



• August 15-18, 2010 • Dallas, Texas •
• Dallas Convention Center •



The Quest for Energy Efficient Outdoor
Lighting ... LED?

Nancy Clanton, PE, FIES, IALD, LC, LEED AP
Clanton & Associates, Boulder, CO

It all starts with ...

Desire to reduce energy use

The buzz around LED



Safety



Detection of Objects and People

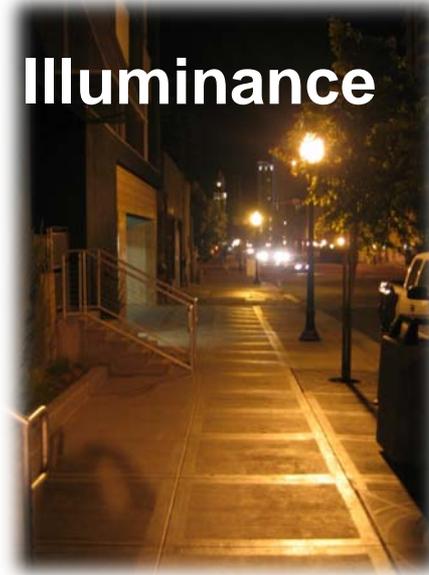


Lighting Design Issues

Uniformity



Illuminance



Luminance



Contrast



Glare



Adaptation



Lighting Design Issue



Glare



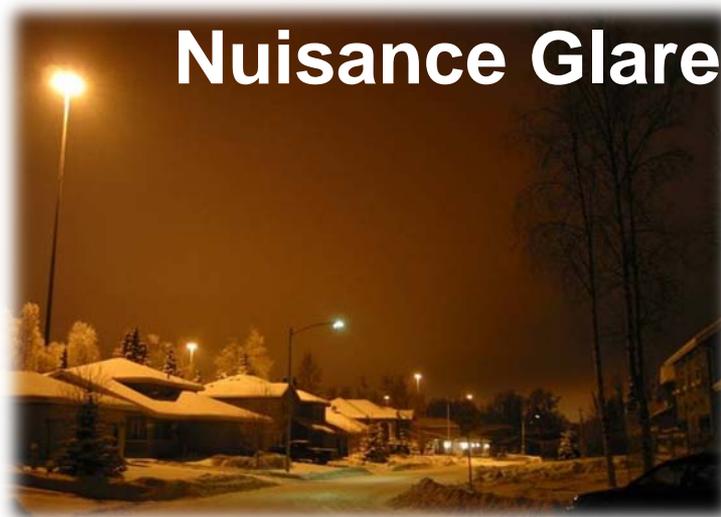
Nuisance Glare



Discomfort Glare

Disability Glare

Glare



Contrast

What do you want to see?



Color Contrast



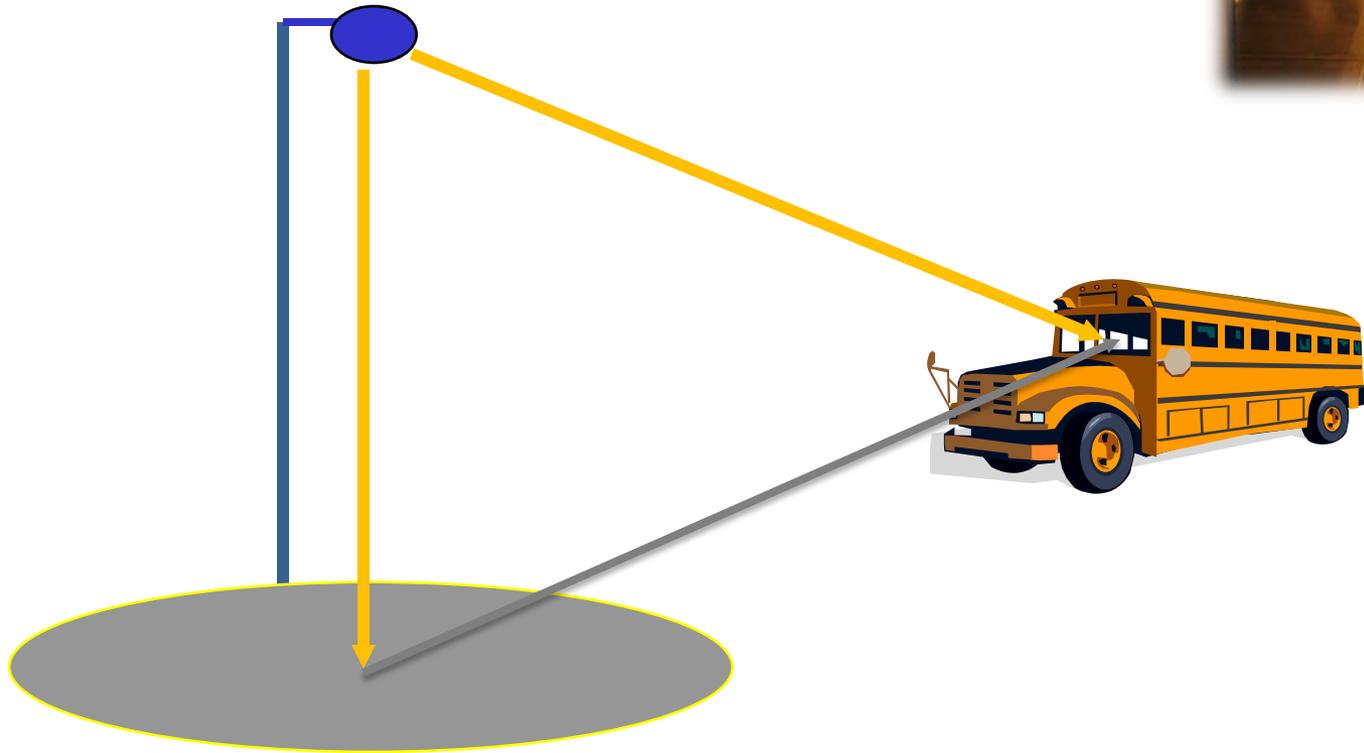
Color Contrast - Detection of People



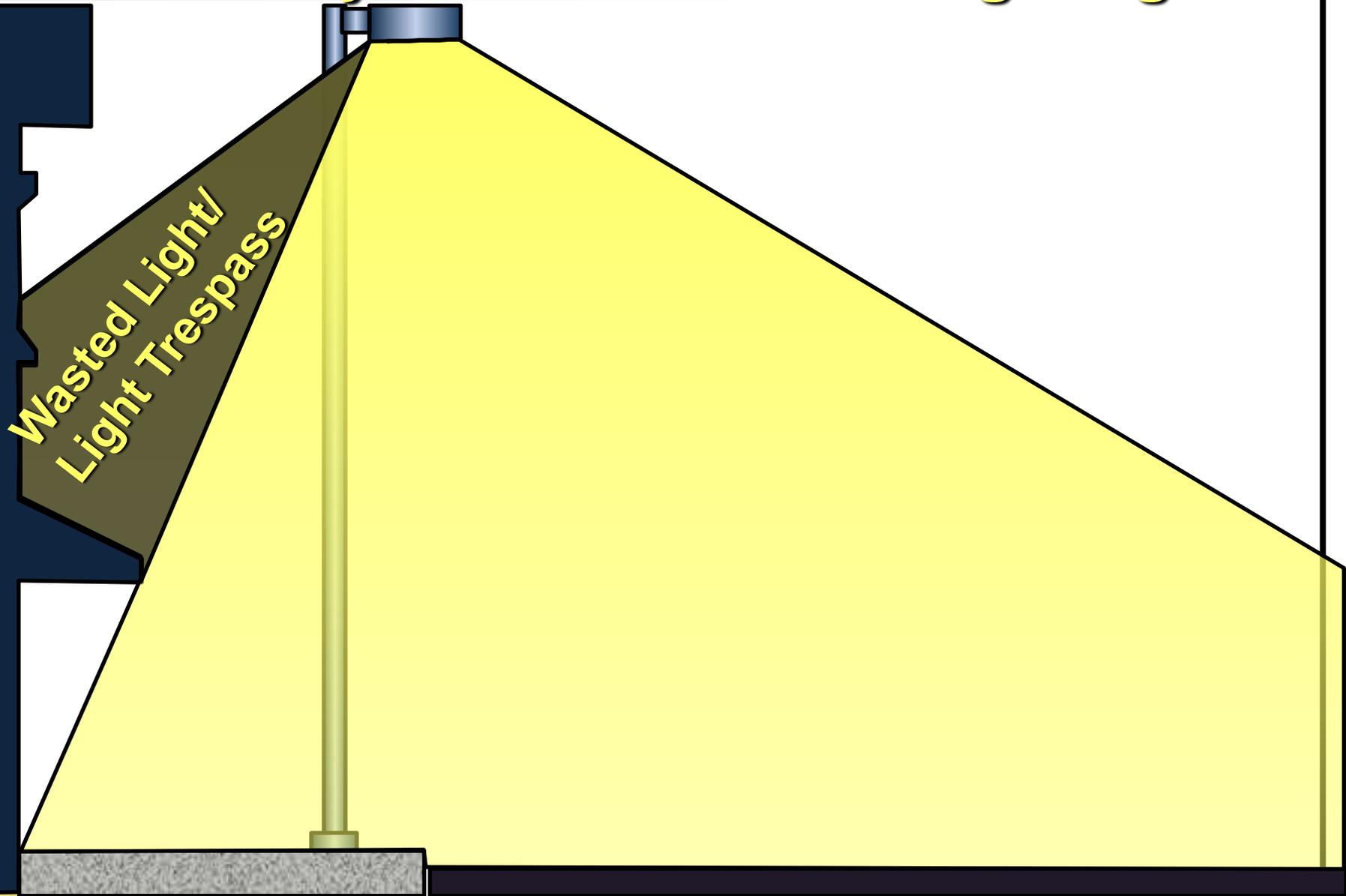
Illuminance Method

Luminance Method

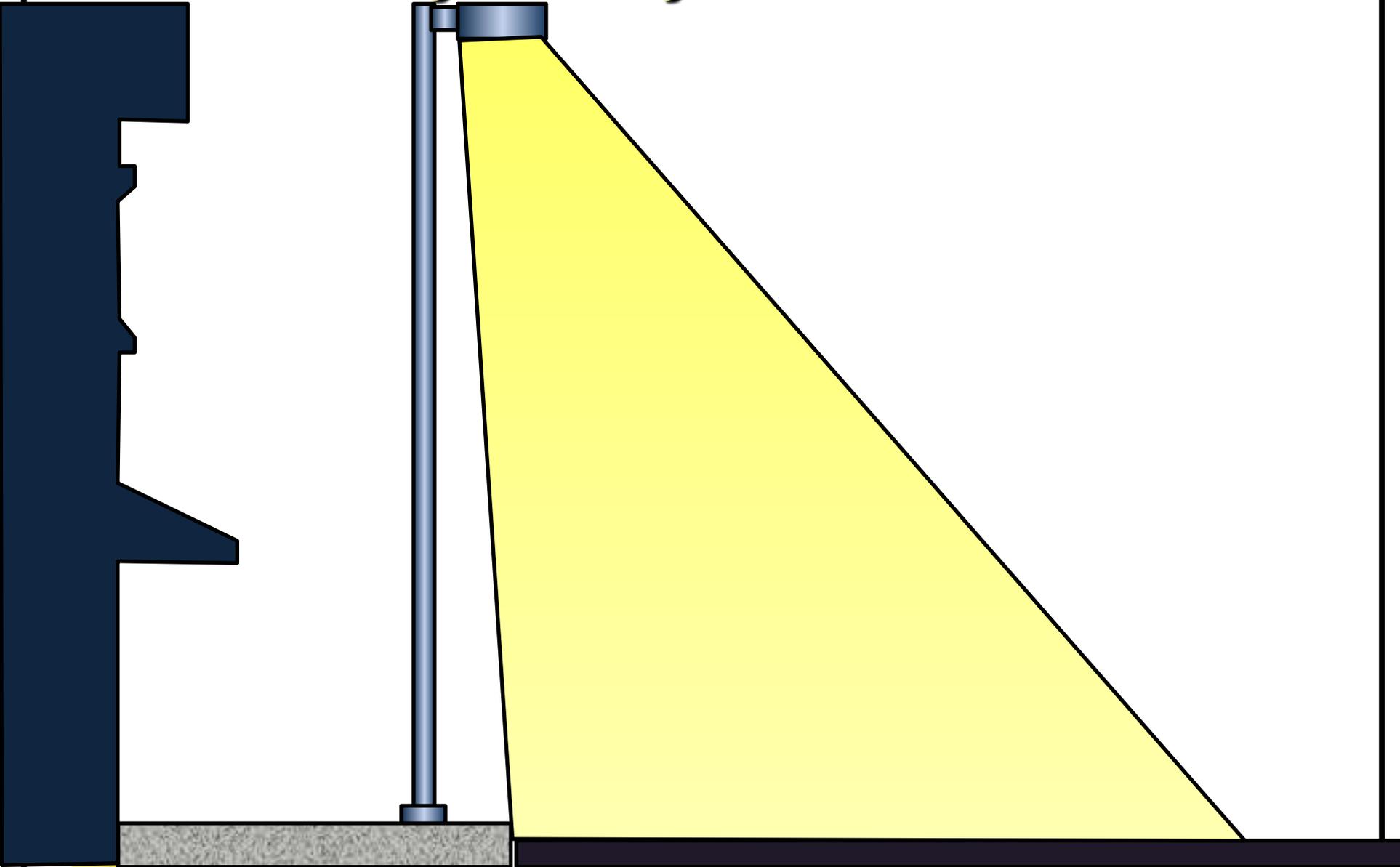
Veiling Luminance



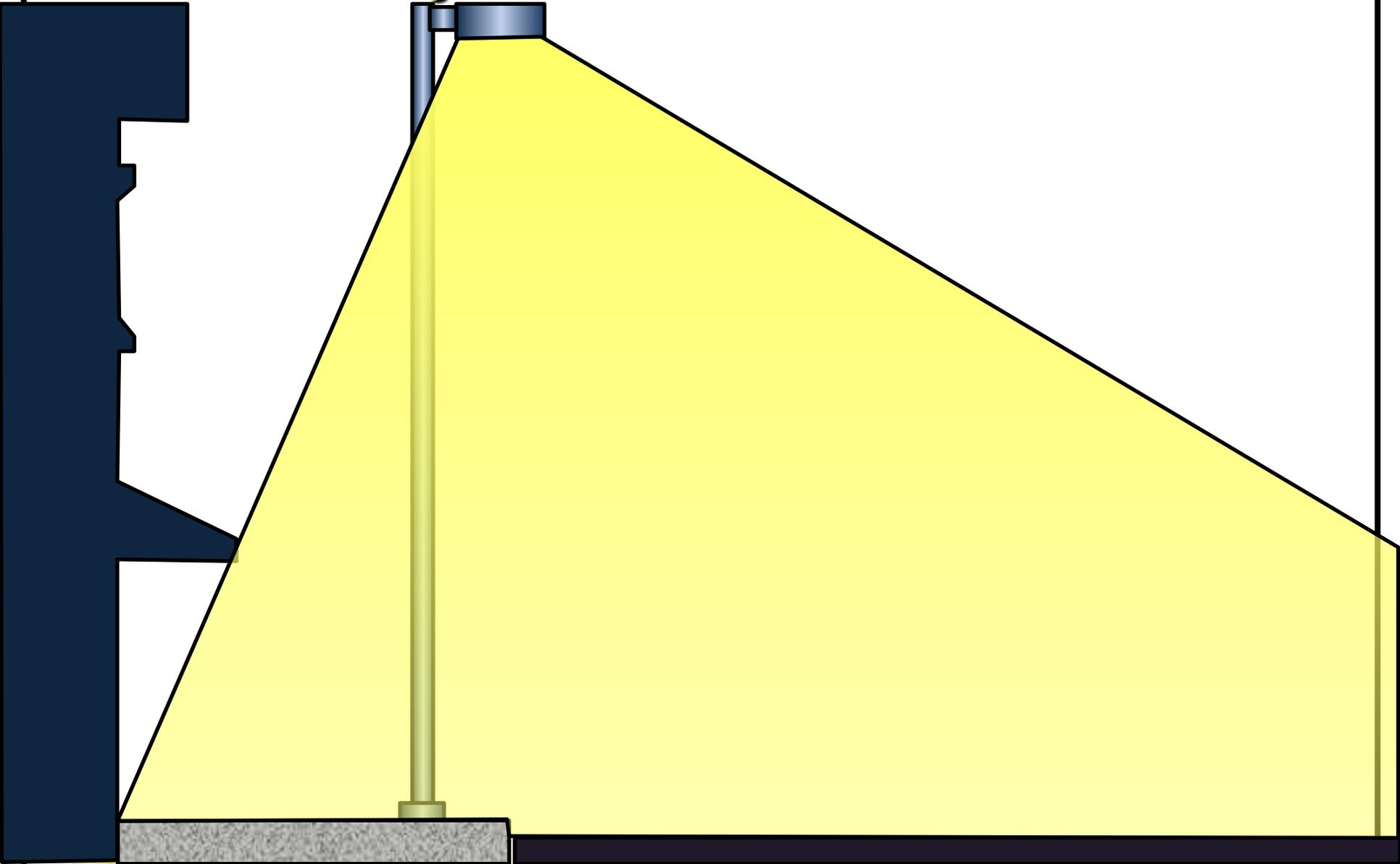
Task Efficiency: Traditional Streetlighting



Task Efficiency: Poorly Defined Task



Task Efficiency: Well defined task



Lamp Comparisons



Description	Life	Color	Maintenance
Induction	Very long 100K hours	Great	Very low
<u>LED</u>	Medium 50K hours	Great	Medium
HPS	Short 24K hours	Poor	High

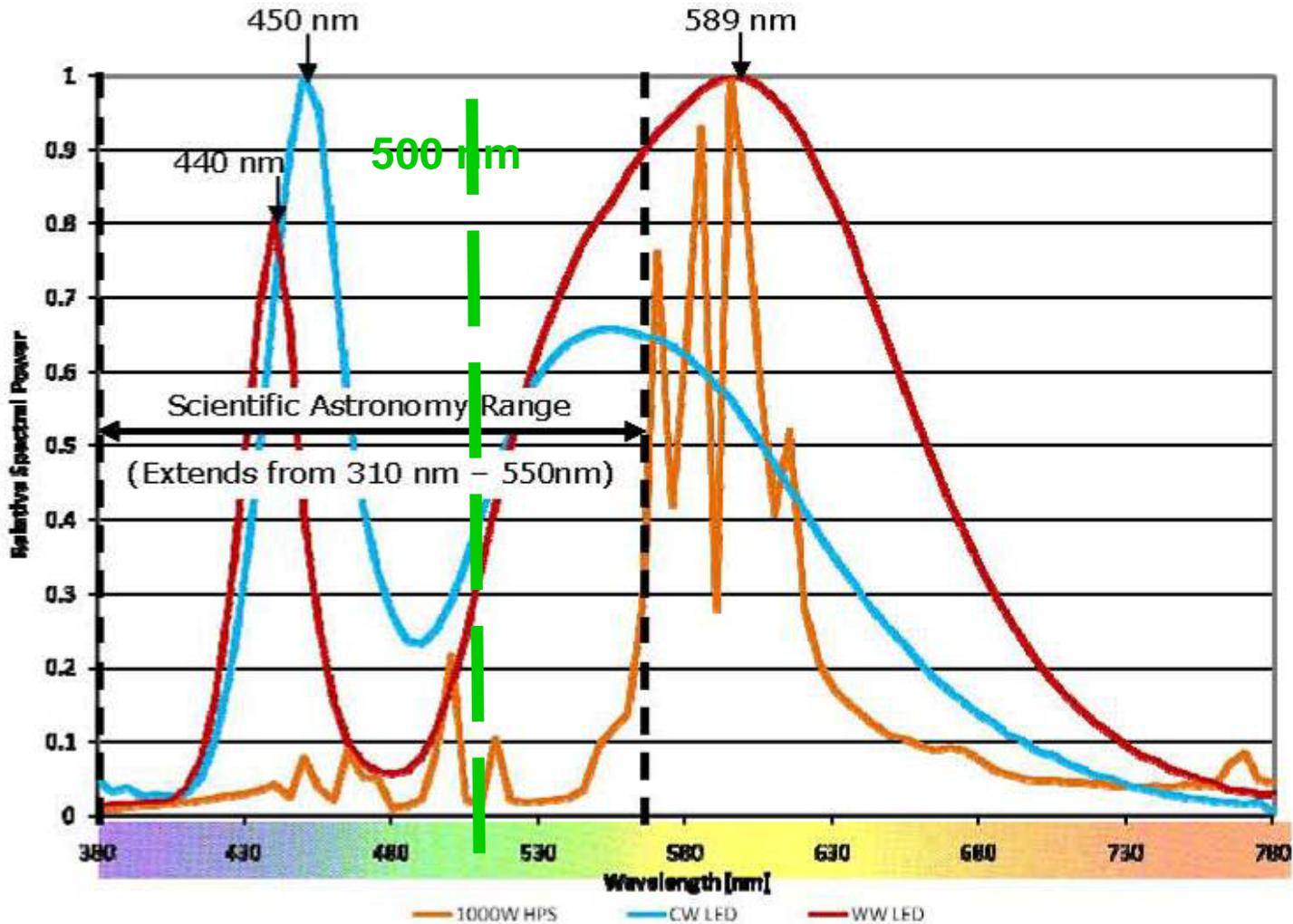
Spectral Distribution (light bulb color) and how it affects visibility

White light increases peripheral detection and renders colors better

Too much **blue** light could affect the environment



Spectral Power Distribution Curves Comparing HPS and LED Sources

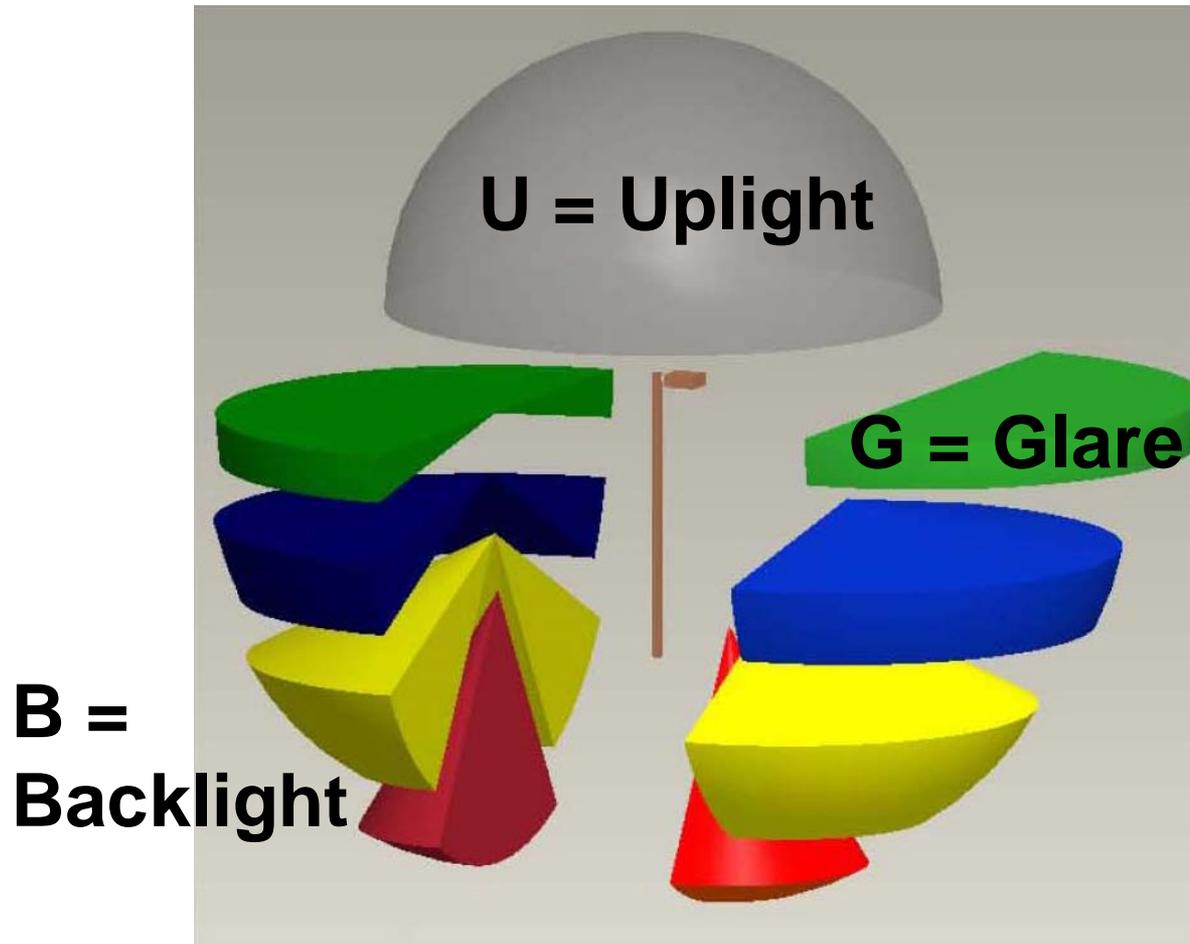


Equipment photometric distribution (BUG)

- Fully shielded
- Mostly shielded
- Minimal shielding
- No shielding

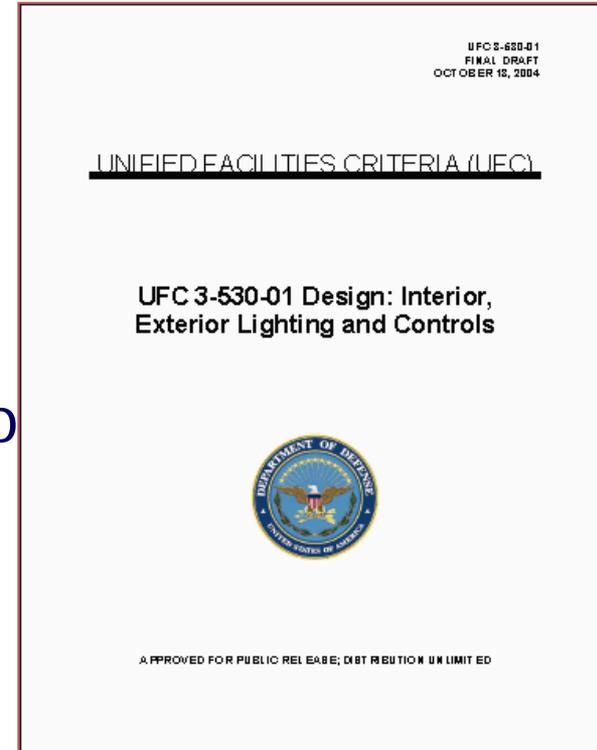


IES TM-15 – Outdoor Luminaire Classification System (BUG)



UFC 3-530-01 Interior, Exterior Lighting and Controls

- Purpose:
 - Provides DoD facility designers the criteria necessary to create effective and efficient lighting designs for the wide variety of facilities. It also introduces emerging technologies to further reduce the energy consumption of DoD Facilities.
- Lead Agency: Navy
 - Point of contact: Richard Cofer
- Current Document Status:
 - Published: Available on the Whole Building Design Guide web site



Design SYSTEMS not just parts



LED SPEC ISSUES



- Heat management
- Correct SPD and Color consistency
- Appropriate BUG rating
- 5+ years warranty for LM-70 (entire system)
- Dimmable (0-10V)
- ALL testing (LM-79, LM-80, Caliper ...)

Great LED applications!



More LED applications



A Tale of Two Three Cities

Anchorage, San Diego, San Jose

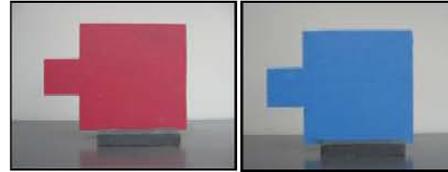


Visibility Tests

- It is an objective assessment
- Response metric (object detection distance)
- Illuminance and luminance metrics (meters mounted on the car)

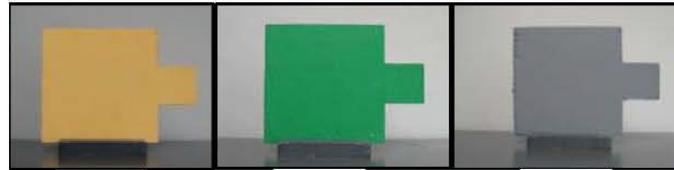


Visibility Test - Targets



Red

Blue



Yellow

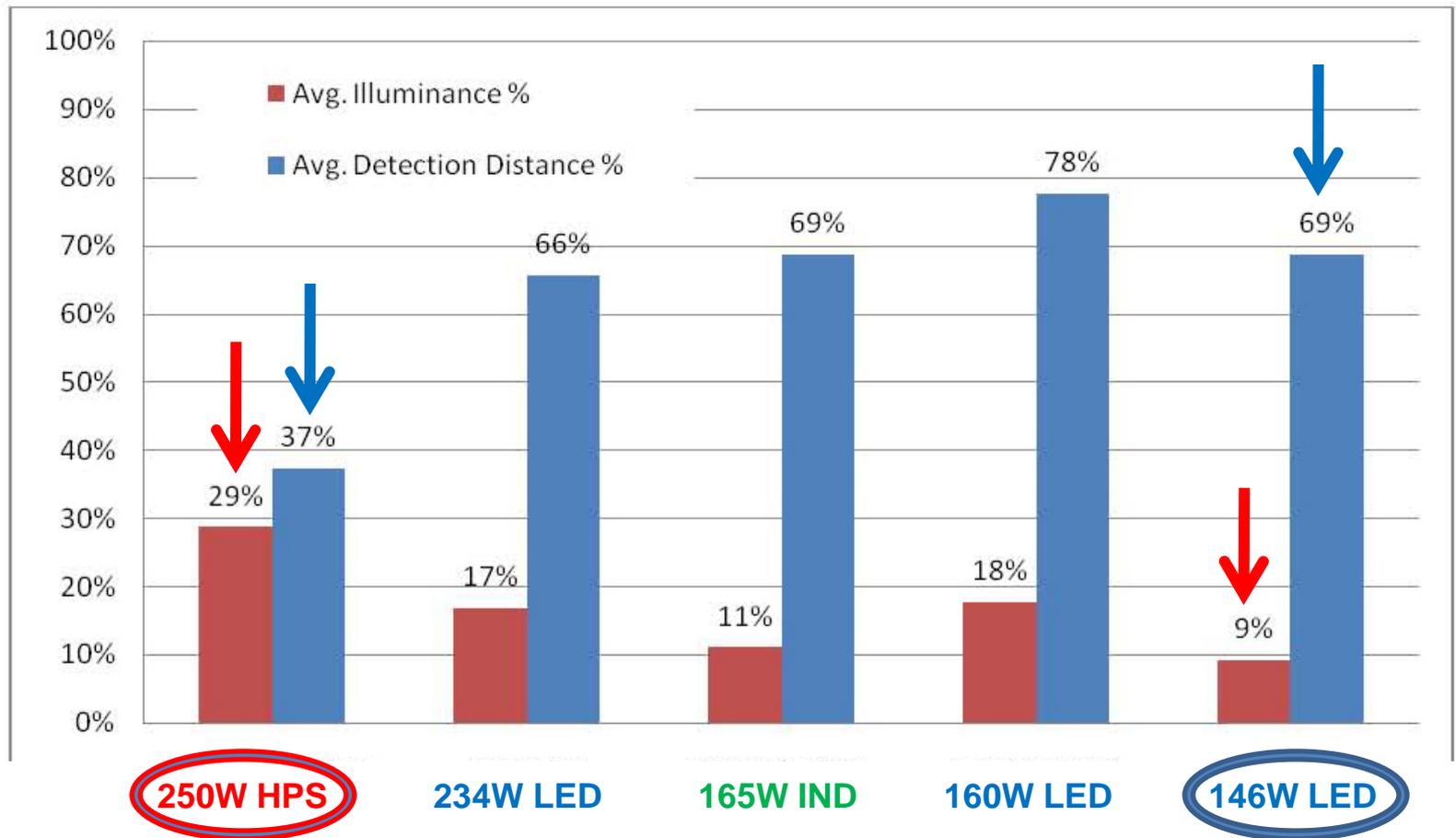
Green

Gray

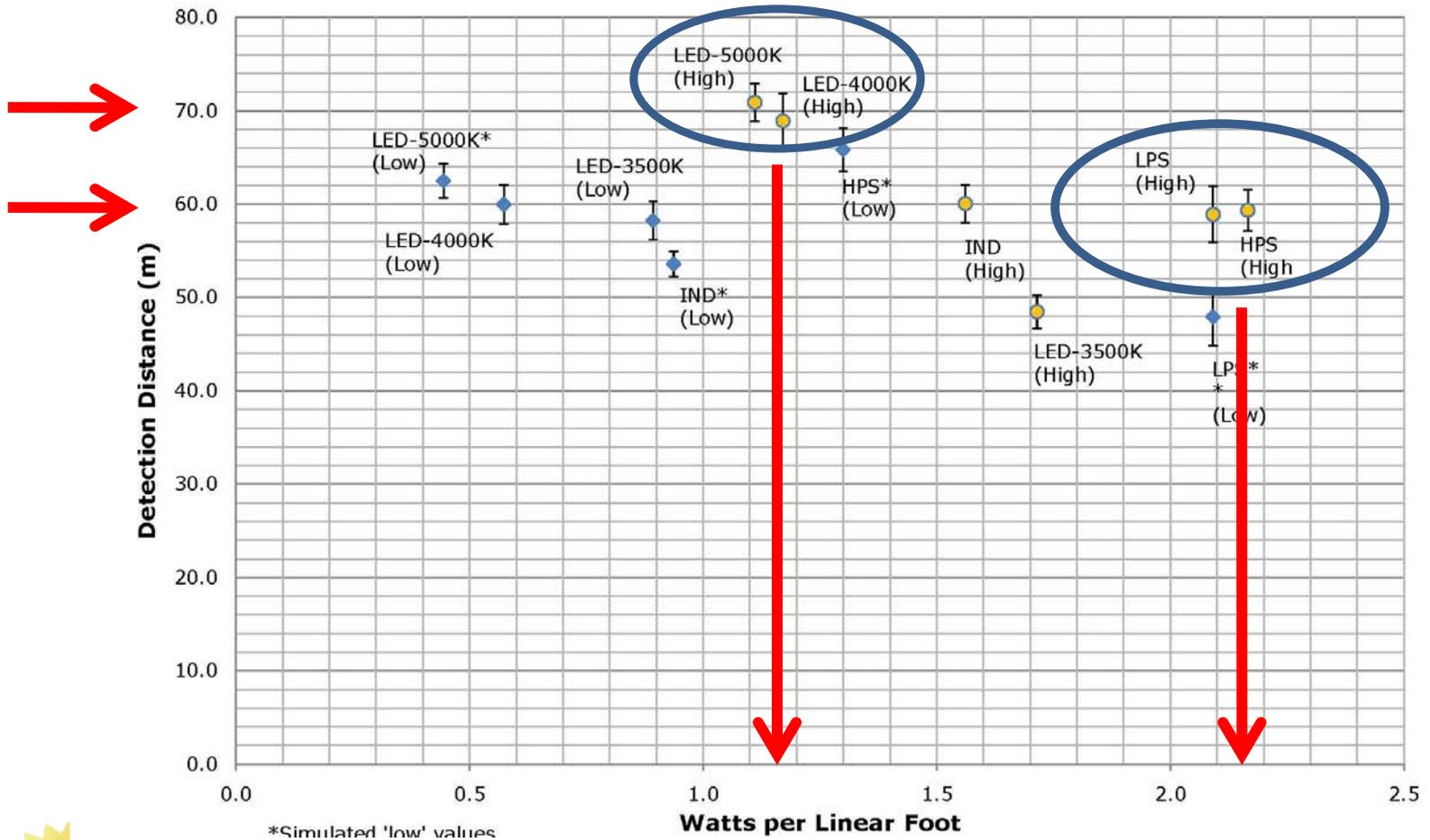
Figure 9: Detection Targets used within Test Areas



Anchorage: Average Illuminance vs Detection Distance (as a % of 400W HPS)



San Jose – Detection distance vs watts per linear feet



Creative Solutions ...





75 – 90% less energy ... and minimizing Light Trespass

LED

150MH

400HPS

Watts

Per 40'

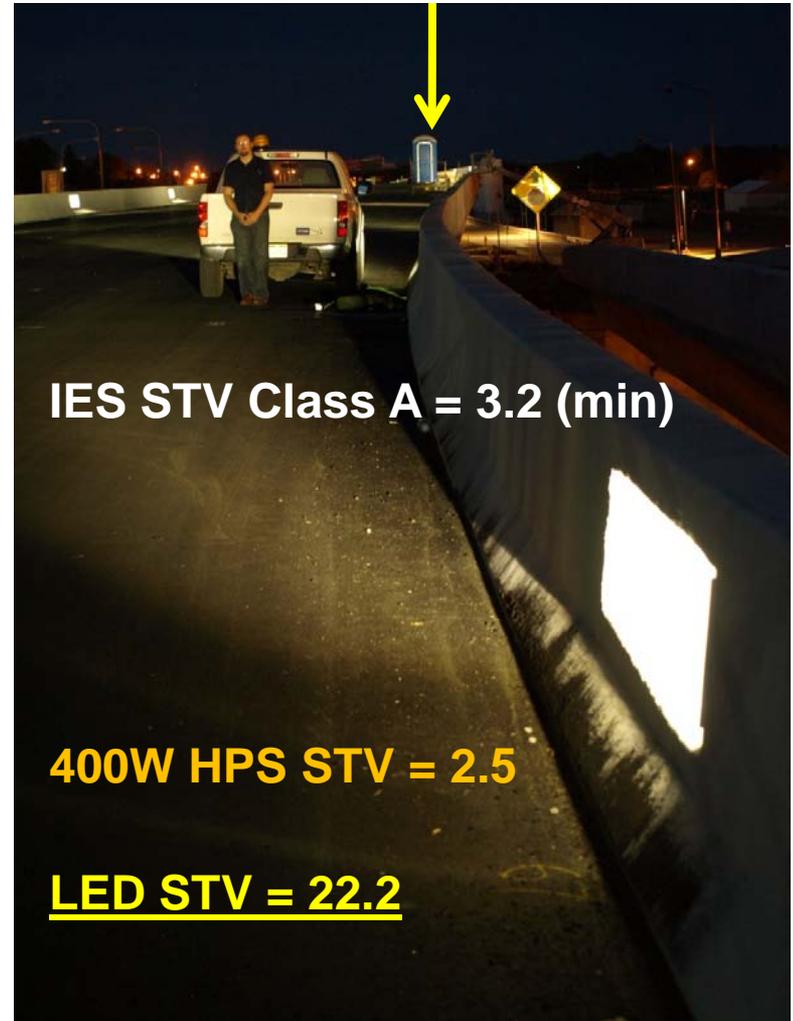
12

44

112



Better Detection?



IES STV Class A = 3.2 (min)

400W HPS STV = 2.5

LED STV = 22.2

Centralized Controls – Smart Grid??

Dimming strategies include

- Curfew
- Seasonal
- Occupancy controls
- Peak load dimming
- Demand response

Two way communication

Outdoor Lighting Operation Status

Virtual Metering (good for adaptive standards)

Warranty Support



Combined Energy and Maintenance Saving Potential – 50 to 70%



Questions?



Nancy Clanton PE, FIES, IALD, LC, LEED AP
Clanton & Associates, Boulder, CO