

Evaluating LED Street Lighting Solutions

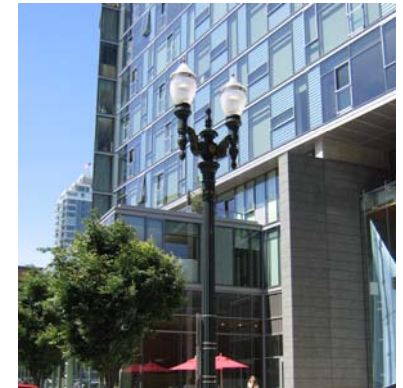
Portland, Oregon



**DOE Municipal Solid-State Street Lighting Consortium
Market Introduction Workshop Webcast – July 20, 2010**

Portland Signals, Street lighting & ITS Division

- **54,000 Street Lights**
 - 44,000 Option “B” street lights
 - (city-owned, utility-maintained)
 - 10,500 Option “C” street lights
 - (city-owned and city-maintained)
- **1,010 Traffic Signals**
 - Central Computer System
 - Communication Network
 - Controllers
 - Hubs
 - Twisted-pair & fiber optic lines
 - Traffic Operations Center



Why is Portland Interested in Solid State Lighting?

- **High Electric Bill (\$6 mil. per year)**
- **Competition with Police, Fire, etc. for General Funds**
- **Sustainability goals:**
 - **Reduce greenhouse gas emissions 10% below 1990 levels**
 - **Invest in energy efficiency measures with \leq 10-yr payback**
- **Street light infrastructure reaching end of useful life**
- **Solid State Lighting Potential**
 - **Energy Savings**
 - **Lighting Monitoring and Controls**

Partnerships

- **Portland Bureau of Planning and Sustainability**
- **Energy Trust of Oregon**
- **Portland General Electric**
- **PacifiCorp**
- **Pacific Northwest National Laboratory**
- **Northwest Energy Efficiency Alliance**
- **Municipal Solid-State Street Lighting Consortium**



SSL Demonstration Projects

- **Lija Loop Gateway Project**
 - LED Assessment
- **Willamette Bluff Light Post Gateway Project**
 - Comparison of Light Sources
 - HPS
 - Induction
 - LED

Lija Loop Demonstration Project - 2008

- 30-home Subdivision
- Eight Street Lights
- 53% Reduced Light Output
- 7.6 year payback for new
- 20.1 year payback for retrofit
 - Today 5-10 yr payback

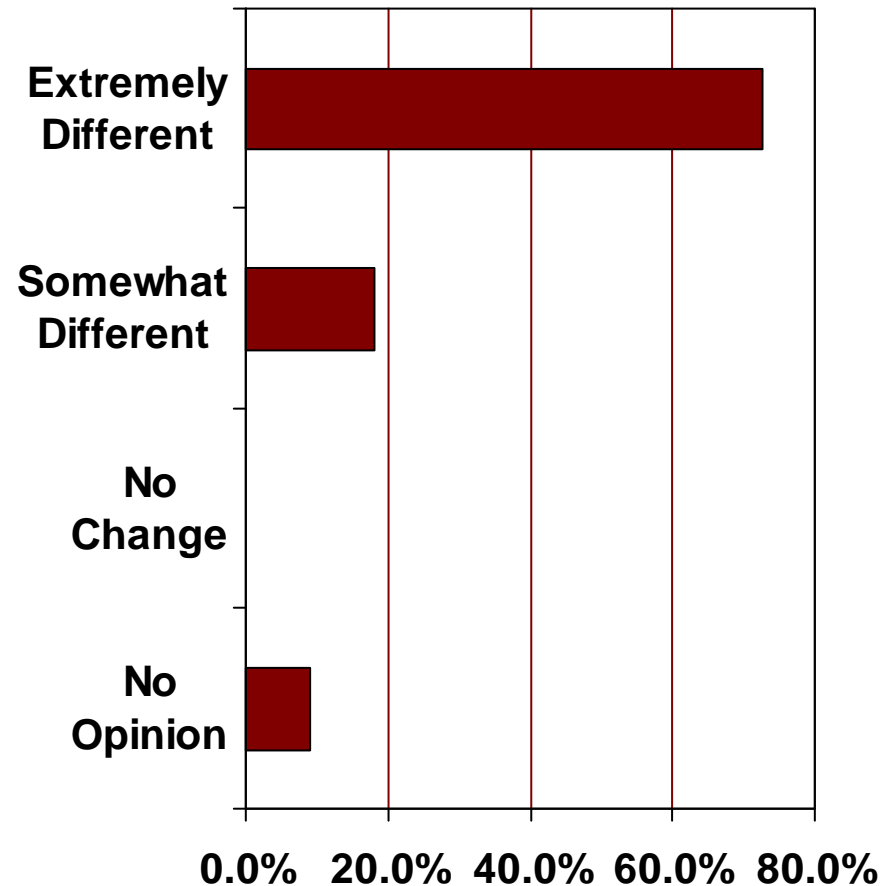


Lija Loop Neighborhood Survey

- **Questionnaires were distributed one month following LED installation**
- **Every home received a questionnaire**
- **36.7 % response rate**
- **Comments were generally positive**

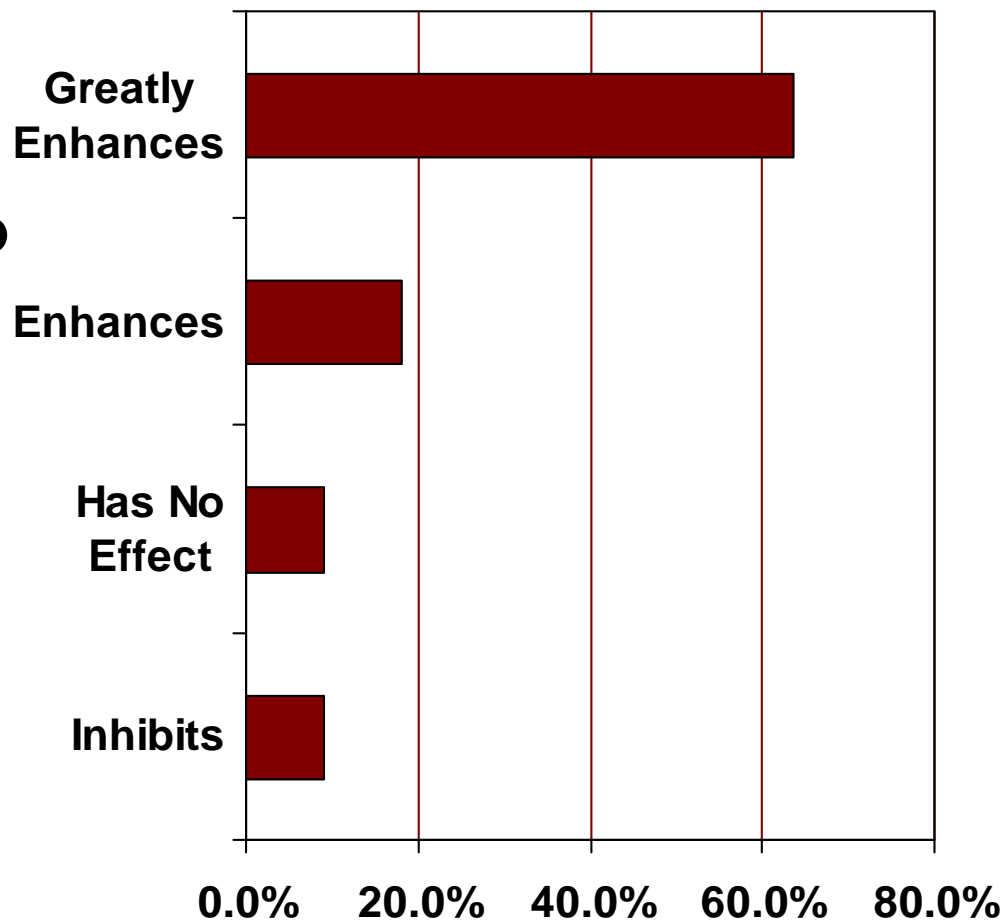
Lija Loop Neighborhood Survey

- “Compared to the standard street lighting on Gertz Road, how would you characterize the lighting on Lija Loop?”



Lija Loop Neighborhood Survey

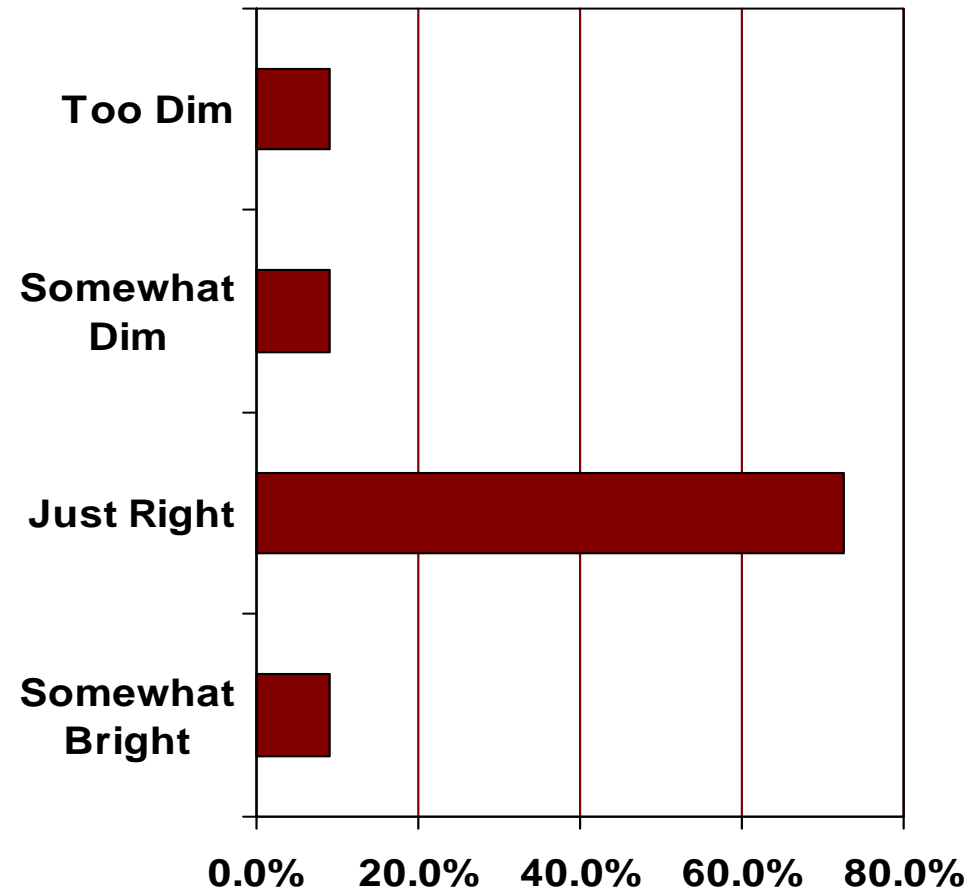
- “The quality of street lighting on Lija Loop _____ my ability to see the street and objects that are on it?”



Lija Loop Neighborhood Survey

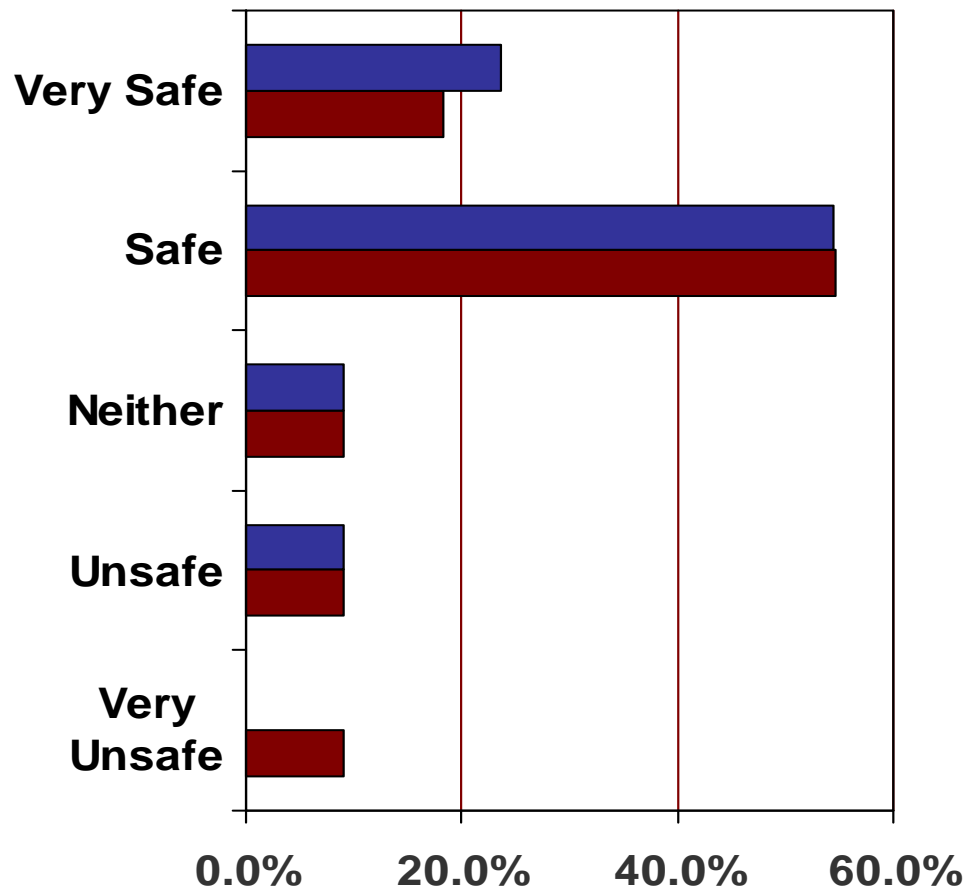
- “The lighting level on Lija Loop is _____?”

- Note: Average horizontal illuminance was reduced 53%, while maintaining minimum lighting standards.



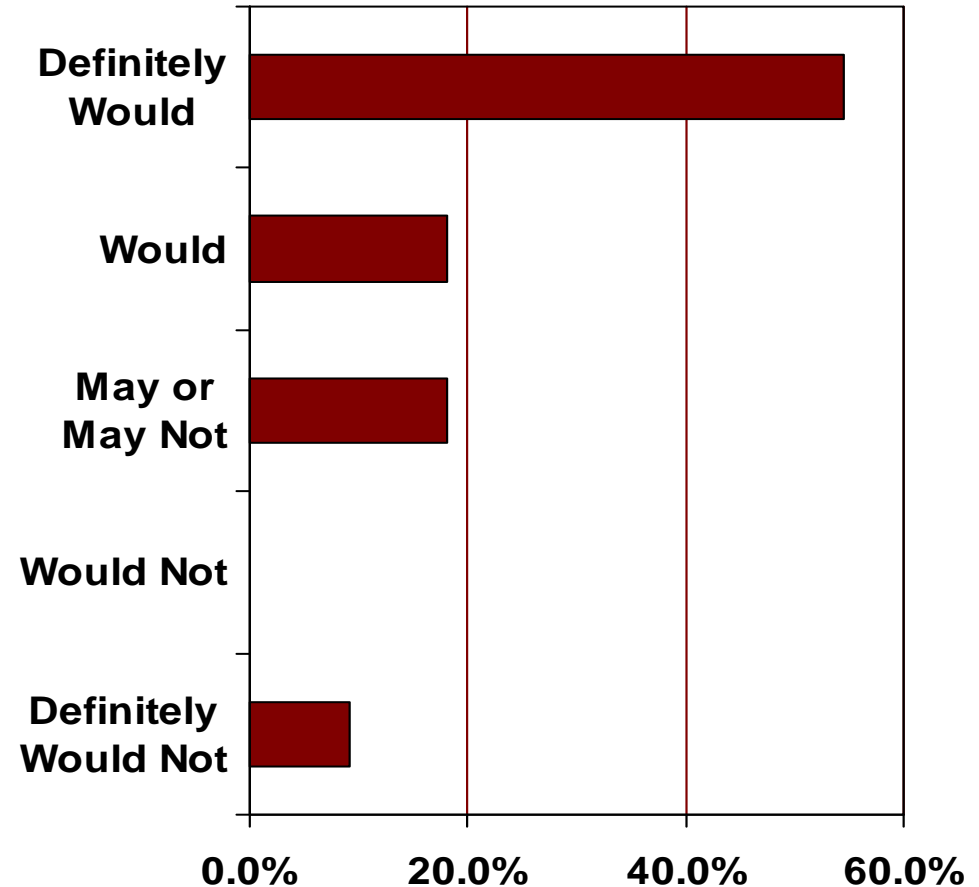
Lija Loop Neighborhood Survey

- “The quality of lighting on Lija Loop makes it seem _____ to drive under?”
- “As a pedestrian, I feel _____ under the lighting on Lija Loop.”



Lija Loop Neighborhood Survey

- “I _____
recommend use of this
type of lighting
elsewhere.”



Neighborhood Comments

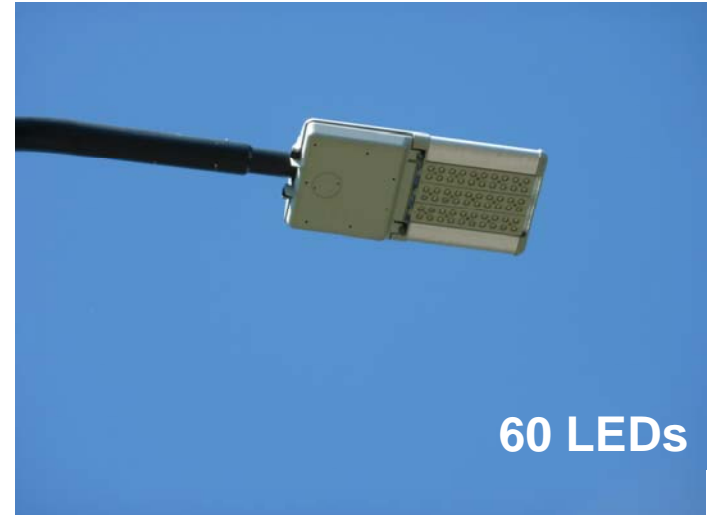
- **“We didn’t notice any difference.”**
- **“Noticeably brighter. We modified our “black out” curtains. Please turn down a notch or two.”**
- **“I like the color compared to the prior, orange/red ones”**
- **“Bring our ‘old’ lights back please!! Maybe if the bulb wasn’t so blue in coloring, it just doesn’t cast the light as effectively, though it is better with glare.” “Excellent quality, makes me enjoy living on Lija Loop!”**
- **“Highly needed...Thank you for your time and support.”**
- **“Yeah!”**

Willamette Bluff Light Post Project

- **Light Sources**
 - 5 Induction lights
 - 5 LED lights
 - 5 HPS lights
- **Visual Uniformity**
 - Illuminance Readings
 - Power Readings
 - Color Temperature
- **Energy Use**
- **Neighborhood Feedback**



Willamette Bluff Luminaires



- 28 ft. Mounting Height
- Similar Pole Spacing
- Separate Circuits
- One Photoelectric Control

Visual Uniformity Comparison



- Photos taken on same evening with same camera settings
- All luminaires mounted on identical poles and spaced for optimal performance

Evaluation Summary

	HPS	Induction(*)	LED
max (lux)	24.1	11.2	27
min (lux)	2.6	0.5	6.3
avg (lux)	9.96	3.02	11.56
avg:min	3.83	6.04	1.83
Watts	115	79	110
PF	0.93	0.98	0.99
CCT	2097	2759	6667
Drivelane lm/Watt	21.2	9.4	25.8

* Neighborhood likes induction lights – “softer light and prettier looking fixtures”

What Have We Learned?

- **Among the light sources tested, LED provided the best uniformity and most potential for controls**
- **The payback for LED installations is improving**
 - In 2008, 7 to 20-year paybacks
 - More recently, we're seeing 5 to 10-year payback on Gateway Projects
- **The apparent brightness of LEDs seems to make people more comfortable when walking and driving**
 - (Caveat: anecdotal/opinion not scientific)
- **Residents seem to prefer “medium” CCTs**
 - 3000K to 4000K range

How Will the Consortium Benefit Portland?

- **Shared Experience with Other Municipalities**
- **Performance Criteria & Applications**
- **Consistent Data for PUC Rate Cases**
 - **Tariffs/Lamp codes**
 - **Energy measurement**
 - **Maintenance requirements**
- **Coordination with Utilities**

Next Steps...

- **Street Lighting Controls Working Group**
- **Demonstration Project**
 - Remote Monitoring
 - Adaptive Controls/Dimming
 - Central Communications
 - Energy Measurement