



# LED Streetlights

“Changing our Glow for Efficiency”

The City of  
Los Angeles Experience



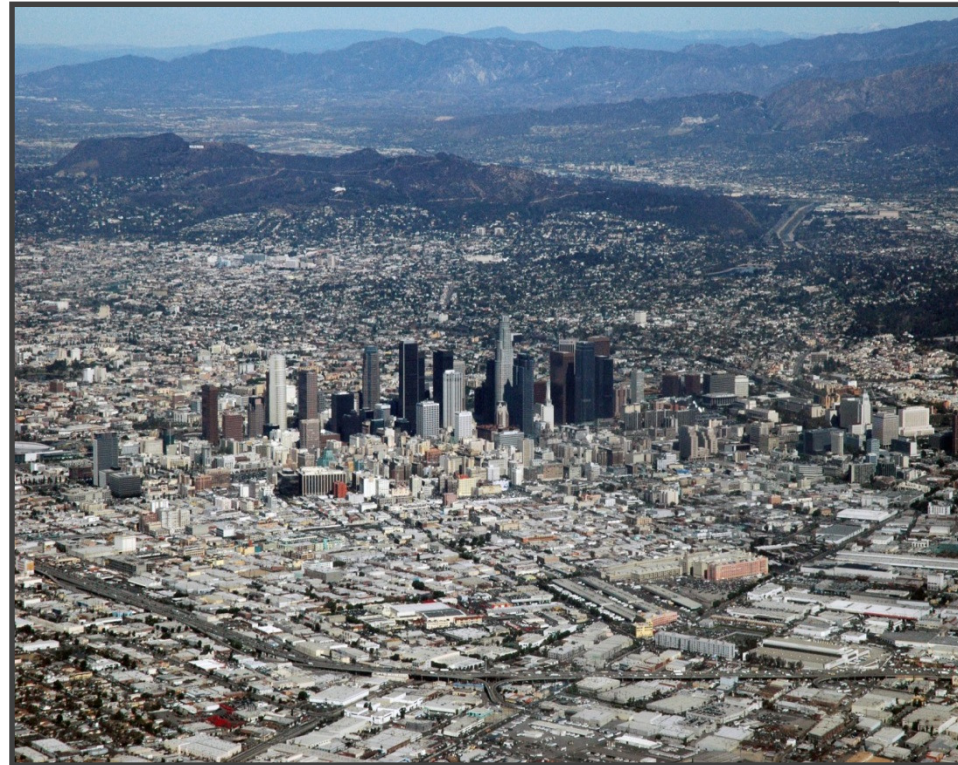
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# City of Los Angeles Facts



- ✓ 2<sup>nd</sup> largest City in the USA
- ✓ 472 sq mi
- ✓ 6500 miles of streets
- ✓ Population of 4 Million
- ✓ \$7.2 Bi. City Budget for 2012
- ✓ Power Utility owned by the City





# Bureau of Street Lighting

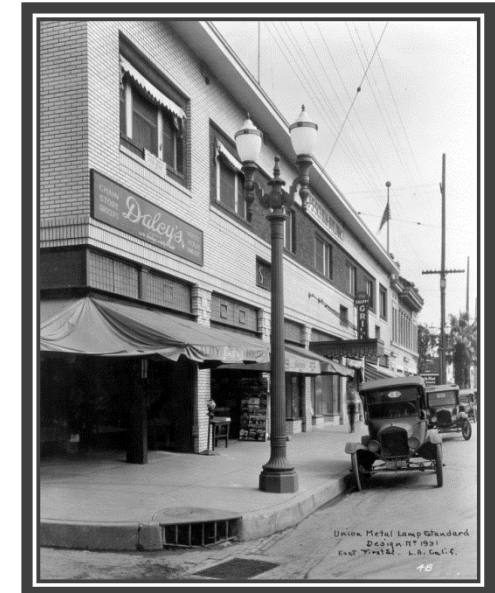


One of five Bureaus in the Department of Public Works, Est. in 1925



215,000 streetlights with over 400 different styles

4500 miles of streets are illuminated





# Bureau of Street Lighting Operations



- Street Lighting Maintenance Assessment Fund



- All maintenance and engineering work In-House 214 Employees



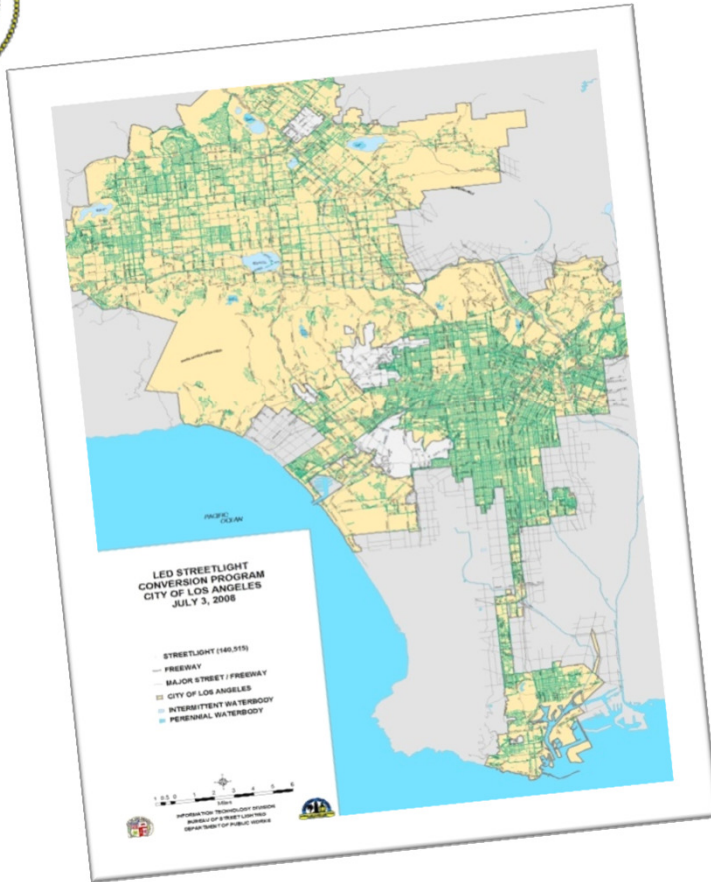
- \$25 Mil. Annual Budget – Appropriation for FY 12/13



## City of LA - LED Program Phase I



- **Converted 140,000 streetlights to LED**
- **Installed Remote Monitoring System**
- **Timeline – 4 years**
- **Total Cost - \$57 million**
- **Loan \$40 million**
- **City crews**
- **Program payback – 7 years**
- **Launched – February 2009**



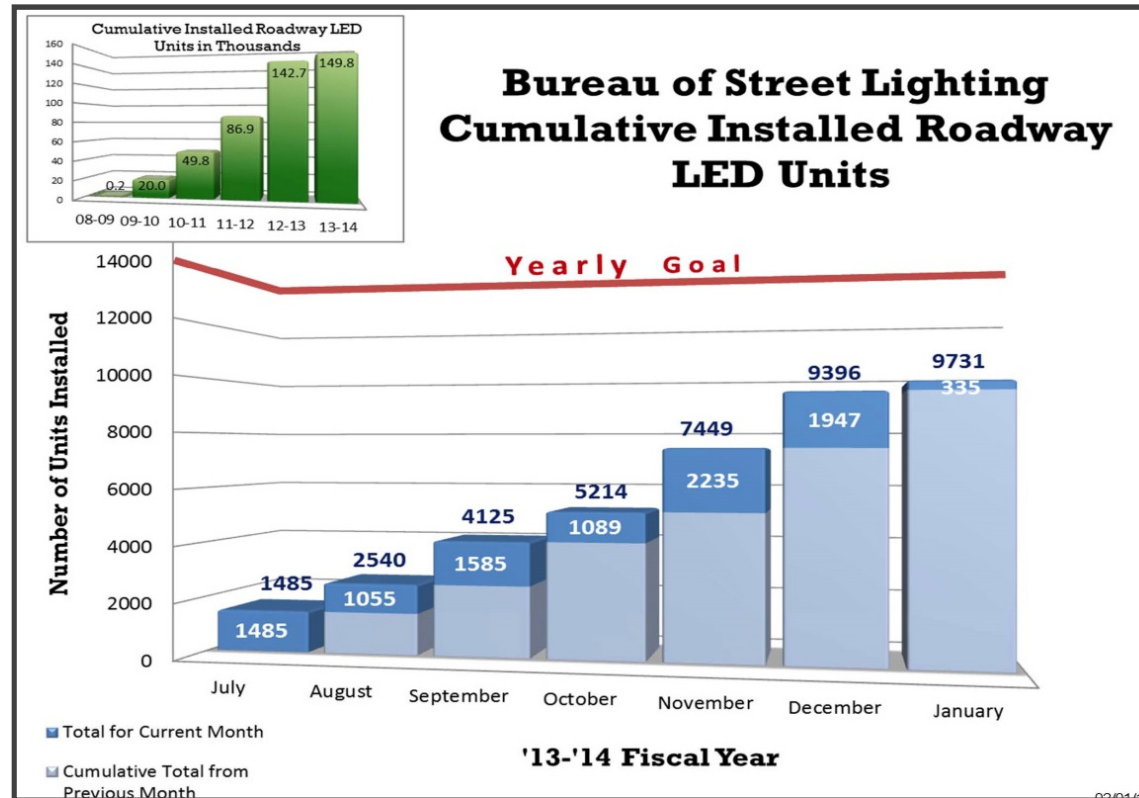
# Program Geographic Area



LED Conversion of  
140,000 streetlights  
in the City of  
Los Angeles

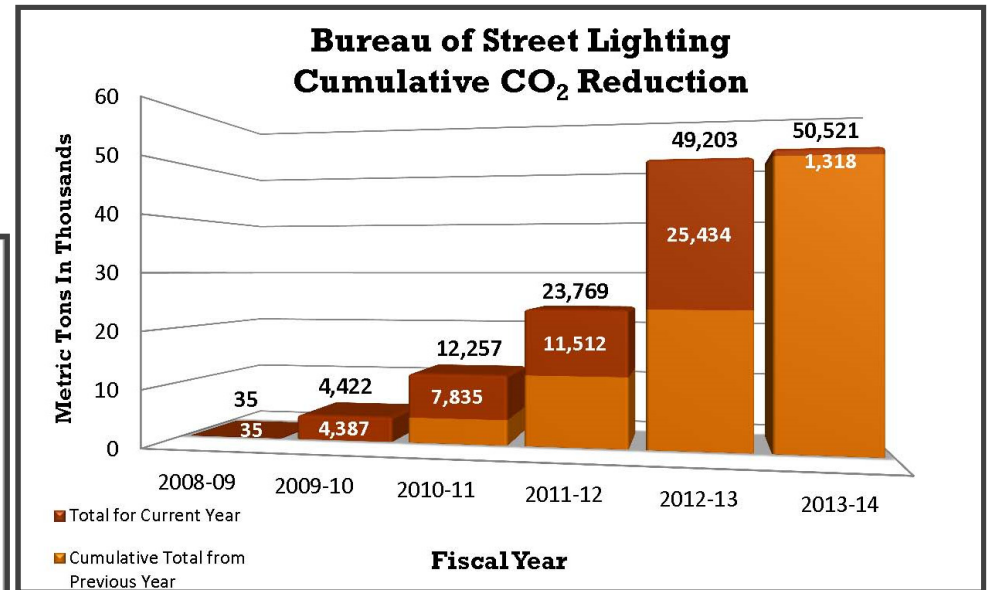
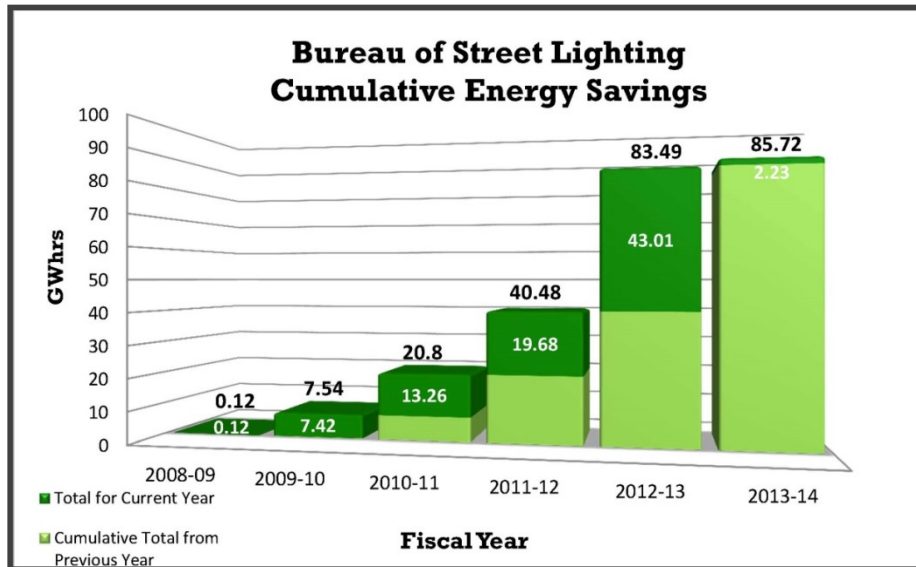


# City of LA LED Program





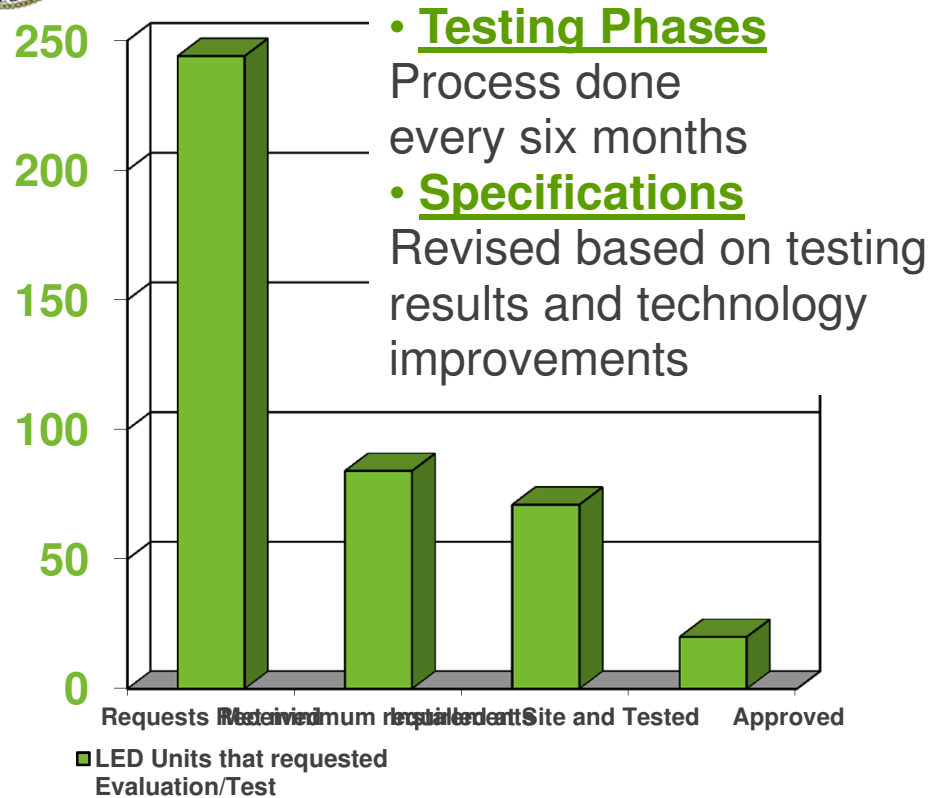
# City of LA LED Program







# Testing and Evaluation



Lighting Evaluation Illumination, Luminance, Uniformity Ratio, Color Temperature, Brightness.

Electrical Evaluation Power consumption, Power Factor, Harmonic Distortion, Remote Monitoring Device compatibility, Remote Dimming/Controls.

Mechanical Evaluation Disconnects, fixture assembly and ease of installation.



## Summary of City of LA Specifications



- 4000 K
- Warranty 10 years
- 70% delivery of initial lumens at 60,000 hours
- Minimum of 60% energy savings
- 3-prong twist-lock PE receptacle
- House-side light control
- Size, Weight, Packaging, Initial Lumens, and Efficacy
- Bureau's Webpage: <http://bsl.lacity.org>



# Public Outreach

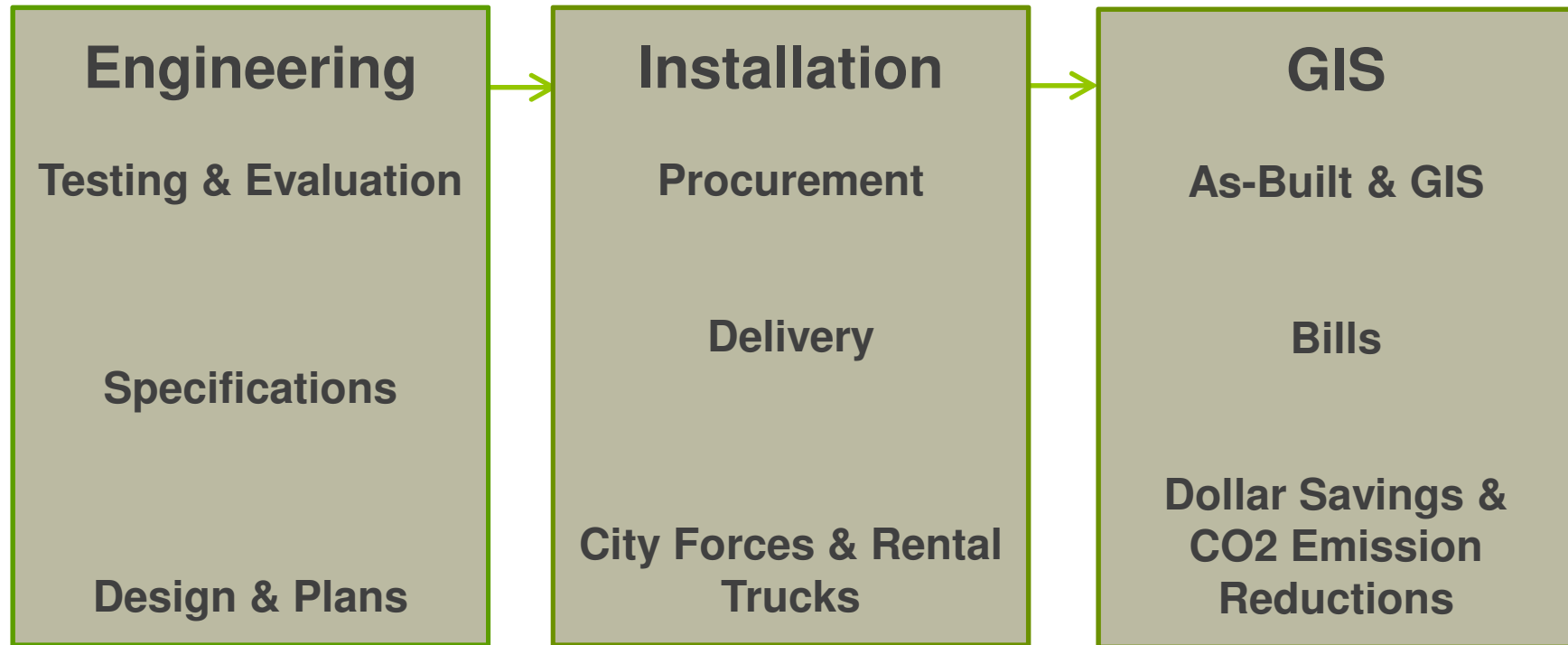


- Improved Lighting
- No Cost
- No Negative Impact
- Surveys
- Dedicated telephone line
- Website  
<http://bsl.lacity.org>





# LED Conversion Project Implementation Process





## Statistics

- Jobs Created  
Manufacturer: 227  
City of LA: 15
- Truck rentals: 7  
No. of Crews: 7

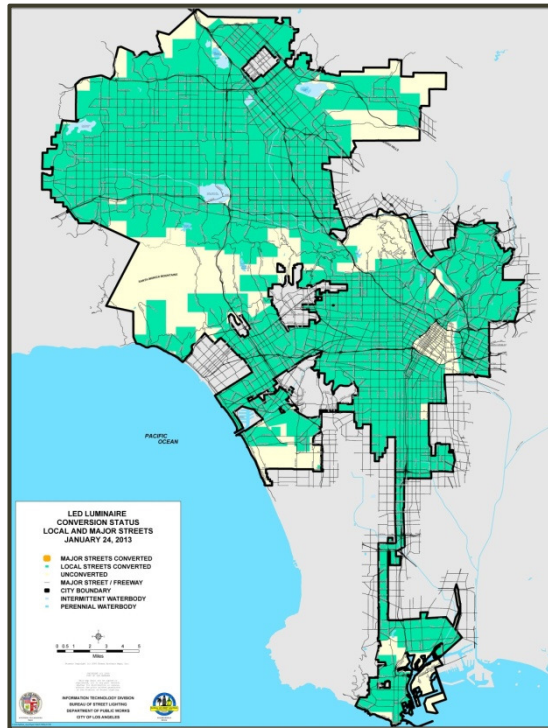


## Workload

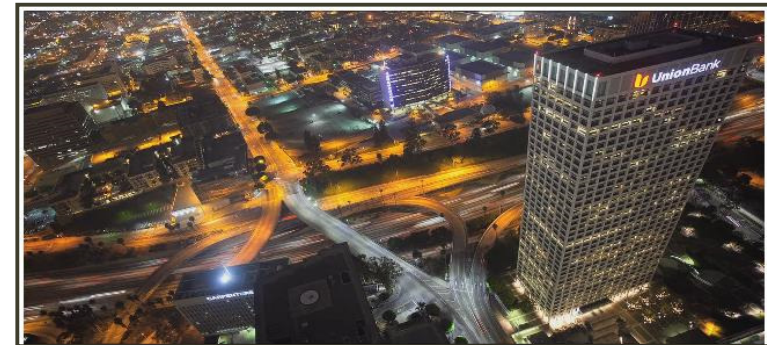
- Weekly Installations: 1,000



# City of Los Angeles LED Conversion Project

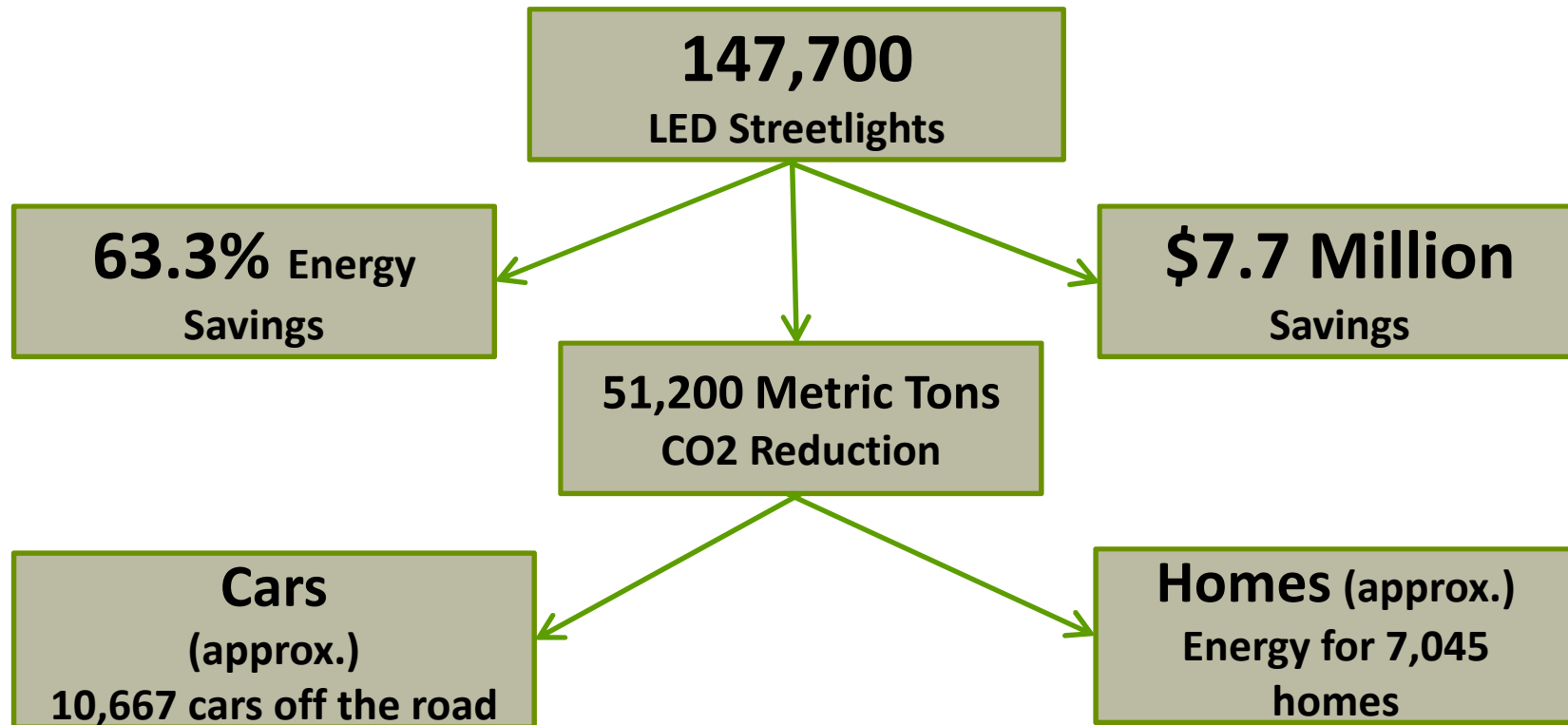


 Local and Major Streets





# City of Los Angeles – Bureau of Street Lighting LED Conversion Project





# Yearly Comparisons

## Local Street LED Fixture



### 2009

- Avg. Price = \$ 432
- Efficacy = 42 Lm/W
- Life = 80,000 hrs
- Warranty = 5 yrs

### 2010

- Avg. Price = \$ 298
- Efficacy = 61 Lm/W
- Life = 111,000 hrs
- Warranty = 6 yrs

### 2011

- Avg. Price = \$ 285
- Efficacy = 72 Lm/W
- Life >150,000 hrs
- Warranty = 6 yrs

### 2012

- Avg. Price = \$ 245      Efficacy = 81 Lm/W
- Life >150,000 hrs      Warranty = 7 yrs





# Yearly Comparisons

## Local Street LED Fixture

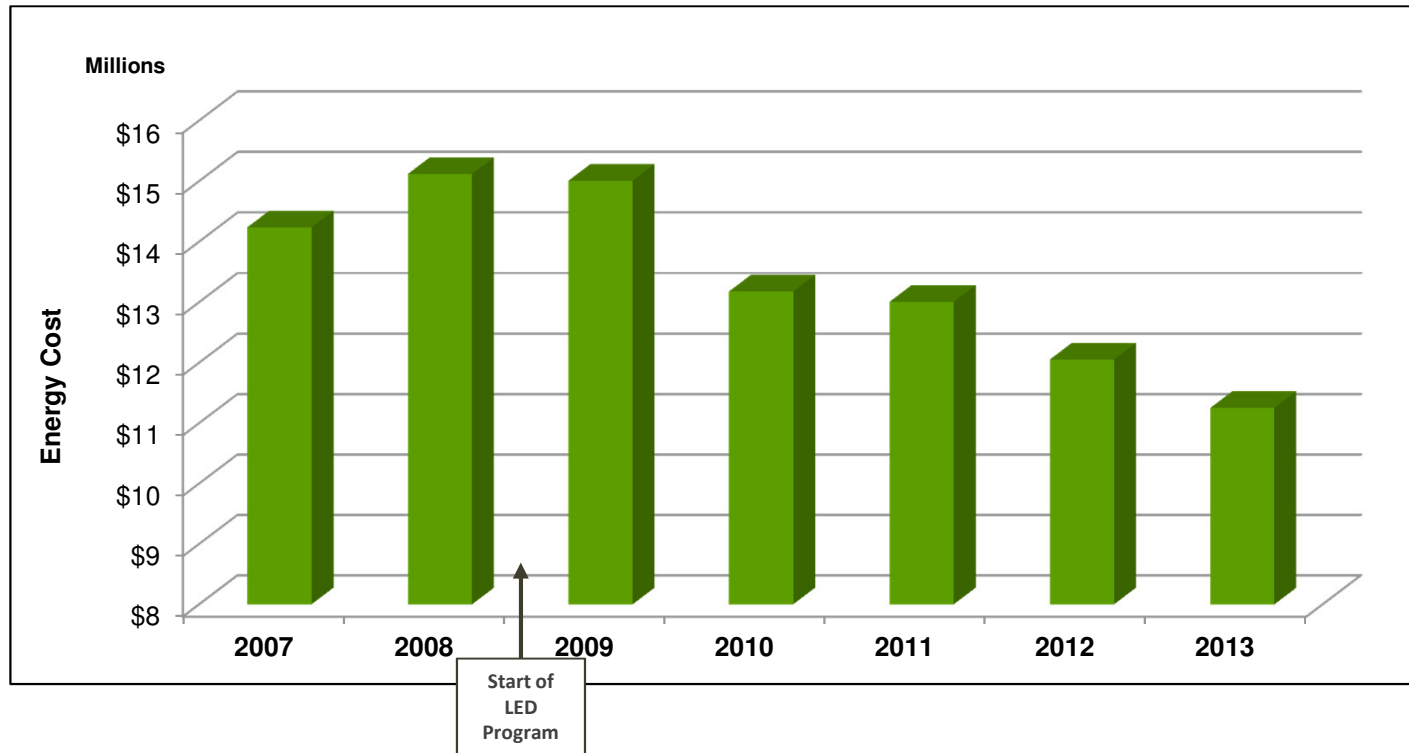


### 2013

- Avg. Price = \$ 141
- Efficacy = 96 Lm/W
- Life > 150,000 hrs
- Warranty = 10 yrs

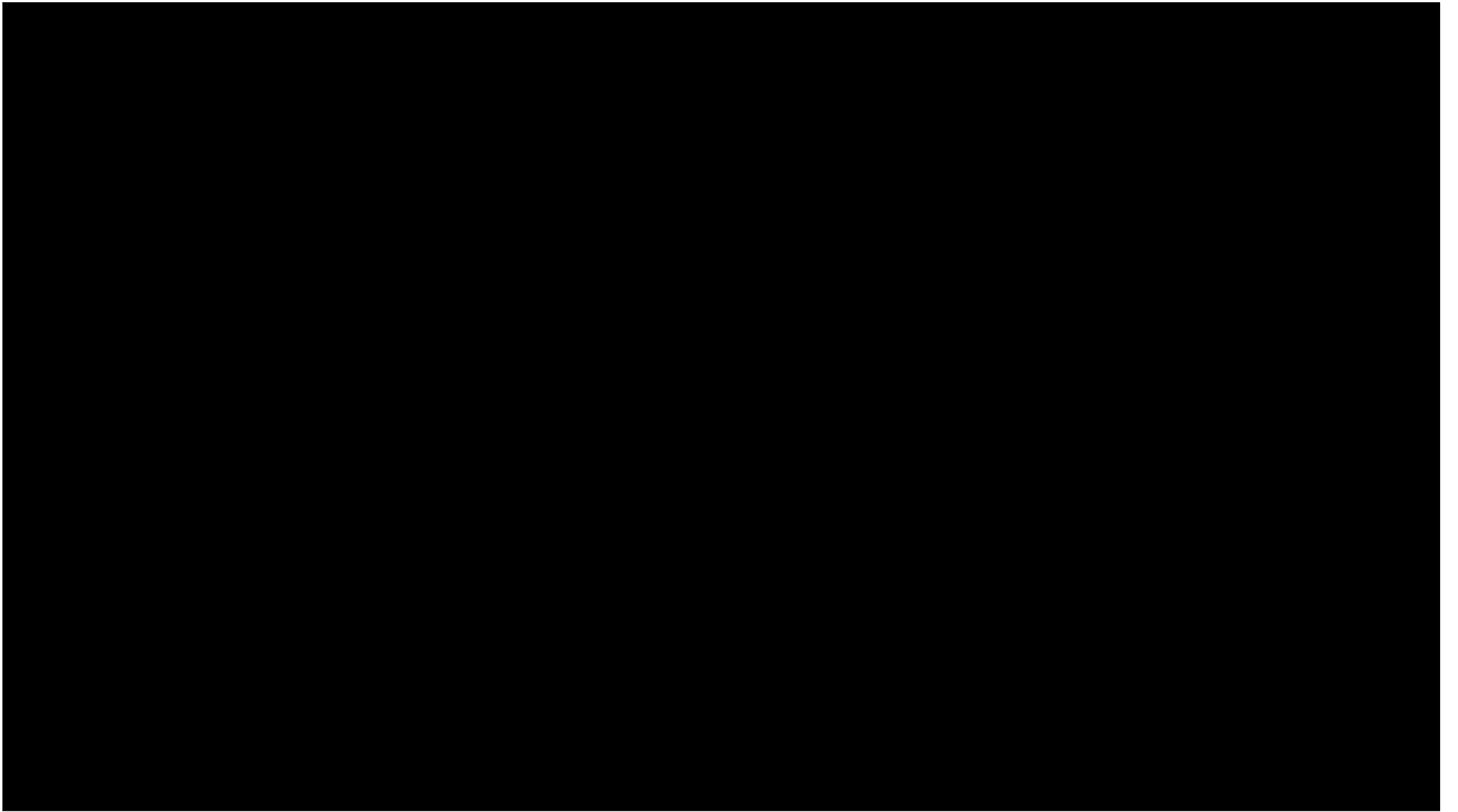


# LED Program Street Lighting Energy Cost





# Completion of LED Street Lighting Energy Efficiency Program Phase I





# Before and After Pictures of LED Program



## Before and After Pictures of Program



Fc.: 4.31

Ave./Min.:2.40

Max./Min.: 5.4



**Before**  
**200 W HPS(240 W)**

**6th Street Bridge**  
**over Los Angeles**  
**River**



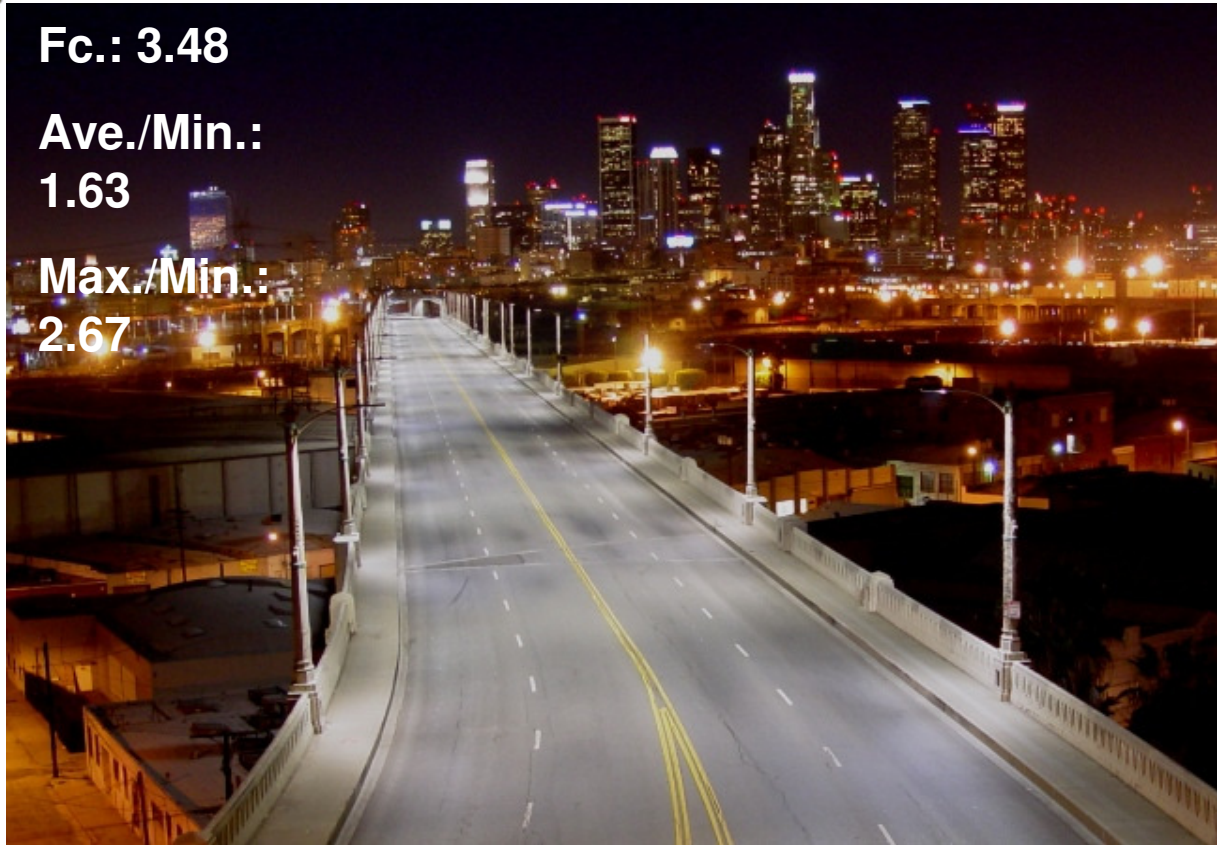
## Before and After Pictures of Program



Fc.: 3.48

Ave./Min.:  
1.63

Max./Min.:  
2.67

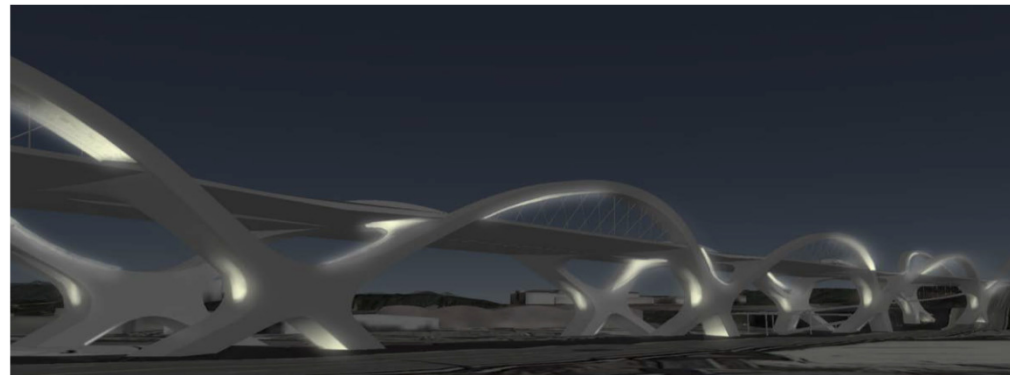
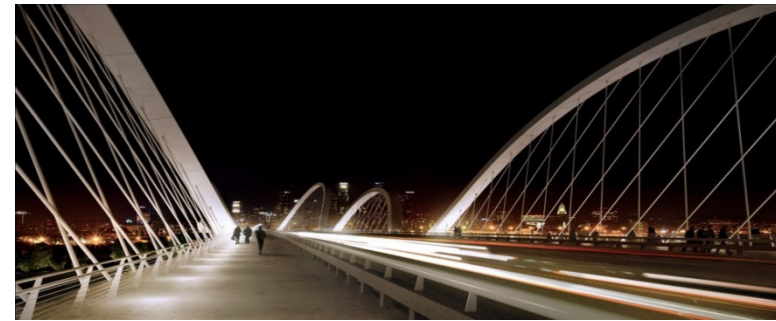


**AFTER**  
**180 W LED (180 W)**

**6th Street Bridge  
over Los Angeles  
River**



# 6<sup>th</sup> Street Bridge over LA River







## Before and After Pictures of Program



Fc.: 1.59

Ave./Min.: 2.3

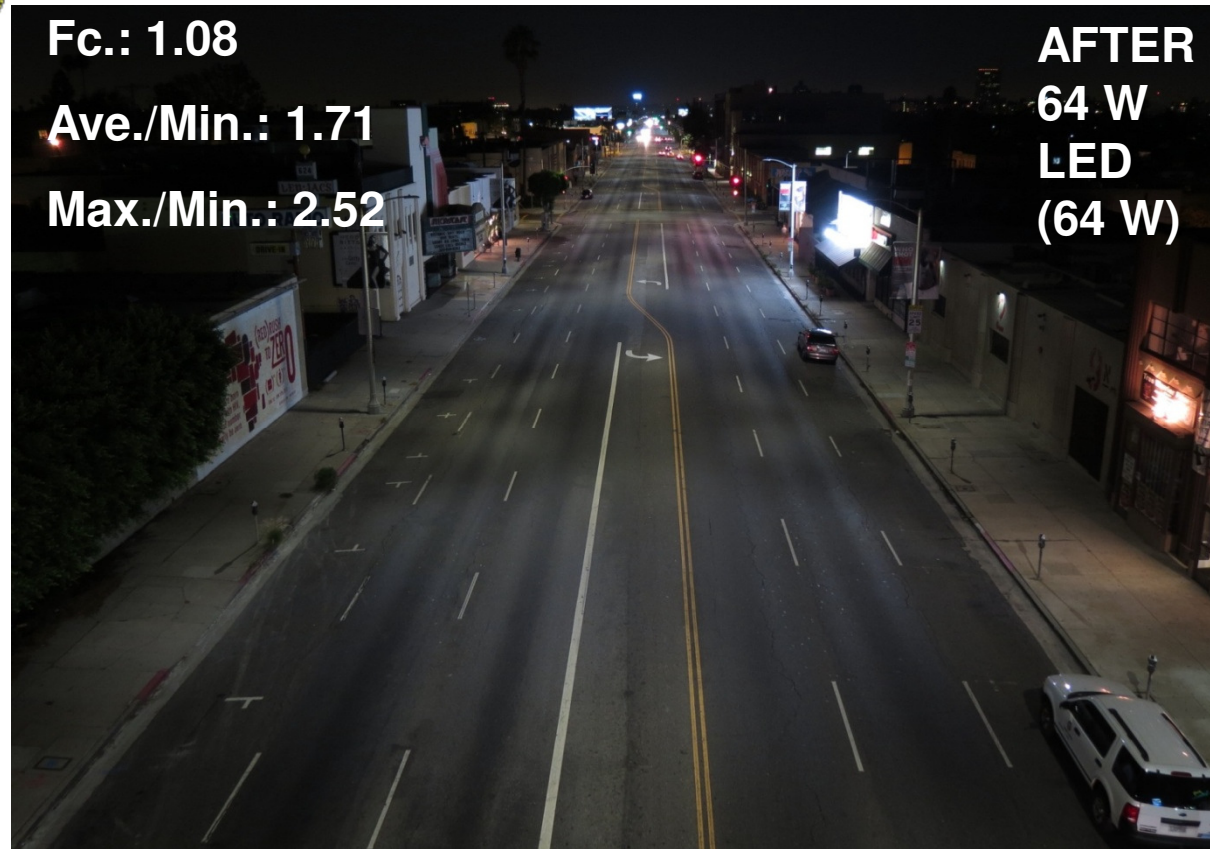
Max./Min.: 5.23

**BEFORE**  
**200 W**  
**HPS**  
**(240 W)**

**La Brea Avenue**  
**(HPS)**



## Before and After Pictures of Program



Fc.: 1.08

Ave./Min.: 1.71

Max./Min.: 2.52

**AFTER**

**64 W**

**LED**

**(64 W)**

**La Brea Avenue  
(LED)**



# Before and After Pictures of Program



**BEFORE**  
**400 W HPS**  
**(465 W)**

**Ventura Blvd.**  
**(HPS)**



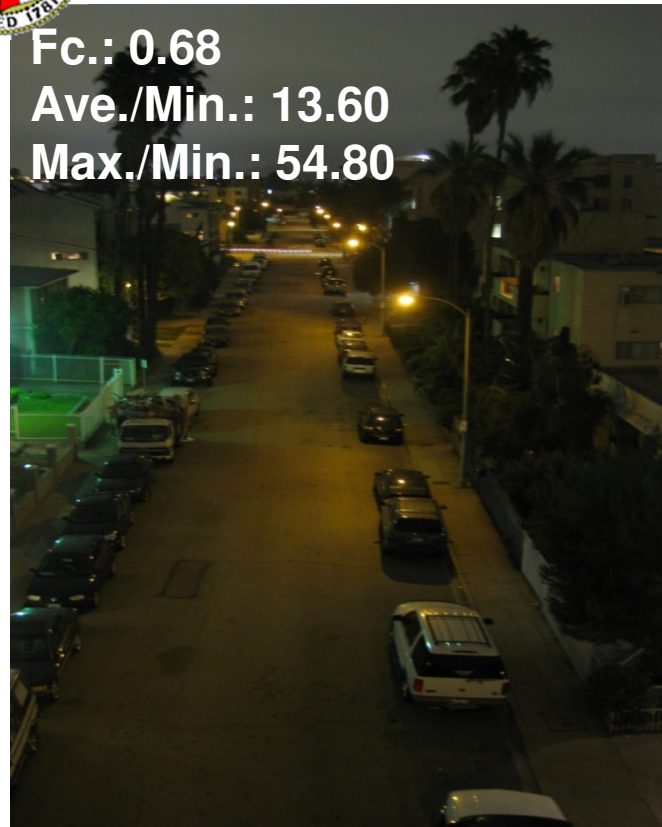
## Before and After Pictures of Program



Ventura Blvd.  
(LED)



# Before and After Pictures of Program



100W HPS  
(138 W)



70W LED  
(70W)



## Before and After Pictures of Program



**Ocean Front Walk,  
Venice – (HPS)**



## Before and After Pictures of Program



Fc.: 1.90

Ave./Min.: 3.29

Max./Min.: 7.44



Ocean Front Walk,  
Venice – (LED)



# Maintenance Savings



- Single Streetlight Repairs

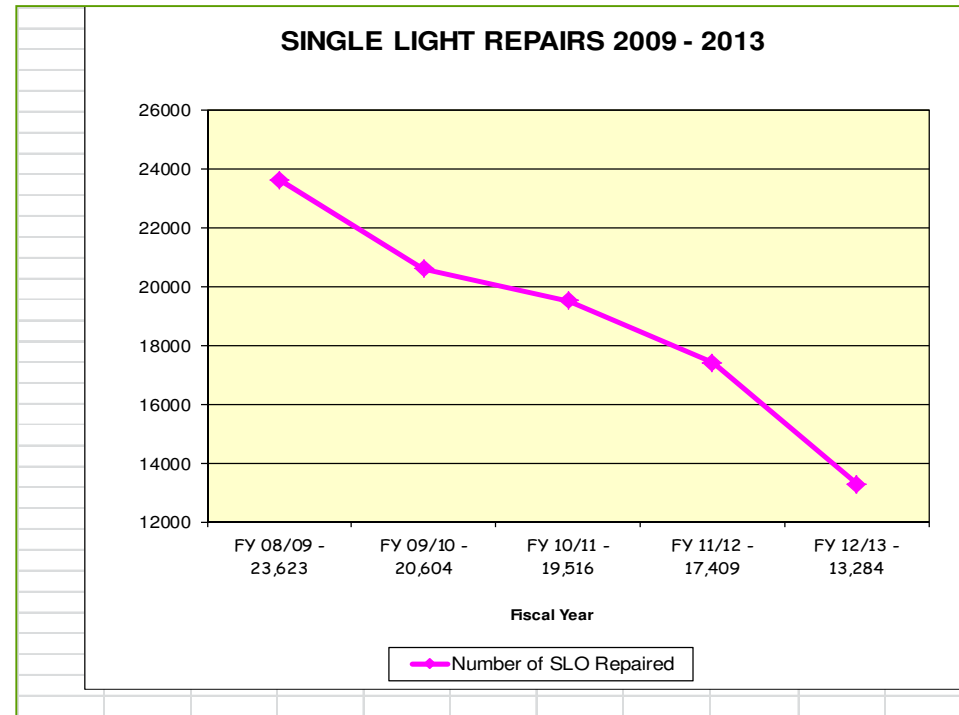
FY 2009: 23,500

FY 2013: 13,000

- Total Streetlight Repairs

FY 2010: 70,000

FY 2013: 43,800







## LED Advantage



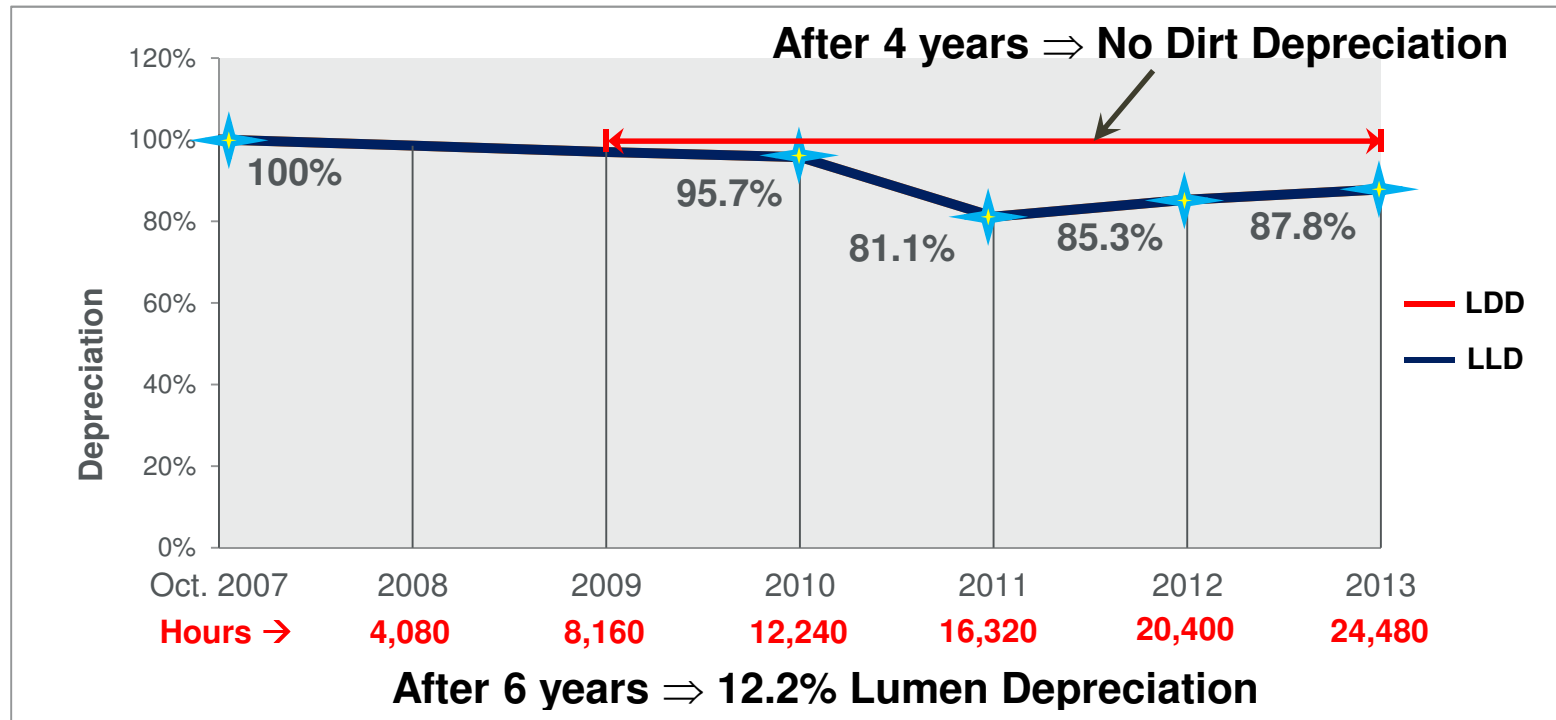
- Reduced Energy Use, Increased Energy Savings
- White Light, Improved Color Rendering & Visibility
- Directional Light Source, Dimmable, Improved Uniformity
- Longer Life, Reduced Maintenance
- Reduced light pollution, Dark Skies
- House Side Shields
- Smaller size, light weight
- Minimal end of life landfill waste, no mercury
- Reduced wire/conduit size, for new construction
- Instant on. No warm up period
- **Failure Comparison (average)**

*HID – 10% (based on past installation history)*

*LED – 0.3% (based on 400 units from 140,000 installed)*



# Dirt and Lumen Depreciation (Lighting Level Analysis)





# LED Program Results



	<u>2008</u>	<u>2013</u>
<b>ENERGY USAGE</b>	190 million kW/year	110 million kW/year
<b>ENERGY COST</b>	\$16 million/year	\$8.8 million/year
<b>ENERGY SAVINGS</b>	40%	63%
<b>TOTAL STREETLIGHT REPAIRS</b>	70,000	46,300
<b>PERFORMANCE</b>	Uniformity a Concern	Good Uniformity, better than HPS
<b>COMMUNITY FEEDBACK</b>	Anticipated Negative	Mostly Positive
<b>INSTALLATIONS</b>	20 / day	30 / day
<b>REMOVED HID UNITS</b>	Recycle old units	Auction and Recycle \$1,161,097 in revenue



# Crime Statistics

## (Incidents between hours of 7 PM to 7 AM)

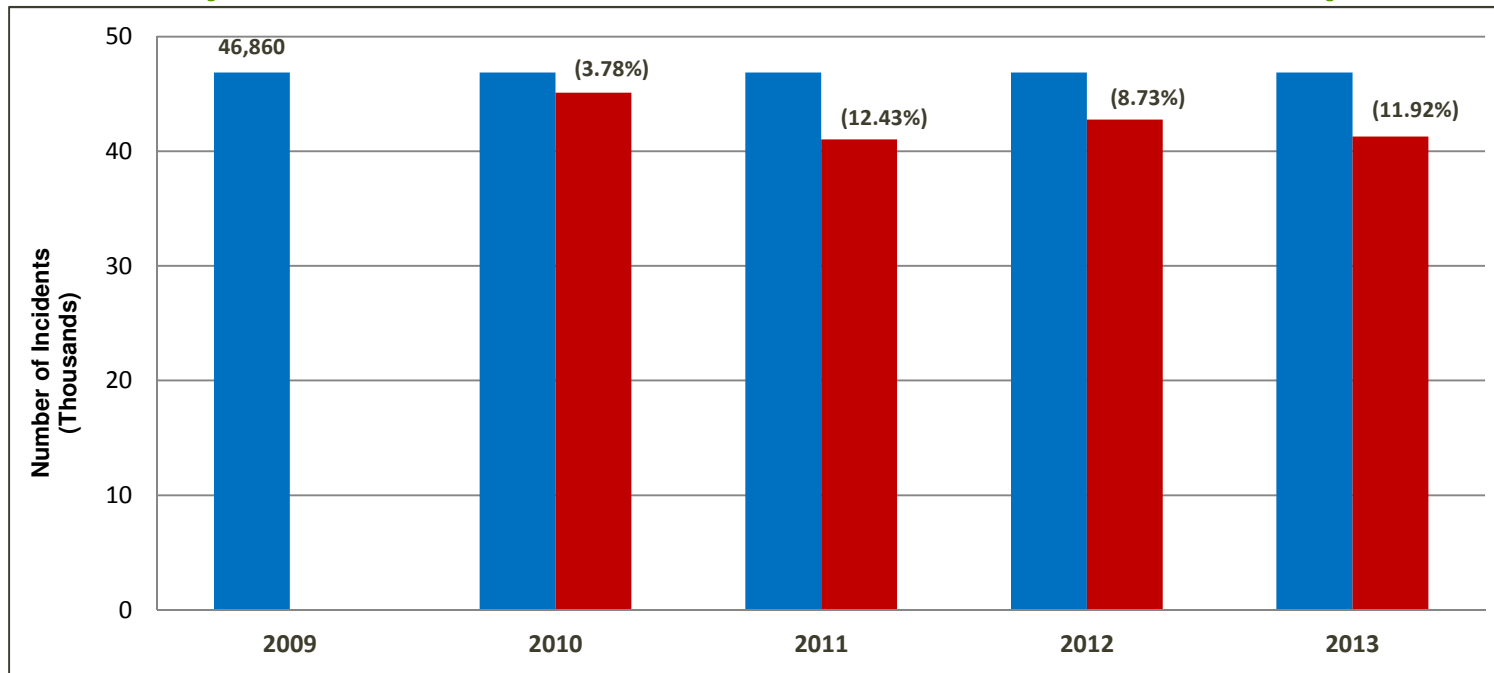
CRIME TYPES	YEAR		REDUCTION
	2009	2013	
Theft from Vehicle	15,778	13,772	12.71 %
Burglary-Robbery-Theft	19,967	18,182	8.94 %
Vandalism	11,115	9,321	16.14 %
<b>Total</b>	<b>46,860</b>	<b>41,275</b>	<b>11.9 %</b>



# LED Program Crime Reduction



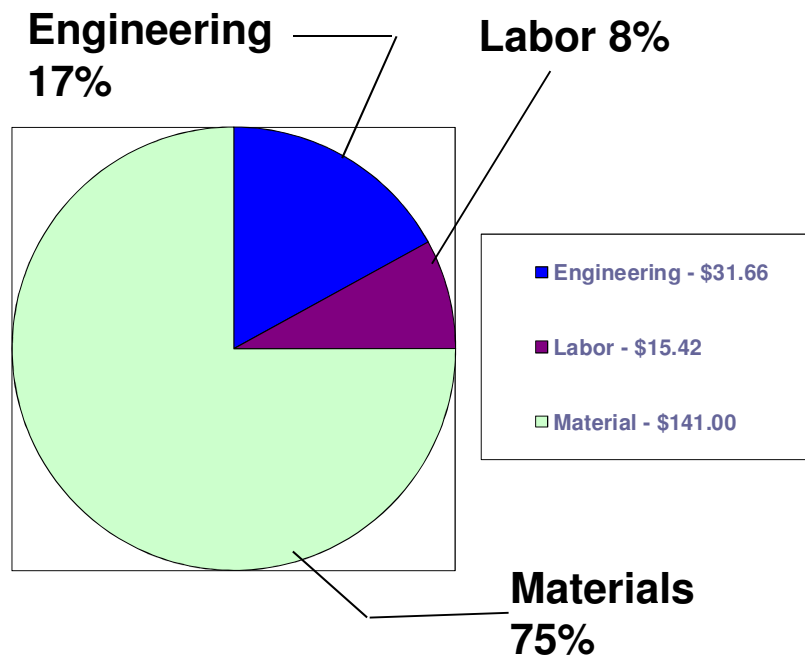
(Incidents between hours of 7 PM to 7 AM)





# Cost Breakdown

(Local Street LED Fixture)



**Unit Cost Breakdown for 2013/14 Fiscal Year - LED Program**

**TOTAL COST PER UNIT = \$188**



## Sepulveda Tunnel under LAX LED Lighting Project



- 2080 foot-long divided tunnel under LAX
- Built in 1953 as part of State Highway 1
- Old Lighting System – High Pressure Sodium
- **New Lighting System – 572 LED fixtures, Range: 30-120 LED's**
- **Energy Savings: 64%**
- **Wireless Remote Controls System**



## Sepulveda Tunnel under LAX



400W HPS  
Light pipe

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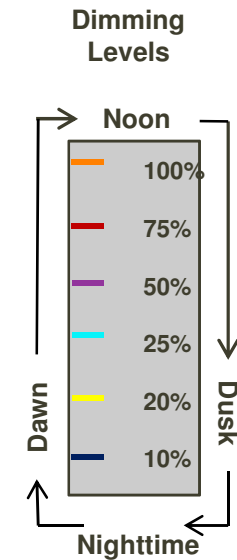
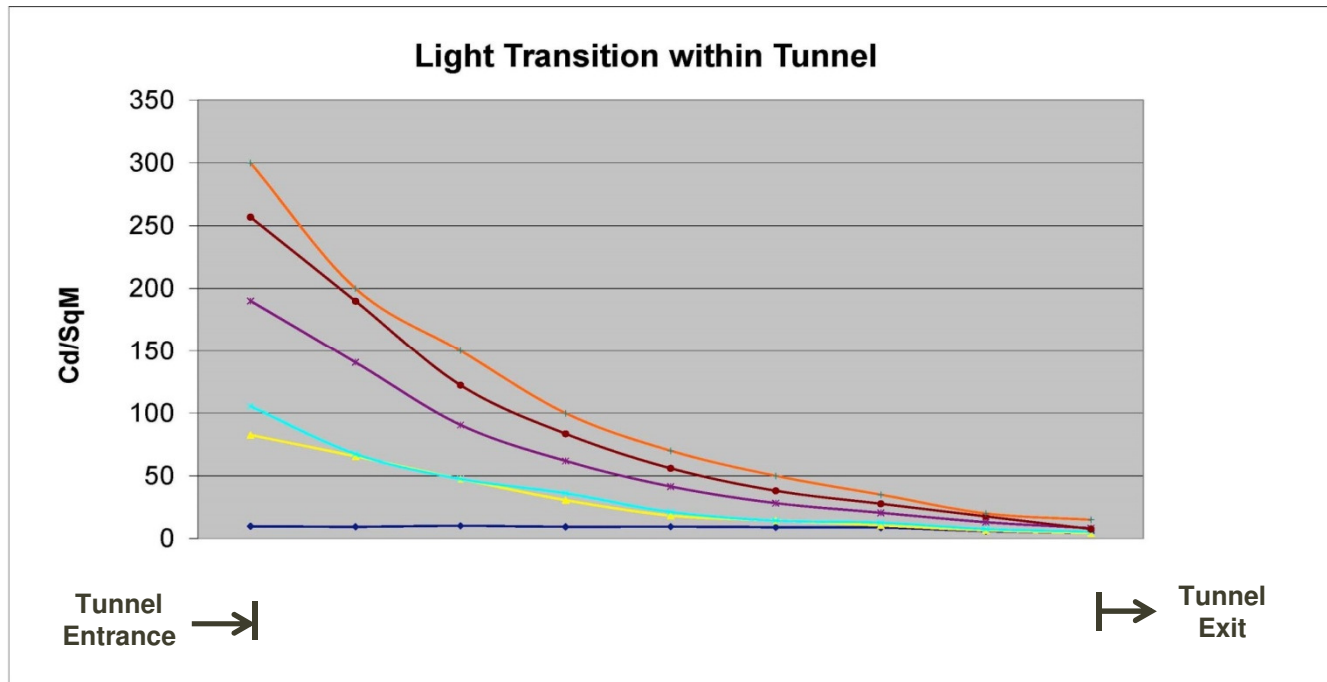
## Sepulveda Tunnel under LAX



572 LED fixtures,  
64% energy  
savings  
300 cd/m<sup>2</sup>



# Sepulveda Tunnel under LAX





# 3<sup>rd</sup> STREET TUNNEL



42 fixtures (HPS & MV)  
16,230 watts



## 3<sup>rd</sup> STREET TUNNEL



114 LED  
(Teardrop & Tunnel)  
14,084 watts



# Tunnel Comparisons

## Before and After Results

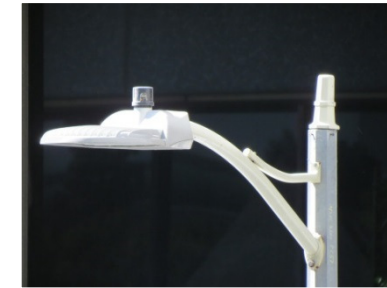
	# of Units		Lighting Levels		Energy Consumption		Energy Savings
	Before	After	Before	After	Before	After	
Sepulveda Tunnel	750	<b>572</b>	300 cd/m <sup>2</sup>	<b>300 cd/m<sup>2</sup></b>	378kW	<b>107kW</b>	<b>64%</b>
3rd Street Tunnel	42	<b>114</b>	2 cd/m <sup>2</sup>	<b>30 cd/m<sup>2</sup></b>	16.2kW	<b>14kW</b>	<b>13.2%</b>



# New Streetlight Applications



Smart Meters



Remote Monitoring



Solar to Grid



Telecommunications Equipment



Wi-Fi

Security Cameras



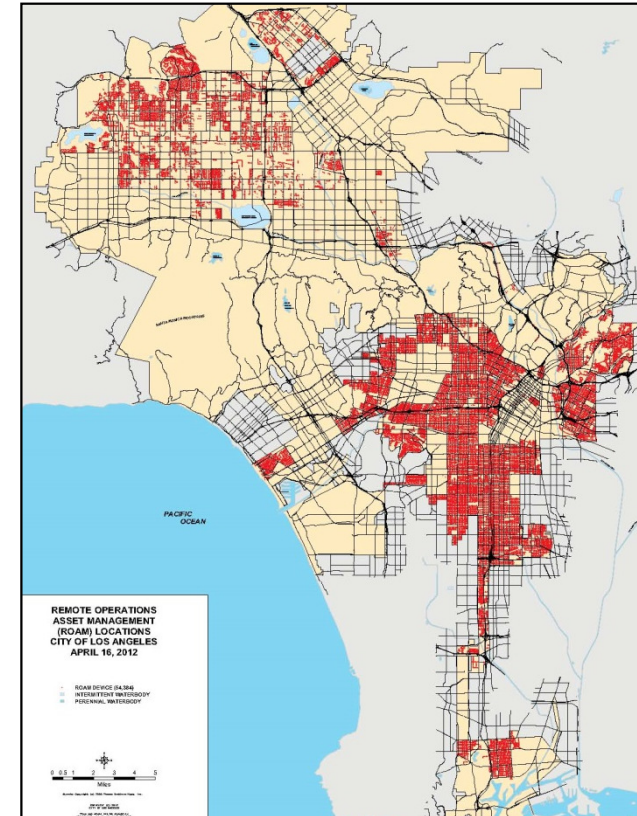
EV Charging Stations



# Remote Monitoring System



- 215,000 streetlights in the City of Los Angeles
- 54,027 street lighting controls installed
- Majority installed over the first 3 years (with our LED program)





# Remote Monitoring System



- System utilizes mesh network and gateway
- Server hosted by manufacturer
- Provide streetlight diagnostics (operations, power consumption etc.)
- On/Off ability
- Lighting Control integrated in PE cell
- No GPS self activation. Manually activated with a Bar Code scanner







# Remote Monitoring System



- Deployment Challenges
  - Stickers and bar coding
  - Cumbersome Process
  - Too much inputting
  - Too many devices
  - Too much time for activation
  - Field crew vs. contractor
- Interference – 3G, 4G to what's next.
- Ornamental Systems





# Remote Monitoring System Street Lighting Control - Future Needs



- Better commissioning deployment
  - GPS built-in option
  - Remote activation
- Meter grade accuracy (2% or less)
- Flexibility for use with decorative systems
- Power back-up system on devices
- No monitoring fees
- Cost Reduction – more affordable
- Systems Compatibility – Standardization
- No Cabinets





# “Moving Forward” LED Decorative Fixtures



48 LEDs; 54 W



4100 K

48 LEDs; 80 W



3000 K

32 LEDs; 48 W



2900 K

42 LEDs; 55 W



2800 K

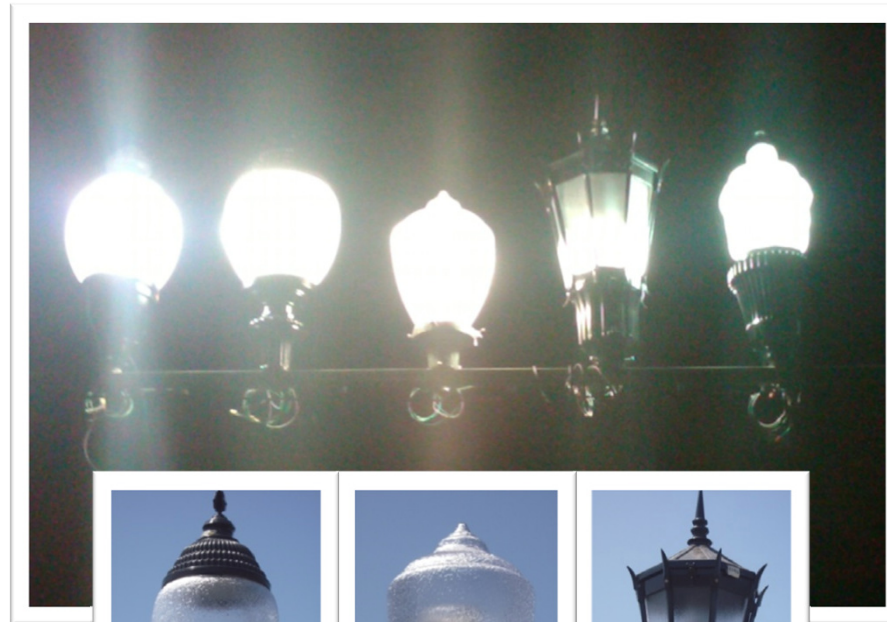
- More than 50,000 existing decorative fixtures
- About 400 different styles
- Color Temperature range – 3000 Kelvin
- Presently testing and evaluating LED and Induction units



Typical  
post-top  
fixture



# “Moving Forward” LED Decorative Fixtures





## “Moving Forward” LED Lamps for Decorative Fixtures



**800 – 1780 lumens, 2700 K**

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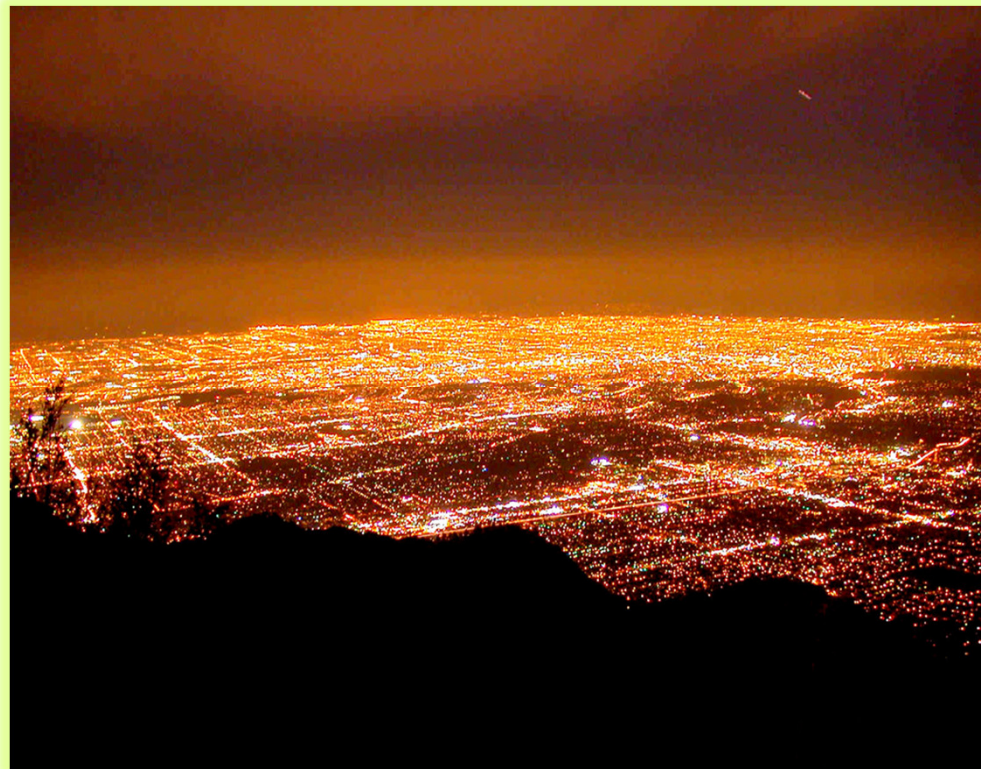
# “Moving Forward”

## Evaluation Test Site for New Lighting Technologies





## Los Angeles Basin – View from Mt. Wilson Before LED Retrofit Project – 2008



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## Los Angeles Basin – View from Mt. Wilson After LED Retrofit Project – 2012



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**THANK YOU**

**City of  
Los Angeles**

**Bureau of Street  
Lighting**

**<http://bsl.lacity.org>**