Visibility - Contrast

We need contrast to see objects

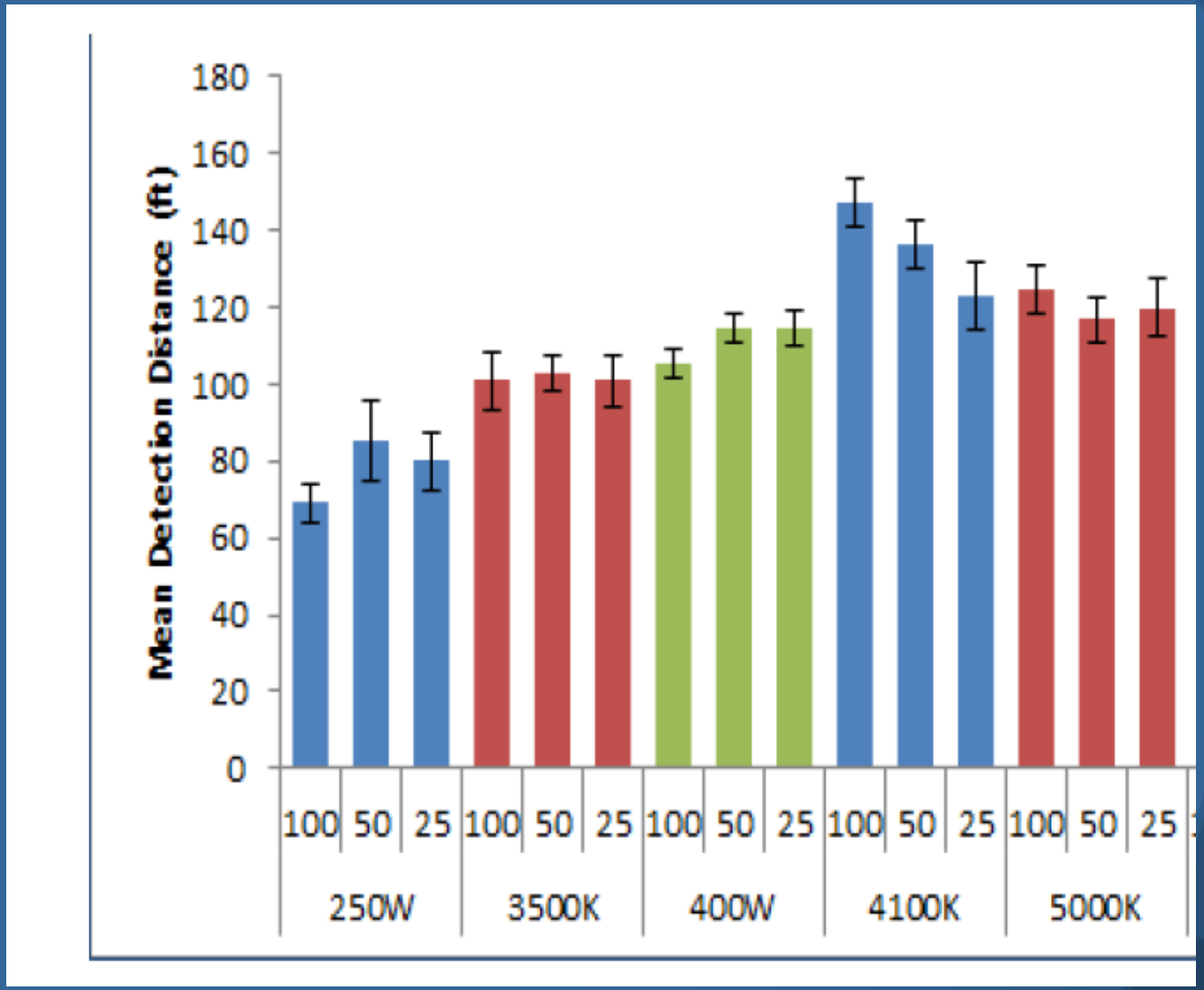
- Negative / Positive - Prefer positive

Figure 2-14 – Examples of Negative and Postive Contrast.

Color Contrast

Spectral Power Distribution of light sources not considered when defining lighting levels

Object Detection Distance Study

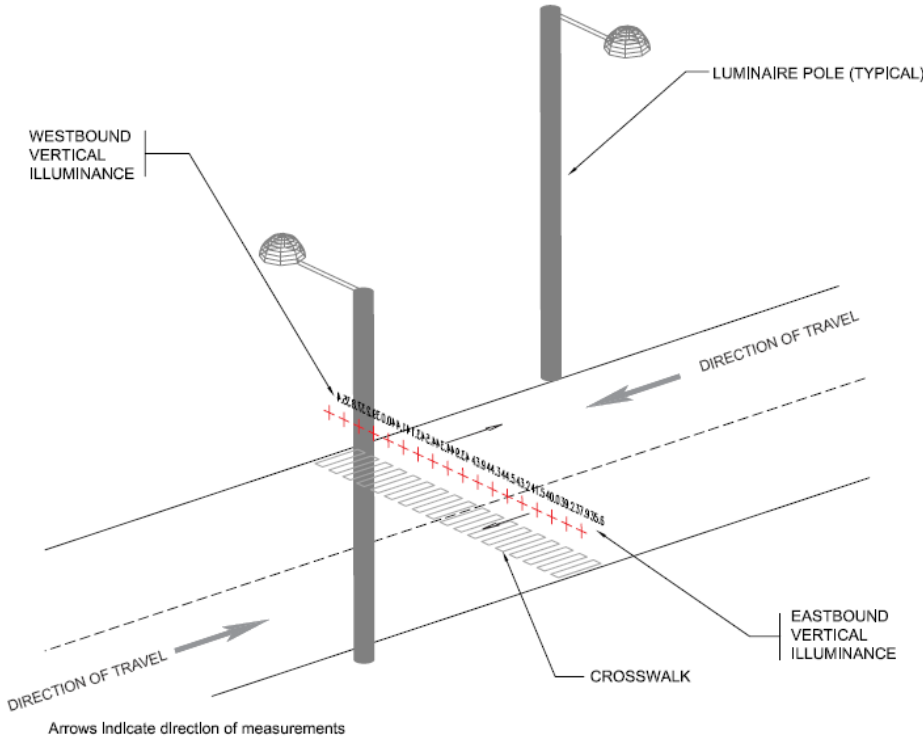


2014 REPORT #E14-286 Seattle LED Adaptive Lighting Study

Crosswalks

- It was found that in Europe, a level of 40 vertical lx was used in all crosswalks. This level reduced nighttime vehicle to pedestrian crashes by 66% (FHWA PL-01-034)
- A VTTI study defined lighting level of 20 vertical lux seems sufficient for crosswalks (FHWA-HRT-08-053)
- Currently defined in IESNA RP-8-18

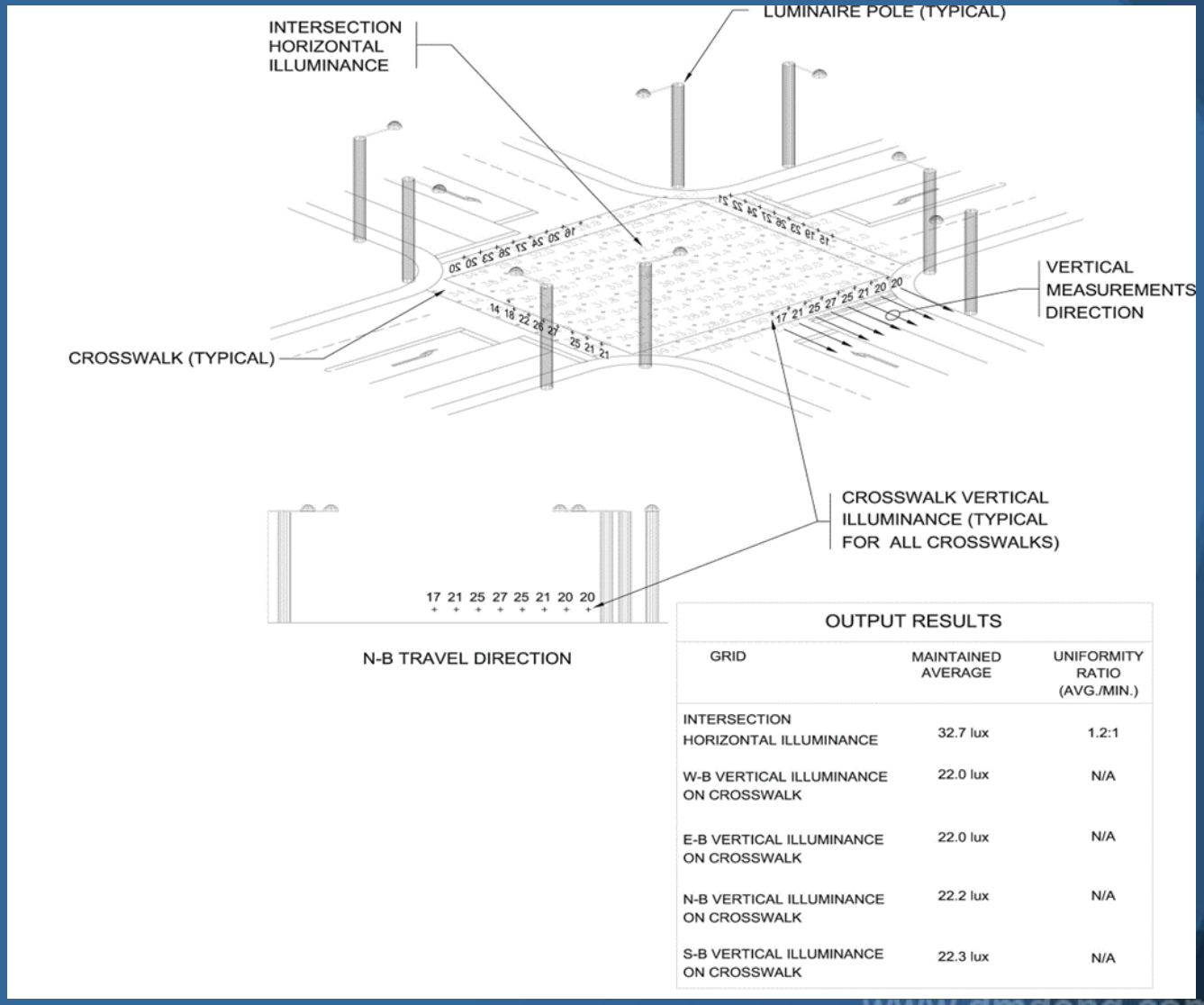
Crosswalk Lighting



Arrows Indicate direction of measurements

OUTPUT RESULTS	
GRID	MAINTAINED AVERAGE
W-B VERTICAL ILLUMINANCE	41.1 lux
E-B VERTICAL ILLUMINANCE	41.1 lux

Intersections



OUTPUT RESULTS

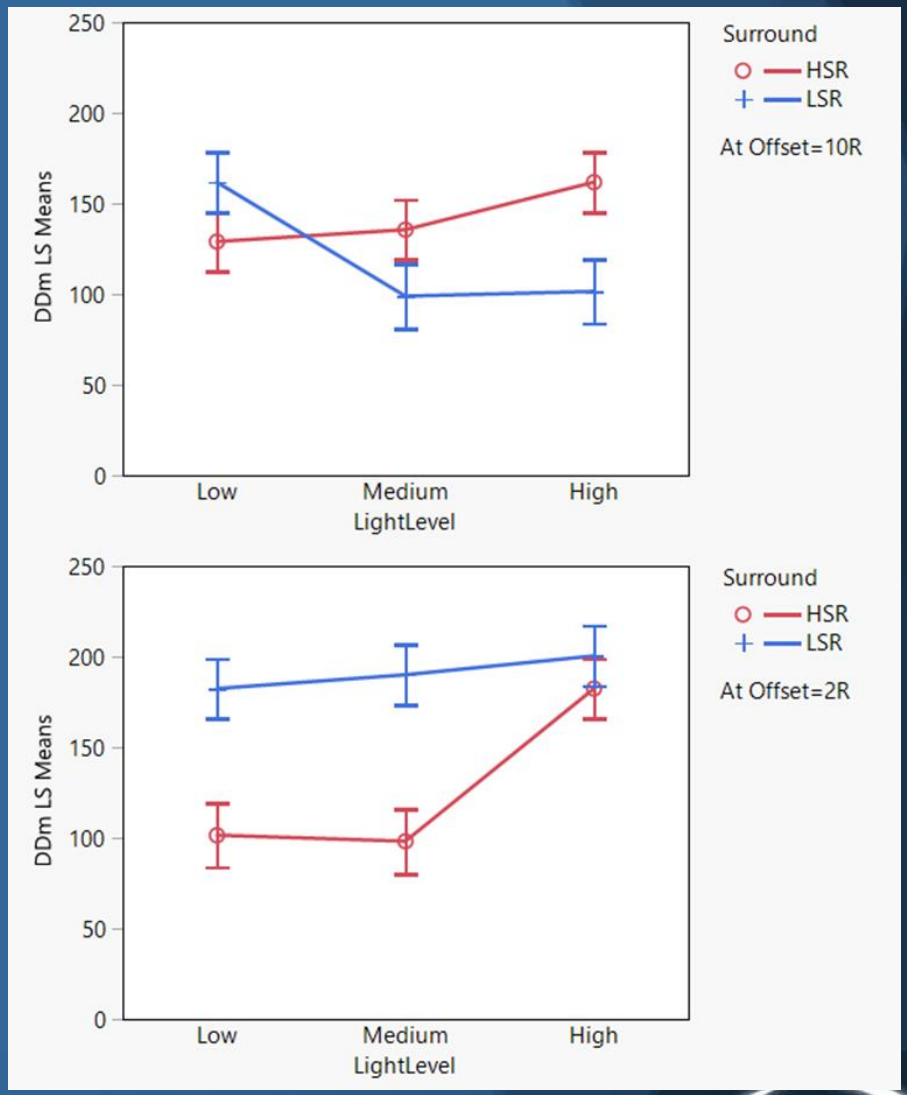
GRID	MAINTAINED AVERAGE	UNIFORMITY RATIO (AVG./MIN.)
INTERSECTION HORIZONTAL ILLUMINANCE	32.7 lux	1.2:1
W-B VERTICAL ILLUMINANCE ON CROSSWALK	22.0 lux	N/A
E-B VERTICAL ILLUMINANCE ON CROSSWALK	22.0 lux	N/A
N-B VERTICAL ILLUMINANCE ON CROSSWALK	22.2 lux	N/A
S-B VERTICAL ILLUMINANCE ON CROSSWALK	22.3 lux	N/A

Surround Lighting

- Surround is the area off the roadway (sidewalk, bike lane, etc)
- Solid State Luminaires have focused on tight optical controls to reduce light spill off the roadway. This creates a dark surround
- Current IESNA standards do not define “Surround Lighting”
- CIE 140:2000 and 115:2007 define a surround ratio of 0.5 to 1.
- Recent research show significant object detection distance benefit for high vs low surround lighting

Surround Lighting

- At 10 ft. Offset
  - Low SR had lower detection distances at Medium and High Light Levels
- At 2 ft. Offset
  - High SR had lowed detection distances at Low and Medium Light Levels
- Light off the roadway to improve Detection Distance



Low (0.7 cd/m2)
Medium (1.0 cd/m2)
High (1.5 cd/m2)

Bicycles

- 900+ cyclist fatalities and 35,000+ serious cyclist injuries (requiring hospitalization).
- The US has a much higher fatality and serious injury rates per kilometer cycled than comparable high-income countries.

The Centers for Disease Control and Prevention's injury statstics 2014,

- Bike lanes and usages increasing
- Bikes at high risk
- Issues include distracted drivers, lack of visibility, etc

Bicycles

- Marked bike lanes are relatively new
- Lighting standards are currently very unclear and don’t deal with conflict points
- Some apply sidewalk levels whereas some simply apply roadway levels to bike lanes
- Vertical levels maybe of benefit – Expect IESNA to be updated to better clarify and define requirements

Security

Crime Prevention Through Environmental Design (CPTED)

- Natural surveillance key (park or lane vs street)
- Lighting can provide a false sense of security in isolated areas.
- Fight or Flight (need visibility)
- Surround can impact visibility

Research and Publications

- NCHRP 05-22 GUIDELINES FOR SOLID STATE ROADWAY LIGHTING (surround lighting testing) - underway
- IDOT and VDoT Intersection Lighting Studies (underway)
- Melatonin Suppression Study (underway)
- Seattle Crosswalk Study (Report #E14-286)
- ADOT - Colour Temperature Study (not public yet)

- Safety (Vision Zero – many cities on board)
- IESNA has a Vision Zero Task force as it relates to lighting
- New IESNA RP-8-18 to be issued -