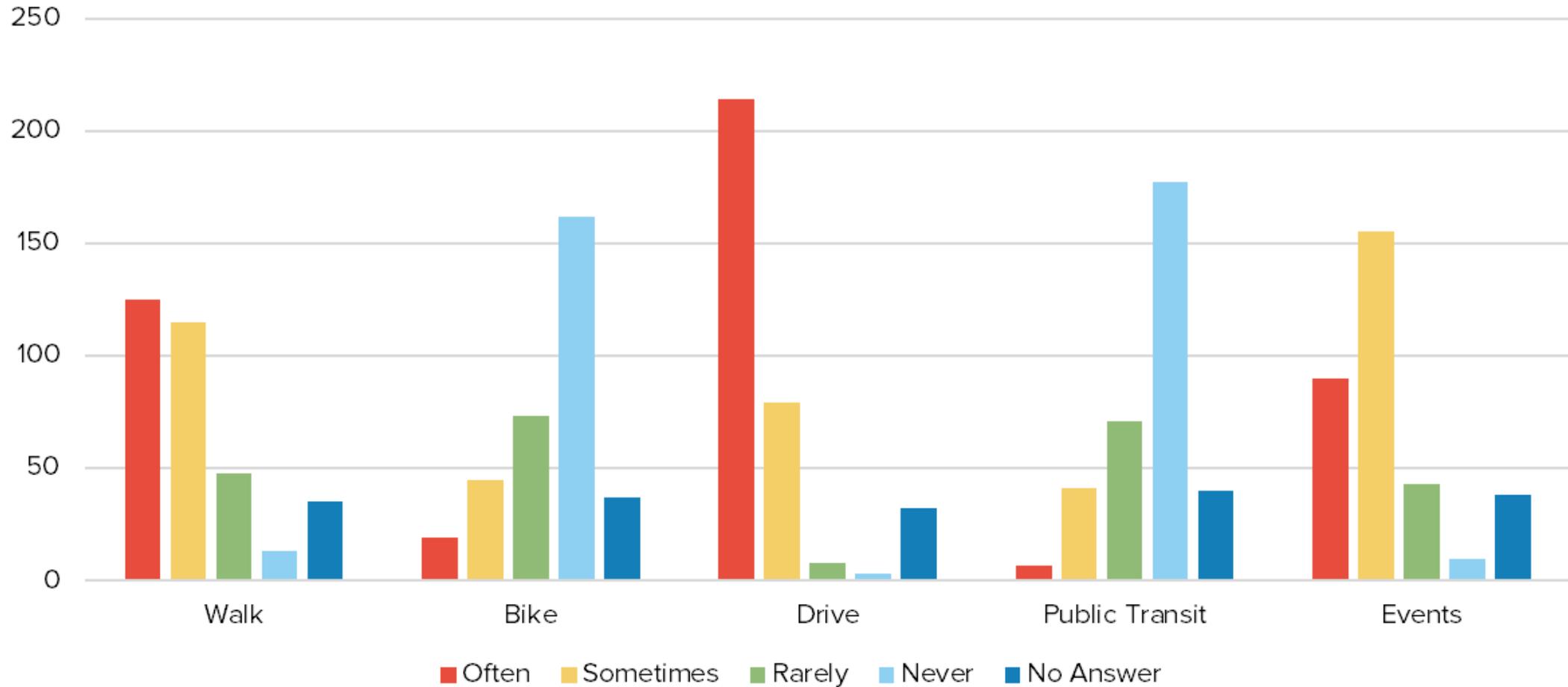


### Quadrant Distribution



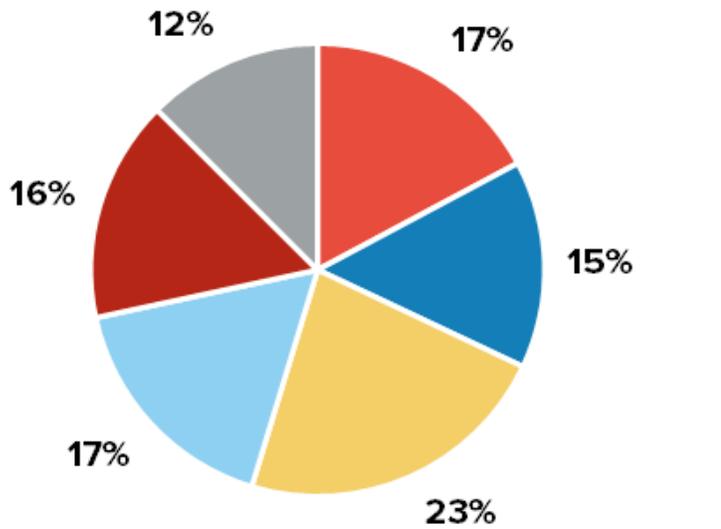
# Nighttime Activity in the Town

## Outdoor Activities at Night



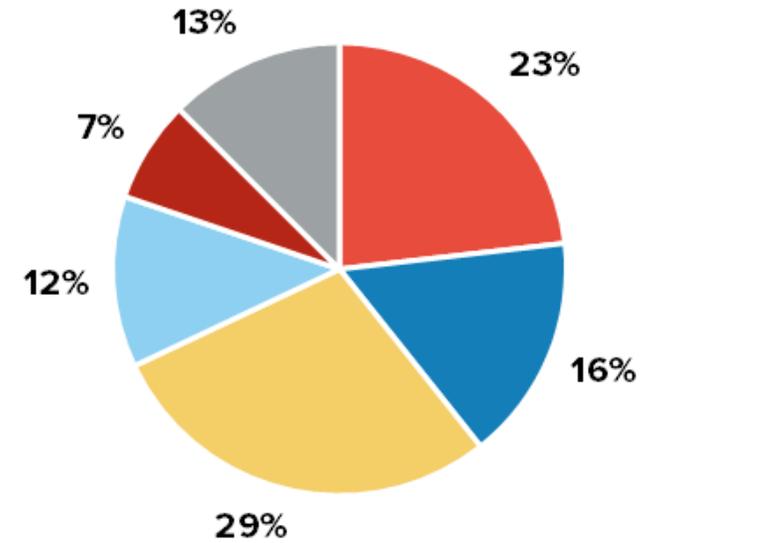
# Aesthetic Satisfaction

## Outdoor Lighting Aesthetic Satisfaction



- Satisfied
- Somewhat Satisfied
- Neutral
- Somewhat Unsatisfied
- Unsatisfied
- No Response

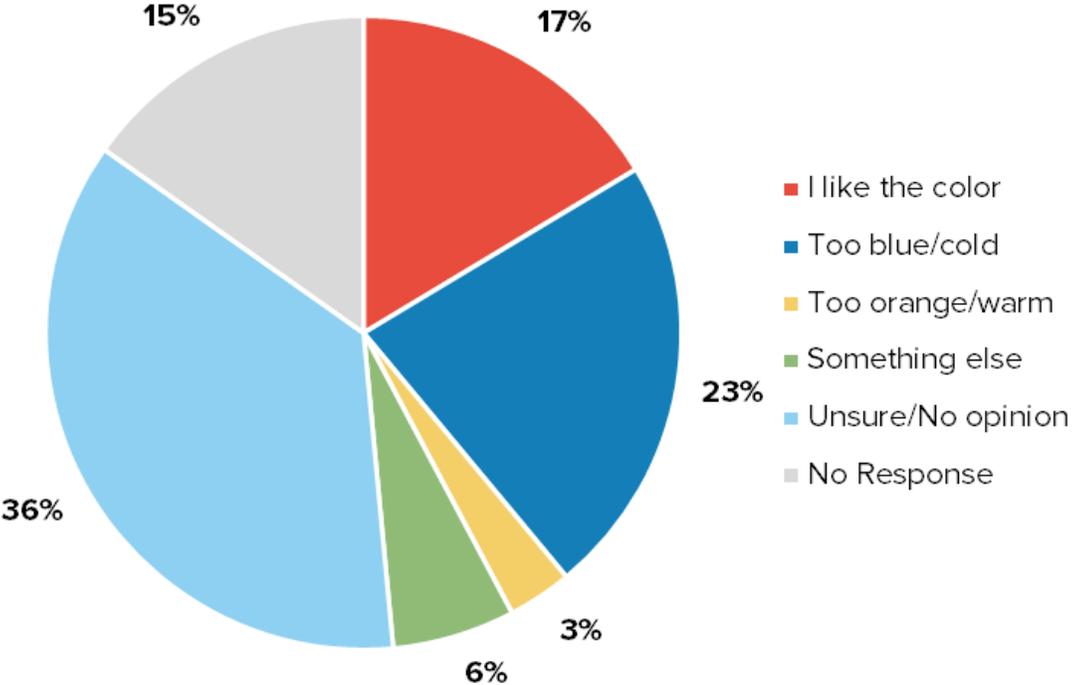
## Lighted Signage Aesthetic Satisfaction



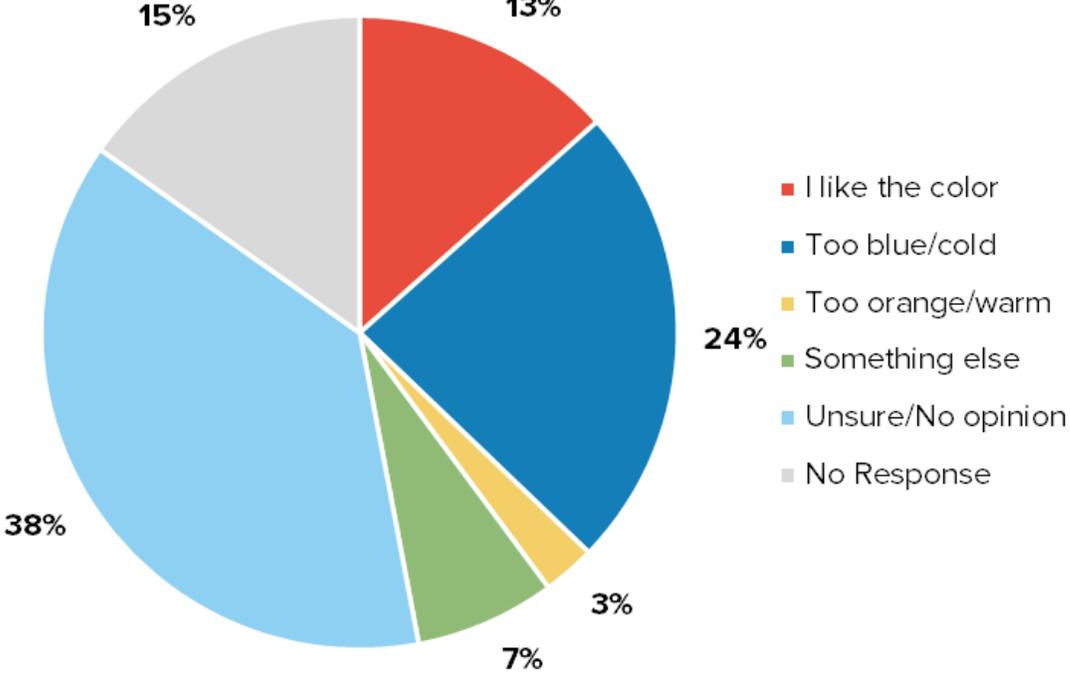
- Satisfied
- Somewhat Satisfied
- Neutral
- Somewhat Unsatisfied
- Unsatisfied
- No Response

# Color Temperature

### Residential CCT

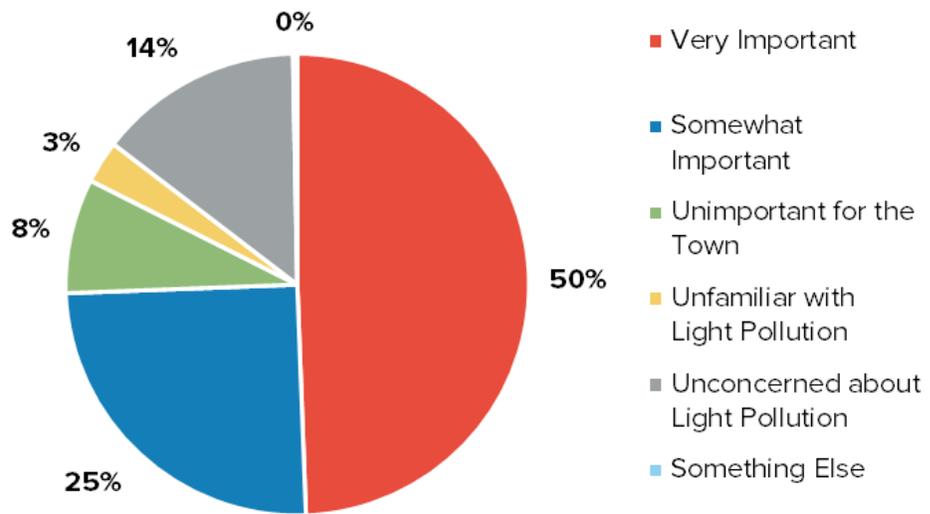


### Commercial CCT

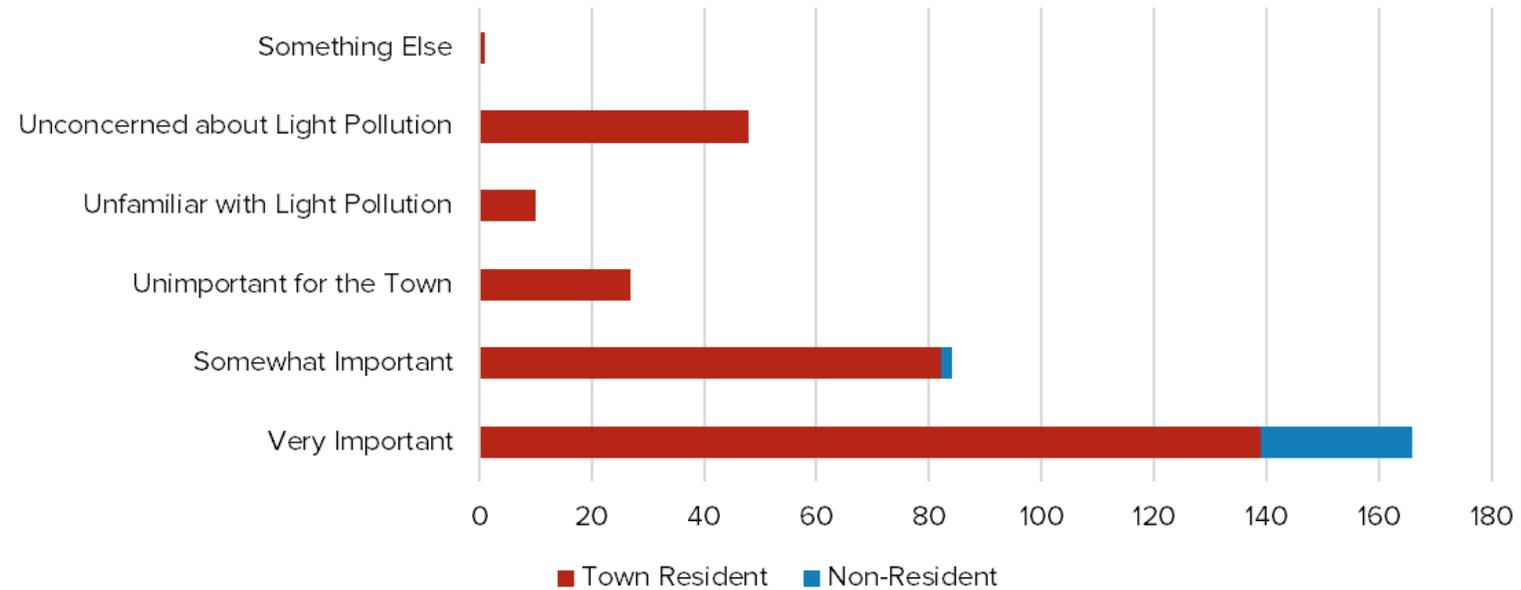


# Light Pollution

## Light Pollution

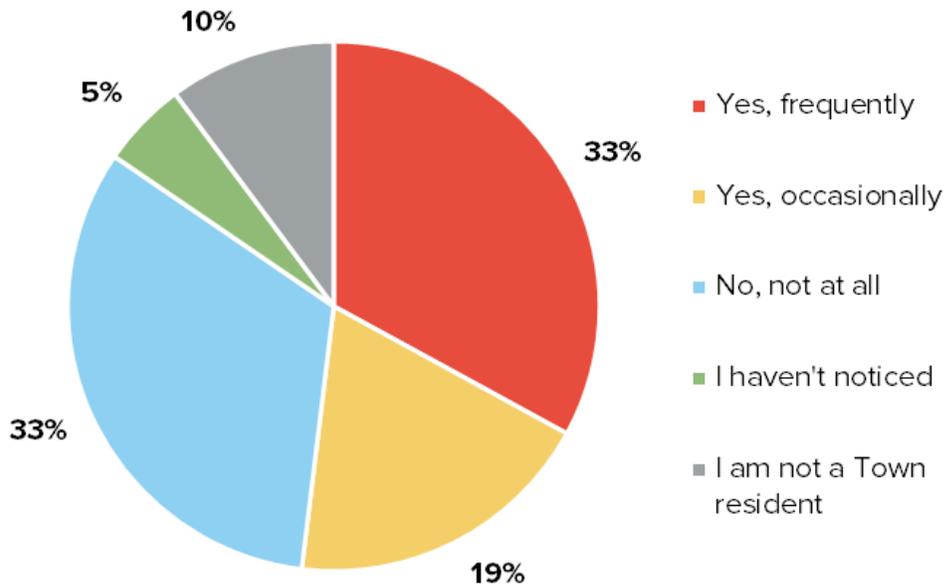


## Light Pollution & Town Residency

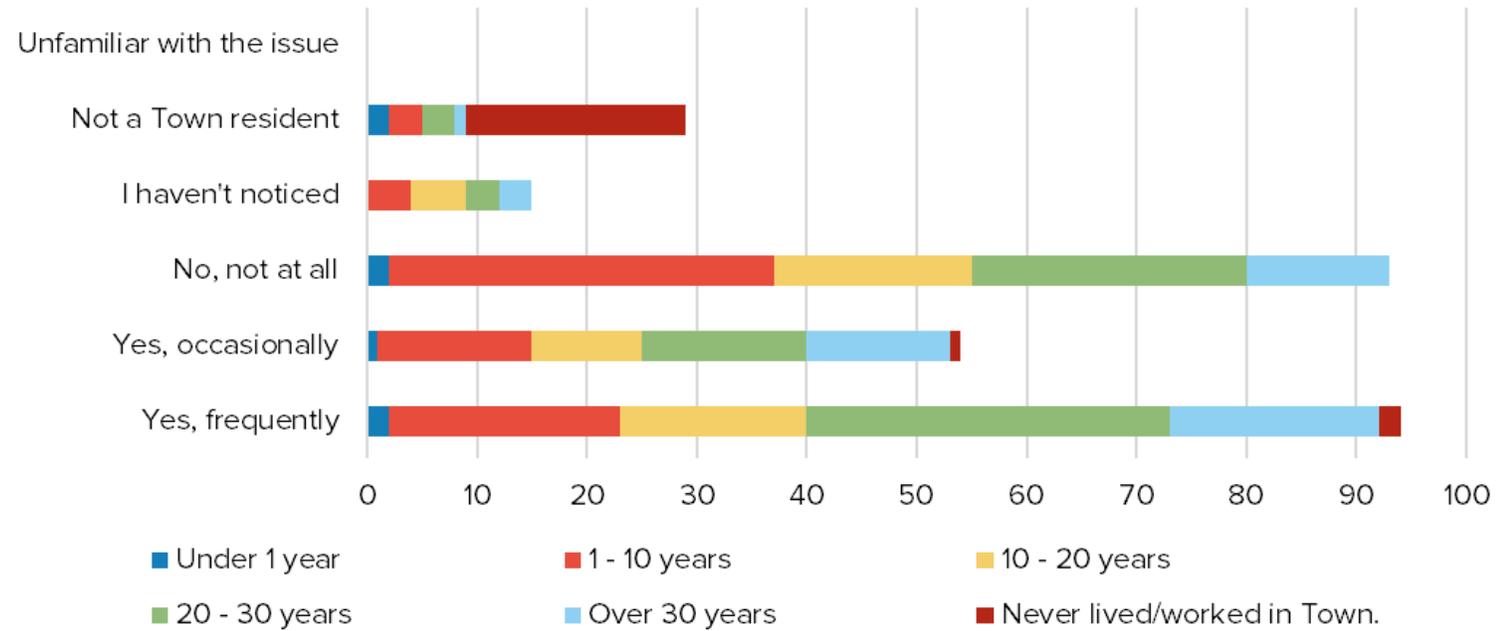


# Light Trespass

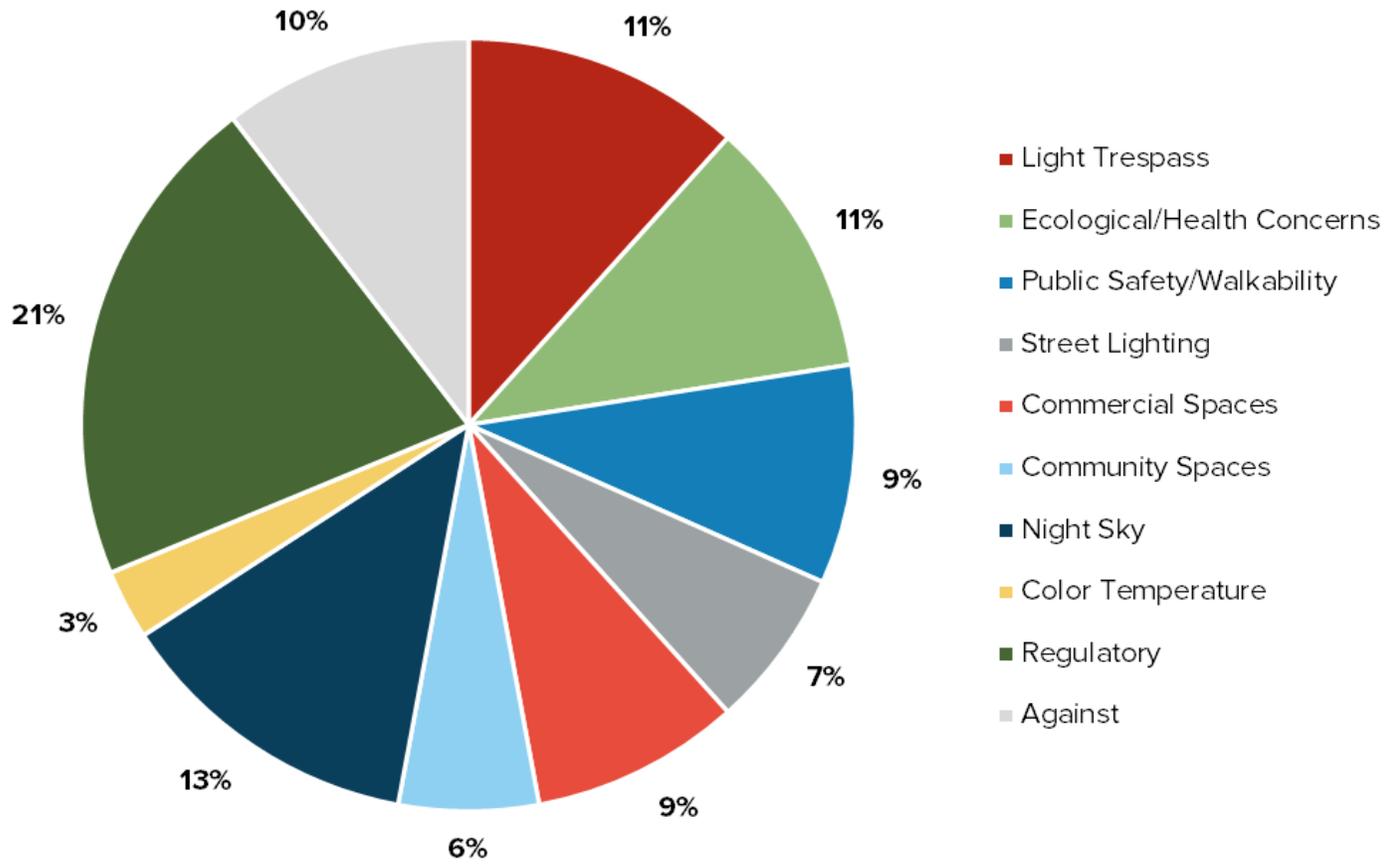
## Light Trespass Experiences



## Light Trespass & Residency



# Free Response: What do you hope a new outdoor lighting ordinance will accomplish for the Town of Vienna?



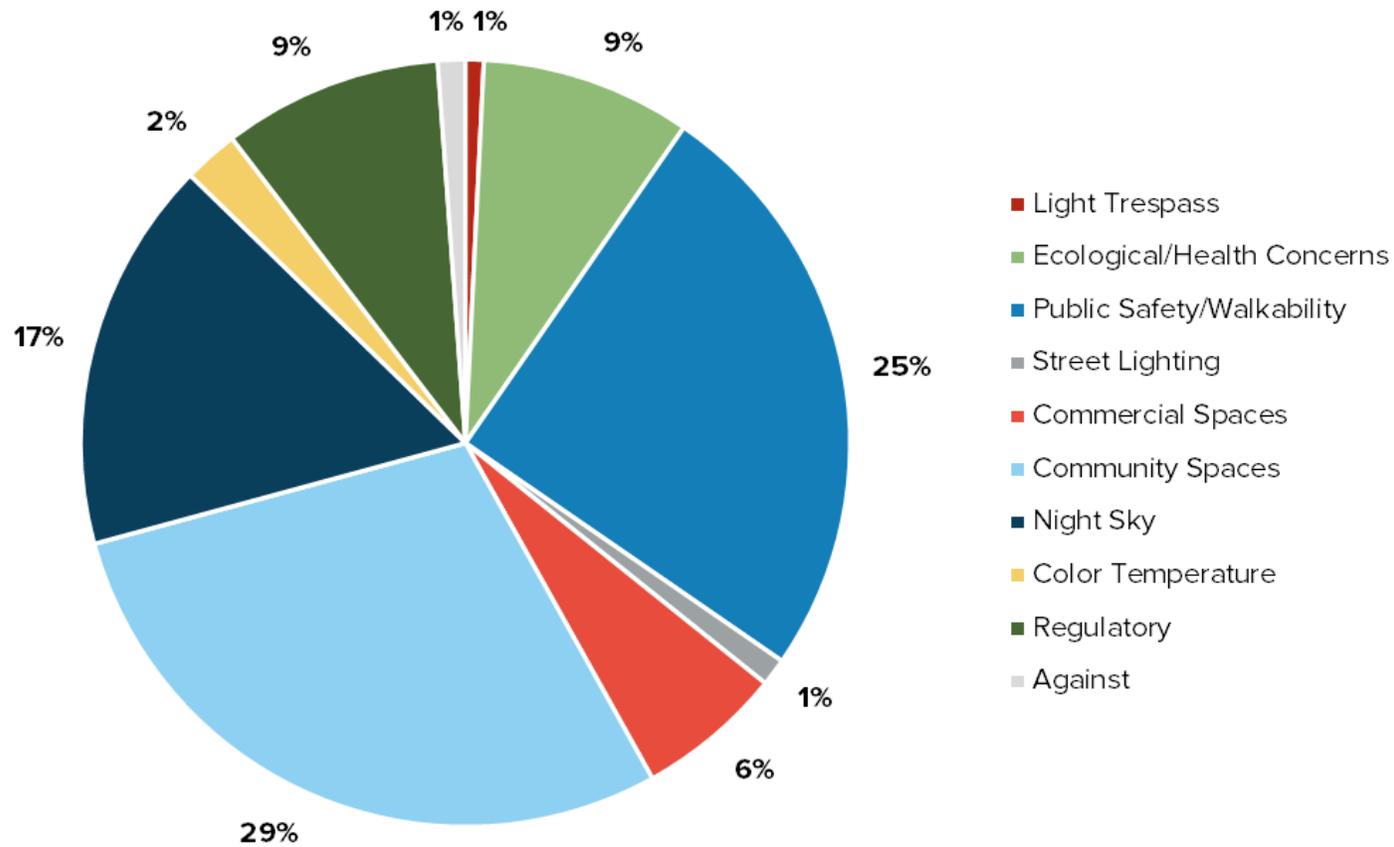
*"A new lighting ordinance would ensure that light-energy is not wasted by lighting the sky, and interfering with wildlife needs"*

*"Less nighttime light pollution in town and regulations for private property. My neighbor has spot lights they often keep on all night and it's very disturbing to sleep when the light shines on my house. "*

*"As town residents become older eye sight is an important consideration. Provide better focused lighting."*

*"I've never thought about the Town's lighting ordinance once before this survey."*

# Free Response: In the future, I want nighttime in the Town of Vienna to feel like...



*"A cozy suburban town with just enough light to see. Not a bright city."*

*"Balanced! Thirty years ago our Town did not have this level of light pollution."*

*"Dark enough to see some stars, light enough to feel safe"*

*"a safe place for an evening stroll."*

A photograph of a street intersection with a large red diamond overlay in the center. The overlay contains the text "Role of Lighting Regulations" in white, bold, sans-serif font. The background shows a brick building with a green roof, a stop sign with an "ALL WAY" plaque, and a cyclist riding across the street. Street signs for "CHURCH ST" and "CENTER ST N" are visible. A large tree is on the left, and a black truck is parked on the left side of the street.

# Role of Lighting Regulations

# How Municipal Regulations Can Help



## Community Lighting Needs:

- Purpose & Goals
- Residential vs. Non-Residential
- Applicability & Amortization
- Exemptions & Prohibitions

## Defines General Lighting Requirements:

- Light Level
- Uplight control
- Trespass thresholds
- Nighttime hours or curfews
- Spectrum / CCT

## Procedures:

- Application Process
- Enforcement & Penalty

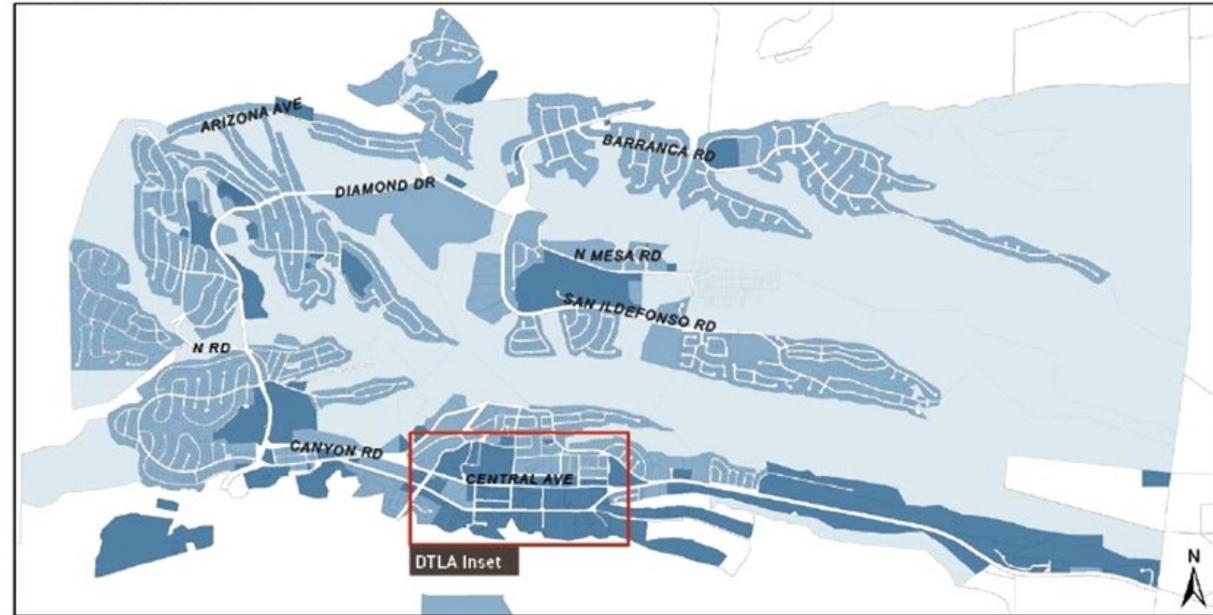
# Lighting Zones

- Protects communities and the natural environment from the unintended consequences of excessive or misapplied light at night
- Best used by municipalities, counties, and states as a planning strategy
- Foundational for many illuminance recommendations and their additional auxiliary design and energy standards

## Current Lighting Zones

- NLz – Natural Dark Zone, no lighting allowed
- Lz0 – Parks and Protected Space, Rural Farms
- Lz1 – Residential, Office, Service, Institutional
- Lz2 – Small/Mid City Commercial, Industrial
- Lz3 – Large City Commercial, Hospitality, Heavy Industrial
- Lz4 – Special District Use Only

Los Alamos Townsite

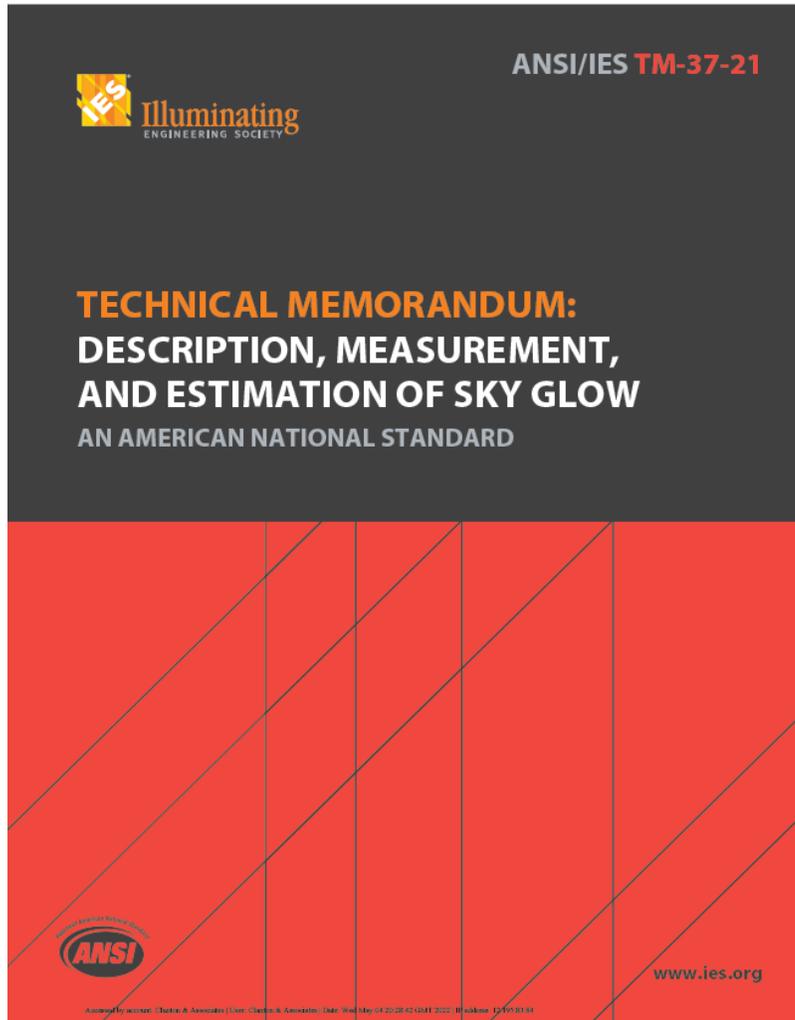


### Legend

- LZ0 Lighting Zone 0
- LZ1 Lighting Zone 1
- LZ2 Lighting Zone 2

**Dekker**  
Architecture in Progress

# Skyglow & Health Risk (TM-18)

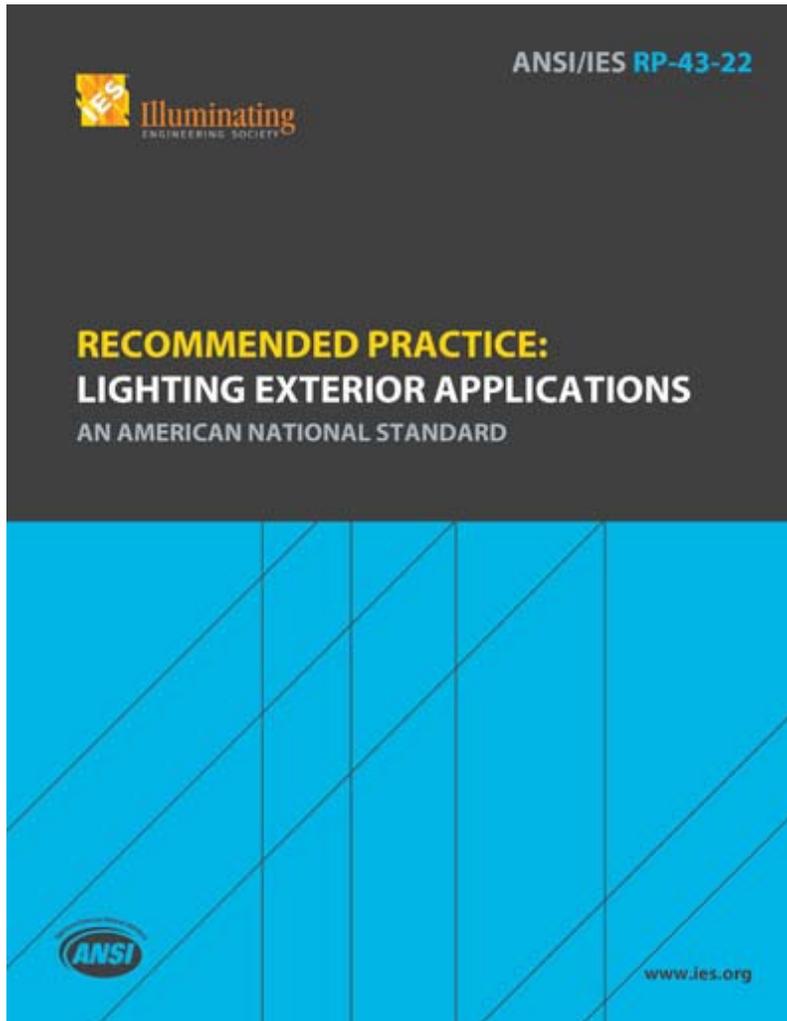


- *"Because blue light is more strongly scattered in the atmosphere, it is more likely to be eventually redirected back toward earth, creating the physical manifestation of sky glow. In addition, advances in biology are showing that many living organisms are sensitive to light at night, and particularly blue light."*
- *"Since the effects of optical radiation can be profound for human health and well-being, it is increasingly important for the lighting community to understand the direct biological influences of light/dark cycles."*
- *"Exposure between 1 lux and 5 lux (0.1 fc and 0.5 fc) at the cornea of specific monochromatic wavelengths of optical radiation (460nm and 509 nm, respectively) could suppress melatonin in healthy humans."*

## Related:

- Flagstaff, AZ, the first IDA Community in 2001, uses 1800-2200K
- California Bill Proposal- State properties would use 2700K maximum and dim to 50% during curfew
- Maui, HI, Bill #21 (Passed Oct 2022) –Limits the amount of blue spectrum (400-500nm) to 2% and limits uplight to U0

# Light Level: ANSI/IES RP-43



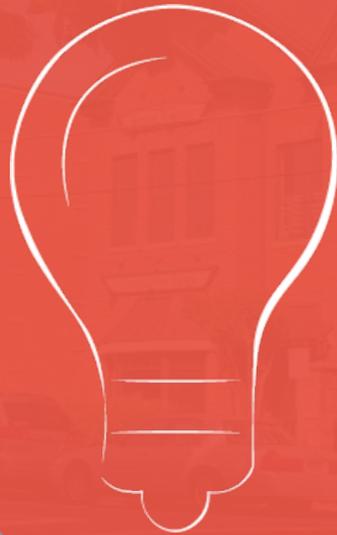
## ANSI/IES RP-43 Illuminance Recommendations:

- Orientation / Wayfinding
- Reassurance
- Terrain Safety
- Atmosphere / Identity
- Enjoyment

# Light Levels: ANSI/IES RP-43

ANSI/IES RP-43: Lighting for Pedestrians in Outdoor Environments  Table A-3	Lighting for Human Vision, Visibility, and Reassurance										Lighting for Responsible Design						
	Recommended Average Maintained Illuminance Targets <sup>10</sup>										Optic Control		Controls	Spectrum			
	Illuminances are at height of Task Surface (TS) above finished grade (AFG)										Glare, Uplight Ratings		Vacancy, Seasonal, & Curfew Reduction	Acceptable Short Wavelength Content <sup>7</sup>			
	Horizontal Illuminance					Vertical Illuminance											
Target E <sub>h</sub> @ Height AFG		Uniformity		Ratio (Avg:Min)	Ratio Basis	Target E <sub>v</sub> @ Height AFG		Uniformity		Ratio (Avg:Min)	Ratio Basis	Max Glare Rating (G)	Max Uplight Rating (U)	Light Output During Controls Reduction	Very Low (VL); Low (L); Medium (M); High (H); Very High (VH)		
lux @ m	(fc @ ft)					lux @ m	(fc @ ft)										
<b>APPLICATION TASK/AREA<sup>8</sup></b>																	
<b>CONTEXT, ORIENTATION, WAYFINDING, REASSURANCE</b>																	
<b>Façades</b>																	
Façades (low reflectance materials, <0.3) <sup>10</sup>																	
Façades (medium reflectance materials, >0.3 and <0.6) <sup>10</sup>																	
Façades (high reflectance materials, >0.6) <sup>10</sup>																	
<b>Building Entrances, Drop-Off, Pick-Up</b>																	
Building Entrances <sup>2,10</sup>																	
<b>LZ4</b>																	
	Lower limit (avg.)					30 @ 0.00	(3 @ 0.0)	5:1	Avg:Min	10 @ 1.5	(1 @ 5.0)	5:1	Avg:Min	G2	U3	20% to 50%	VL, L, M, H
	Upper limit (avg.)					50 @ 0.00	(5 @ 0.0)	5:1	Avg:Min	30 @ 1.5	(3 @ 5.0)	5:1	Avg:Min				
<b>LZ3</b>																	
	Lower limit (avg.)					20 @ 0.00	(2 @ 0.0)	5:1	Avg:Min	8 @ 1.5	(0.8 @ 5.0)	5:1	Avg:Min	G2	U3	20% to 50%	VL, L, M
	Upper limit (avg.)					40 @ 0.00	(4 @ 0.0)	5:1	Avg:Min	20 @ 1.5	(2 @ 5.0)	5:1	Avg:Min				
<b>LZ2</b>																	
	Lower limit (avg.)					10 @ 0.00	(1 @ 0.0)	5:1	Avg:Min	4 @ 1.5	(0.4 @ 5.0)	5:1	Avg:Min	G2	U2	20% to 50%	VL, L, M
	Upper limit (avg.)					20 @ 0.00	(2 @ 0.0)	5:1	Avg:Min	10 @ 1.5	(1 @ 5.0)	5:1	Avg:Min				
<b>LZ1</b>																	
	Lower limit (avg.)					5 @ 0.00	(0.5 @ 0.0)	5:1	Avg:Min	2 @ 1.5	(0.2 @ 5.0)	5:1	Avg:Min	G1	U1	20% to 50%	VL, L
	Upper limit (avg.)					10 @ 0.00	(1 @ 0.0)	5:1	Avg:Min	5 @ 1.5	(0.5 @ 5.0)	5:1	Avg:Min				

**Questions?**





# Thank You!

CLANTON & ASSOCIATES

---

LIGHTING DESIGN AND ENGINEERING