

# Yellow road lighting is the wrong colour

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Chair, IES Outdoor Environmental Lighting Committee  
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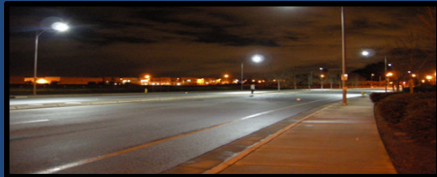
# In Situ - Street Light Studies



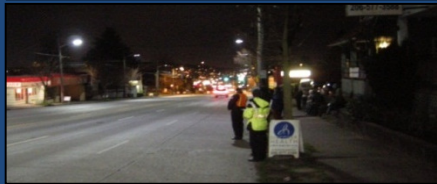
1. Anchorage



2. San Diego



3. San Jose



4. Seattle

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# Color Contrast Importance?

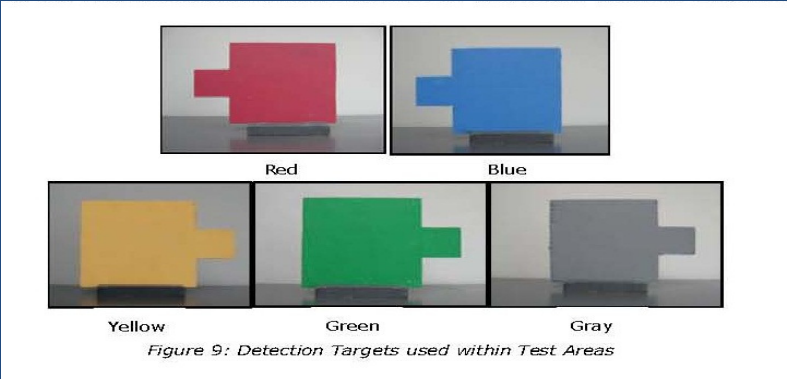


# Do lighting levels describe visibility?





# Visibility Test - Targets



# Detection Distances collected by Virginia Tech Transportation Institute

Passengers pressed buttons when  
they first saw visibility targets

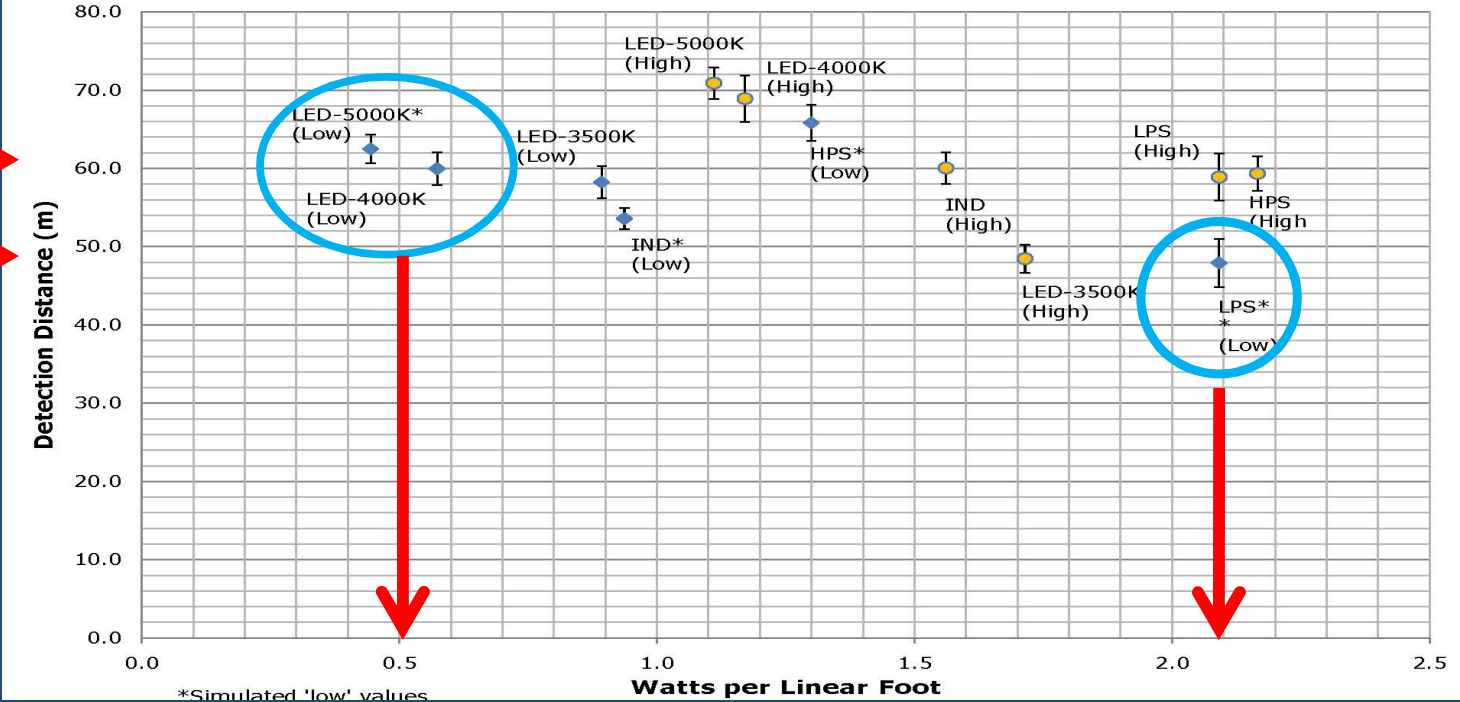


VTTI lab equipment enabled  
researchers to record GPS  
position, luminance, and  
illuminance

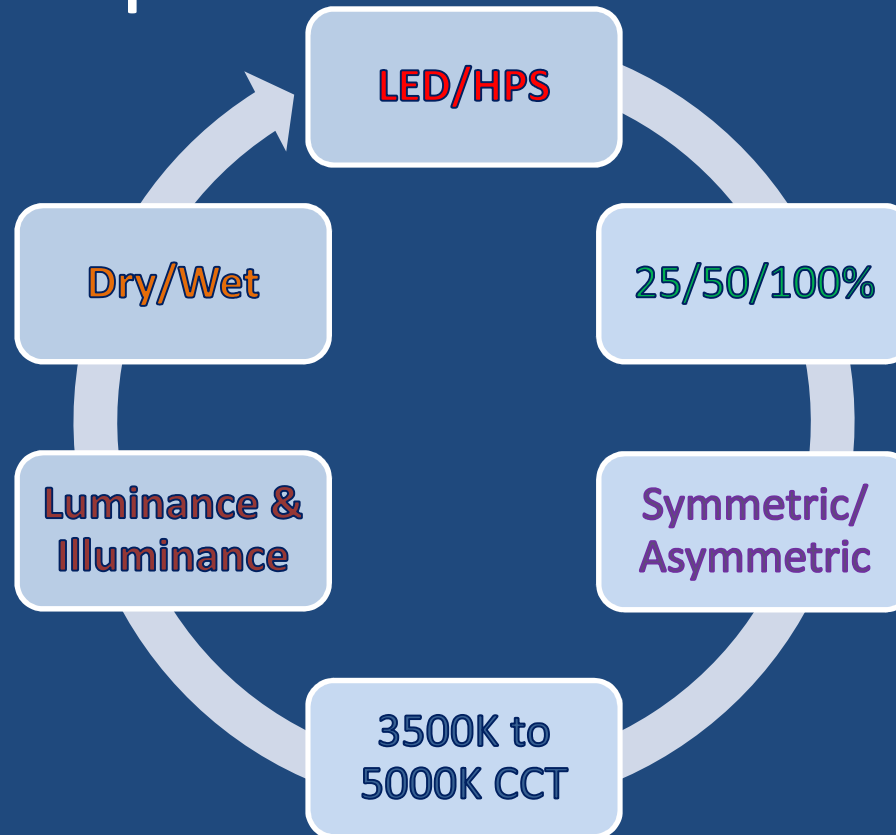


# San Jose – Detection distance

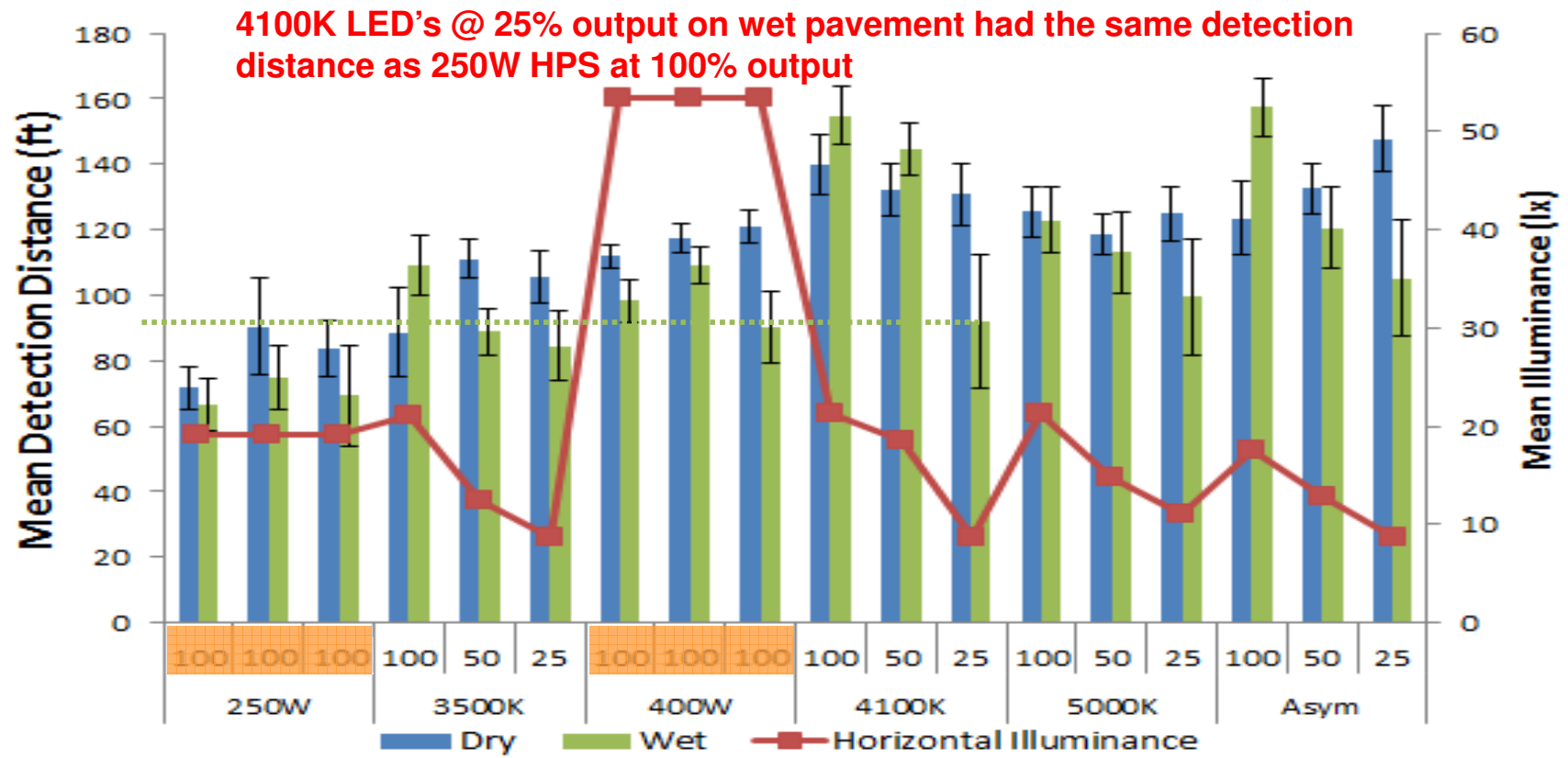
## LOW (50%) setting



# NEEA – Seattle Experiment Variables

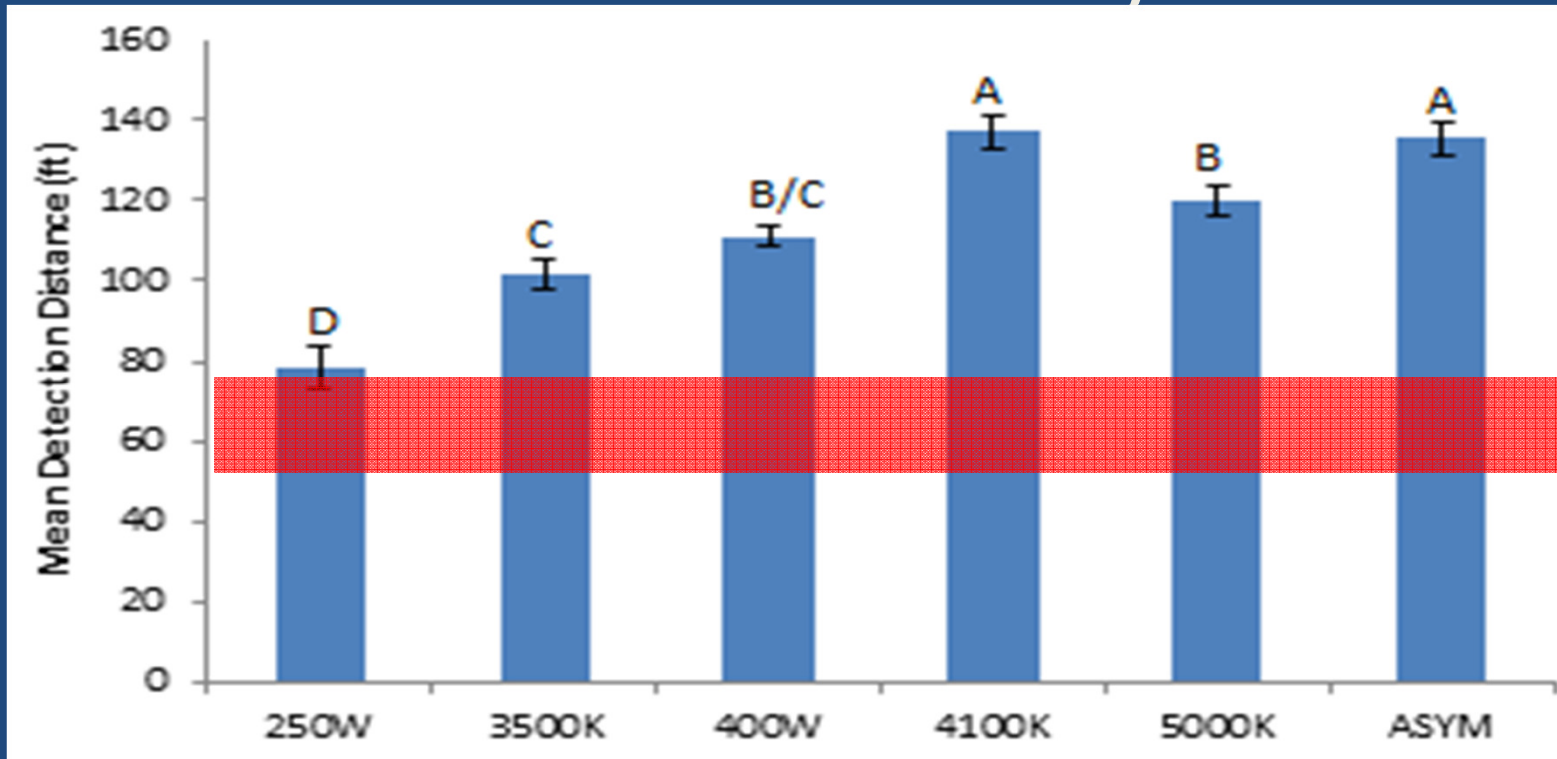


# Seattle - Detection Distance vs Horizontal Illuminance



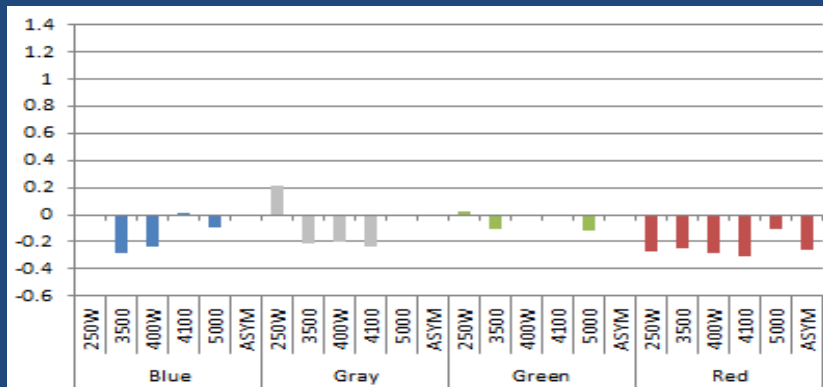


# Seattle - Objective Results (Detection Distance)

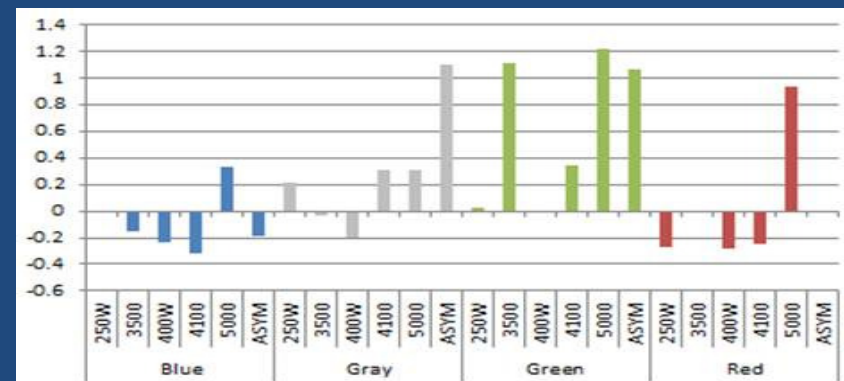


Stopping distance at 25mph (wet)\*

# Seattle: Target/Pavement Contrast Dry Conditions



100% output



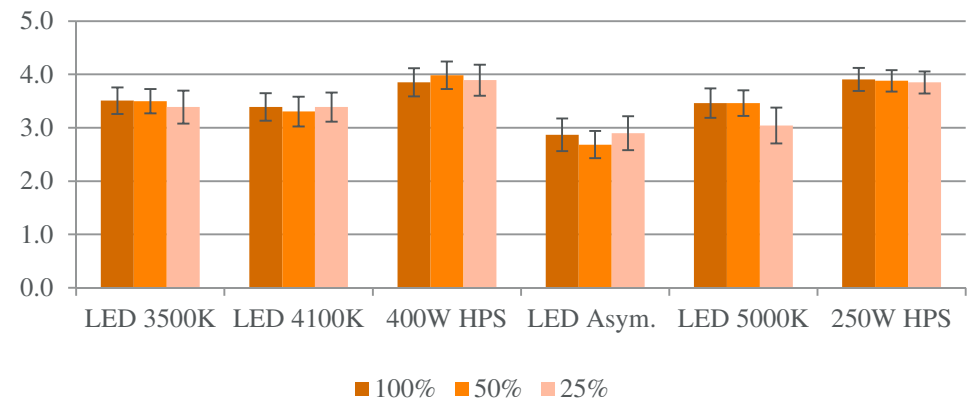
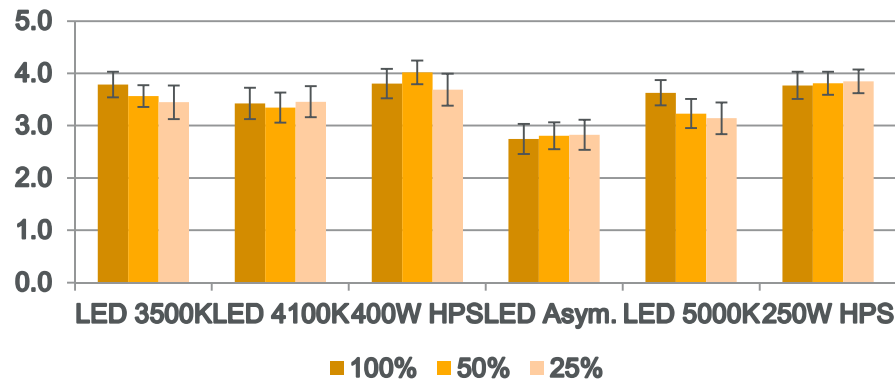
25% output LED,  
100% HPS



# Seattle – Public Perception



# Seattle - Lighting is Comfortable – **No** statistical difference between responses (100% to 25%)



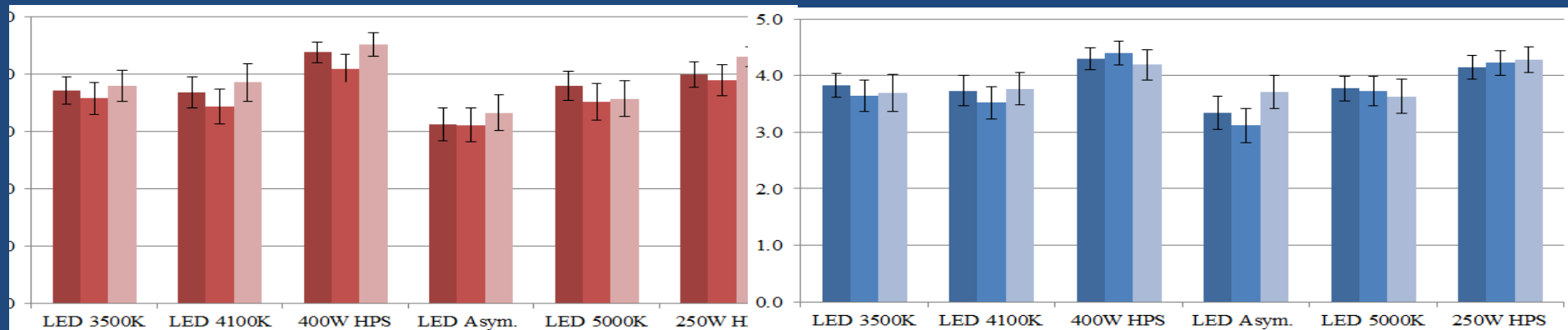
DRY

- 5 - Strongly agree
- 1 - Strongly disagree

WET

# Seattle - Lighting is Safe

**No** statistical difference between responses (100% to 25%)



DRY

- 100%
- 50%
- 25%

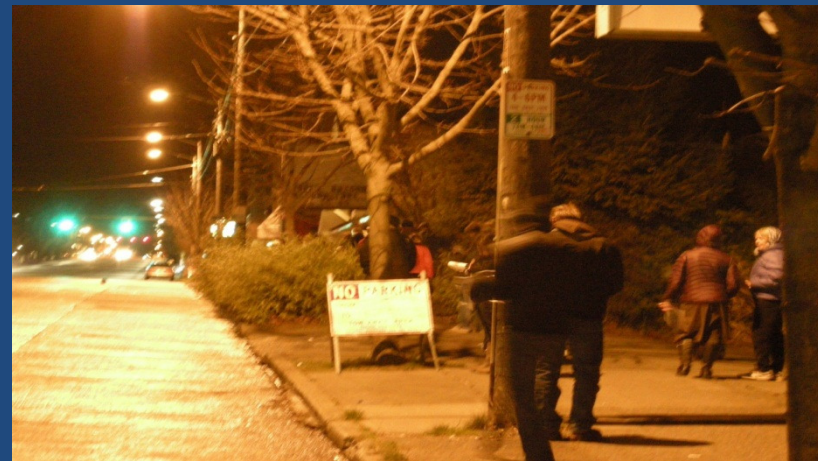
WET

- 100%
- 50%
- 25%

- 5 - Strongly agree
- 1 - Strongly disagree



# Importance of Lighting Sidewalks



# Safety



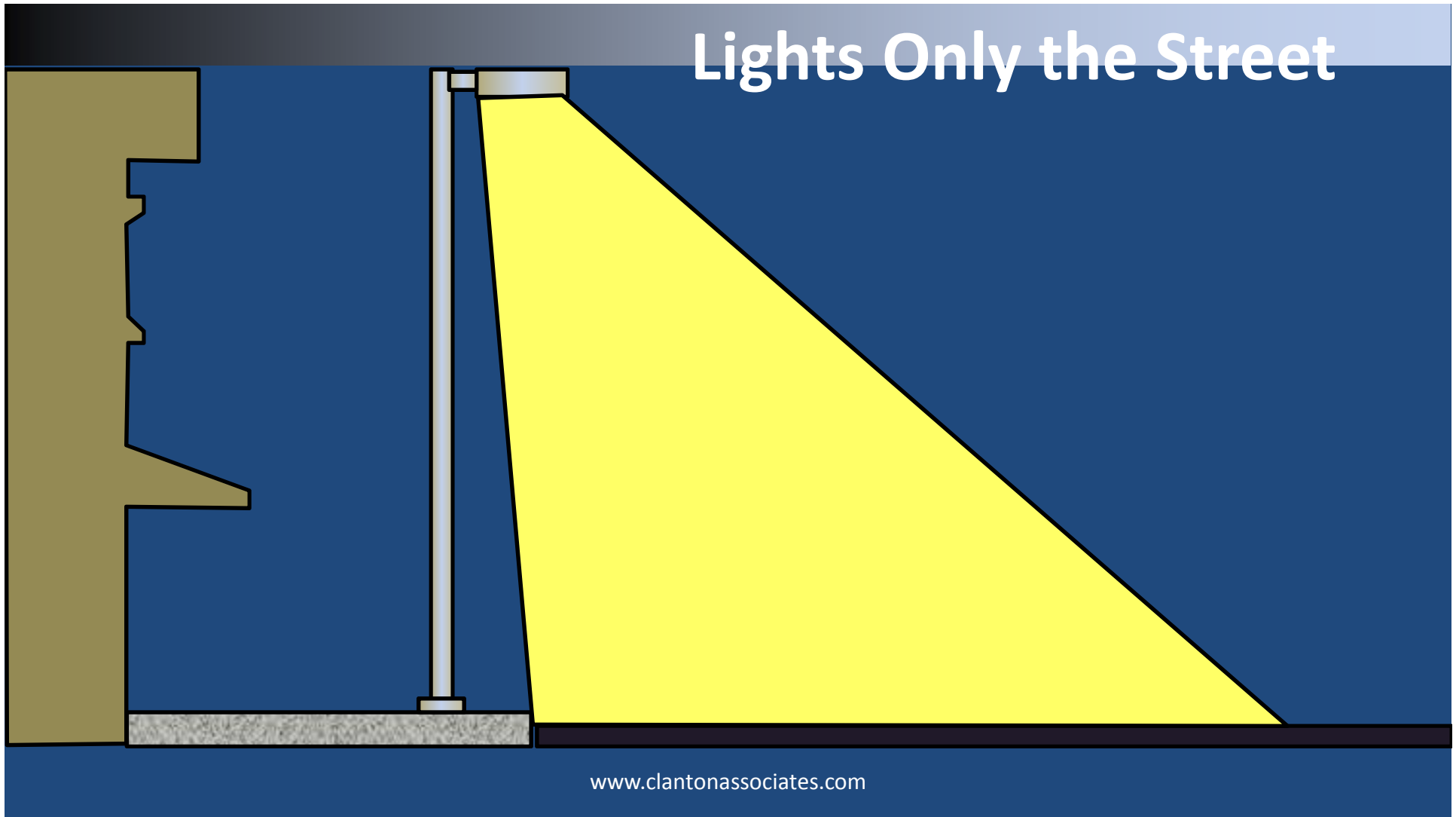
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# Traditional Lighting

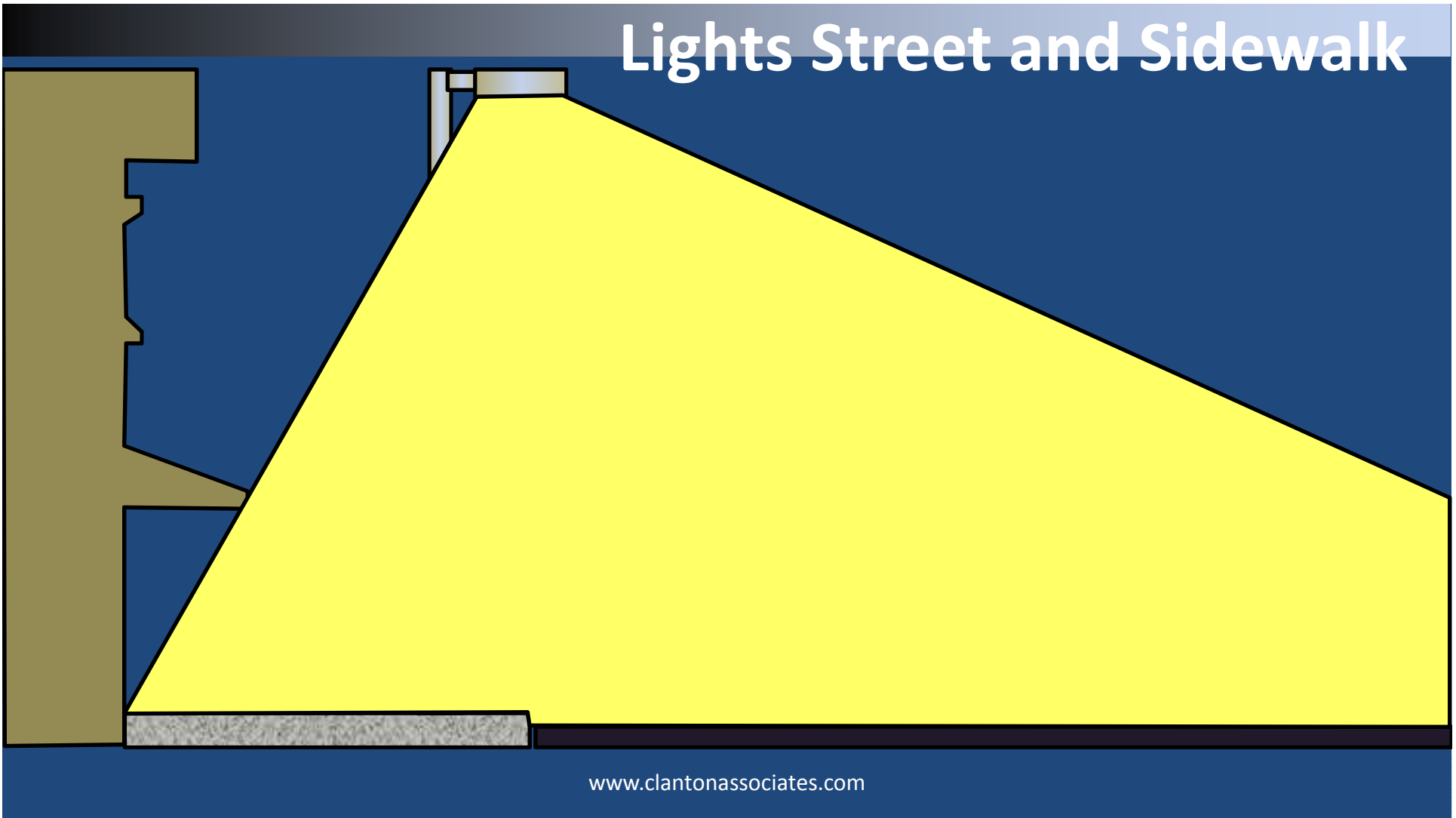
Wasted  
Light/ Light  
Trespass

A cross-sectional diagram of a room showing a ceiling-mounted light fixture. A large yellow cone of light extends downwards from the fixture. A portion of this light cone is shown spilling over the edge of a brown wall on the left side of the room. This spilled light is shaded with a dark, textured pattern and labeled 'Wasted Light/ Light Trespass'. The room's floor is shown in grey, and the ceiling is dark blue. The background wall is also dark blue.

# Lights Only the Street

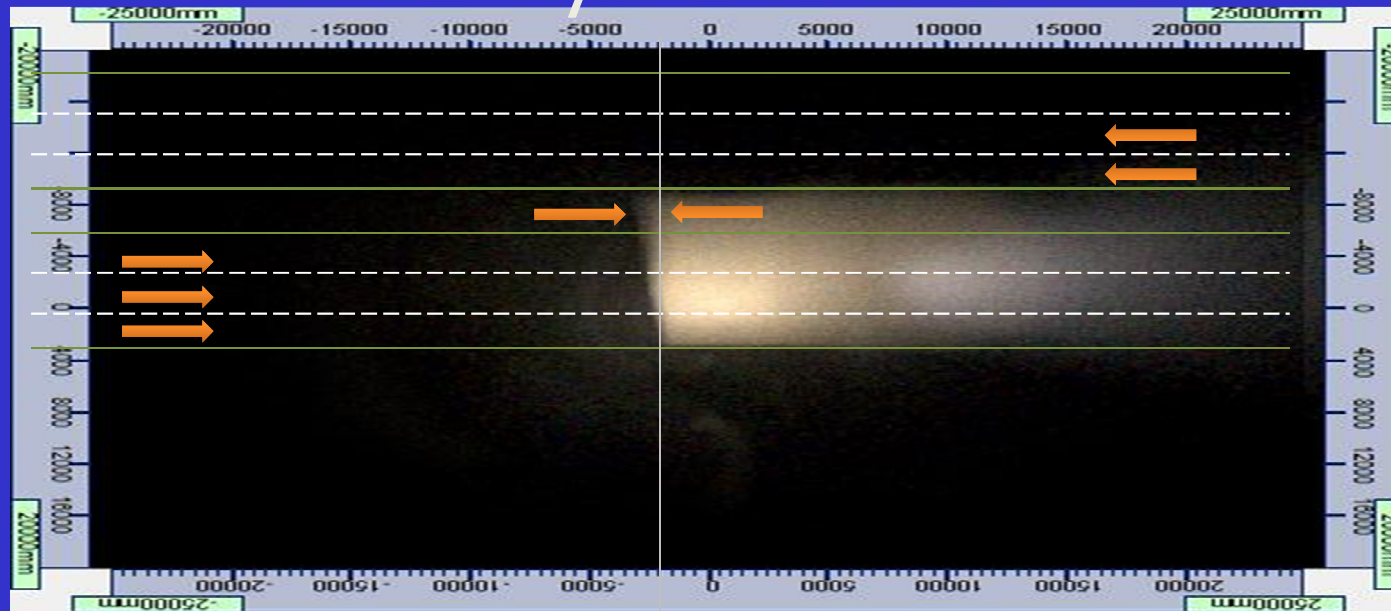


# Lights Street and Sidewalk

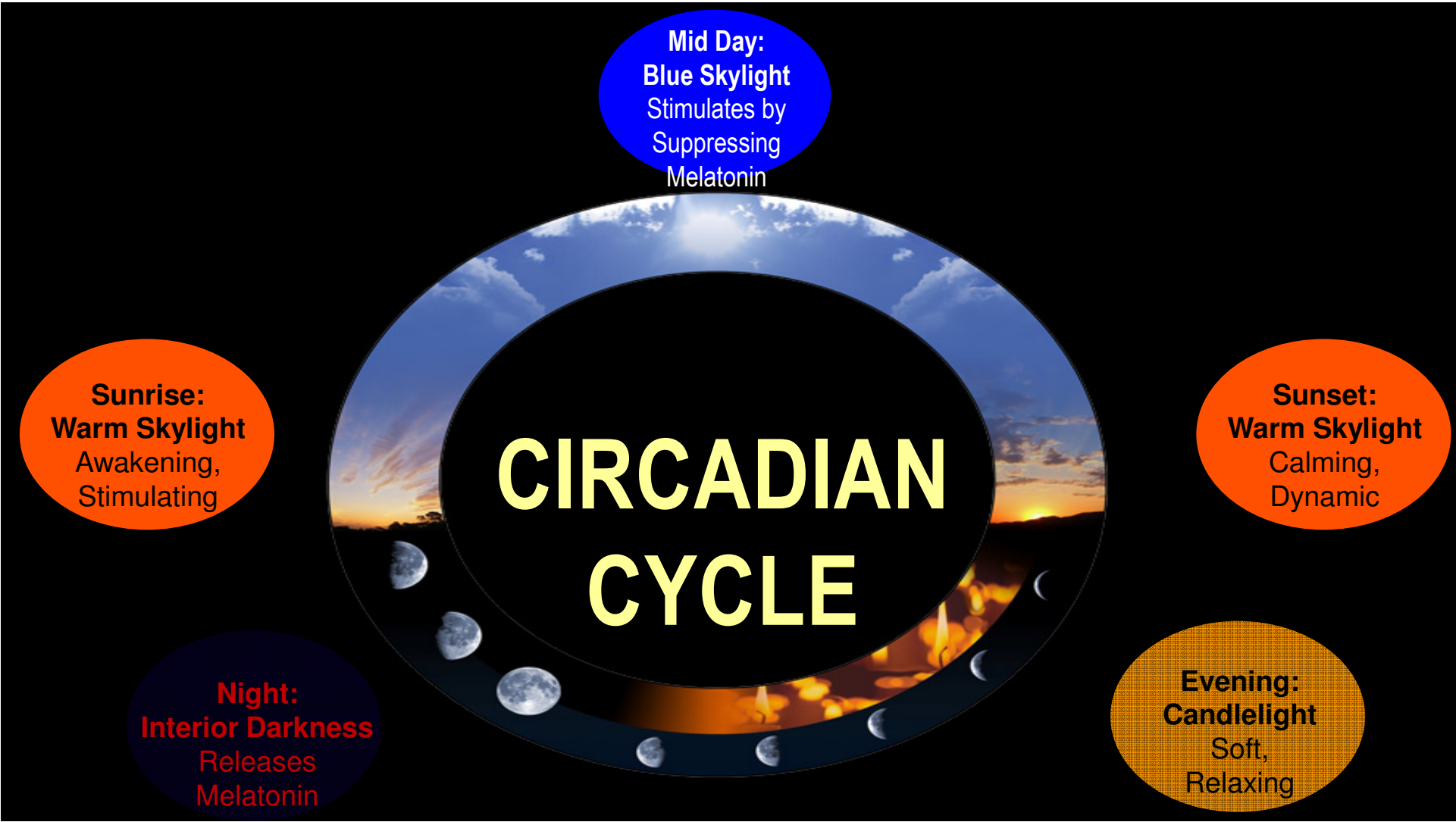




Symmetric Ave/Min = 8.41 : 1  
400W Ave/Min = 4.45 : 1



Improvements to Uniformity Criteria are needed



# CIRCADIAN CYCLE

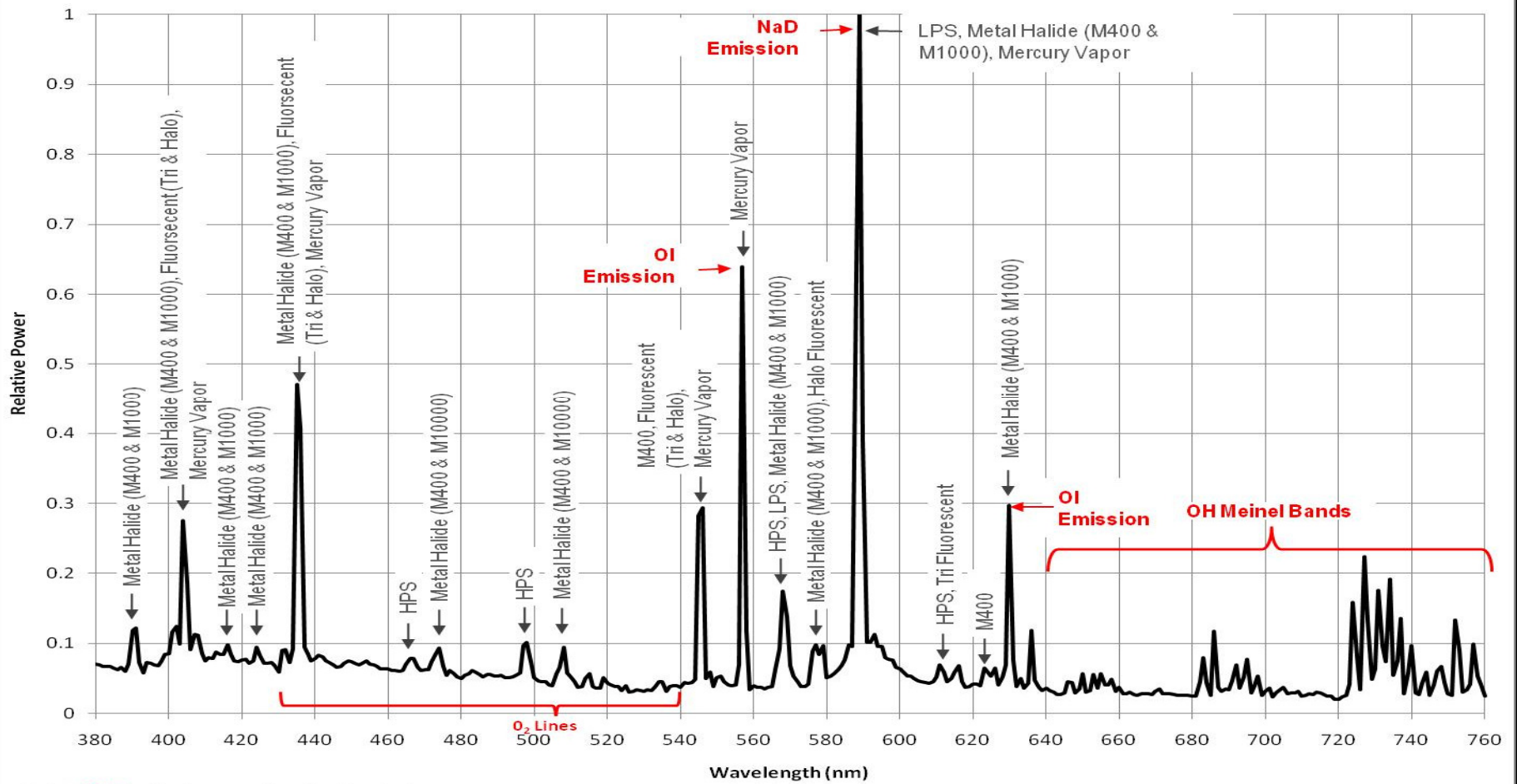
**Mid Day:**  
Blue Skylight  
Stimulates by  
Suppressing  
Melatonin

**Sunrise:**  
Warm Skylight  
Awakening,  
Stimulating

**Sunset:**  
Warm Skylight  
Calming,  
Dynamic

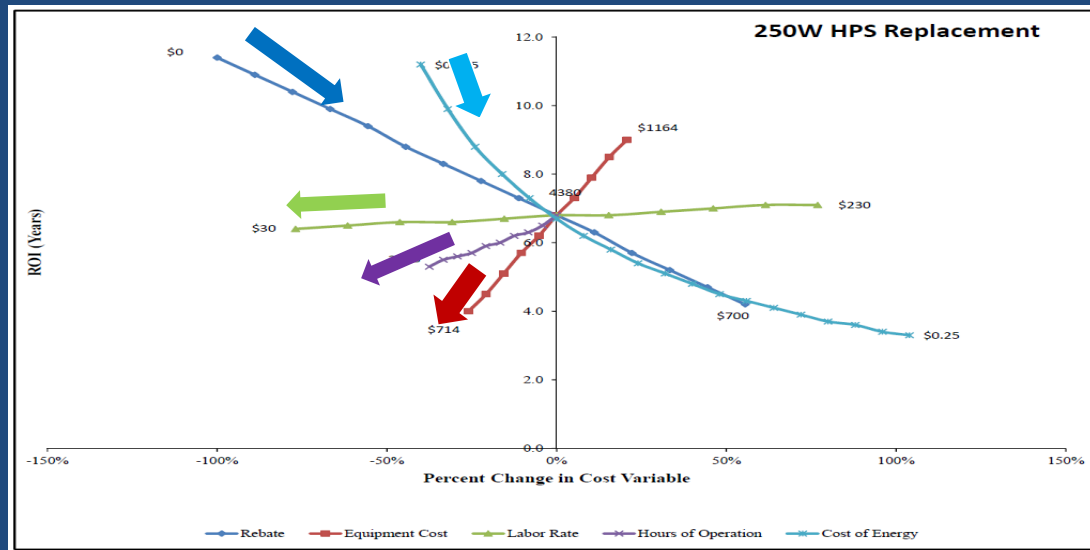
**Night:**  
Interior Darkness  
Releases  
Melatonin

**Evening:**  
Candlelight  
Soft,  
Relaxing



# Return on Investment (ROI)

Annual Energy Savings Analysis						
Light Source (Cobrahead)	250W HPS	175W MH	90W MH	LED	LED	LED
Controls	-	-	-	-	Localized	Centralized
System kWatts	29.0	21.0	9.6	13.0	13.0	13.0
Annual kWh	127,020	91,980	42,048	56,940	49,816	42,705
Average Monthly kWh per light	106	77	35	47	42	36
Annual Energy Cost (US\$)	US\$ 5,916.00	US\$ 4,284.00	US\$ 2,016.00	US\$ 2,664.00	US\$ 2,340.00	US\$ 2,016.00
Payback Period (yr)	0	1.3	1.5	3.2	3.5	3.9



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# Further Research Wish List

- **Research under adverse weather conditions** (rain and fog)
  - Both effect the light distribution from the luminaire
- Still have not found the **lowest lighting level**
- What are the **adaptive impacts of off site lighting?**
- **Street and sidewalk uniformity** differences
- **Full crash rate** (how many crashes per number of vehicles)
- **Higher speeds (55MPH)**
- **Develop color contrast algorithms**
- **Light At Night (LAN) impacts**



LET'S DREAM!

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# QUESTIONS??

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