



# ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT (EECBG): STREETLIGHT CONVERSION PROGRAM

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February 8, 2011

# Background



- DOE awarded the City \$491,000 EECBG in 2009
- In December 2010, Council authorized reallocating \$85,000 from the Financial Incentive Program to the Streetlight Conversion Program
- \$382,000 available for Streetlight Conversion Program
- Estimated to convert 650 – 800 streetlight fixtures
- Two primary alternatives to High Pressure Sodium (HPS)
  - Light-Emitting Diode (LED)
  - Induction

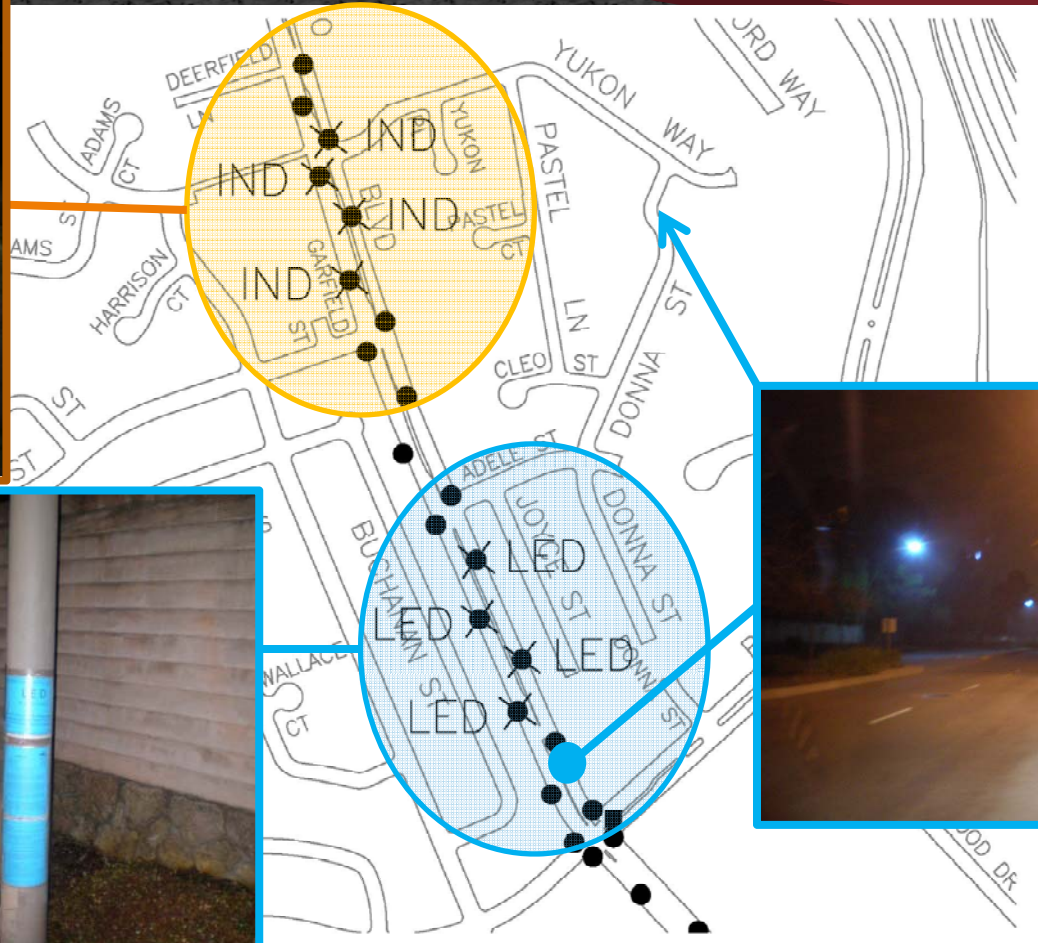


# Pilot Test



- Requested at December 14, 2010, Council meeting
- South Novato Boulevard between Rowland Blvd and Yukon Way
  - Major street adjacent to residential neighborhood
  - Streetlights are equally spaced
  - Existing HPS had consistent wattages
  - Short block allowed almost full conversion
- Four (4) LED fixtures: Rowland Blvd and Adele Street
- Four (4) Induction fixtures: Arthur Street and Yukon Way

# Pilot Test (cont.)





# Pilot Test (cont.)



- LED fixtures installed during week of December 20, 2010
- Induction fixtures installed during week of January 3
- Online survey posted on City website on January 6
- Survey will provided feedback on:
  - Light Preference – LED or Induction
  - Quality of the light output
  - Where light conversion should occur
  - General rationale for preference
- Survey was available until January 31
- Press Release issued on January 10



# Lighting Fixtures

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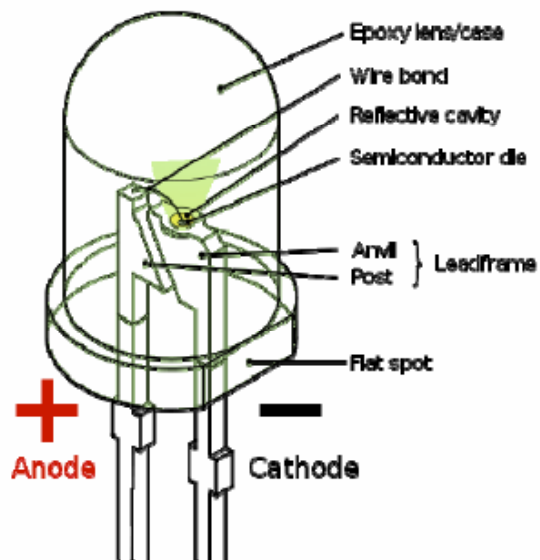


# Light-Emitting Diode (LED)



## Light Emitting Diode (LED)

A light-emitting diode (LED) is a [semiconductor](#) light source. In [electronics](#), a diode is a two-terminal [electronic component](#) that conducts [electric current](#) in only one direction. Like a normal [diode](#), the LED consists of a chip of semiconducting material [doped](#) with impurities to create a [p-n junction](#). As in other diodes, current flows easily from the p-side, or [anode](#), to the n-side, or [cathode](#), but not in the reverse direction. Charge-carriers—[electrons](#) and [holes](#)—flow into the junction from [electrodes](#) with different voltages. When an electron meets a hole, it falls into a lower [energy level](#), and releases [energy](#) in the form of a [photon](#). The [wavelength](#) of the light emitted, and thus its color depends on the [band gap](#) energy of the materials forming the *p-n junction*.



- Utilizes arrays of LEDs to distribute light
- Arrays can be directed to expand or narrow light distribution
- Each manufacturer has their own design, LED array and cooling mechanism
- No industry standards for LED streetlighting; however, LEDs are the current standard for traffic signals
- Produce a cold white light
- Reduce monthly energy costs by 40%
- Anticipated life of ~10 years

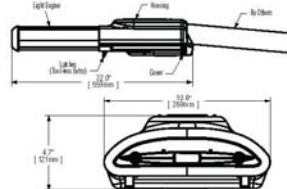
# LED Fixture



## STR-LWY-3M-HT LEDway® Streetlight – Type III Medium Rev. Date: 11/12/10

BetaLED Catalog #: STR - LWY - - HT - - C - - - -

Reset



### Notes:

Product	Family	Optic	Mounting	# of LEDs (x 10)	LED Series	Voltage	Color Options	Factory-Installed Options
STR	LWY	<input type="checkbox"/> 3M <sup>1</sup> <input type="checkbox"/> 3MB <sup>2</sup>	HT <sup>3</sup>	<input type="checkbox"/> 04 <input type="checkbox"/> 05 <input type="checkbox"/> 06	C	<input type="checkbox"/> HL Universal 120-277V <input type="checkbox"/> HL Universal 347-480V	<input type="checkbox"/> BV Blue <sup>4</sup> <input type="checkbox"/> BK Black <sup>4</sup> <input type="checkbox"/> WH White <sup>4</sup> <input type="checkbox"/> BR Bronze <sup>4</sup> <input type="checkbox"/> PR Platinum <input type="checkbox"/> WH White <sup>4</sup>	Please see additional options in manually on the lines provided above. <input type="checkbox"/> 700B 350mA Drive Current <sup>5</sup> <input type="checkbox"/> 43K 4300K Color Temperature <sup>6</sup> <input type="checkbox"/> 700 700mA Drive Current <sup>5</sup> <input type="checkbox"/> DIMS 0-10V Dimming (520mA maximum) <sup>7</sup> <input type="checkbox"/> DIM7 0-10V Dimming (700mA maximum) <sup>7</sup> <input type="checkbox"/> F Fuse <sup>8,9</sup> <input type="checkbox"/> HL No Fuse (170/26/0/26, dual circuit input) <sup>10</sup> <input type="checkbox"/> W No Quick Disconnect Harness or Leaking Bubble <sup>11</sup> <input type="checkbox"/> PD Power Diss <sup>12</sup> <input type="checkbox"/> R NEMA Physical Receptacle <sup>13</sup> <input type="checkbox"/> SC Door Safety Tester <sup>14</sup>

### Features:

1. LEDway Type III Medium distribution
2. LEDway Type III Medium distribution with backlight control
3. Horizontal beam mount
4. Light requires portion of adjustment is not painted and will remain natural aluminum regardless of color selection
5. Driver operates at 350mA instead of the standard 520mA providing a lower lumen output and a longer life
6. Color temperature per fixture, minimum 70 CRI
7. Driver operates at 700mA instead of the standard 420mA providing a higher lumen output and a shorter life
8. Control by others
9. Refer to [factory spec sheet](#) for availability and additional information
10. Not available with HL option when 120V voltage is selected
11. When code dates having use time delay fuse
12. Refer to [factory spec sheet](#) for availability and additional information
13. Standard product features unless N option is specified. Door clips not included
14. All connections between door and fixture are shipped unconnected from the factory; door release spring included to open door automatically when the latches are released
15. Shape retaining clips not included as part of this option
16. Not available with HL option
17. Stainless steel anchor cable

### LED PERFORMANCE SPECS

# of LEDs	Initial Delivered Lumens - Type III Medium @ 6800K			Initial Delivered Lumens - Type III Medium w/ Backlight Control @ 6800K			Initial Delivered Lumens - Type III Medium @ 4300K			Initial Delivered Lumens - Type III Medium w/ Backlight Control @ 4300K			System Losses (%)	Total Losses (%)	Total Losses (%)	System Losses (%)	Total Losses (%)	Total Losses (%)	L <sub>70</sub> Hours*
	Factor	B	U	U	B	U	B	U	B	U	B	U							
350mA Fixture Operating at 20° C (77° F)																			
40	3,476 (04)	11.11	2,259 (04)	0.11	3,049 (04)	11.11	2,287 (04)	0.11	4.7	0.40	0.22	0.20	53	0.16	0.16	153,000			
50	4,248 (05)	11.12	2,886 (05)	0.11	3,276 (05)	11.12	2,796 (05)	0.11	64	0.53	0.29	0.25	70	0.20	0.19	141,000			
60	5,020 (06)	11.13	3,513 (06)	0.11	4,472 (06)	11.13	3,564 (06)	0.11	76	0.62	0.34	0.29	81	0.23	0.20	131,000			
520mA (Standard) Fixture Operating at 20° C (77° F)																			
40	4,658 (04)	11.12	3,493 (04)	0.11	4,085 (04)	11.12	3,054 (04)	0.11	70	0.59	0.32	0.28	76	0.22	0.20	98,000			
50	5,620 (05)	11.13	4,270 (05)	0.11	4,803 (05)	11.13	3,243 (05)	0.11	89	0.76	0.42	0.36	103	0.29	0.24	85,000			
60	6,611 (06)	11.14	5,123 (06)	0.11	5,562 (06)	11.14	4,434 (06)	0.11	113	0.94	0.50	0.42	119	0.34	0.27	79,000			
700mA Fixture Operating at 20° C (77° F)																			
40	5,700 (04)	11.12	4,375 (04)	1.12	5,000 (04)	11.12	3,750 (04)	1.12	96	0.81	0.44	0.37	104	0.30	0.24	65,000			
50	6,840 (05)	11.13	5,256 (05)	1.13	6,111 (05)	11.13	4,632 (05)	1.13	124	1.04	0.55	0.46	133	0.36	0.29	56,000			
60	8,010 (06)	11.14	6,270 (06)	1.14	7,332 (06)	11.14	5,500 (06)	1.14	149	1.23	0.64	0.54	154	0.44	0.34	50,000			

\* Lifetime magnetic step-down transformer \*\* For recommended lumen depreciation data see TD-13 \*\*\* For more information on the H-LED (Backlight) Light-Use Rating visit [www.betaled.com/LED/LED-Use-Rating-Addressing-404](http://www.betaled.com/LED/LED-Use-Rating-Addressing-404)

NOTE: All data subject to change without notice  
 © 2010 BetaLED®, a division of Rowal Lighting 1200 92nd Street • Sturtevant, WI 53177 • 800-236-6800 • [www.betaLED.com](http://www.betaLED.com)  
 Made in the U.S.A. of U.S. and imported parts  
 Meets Boy American requirements within the A65A



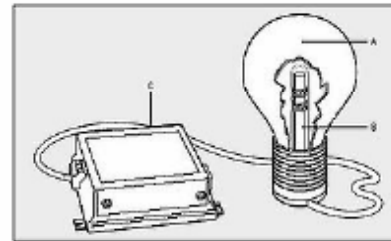


# Induction

- Converts electrical power into visible radiation similar to fluorescent lamps
- Not new technology, but not readily used to date in municipal streetlight applications
- Roughly ½ the price of LED fixtures
- Similar electrical costs to LED
- Similar lifespan to LED
- Light output is typically softer white than LED with a wider range of color
- More narrow light distribution than LED

## Induction Lighting

External inductor lamps are basically fluorescent lamps with electromagnets wrapped around a part of the tube. In the external inductor lamps, high frequency energy, from the electronic ballast, is sent through wires, which are wrapped in a coil around a ferrite inductor on the outside of the glass tube, creating a powerful [electromagnet](#) called an inductor. The induction coil (inductor) produces a very strong magnetic field which travels through the glass and excites the mercury atoms in the interior. The mercury atoms are provided by the [amalgam](#) (a solid form of mercury). The excited mercury atoms emit UV light and, just as in a [fluorescent tube](#), the UV light is down-converted to visible light by the [phosphor](#) coating on the inside of the tube. The glass walls of the lamp prevent the emission of the UV light as ordinary glass blocks UV radiation at the 253.7 nm and 185 nm range.



A) Discharge vessel, B) Tube with power coupler and C) Electronic ballast.

# Induction Fixture



Project :  
Type :  
Quantity :

## Jersey Street Lighting



- Wattage: 40W, 80W, 100W, 120W and 150W
- High index, CRI: 85; Makes colors look more true and vibrant
- Vibration resistant: Electrodeless design allows for use in high-vibration applications
- Instant on and Instant re-strike
- Applications: Street Lighting, Area Lighting

### Housing

- Rugged die-cast aluminum housing
- Electrostatic powder-coated surface for corrosion-resistance and long life
- Tempered glass lens for superior lighting performance and durability
- Anodized aluminum reflector for optimal light distribution
- Gas tight silicon rubber seal
- Tool less lamp access and terminal access
- Protection class: IP65 (Dust and low pressure water)
- Bolt mast arm mount is adjustable for arms from 1-1/4" to 2" (1-5/8" to 2-3/8" O.D.) diameter
- Terminal block and NEMA photocontrol receptacle

### Specification

#### Induction Lamp

Wattage □ W □	Luminance (LM)	CRI	Color temperature (Kelvin)	Rated life (Hours)
40	3,400	85	5,000	100,000
80	6,800	85	5,000	100,000
100	8,500	85	5,000	100,000
120	10,200	85	5,000	100,000
150	12,750	85	5,000	100,000

#### Driver

Wattage (W)	Input voltage range(VAC)	Input current (A)	Input frequency	Power factor	Operating temp	Input power (W)
40	120/277	0.38-0.17	50-60Hz	0.98	-30 to 122°F	45
80	120/277	0.74-0.32	50-60Hz	0.98	-30 to 122°F	87
100	120/277	0.90-0.41	50-60Hz	0.98	-30 to 122°F	110
120	120/277	1.08-0.49	50-60Hz	0.98	-30 to 122°F	127
150	120/277	1.38-0.60	50-60Hz	0.98	-30 to 122°F	160



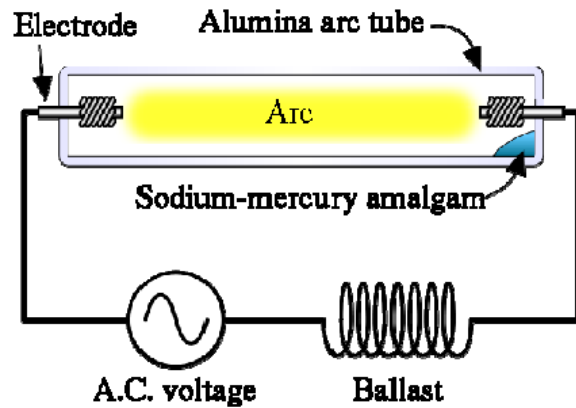


# High Pressure Sodium (HPS)



## High Pressure Sodium Vapor

A Sodium vapor lamp is a [gas discharge lamp](#) that uses [sodium](#) in an excited state to produce [light](#).


















# Product Comparison Chart



ENERGY EFFICIENT STREETLIGHTS COMPARISON CHART

FEATURE	LED	INDUCTION
INSTALLATION COSTS	Increased wattage increases cost Downlamping can reduce cost to approach that of induction	 Cost is about 30% below LED as increased wattage does not increase cost
TECHNOLOGY	 Significantly improved light distribution characteristics	Very similar to HPS
ENERGY EFFICIENCY	 Less than half the demand of HPS lamps	 Less than half the demand of HPS lamps
LOCAL PUBLIC OPINION POLL	 60% favor LED	45% favor Induction
PG&E REBATE PROGRAM	 PG&E offers a per lamp rebate for LED installations	No rebate for Induction installations
PG&E TARIFF REDUCTION	 Same for both	 Same for both
ENVIRONMENTAL	 100% Recyclable	Contains a small amount of mercury & requires special handling
STATEWIDE RETROFITS	 LED is the selected technology by a wide margin including Los Angeles and San Francisco	Recently Santa Rosa and San Diego have selected Induction
NATIONWIDE RETROFITS	 LED is the selected technology by a wide margin	Many cities have bid both technologies and LED has been selected by a wide margin



# On-Line Survey

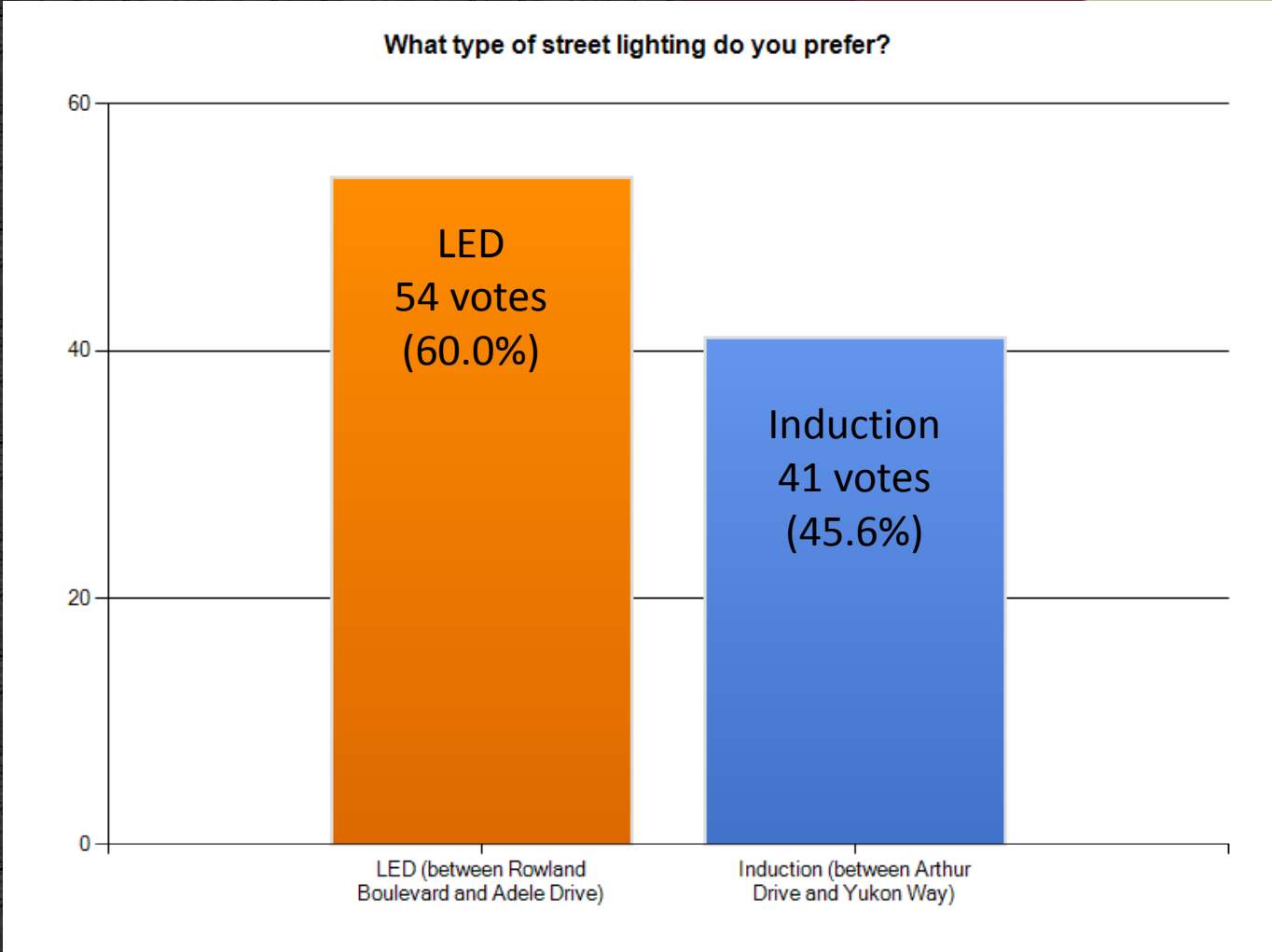
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Survey Monkey Results  
January 6 – 31, 2011



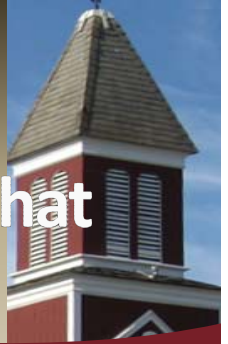
# On-Line Survey

## Question 1: What type of street lighting do you prefer?

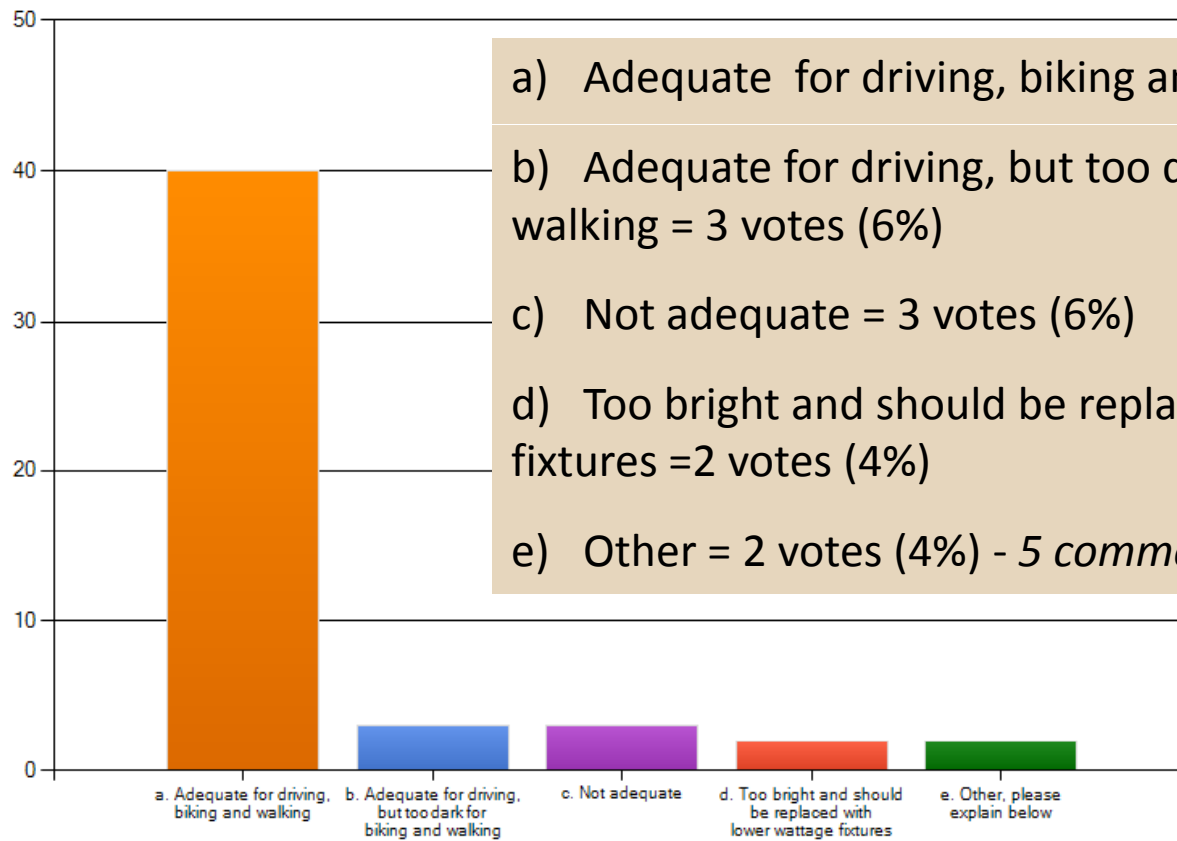


# On-Line Survey

Question 2: For your preferred streetlight, did you feel that light output was?



For your preferred streetlight type, did you feel that light output was?



a) Adequate for driving, biking and walking = 40 votes (80%)

b) Adequate for driving, but too dark for biking and walking = 3 votes (6%)

c) Not adequate = 3 votes (6%)

d) Too bright and should be replaced with lower wattage fixtures = 2 votes (4%)

e) Other = 2 votes (4%) - 5 comments provided

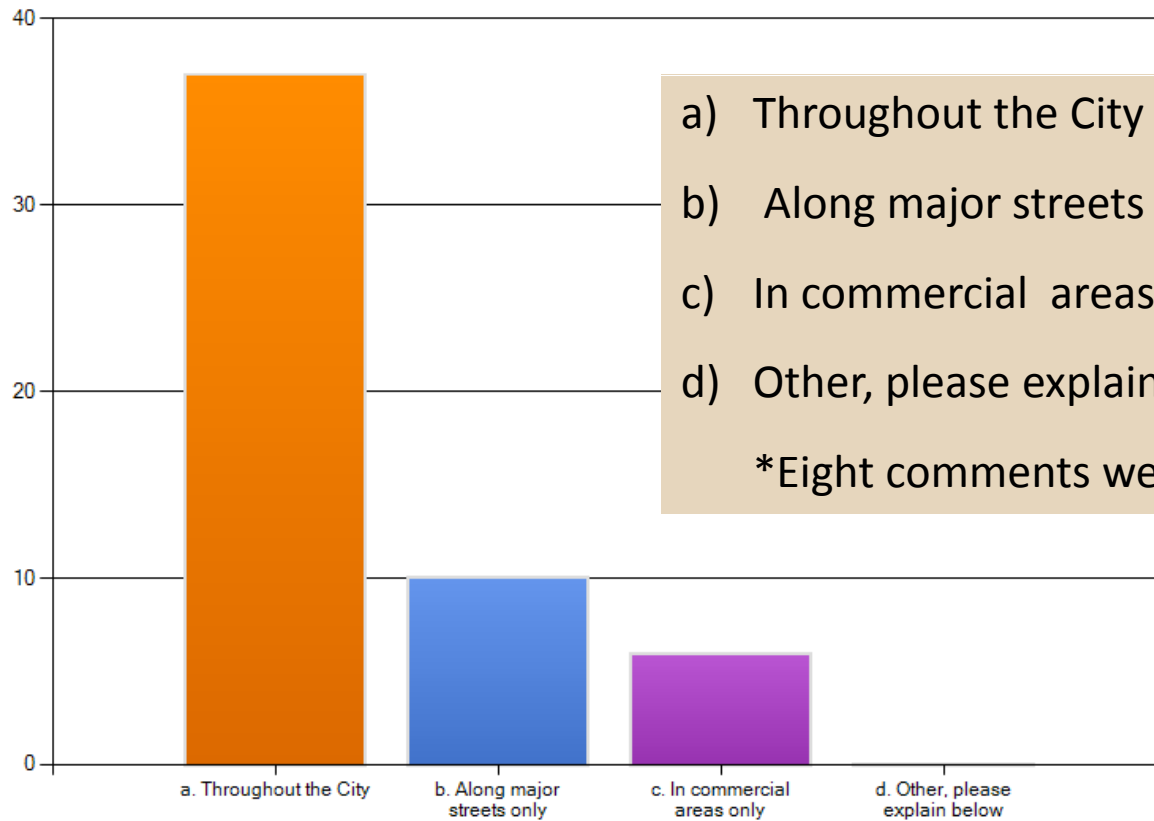


# On-Line Survey

## Question 3: For you preferred streetlight type, would you prefer installing?



For your preferred streetlight type, would you support installing:



- a) Throughout the City =37 votes (74%)
  - b) Along major streets only = 10 votes (24%)
  - c) In commercial areas only = 6 votes (12%)
  - d) Other, please explain below = 0 votes (0%) \*
- \*Eight comments were given

# On-Line Survey

## Questions 4 & 5: Why I Prefer..



### Question 4:

#### Why I prefer LED lighting

23 provided answers including

- Improved visibility
- Reduced cost
- Better efficiency
- Economy
- Longer life span

### Question 5:

#### Why I prefer Induction lighting

25 provided answers including

- Less glare
- Night sky vision not diminished
- Economy
- Better street visibility
- Longer life





# Conversion Program

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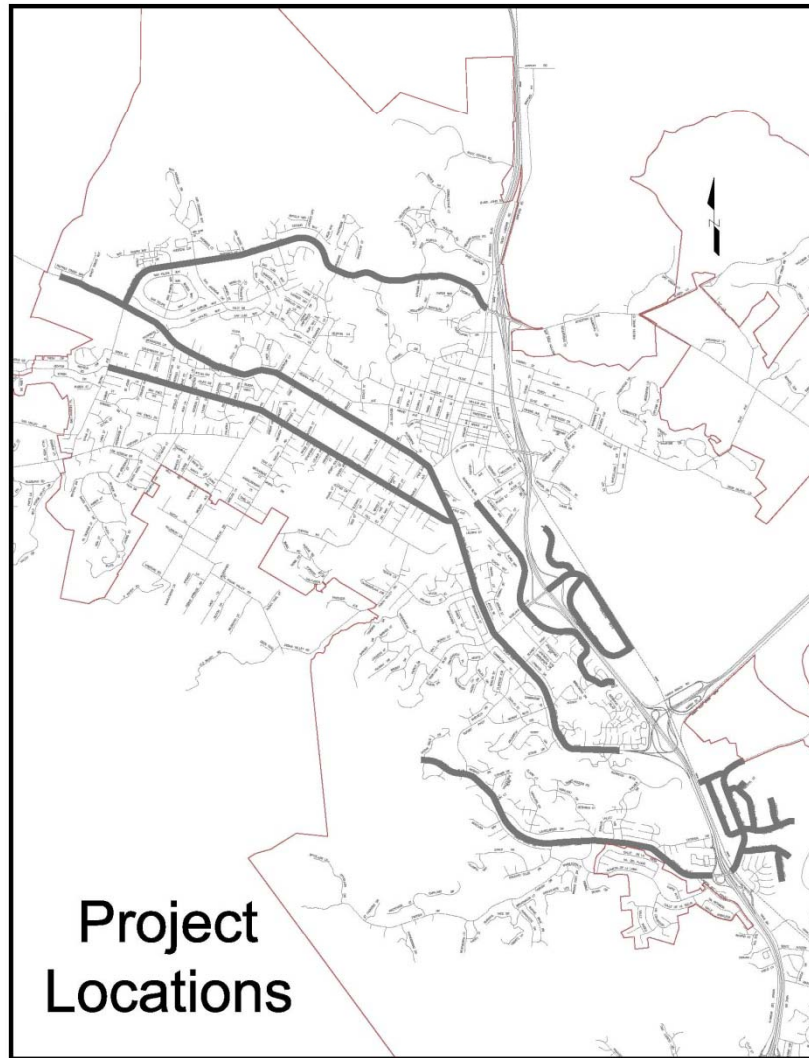
# Streetlight Conversion Program



- Methodology & Criteria
  - LED & Induction tend to have cooler light
  - Focus on major streets, commercial & industrial areas and signalized intersections
  - Ability to convert entire corridor
  - Predominantly standard cobra-head type HPS fixtures
  - Typically higher wattage more costly HPS fixtures
- Intentionally excluded:
  - Redwood Blvd north of Lamont
  - Grant Avenue



# Streetlight Conversion Program (cont.)



**Project  
Locations**

# Streetlight Conversion Program (cont.)



- Vintage Oaks Area
  - Rowland Boulevard along Vintage Oaks
  - Vintage Way
  - Rowland Way
- Bel Marin Keys Area
  - Bel Marin Keys Boulevard from 101 to City Limit east
  - Commercial Boulevard
  - Pamaron Way
  - Digital Drive
  - Leveroni Court
  - Galli Drive
  - Pimental Court
  - Hamilton Drive
- Novato & South Novato Boulevard
  - Northern City limits to Highway 37



# Streetlight Conversion Program (cont.)



- Redwood Boulevard
  - Lamont Avenue to dead end south
- San Marin Drive
  - Novato Boulevard to Redwood Boulevard
- Ignacio Boulevard
  - Indian Hills Drive to Enfrente Road
- Center Road
  - Sutro Avenue to South Novato Boulevard
- Signalized Intersections (not included in other scope of work above)
  - DeLong Avenue at Redwood Boulevard
  - Nave Drive at Hamilton Place Shopping Center
  - Nave Drive at Hamilton Parkway
  - Nave Drive at Main Gate Road
  - Nave Drive at Bolling Dr
  - Main Gate Road at Randolph Drive



# Other Streets to Consider



- Main Gate Drive
- Palm Drive
- South Palm Drive
- DeLong Avenue
- Olive Avenue
- Rowland Way
- Grant Avenue
- Redwood Boulevard north of Lamont Avenue
- Sutro Avenue
- Wilson Avenue
- Sunset Parkway
- Hamilton Parkway
- Seventh Street
- Simmons Lane
- Nave Drive





# Other Issues

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# Comments From January 11 Meeting

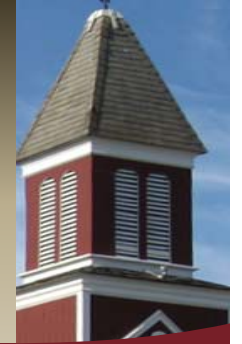


- Be consistent with Dark Sky Association recommendations
- Contact & hold discussions with SMIA
- Consider down-lamping
- Identify clear criteria for making decisions
- Convert as many streetlights as possible to reduce energy costs
- Consider solar options



# Solar Options

- Technology is not practical yet to power streetlights.
- May be more viable in the future.
- Predominantly for landscape and walkway lighting.
- Significant expense



# Hazardous Materials & Recycling



- All induction and HPS lights contain a small quantity of mercury, which is considered a hazardous material and requires special handling and disposal.
- There are no known hazardous materials associated with LED lights which are considered to be 100% recyclable.
- Republic ITS has an approved standard practice for both recycling and disposal of hazardous materials. This is included in the City's annual service contract as routine and would not result in additional costs to the City.





# Conclusions & Recommendations

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# What Others Are Doing



## LED

- Washington D.C.
- Los Angeles
- Walnut Creek
- Pittsburg
- Santa Cruz
- Danville
- Morgan Hill
- Petaluma
- County of Marin

## Induction

- San Diego
- Cupertino
- Santa Rosa



# Recommendation



## Recommendation

- Staff recommends the use of Light-Emitting Diode (LED) fixtures and awarding a contract, based on the base bid, to the lowest responsible bidder for the bid alternate.

## Alternatives

- Select LED technology and award a contract for the base bid to the lowest responsible to bidder. Reject all bids for 090-006B, Induction.
- Select Induction technology and award a contract for the base bid to the lowest responsible bidder. Reject all bids for 090-006A LED.
- Select Induction technology and award a contract, based on the base bid, to the lowest responsive bidder for the bid alternate. Reject all bids for 09-006A LED.
- Choose to reject all bids for both projects.



# Recommendation (cont.)



- Council can defer awarding contract until February 22
- Price gap between LED and Induction narrows significantly with down-lamping.
- Based on the bids additional streets will be included in the program.
- Budget resolution allocating funds previously transferred from the Municipal Financing Program.



# ADDITIONAL STREETS IN PRIORITY ORDER



## PRIMARY:

1. Signalized Intersections (not already included)
2. DeLong/Diablo
3. Rowland Boulevard (Hwy 101 to S. Novato Blvd)
4. Nave Drive
5. Hamilton Parkway (135 total lights added)

## SECONDARY:

6. Sunset Drive
7. Main Gate/Palm/South Palm
8. Simmons Lane