



# Lighting Product Innovation

---

DOE SSL R&D Workshop

January 29<sup>th</sup> 2020

Mark Hand

The background of the slide features a photograph of a city street at night, with tall buildings and streetlights. A large, semi-transparent white triangle is overlaid on the right side of the image. The Acuity Brands logo is positioned in the bottom right corner, within the white triangle.

**Acuity**Brands.

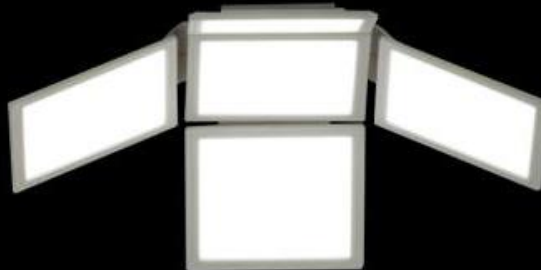
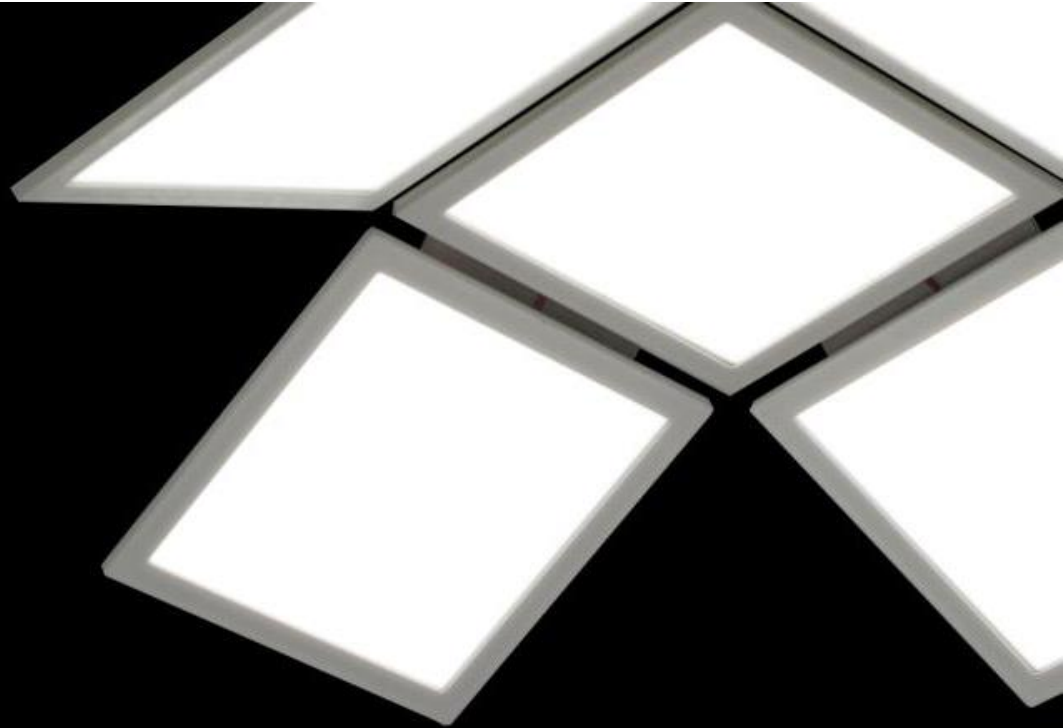
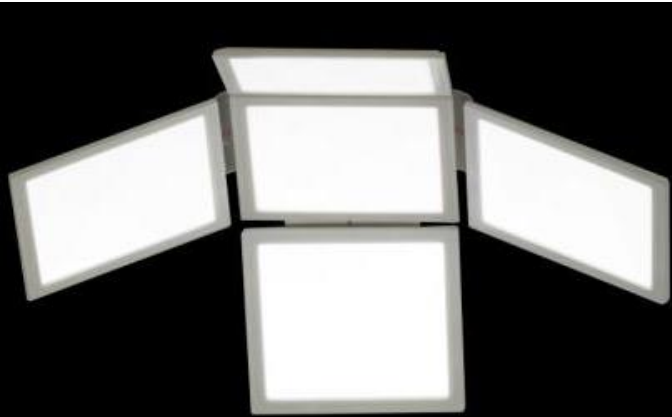
# Agenda

- Introduction
- Genesis
  - Indoor Lighting
  - Early Outdoor Lighting
  - Glare
  - Market response
  - Roadmap Journey
- Radean
- Conclusion



# Genesis

- Indoor Lighting
  - OLED
    - Comfortable
    - Approachable



# Genesis

- Indoor Lighting
  - Troffer Trends
    - Vanilla Popularity
    - Less Glare
    - Edgelit Lighting Panels



# Genesis

- Outdoor Lighting
  - Early Days
    - Great Layouts
    - Improvements over HID



# Genesis

- Outdoor Lighting
  - Early Days
    - Great Layouts
    - Improvements over HID
    - Still Glare Bombs



# Genesis

## Discomfort glare in outdoor sports and area lighting (CIE-112 1994)

### ■ Outdoor Lighting

- Glare
- Trending
- Ongoing Research
- UGR Metrics

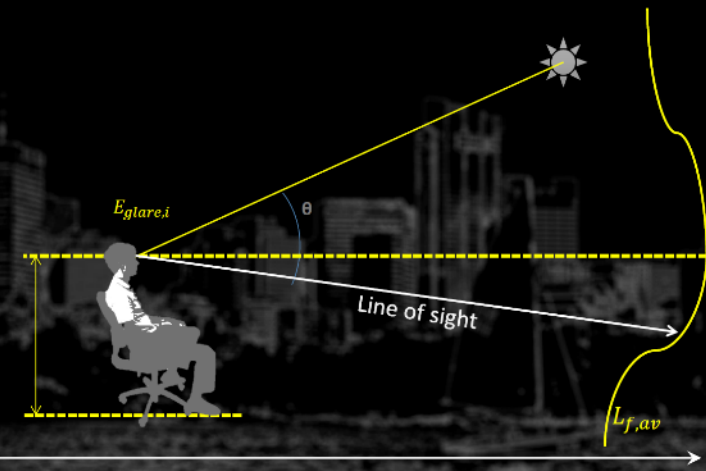
$$GR = 27 + 24 \log \left( \frac{L_{vl}}{L_{ve}^{0.9}} \right)$$

$$L_{vl} = 10 \sum_{i=1}^n \frac{E_{glare,i}}{\theta_i^2}$$

$$L_{ve} = 0.035 \times L_{f,av}$$

$$L_{f,av} = E_{hor,av} \times \frac{\rho}{\pi}$$

| glare control mark GF |                 | glare rating GR |
|-----------------------|-----------------|-----------------|
| 1                     | unbearable      | 90              |
| 2                     |                 | 80              |
| 3                     | disturbing      | 70              |
| 4                     |                 | 60              |
| 5                     | just admissible | 50              |
| 6                     |                 | 40              |
| 7                     | noticeable      | 30              |
| 8                     |                 | 20              |
| 9                     | unnoticeable    | 10              |



[https://www.energy.gov/sites/prod/files/2016/11/f34/tyukhova\\_glare\\_denver2016.pdf](https://www.energy.gov/sites/prod/files/2016/11/f34/tyukhova_glare_denver2016.pdf)

# Genesis



- Market Response
  - Parking Garage
  - Visually Comfortable



**Credit: Cooper Lighting Solutions**

[http://www.cooperindustries.com/content/public/en/lighting/products/parking\\_garage\\_and\\_canopy/\\_848908.html](http://www.cooperindustries.com/content/public/en/lighting/products/parking_garage_and_canopy/_848908.html)

# Genesis

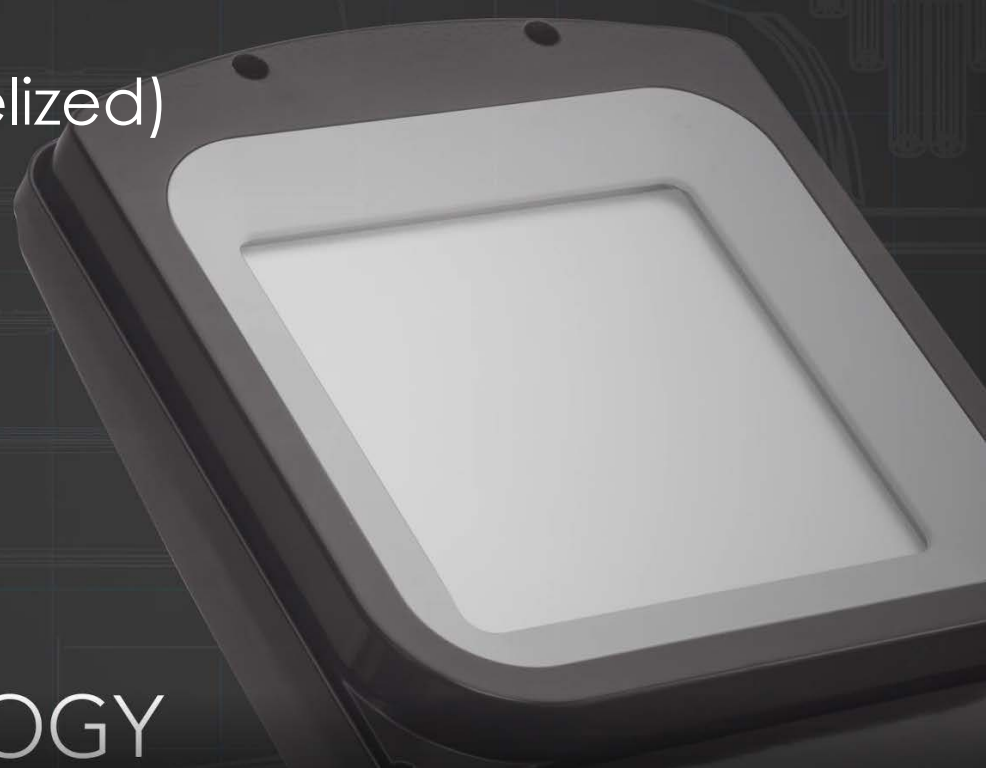


- Market Response
  - DSX VC

# Genesis

- Market Response
  - DSX VC
  - Uniform Source (non-pixelized)

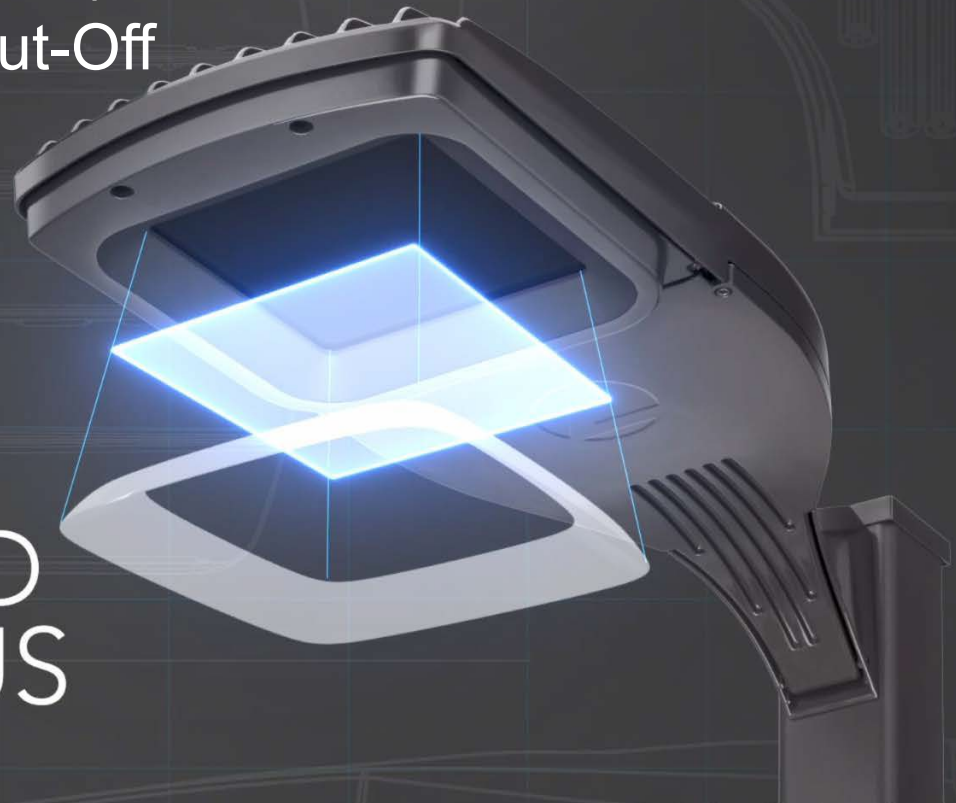
LIGHT  
GUIDE  
TECHNOLOGY



# Genesis

- Market Response
  - DSX VC
  - Uniform Source (non-pixelized)
  - Recessed for High Angle Cut-Off

RECESSED  
LUMINOUS  
SURFACE



# Genesis

## ■ Market Response

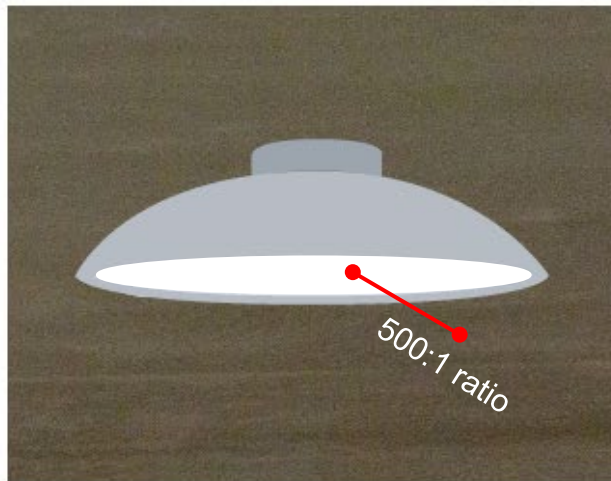
- DSX VC
- Uniform Source (non-pixelized)
- Recessed for High Angle Cut-Off
- Transition Zone
  - Contrast Ratios



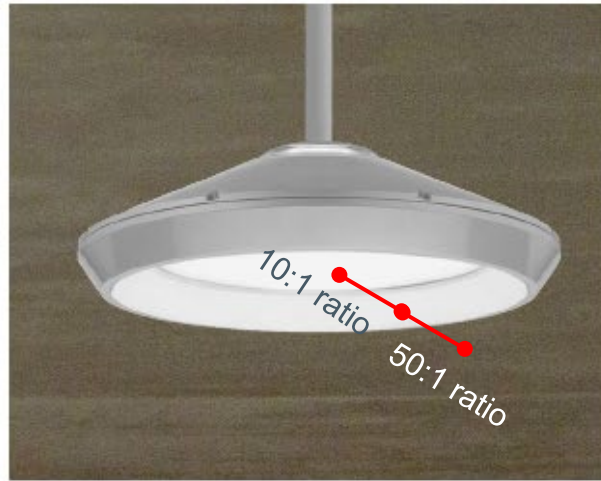
# Genesis



- Market Response
  - VCPG



Competition



Transition Zone



Transition Zone + Up-Light



## Introducing the **RADEAN** Family from Lithonia Lighting

### Forms

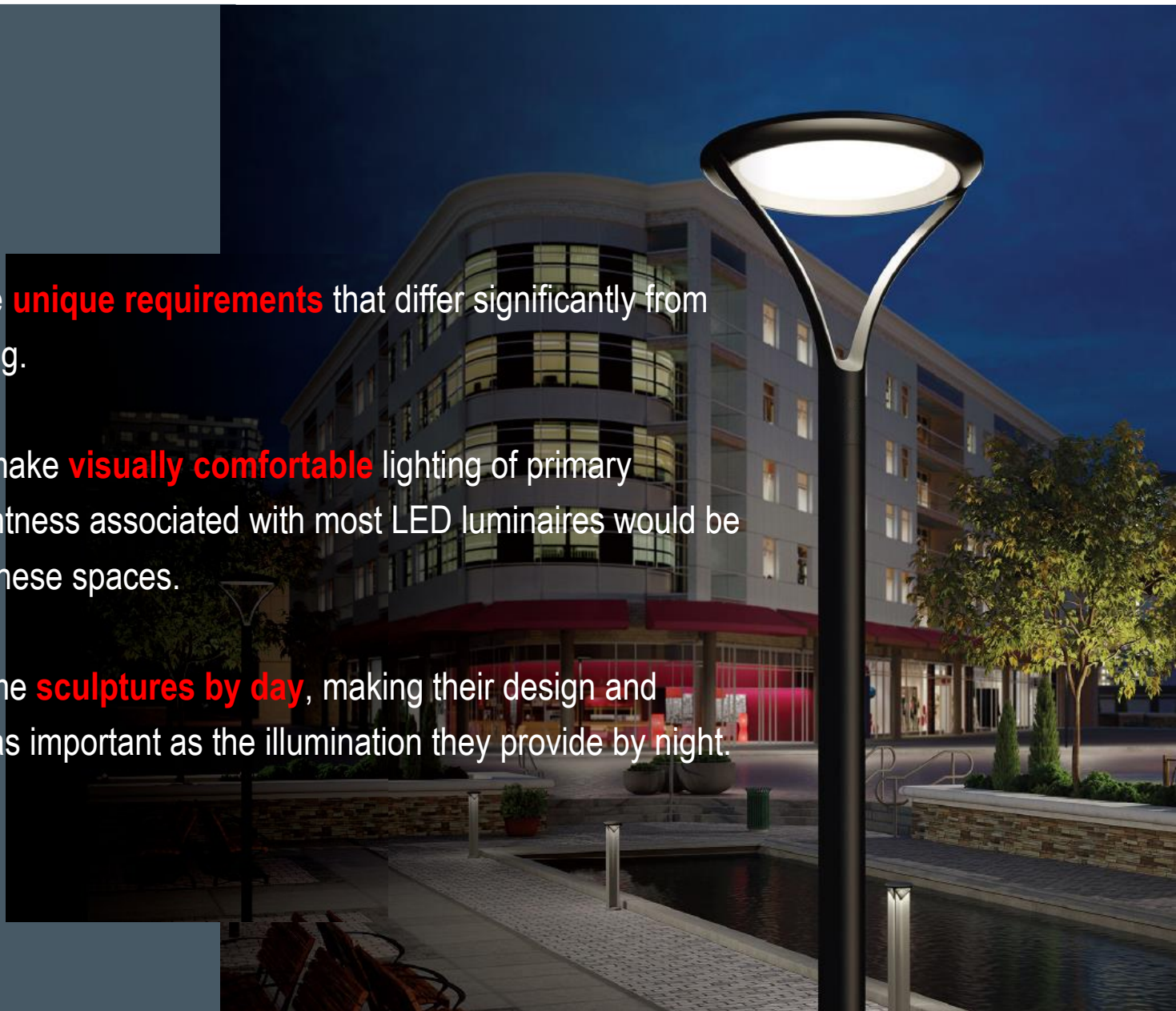
- Post Top
- Arm Mount
- Bollard

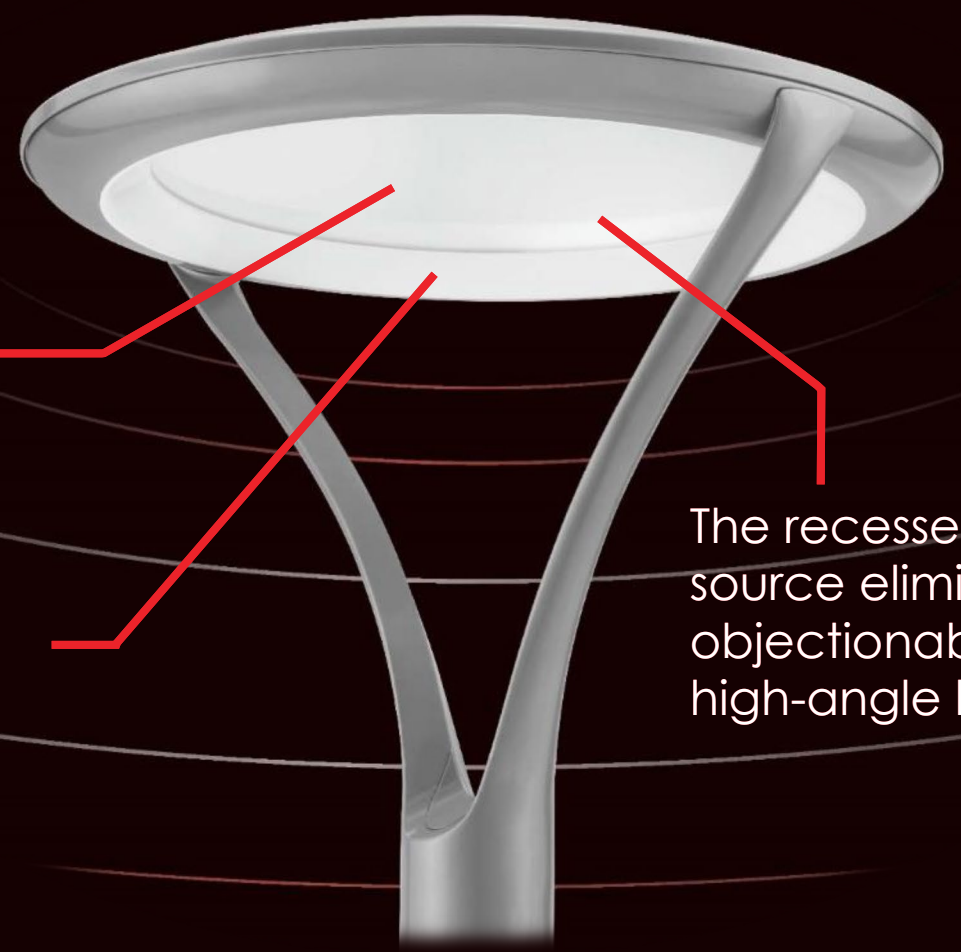
- 
- Urban pedestrian spaces are a **rapidly-growing** segment
  - This **emerging trend** provides public spaces for pedestrians to mingle and socialize
  - Nighttime use of these spaces requires **specialized lighting** that enhances the occupant's experience.

Pedestrian spaces have **unique requirements** that differ significantly from typical parking lot lighting.

Low mounting heights make **visually comfortable** lighting of primary importance, as the brightness associated with most LED luminaires would be highly objectionable in these spaces.

These luminaires become **sculptures by day**, making their design and construction detail just as important as the illumination they provide by night.





The uniformly luminous waveguide has low surface brightness

The diagram shows a cross-section of a luminaire. A circular waveguide at the top emits light rays downwards. A transition zone narrows the waveguide, creating an intermediate luminous surface. The light rays are shown as a series of concentric arcs, indicating a recessed source that eliminates objectionable high-angle light.

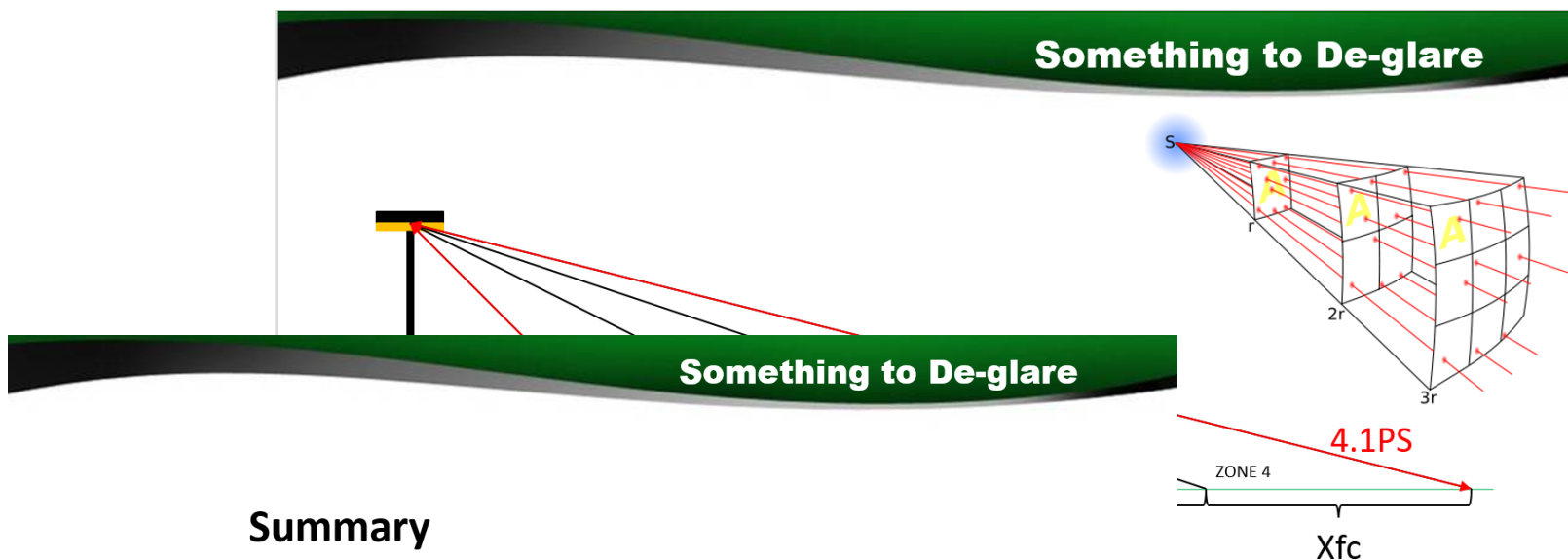
The transition zone creates an intermediate luminous surface to reduce contrast

The recessed source eliminates objectionable high-angle light

# Conclusion

- Innovation or Evolution?





## Summary

- Longer Pole Spacings induce glare
- ~~Cheaper Brighter LEDs~~ do not reduce Pole Costs
- Is the current LED architecture moving in the right direction?
- Could Big and Dim be better than Small and Bright?

es that of Zone 1

# I Told You So

## 2011 R&D Workshop

# Thank You