

Cool Fixes for Hot Cities

Part 2: Los Angeles

Thank you for joining. We will start in a few minutes.

NEW! Two audio options:

1. Listen via computer
2. Call in to 1-855-210-5748



Cool Fixes for Hot Cities

Part 2: Los Angeles

September 12, 2018

Hosted by:

U.S. EPA Heat Island Reduction Program





Webcast Agenda

- **Introduction**
 - Victoria Ludwig, U.S. EPA Heat Island Reduction Program
- **Overview of Cool Pavements for Heat Island Reduction**
 - Kurt Shickman, Global Cool Cities Alliance
- **Los Angeles' Cool Pavements Pilot Project**
 - Greg Spotts, Los Angeles Bureau of Street Services
- **Los Angeles' Cool Roof Ordinance and Free Tree Program**
 - Craig Tranby, Los Angeles Department of Water & Power
- **Question and Answer Session**



Webcasts now use Adobe Connect



Troubleshooting Tips

- Try a different web browser (e.g., Firefox, Chrome)
- Download the latest version of Adobe Flash Player or the Adobe Connect Plug-in
- Check with your Information Technology (IT) department about your internet security settings
- Find help [online](#)



How to Participate



Audio



■ Computer

- Audio will begin when the Host signs on
- Tip! Unmute your speakers or headphones



■ Phone

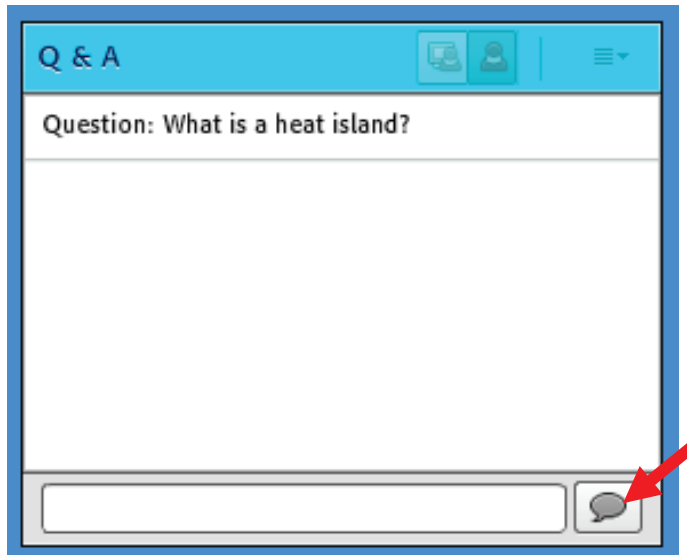
- Call in to 1-855-210-5748
- Tip! Mute your computer speakers to avoid audio feedback

■ Participants are muted

How to Participate

Question and Answer

- Enter your question in the Q&A box
- Questions will be moderated at the end
- EPA will post responses to unanswered questions on the [Heat Islands webpage](#)

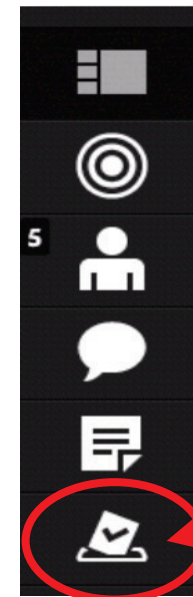
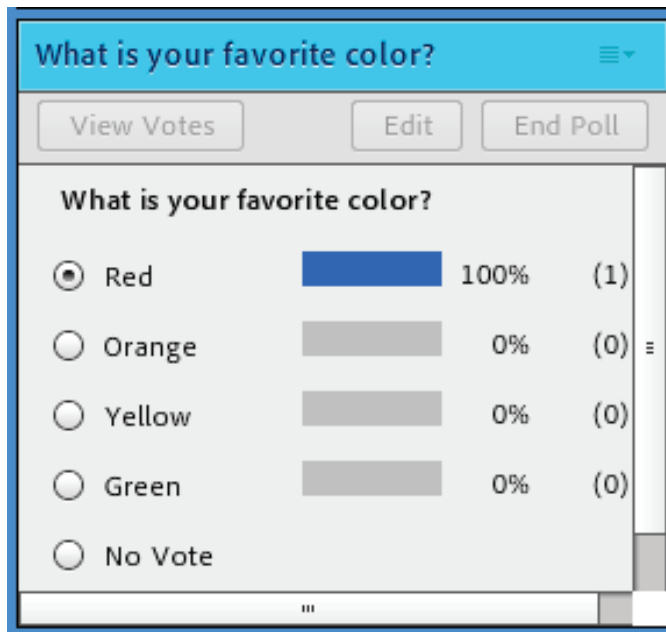


The screenshot shows a web interface for a Q&A section. At the top, there is a blue header with the text "Q & A" and icons for a computer monitor, a person, and a menu. Below the header, the question "Question: What is a heat island?" is displayed. Underneath the question is a large, empty white text area for an answer. At the bottom of the interface, there is a white text input field and a grey speech bubble icon. A red arrow points to the speech bubble icon, indicating where to click to submit the question.

How to Participate

Polling

- We'll ask several poll questions during the webcast
- On mobile devices or tablets
 - Exit full screen mode
 - Tap on the Poll icon



Introduction

Victoria Ludwig
U.S. EPA Heat Island Reduction Program



EPA's Heat Island Reduction Program

■ Mission

Outreach and technical assistance program working with local officials, researchers, non-profits, and industry to identify opportunities to implement effective heat island reduction programs and policies.

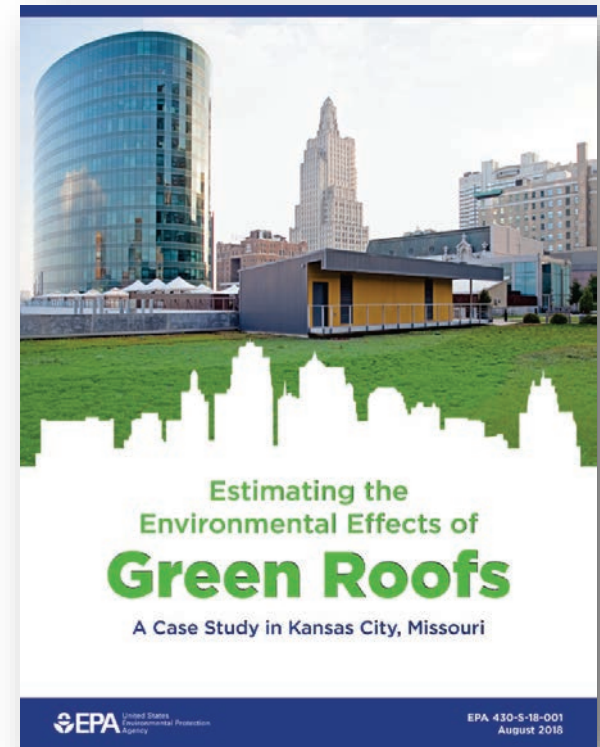
■ Program Audiences

- Local and state policymakers and program implementers
- Academia/researchers
- Other federal agencies
- Non-profit organizations
- Industry



Newly Sprouted Green Roofs Page!

- [Using Green Roofs to Reduce Heat Islands](#)
- [Estimating the Environmental Effects of Green Roofs, A Case Study in Kansas City, Missouri](#)
- New photo gallery and graphics
- Refreshed content



Heat Island Program Resources

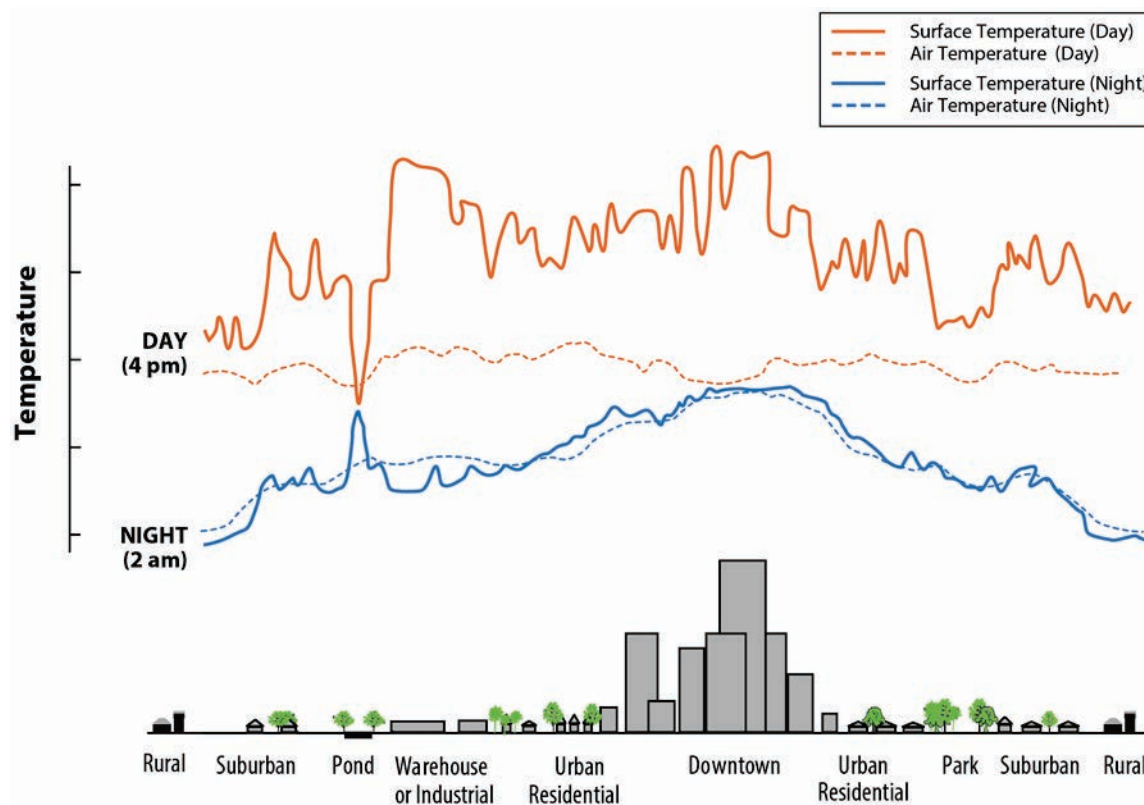
- **[Compendium of Strategies: Reducing Urban Heat Islands:](#)** Heat island science, detailed info on mitigation strategies, local examples, policy options
- **[Website:](#)** Basic information on heat island topics, calendar of events, newsroom, links to other resources
 - NEW: [Using Green Roofs to Reduce Heat Islands](#)
- **[Examples:](#)** Database of more than 75 local and statewide initiatives to reduce heat islands
- **[Webcasts:](#)** Topics include case studies, public health connections, advances in mitigation policy
 - NEW: [Materials from Cool Fixes for Hot Cities Part 1: San Antonio](#)
- **[Newsletter:](#)** Recent news on projects and policies, research, funding opportunities





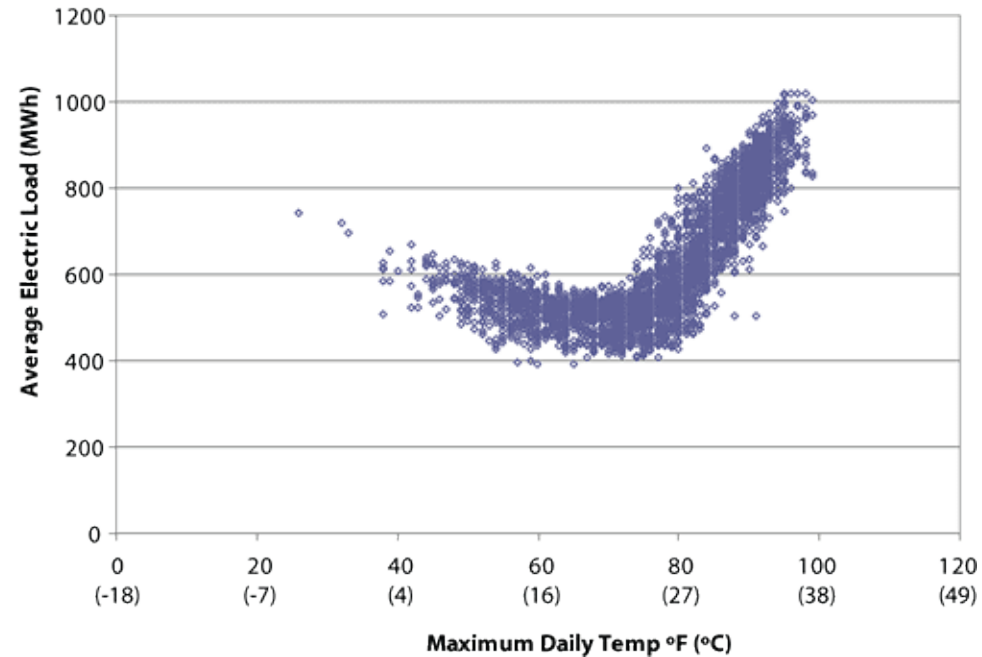
What is the Heat Island Effect?

- Micro-scale temperature differences between urban and rural areas
- Urban areas can be 0.9 °– 7.2 ° F higher than rural areas in the daytime, and 1.8 °– 4.5 ° F higher at nighttime



Heat Island Impacts

- Higher energy consumption and emissions
- Lower air quality
- Higher risks to public health
- Impaired water quality
- Quality of life





Contact Information

[Victoria Ludwig](#)

U.S. Environmental Protection Agency

202-343-9291



[Website](#)

[EPA Heat Island Newsletter Sign-Up](#)




Poll 1



Pavement Choices for Cooler Cities

Kurt Shickman
Global Cool Cities Alliance



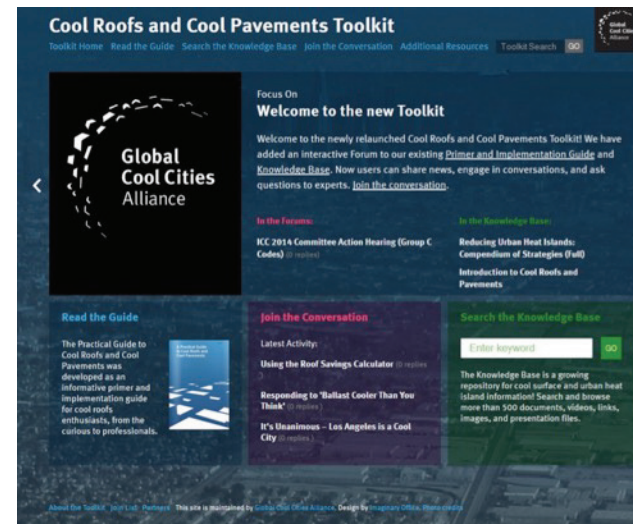
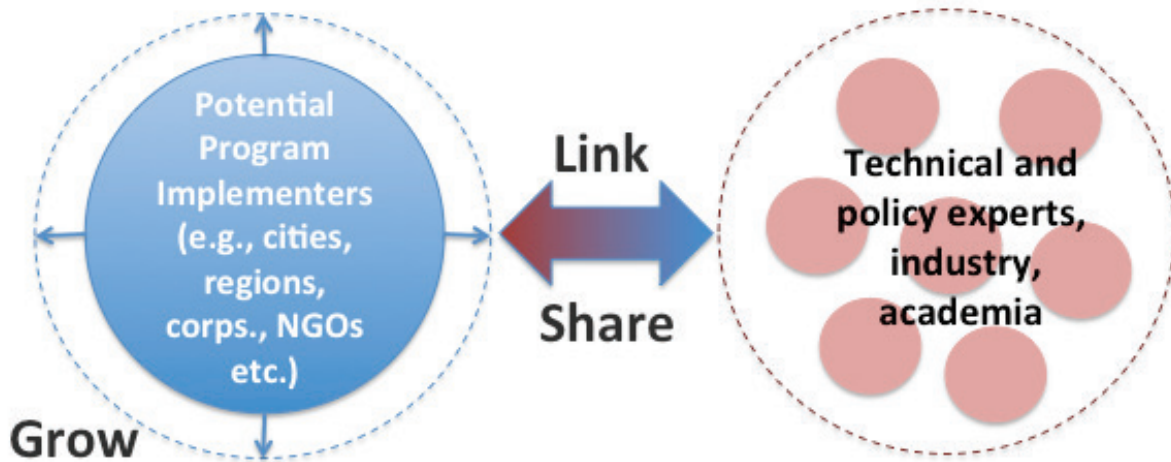
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1. Overview
 2. Performance and Impact
 3. Considerations
 4. Product Round-up

Ginza-Dori Avenue (National Route 15)

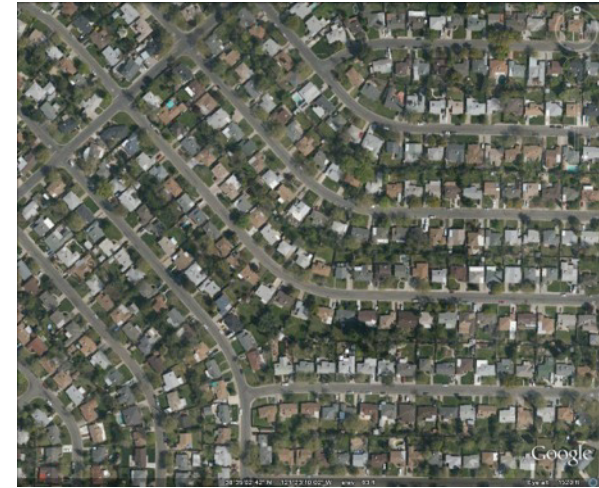
Photo: Kanto Regional Development Bureau.

Global Cool Cities Alliance (GCCA)

The Global Cool Cities Alliance is dedicated to advancing policies and actions that reduce excess urban heat in order to cool buildings, cool cities, and to mitigate the effects of climate change through global cooling.



Pavement makes up 1/3rd of the average city



Of that third, about

- 45% are streets (usually asphalt concrete)
- 15% are sidewalks (usually cement concrete)
- 40% is exposed parking (usually asphalt concrete)

Two options for cooler pavements

High solar reflectivity



Cools by reflecting, rather than absorbing, solar energy

Permeable/porous



Cools via evapotranspiration

Reflectivity of common urban surfaces

(also known as albedo)

Common Albedo Values (Emerald Cities)

Fresh Asphalt	0.05	Fresh Grey Portland Cement	0.35
Black Soil	0.13	Desert Sand	0.40
Bare Soil (land)	0.17	Cool Pavement Coatings	+0.50
Aged Asphalt	0.20	Arctic Region	0.77
Green Grass	0.25	White Portland Cement	0.80
Aged Portland Cement	0.29	White Roof Coatings	0.88

Higher solar reflectance (SR) = lower surface temperatures

SR 0.06

SR 0.32

SR 0.46



58.8°C (138°F)

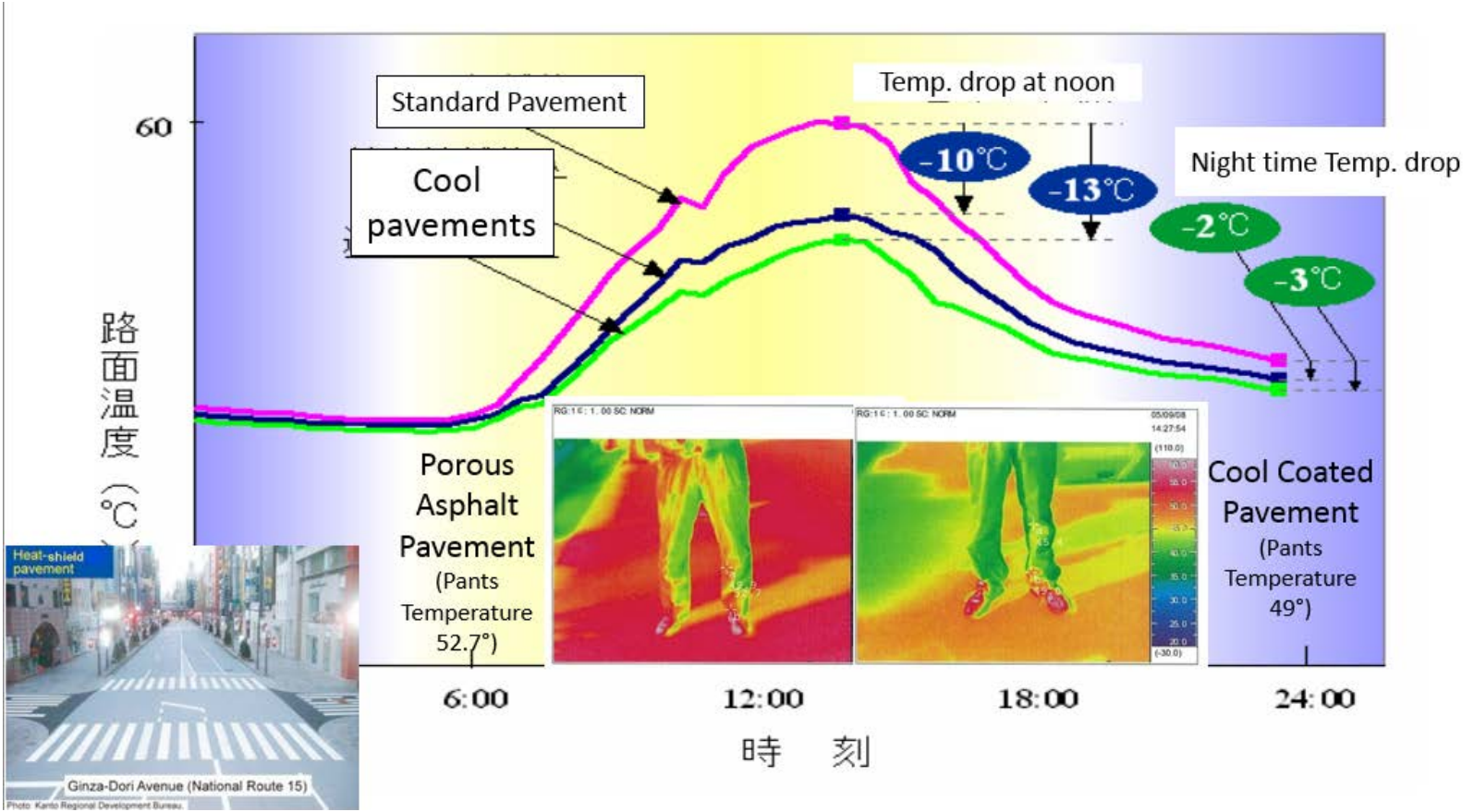
46.2°C (115°F)

41.4°C (107°F)

- Measurements performed in Berkeley, 26 June 2012
- Air temperature 22.5°C (72.5°F), no wind or clouds

Increasing pavement SR by 0.1 decreases temperature \approx 7°F (4°C)

Cool pavements pilot results (Tokyo)



Longer pavement life

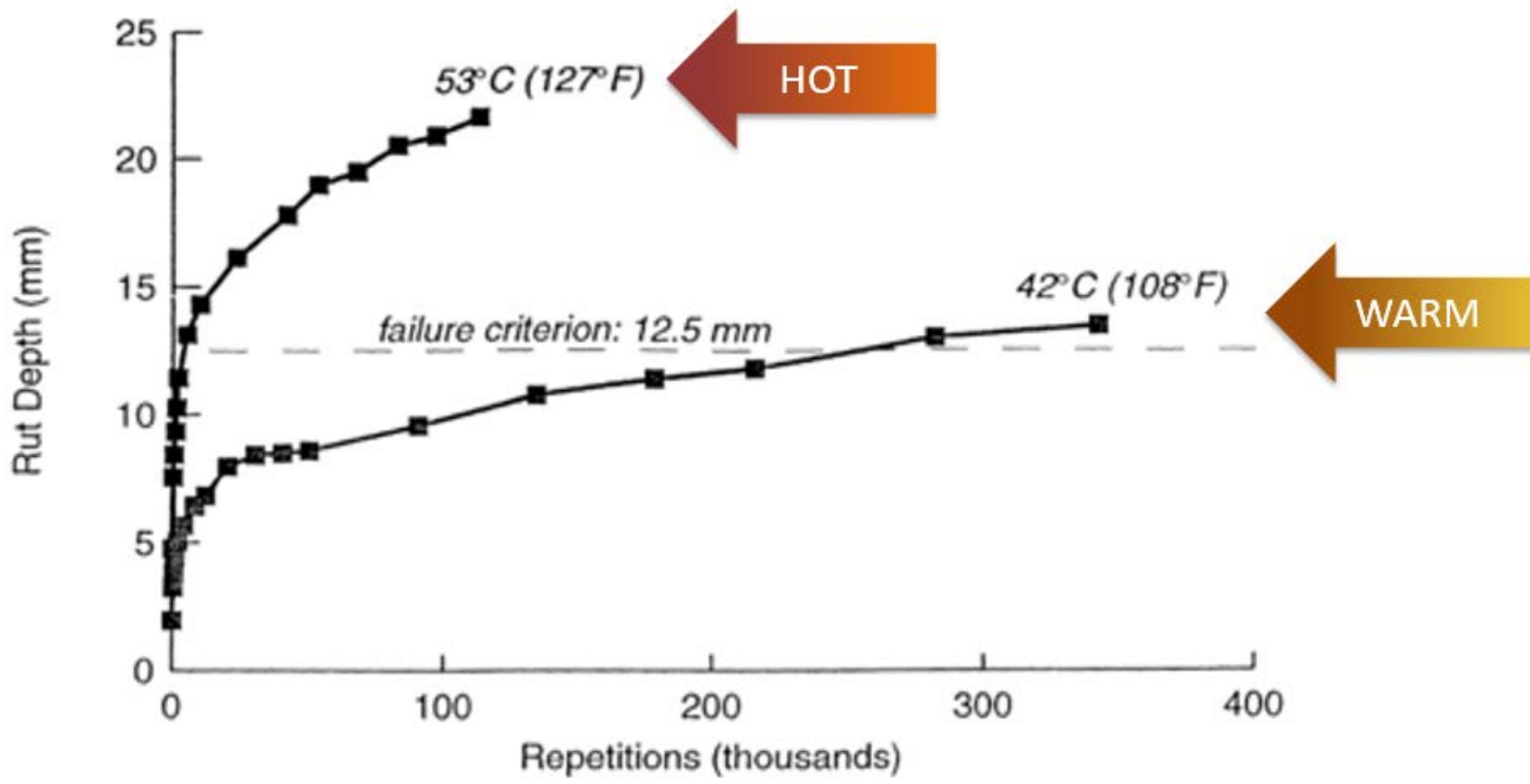


Fig. 2. Depth of Rutting vs Number of Repetitions of a Standard Axle Load, Wide-base Single Tire, at Pavement Surface Temperatures of 42°C and 53°C

Enhanced visibility and safety

- Nighttime illumination

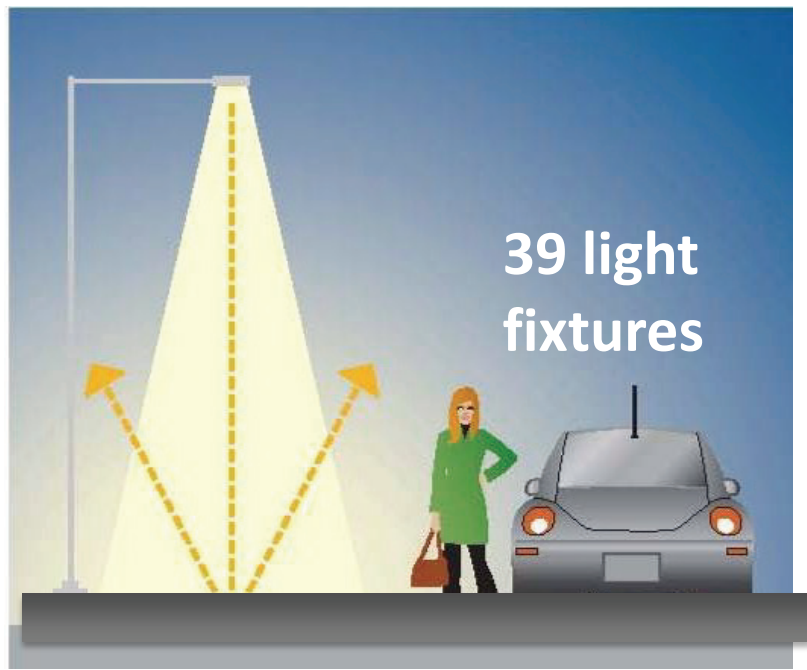


- Reflected illumination is roughly proportional to solar reflectance

Energy savings

- Reduced energy for street lighting
 - Enhanced illumination or fewer fixtures

Source: Stark, R.A. (1986)



=



Dark pavement

Light pavement

May also enhance building daylighting. Impact on air conditioning use is building specific.

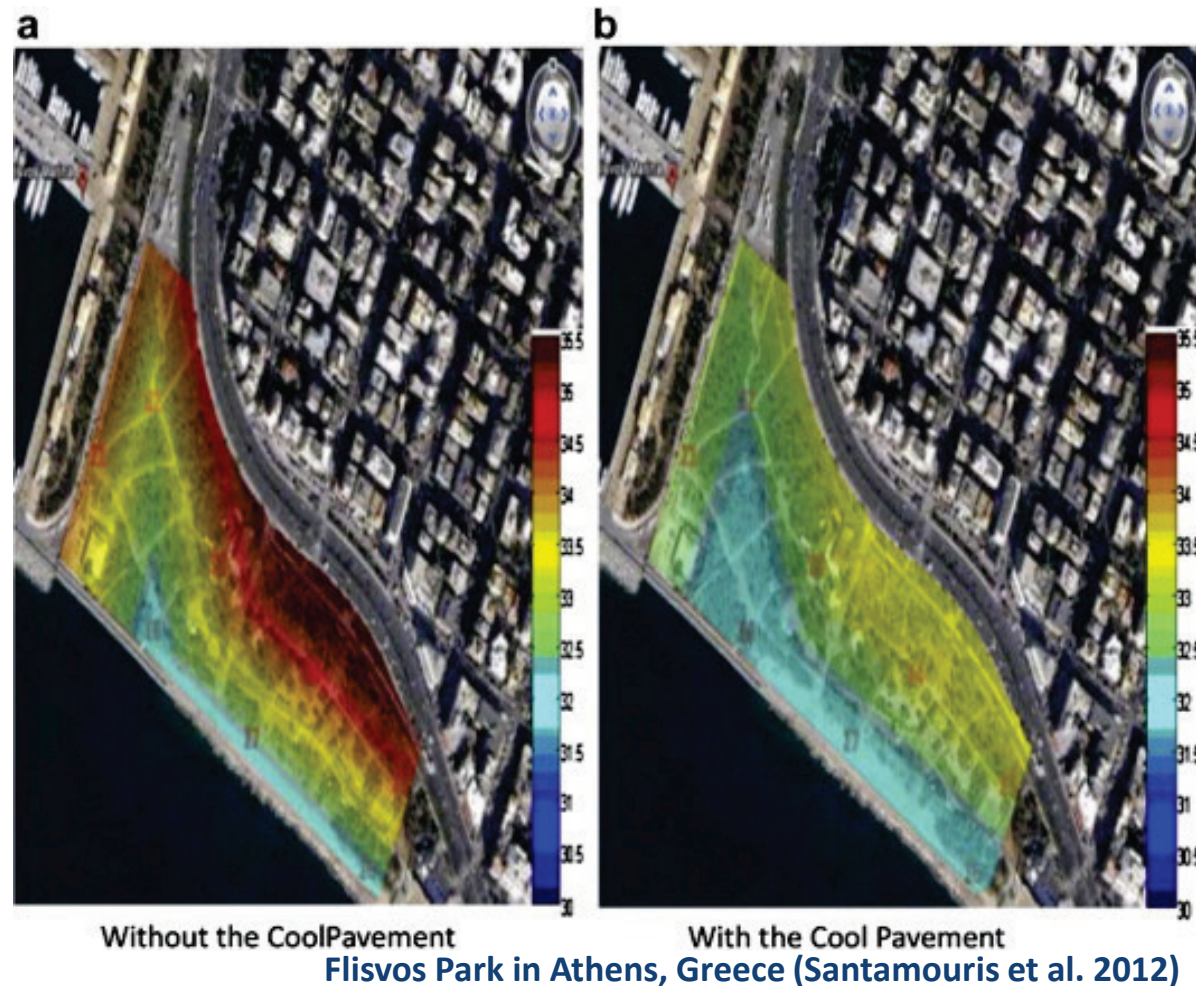
Preserved water quality

- EPA's Clean Water Act addresses heat pollution – temperature is “pollutant of concern”
- Ultra urban streams warm by 8°F one hour after summer squalls
- A change of 5°F over 5 hours can induce stress in most desirable species of fish

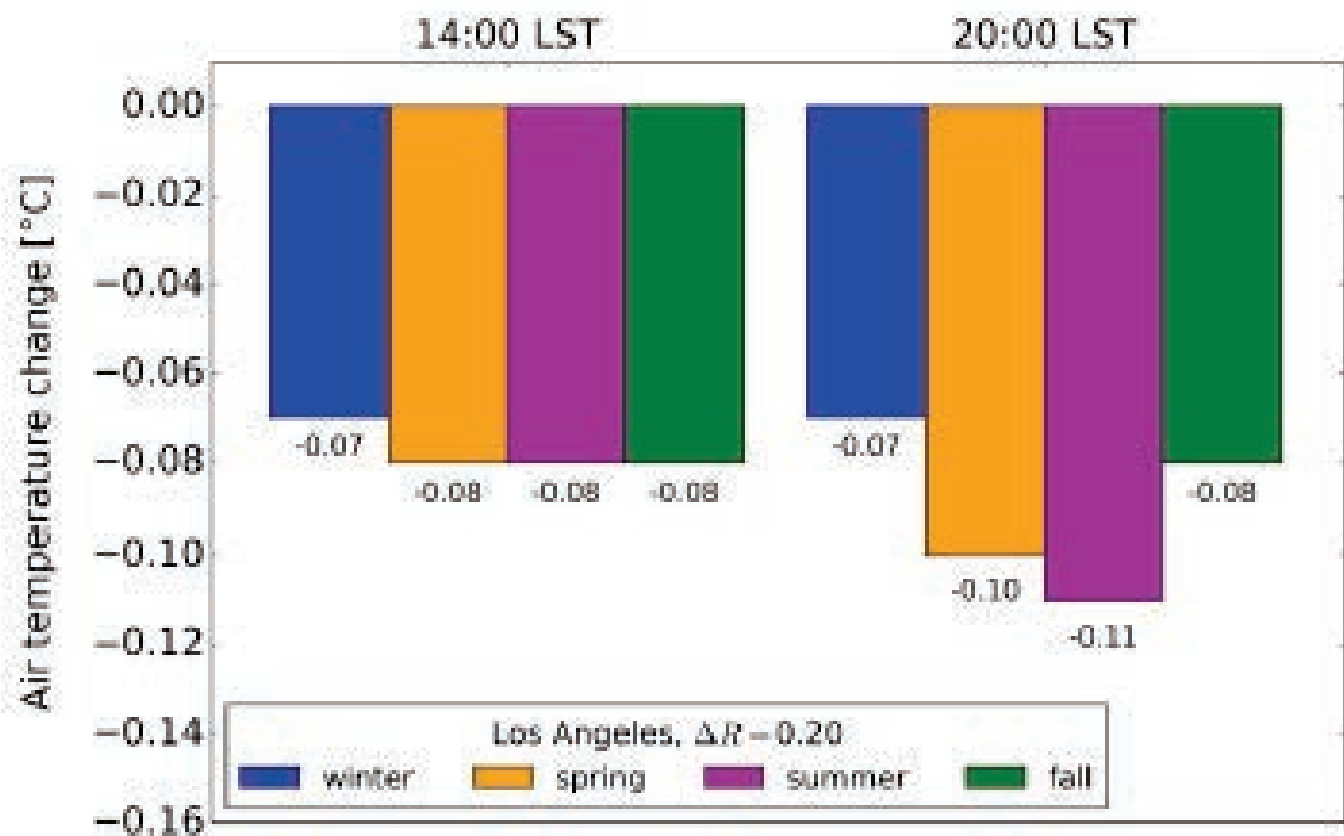
Brook Trout

Improved outdoor comfort

- An urban park in Athens, Greece installed 4,500 m² of cool pavements
- Reduced peak air temperatures by 2°C (Santamouris et al. 2012)



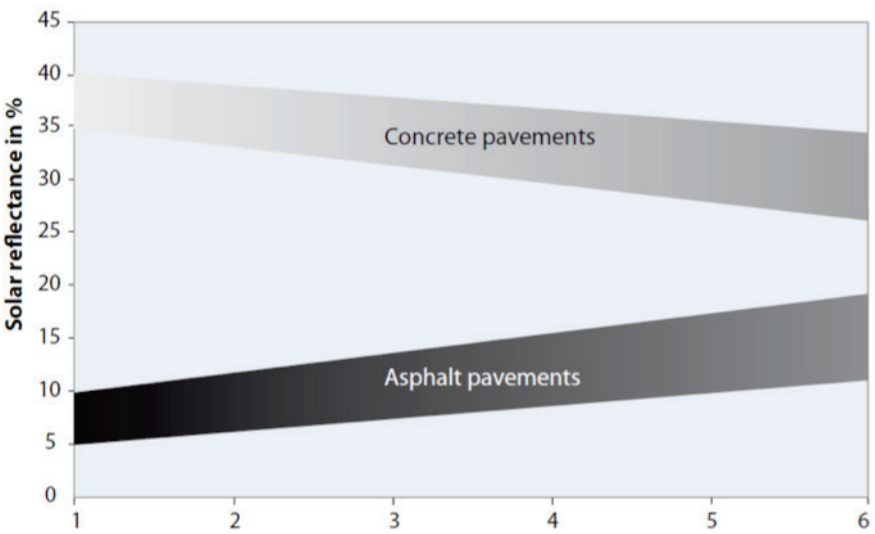
Air temperature reductions – city scale



Source: LBNL, UC Davis & USC. *Life-Cycle Assessment and Co-Benefits of Cool Pavements*

Simulated cooling rate of 0.9°C per 0.1 SR increase is in line with other major findings

Issues to consider (relatively minor)



Reflectivity changes over time



Shading from trees, buildings, cars etc. may lessen urban heat island reduction potential of pavements

Issues to consider (uncertain)



- Building orientation, vintage, window:wall ratio, proximity to pavement
- Possible increase in reflectivity-related cooling demand
- Possible reduction in cooling demand due to cooler air
- Possible reduction in internal lighting loads

Pavement/Building Interactions are a Complex System

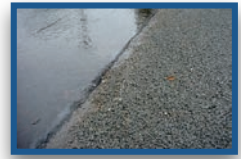
Issues to consider (potentially major)

- First cost (1.5 – 2.5x premium in some cases)
- Impact on recyclability of asphalt pavement
- Potentially negative impact on pedestrian comfort due to radiated solar energy, if not paired with shade solutions.
- Lifecycle global warming potential (GWP) may outweigh urban heat island benefit.

Cool Pavement Options



Lighter aggregate
(asphalt)



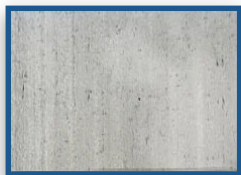
Permeable/Pervious



Coatings, slurries, overlays
(asphalt)



Clear resin (w/light
aggregate)



Fine light aggregate
(cement)



Grass pavers



Slag addition
(cement)



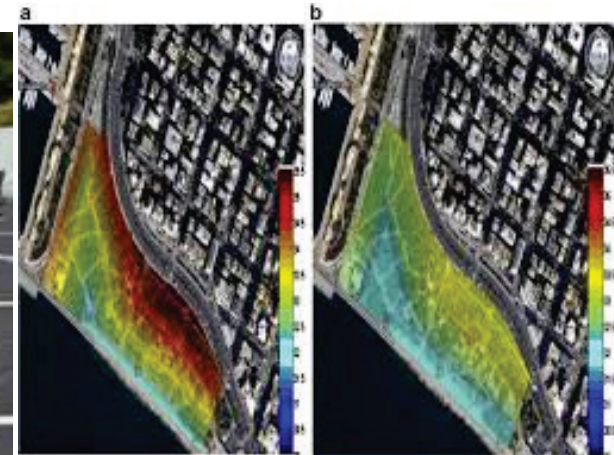
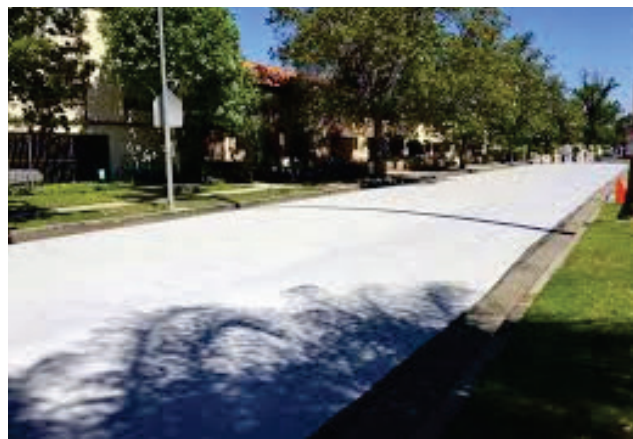
Titanium dioxide
(TiO₂) addition

What's Next for Cool Pavements?

More pilots (e.g., Los Angeles, Melbourne, Athens, Tokyo, Chula Vista)

More locally relevant studies/discussions (e.g., AB296, New York City)

More innovation (price point, GWP, broader product offerings)





Thank you!

GlobalCoolCities.org

CoolRoofToolkit.org

Cool Pavement
kurt@globalcoolcities.org

202-550-5852

[@globalcoolcity](https://www.instagram.com/globalcoolcity)

Poll 2



Los Angeles' Cool Pavements Pilot Project

Greg Spotts

Los Angeles Bureau of Street Services





Eric Garcetti
Mayor



Kevin James, President
Board of Public Works

Cool Pavement Pilot Project

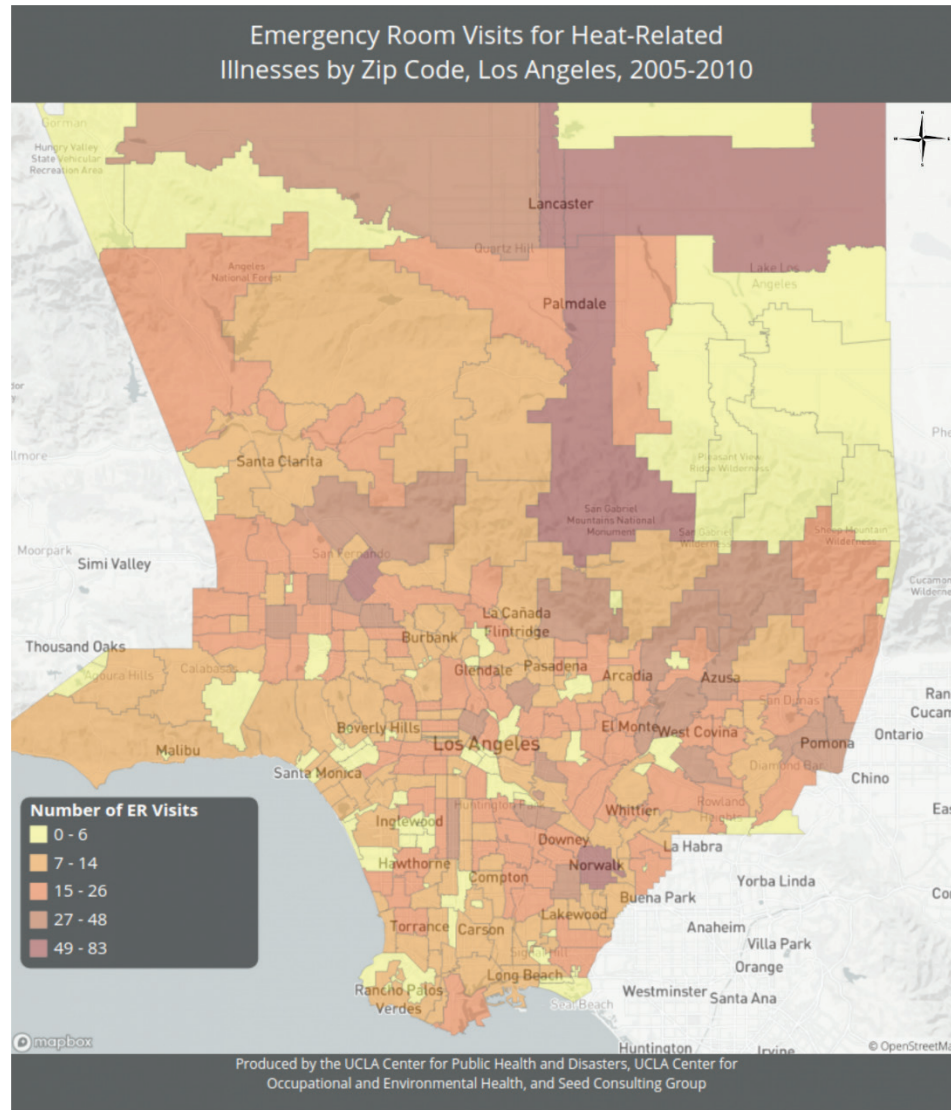
Greg Spotts
Assistant Director + Chief Sustainability Officer
Bureau of Street Services (BSS)
August 2018



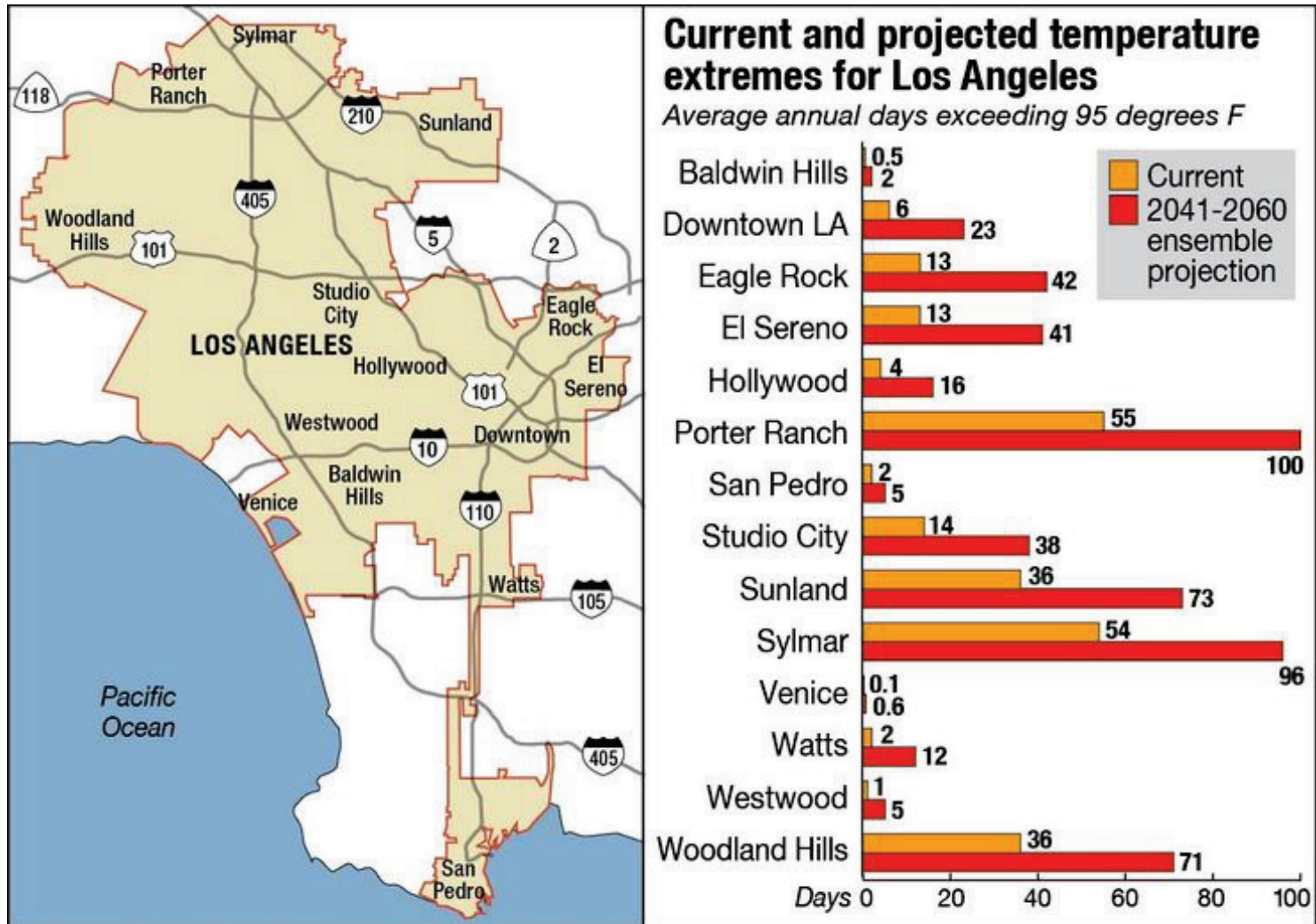
Quality • Timeliness • Efficiency

LA experiences heat-related illnesses and deaths

(One of the only cities with heat-related deaths in Winter)



And LA is expected to get HOTTER!



Source: UCLA LARC study, 2012; chart based on the mean/average projected by the 18 climate models

In July 2015, BSS partnered with Rec & Parks and the materials testing department to install a test patch of cool pavement coating at Balboa Sports Complex



Two coats of Guard Top Cool Seal are applied



Finished product with striping

Gray coating is 10 degrees Fahrenheit cooler than black asphalt



Materials Test Results:

Material passed California skid test and slip test, meaning it is safe under wet conditions

In summer afternoons, coated area was 10 degrees cooler than untreated black asphalt across the median

Next Step: Obtained funding to install coating on 1 city block in each of the 15 Council Districts (CDs)



Results of Pilot Project Phase 1



Greg Spotts

@Spottnik

It's very hot on Coronado St in CD13- but the Cool Seal treated pavement is more than 10 degrees F cooler than black asphalt

[@MitchOFarrell](#)



3:06 PM - 29 Aug 2017

1. Thermal performance is as expected: 10 degrees cooler
2. Residents greeting the installation with excitement
3. Press coverage from LA Times, New York Times, Washington Post, National Public Radio, local television stations
4. Inquiries from other cities
5. Potential concerns about staining / darkening

Summer 2018: Guard Top contractor re-coats the 15 locations with revised Cool Seal formulation

GOAL: improved thermal performance as coating ages, with reduced erosion and staining



First coat applied using slurry buggy

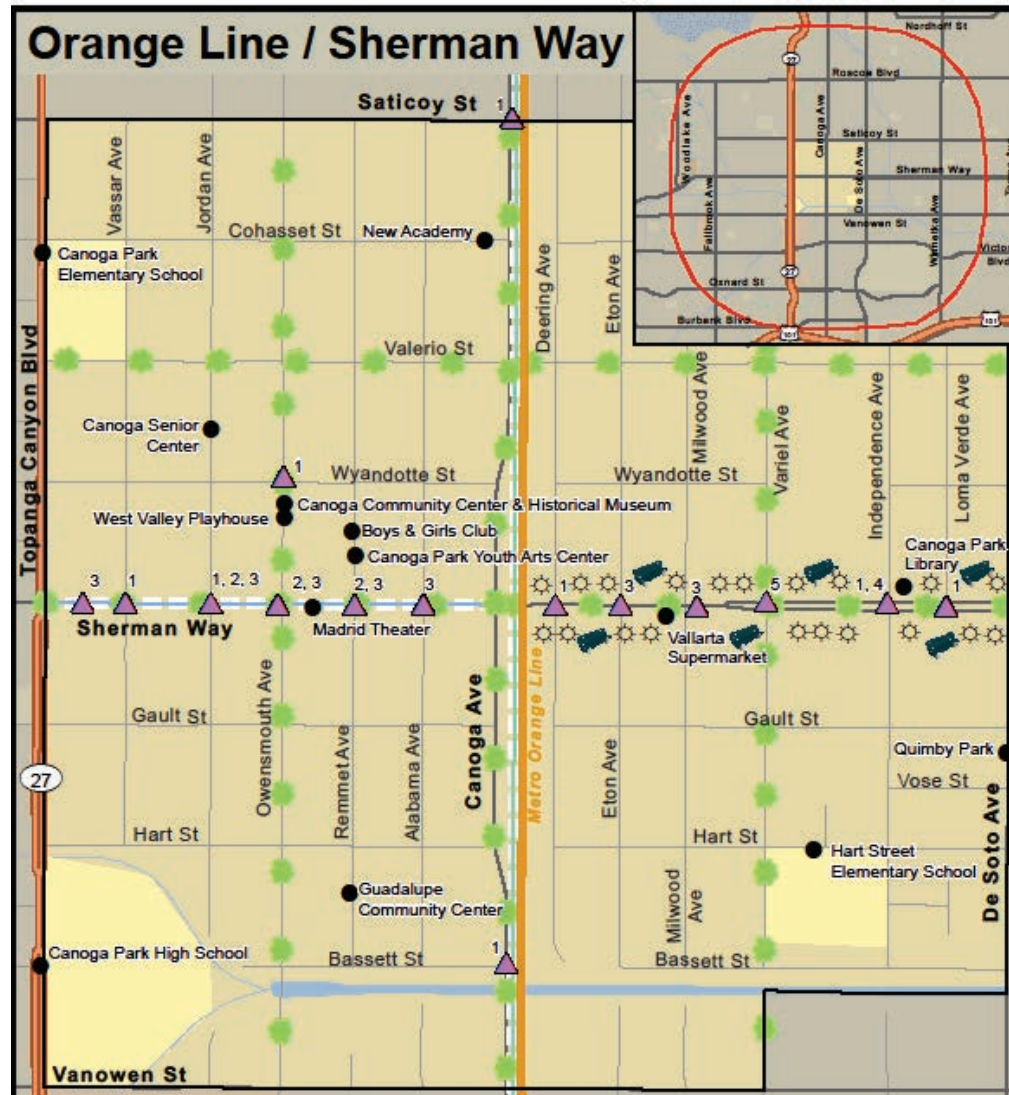


Second coat applied by hand spray

Next Steps: SB1 Climate Adaption Planning Grant

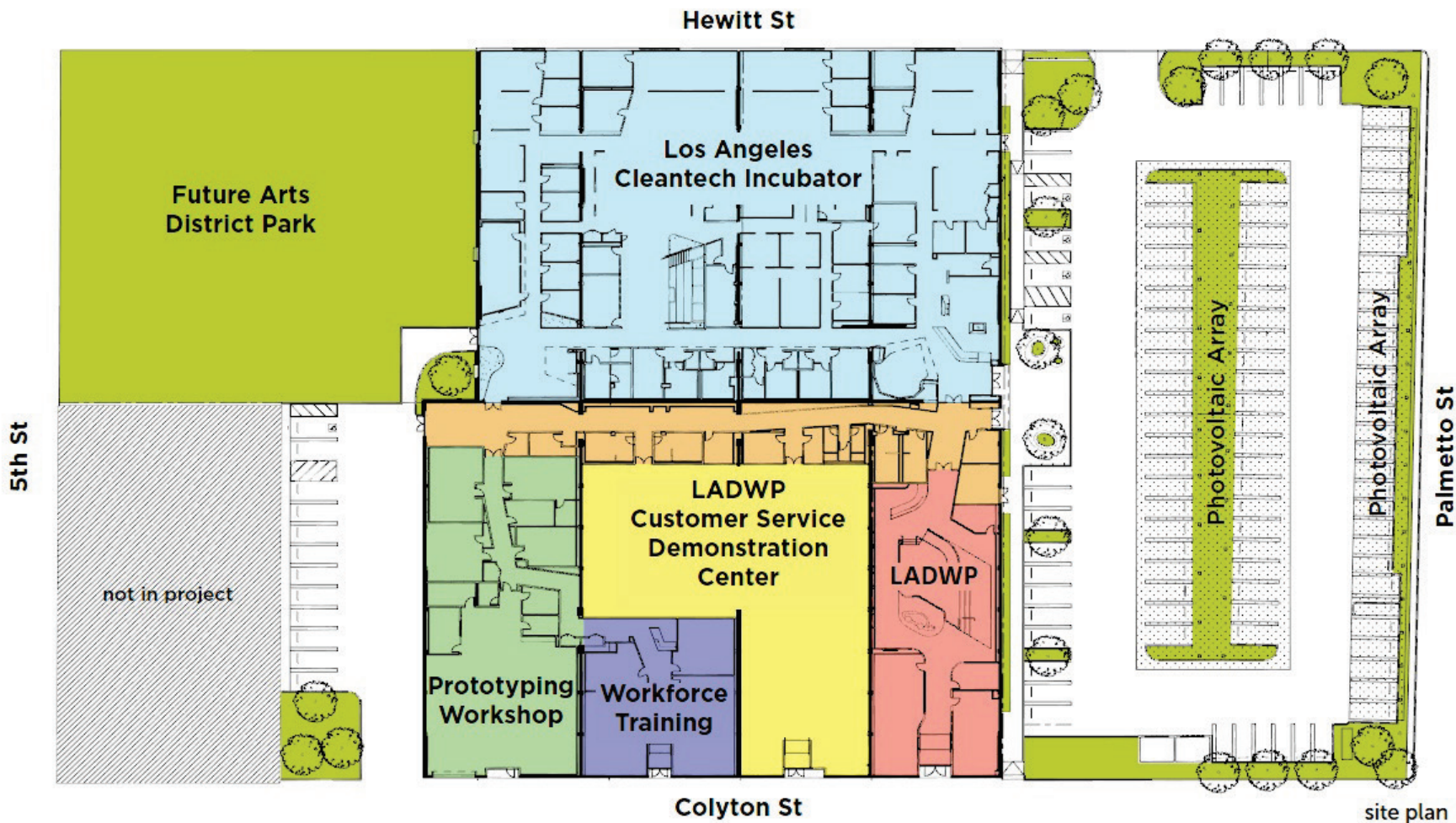
Sherman Way Orange Line Station

Cool Pavement + Cool Roofs + Shade Trees = Cool Neighborhood!



Next Steps: Multi-Product Demonstration Site At Los Angeles Department of Water and Power LaKretz Innovation Campus in the Downtown LA Arts District

Coating Demo
Patches

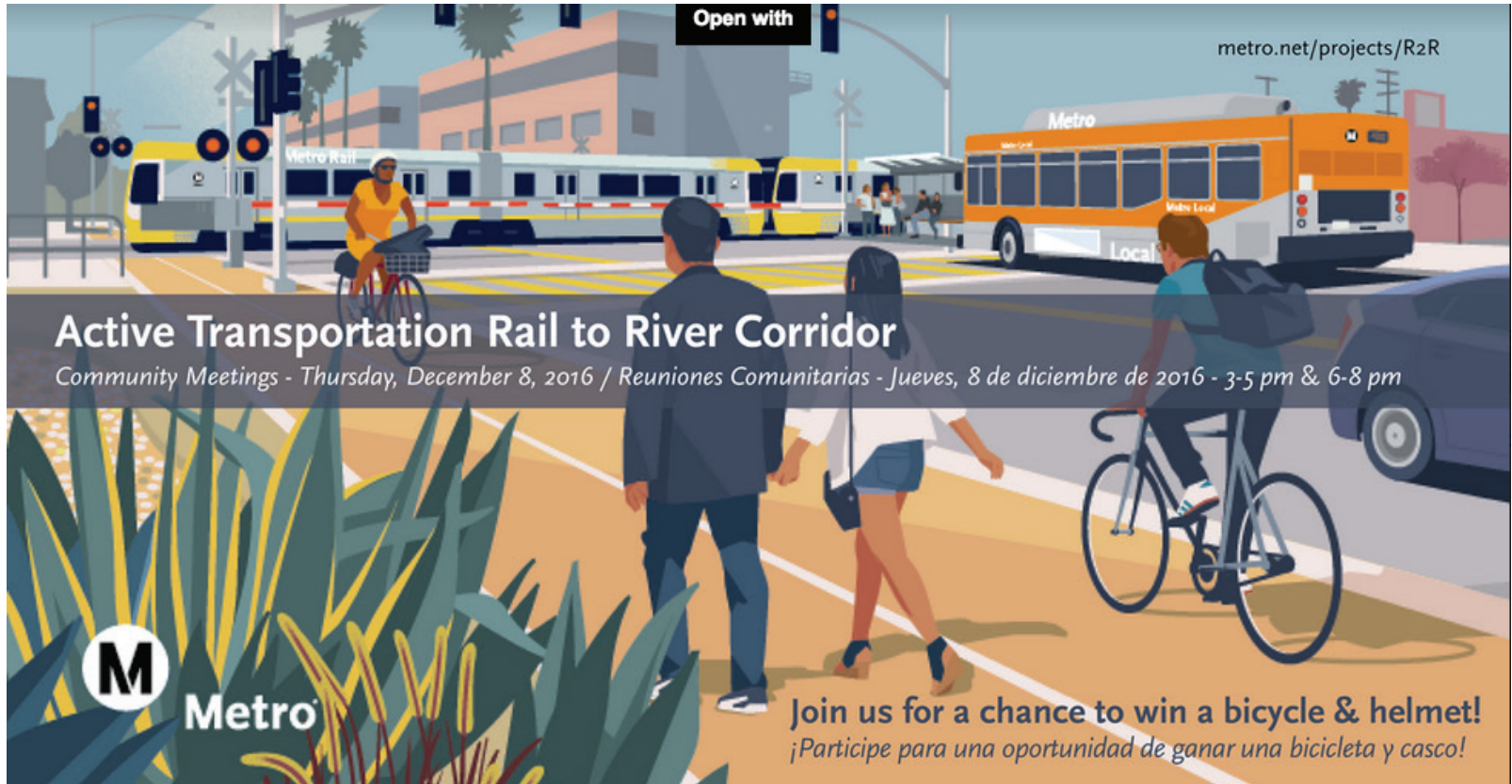


Next Steps: Cool Pavement Phase 2

Coating a subdivision to see if a neighborhood-level cooling effect can be realized



Next Steps: Cool pavement on a major off-street bike path?




Open with

metro.net/projects/R2R

Active Transportation Rail to River Corridor

Community Meetings - Thursday, December 8, 2016 / Reuniones Comunitarias - Jueves, 8 de diciembre de 2016 - 3-5 pm & 6-8 pm



Metro

Join us for a chance to win a bicycle & helmet!
¡Participe para una oportunidad de ganar una bicicleta y casco!

ME: greg.spotts@lacity.org

BSS: WE'RE HERE TO HELP!



311 or 800-996-CITY



www

<http://lacity.org/myla-311>



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facebook.com/BSSLosAngeles

Mobile App

– MyLA311 (IOS & Android)



"MyLA 311 puts the power of City Hall in the palm of your hand."

Poll 3



Los Angeles' Cool Roof Ordinance and Free Tree Program

Craig Tranby

Los Angeles Department of Water & Power





COOL ROOFS AND FREE TREES



COMBATING URBAN HEAT ISLAND IN LOS ANGELES

Craig Tranby
Efficiency Solutions



Los Angeles Department of Water and Power (LADWP)

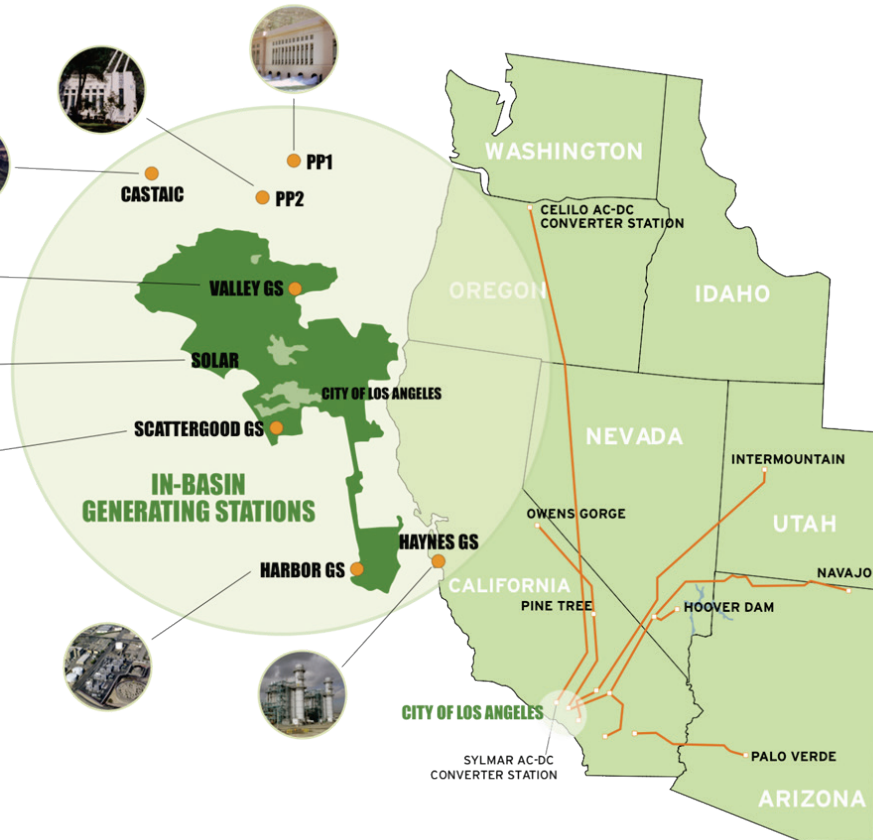
The nation's largest municipal electric utility, began delivering electricity in Los Angeles (LA) in 1916

Service Area

- 748 square kilometer area of LA
- Much of Eastern Sierra's Owens Valley

Population Served

- 4 million residents in the City of LA
- 1.4 million residential and business customers



Power System:

- Supplies more than 23 million MWh of electricity each year
- LADWP has over 7,640 MW of generation capacity from a diverse mix of energy sources
- Over the next 15 years, LADWP will replace more than 70% of its existing power supply

LADWP is a Vertically Integrated Utility

LADWP Efforts Relating to Urban Heat Island

Cool Roofs Rebate & Ordinance to Accelerate Adoption

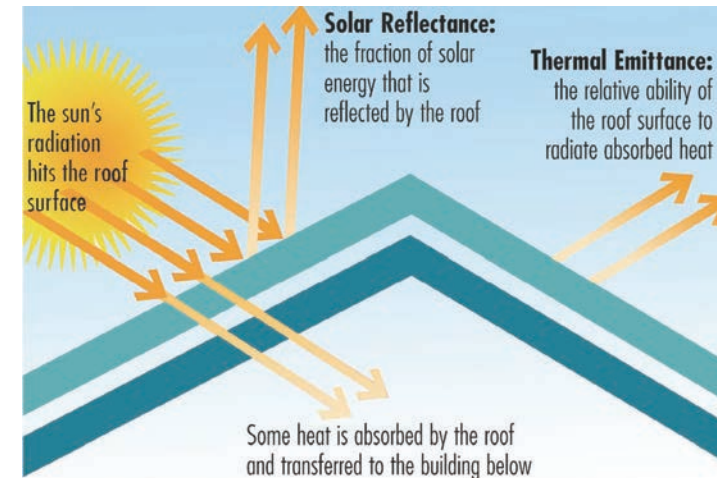
- Aggressive residential cool roof rebate introduced in October 2010; later expanded to support code requirement
- Mandatory code requirement fully in effect January 2015; also addressed non-roof areas of new construction projects

Trees

- Tree planting programs 2002-present

Cool Pavements

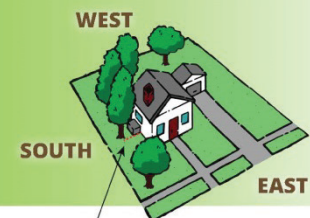
- Cool pavement facilitation



SAVE ENERGY

Plant trees to the West, South and East of your house to save energy.

Plant 15-20 feet away from your house. You can still get good energy savings at 40 feet with larger trees.



Plant trees 15-20 feet away from the house



www.ladwp.com

City of L.A. Cool Roof Ordinance

Mandatory and Supported by LADWP Rebates

Los Angeles Municipal Code - Roof replacements of any value are subject to Cool Roof for Reduction of Heat Island Effect excepting roof repair, replacement of $\leq 50\%$, or building-integrated photovoltaics.



LADWP rebate was enhanced to include a lower tier starting at the compliance threshold

Avoiding Prescriptive Exceptions

- Low-sloped roofs
 - Attics with no ducts
 - Reflectance/insulation tradeoff, per [Table 150.2-A](#)
- Steep-sloped roofs (considered [equivalent](#))
 - Air space between roofing & roof deck
 - Profile ratio of roofing product
 - Existing ducts insulated & sealed (HERS)
 - Ceiling has at least R-38 insulation
 - Attics with radiant barrier
 - Attics with no ducts
 - Insulate above roof deck (CZ 10-15)



Cool Roof

Permit(s) are required, except for liquid applied coatings. Roofing material must meet the three year Solar Reflectance Index (SRI) as shown below.

[How to apply for the Consumer Rebate Program](#) →

Roof Slope	3 Year SRI	
	\$0.20 per sq. ft.*	\$0.30 per sq. ft.*
Low ($\leq 2:12$)	≥ 75 SRI	≥ 85 SRI
Steep ($> 2:12$)	≥ 16 SRI	≥ 35 SRI

*Square footage is subject to verification by the LADWP. The square footage of parapet is not included in the rebate.

SRI is rated by the Cool Roof Rating Council (www.coolroofs.org).

[Cool Roofs Ordinance Fact Sheet](#)

[Cool Roofs: Frequently Asked Questions](#) →

City of L.A. Cool Roof Fact Sheet



Cool Roofs

What You Need to Know About LADWP Rebates and Building Code Requirements

What is a Cool Roof?

A cool roof is a roofing product that reflects sunlight and absorbs less heat than traditional roofs. Cool roofs lower roof temperatures on hot sunny days and therefore keep homes cooler inside, saving energy by reducing the need for running air conditioning systems.

Although often light in color, cool roofs come in a wide variety of colors ranging from white to black and including blues, grays, greens, oranges, browns, and tans.

Cool roofs also are available in a variety of styles: shingle, shake, tile, membrane, and spray-on liquid coatings.

"Coolness" Factors

The "coolness" of a roof is determined by several properties of roofing materials and their combined effects on temperature. The primary factor is the material's ability to reflect the sun's energy back into the atmosphere ("solar reflectance"). A higher "solar reflectance" factor means the roof will stay cooler. Also the "solar reflectance" is measured by how long it retains its effectiveness ("aged solar reflectance"). If the product is new and the "aged solar reflectance" value is unavailable, it can be calculated using the following formula:

Formula:

$$3\text{-year Aged Solar Reflectance} = [0.2 + 0.7 \times (p_{\text{initial}} - 0.21)]$$
 (where p_{initial} = Initial Solar Reflectance)

In addition to "solar reflectance" a secondary factor used is known as "thermal emittance," which measures the material's ability to release heat. The Solar Reflectance Index (SRI) combines these two factors into a simple to use index value.

Building Code Requirements

Starting Oct. 1, 2014, the 2014 Los Angeles Green Building Code requires that roofing material used in residential buildings meet certain values for the "aged solar reflectance" and "thermal emittance," or for "SRI".

	Min. 3-yr Aged Solar Reflectance	Min. Thermal Emittance	SRI
Low-slope \leq 2:12	0.63	0.75	75
Steep-slope $>$ 2:12	0.20	0.75	16

Exceptions... Cool roof is NOT required for:

- Roof repair; or
- Roof replacement when the roof area being replaced is equal to or less than 50% of the total roof area, or
- Where building-integrated photovoltaics (BIPV) are installed
- Permits issued prior to January 1, 2015, for the replacement of an existing roof with asphalt roof shingles or asphalt composition roll roofing.

Please note: Funding is limited and rebates are not guaranteed. This program shall at all times be subject to change or termination without notice.



City of Los Angeles Cool Roof Ordinance FAQ

Why did the City pass the Cool Roof Ordinance?

In March 2013, the City helped convene a cool roofs conference where researchers, policy makers, industry representatives, and other stakeholders gathered to exchange information about cool roofs. The conference identified a number of benefits that cool roofs would bring to Los Angeles, including reduced smog formation, reduced heat-related illness/death, and increased energy savings. Recognizing the array of benefits and the untapped potential for residential roofs, the City Council unanimously approved a residential cool roof requirement as part of the Los Angeles Green Building Code. After a grace period for the roofing industry to prepare for enforcement, the code went into full effect on January 1, 2015. The Department of Building and Safety is responsible for permitting and inspection, and LADWP broadened its residential cool roof incentives to support the transition to the new requirement. (See reverse for information on the incentive program.)

What cool roofing products are available to comply with the ordinance?

There are hundreds of products that comply with the ordinance which can be searched on the Cool Roofs Rating Council's (CRRC's) website at www.coolroofs.org/products. These products occur in a variety of colors across all types of roofs, including, asphalt shingles, tiles, flat roofs and coatings. Additionally, the City has been working with the roofing manufacturers and suppliers to provide easy to understand information about key compliant product types. Here are just a few sample images of compliant roof products:



Do cool roofs cost more?

Most types of compliant roofs (such as tiles, flat roofs, and coatings) have little or no increased costs over non-cool roofs.* Costs can increase for asphalt shingle roofing products when purchasing a color other than white. To offset increased costs, LADWP has enhanced its cool roof rebate to offer between \$0.20 and \$0.30 per square foot of roofing, found at www.ladwp.com/rebatesandprograms (click on "Building Products"). Additionally, the building owner should realize reduced energy consumption, better indoor comfort, and increased life expectancy of the roof.

How do I find compliant roofing products?

As noted in a previous section, to see the entire array of cool roof options, one can search www.coolroofs.org/products. Each search result links to product websites where you can inquire about local distributors. If you need further help identifying product options, you can also contact the CRRC at info@coolroofs.org or (866) 445-2523. The nonprofit organization Climate Resolve features guidance on its website <http://climateresolve.org/hot-city-cool-roofs>. Of course, your local contractor can often best advise on the right roof for you.

What about historic buildings or zones?

For historic buildings and zones, the approval process for cool roofs is the same as for any other roof. Cool clay tile products, in particular, are offered in a wide variety of colors and styles.

Do other efficiency measures, like increased insulation and radiant barriers, provide the same benefits as cool roofs?

No. While other measures may also cost-effectively save energy within a building, they do not provide the area wide cooling of cool roofs which helps reduce Los Angeles' pronounced urban heat island effect. In this era of rising temperatures, the additional benefits of cool roofs above and beyond energy savings include: reducing heat-related illness and death, reducing smog formation, and reducing cooling loads for all buildings in the City.

Where can I learn more about cool roofs and their benefits, along with the urban heat island effect?

The Global Cool Cities Alliance is a good place to learn about the science behind cool surfaces and benefits cool roofs bring to cities and their residents. The California Energy Commission's Consumer Energy Center is a good place to learn about the basics of cool roofs, in particular their role in saving consumers money on their energy bills.

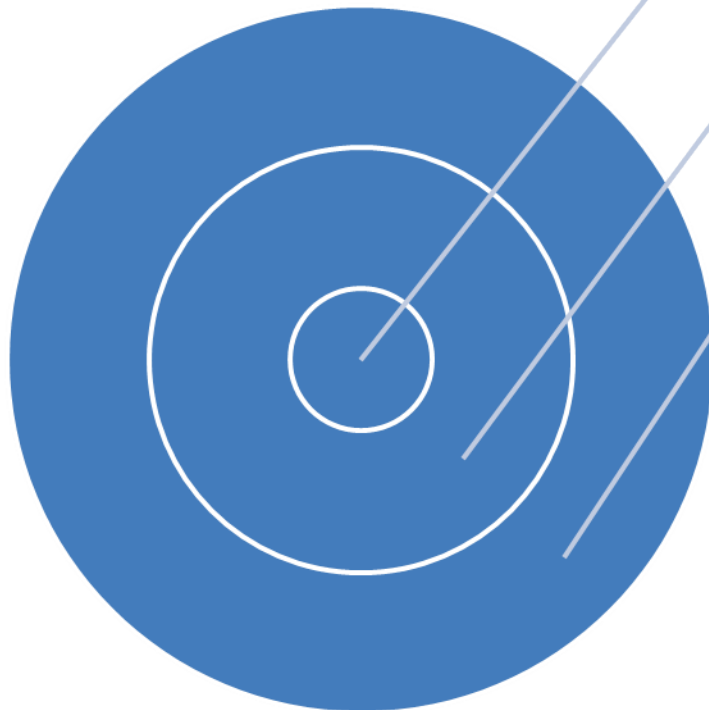
For more information, please visit www.coolrooftoolkit.org or www.consumerenergycenter.org

*Energy Cost-Effectiveness Study for Cool Roofs, July 2014. TRC Solutions, Inc. Approved by the California Energy Commission.

Cool Roof Collaboration

- City Departments – LADWP, Los Angeles Department of Building and Safety, Board of Public Works (City Plants), Bureau of Street Services
- Non-Profit – Climate Resolve, Cool Roof Rating Council, outreach grantees
- Academic – Lawrence Berkeley National Laboratory, University of Southern California, University of California Los Angeles, and more
- Business - Roofing industry, Los Angeles Better Buildings Challenge, Los Angeles Cleantech Incubator
- Local Govts./Utilities – L.A. County, Pasadena, Southern California Edison, others

Cool Roof Results



Over 2,200 rebates paid since 2010, covering \approx 7 million sq ft, saving over 1.5 GWh/yr

Over 18,000 permitted roofs since in effect (1/1/15), covering \approx 26 million sq ft., saving over 3.6 GWh/yr

Market transformation underway

- Manufacturers adjusting product offerings
- Expect effects on non-permitted roofs and other local jurisdictions



LADWP provides free trees to customers through its partnership with and funding of City Plants.

City Plants is a tree planting organization administered by the City's Board of Public Works.

Growing Benefits

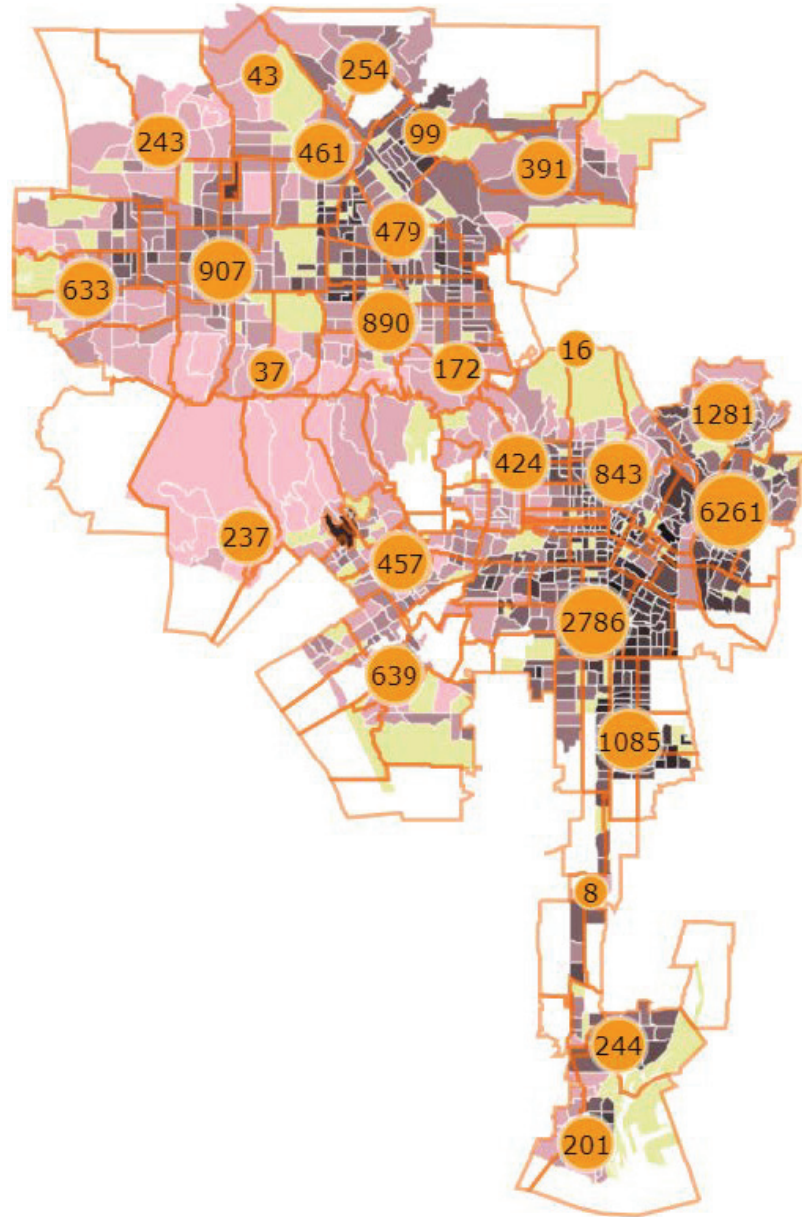
Trees are infrastructure that increase in value over time – saving customers money and energy by providing shade while improving the community.



www.ladwp.com



Using data, we can determine where to plant trees and target our communities lacking adequate canopy cover.





Accomplishments

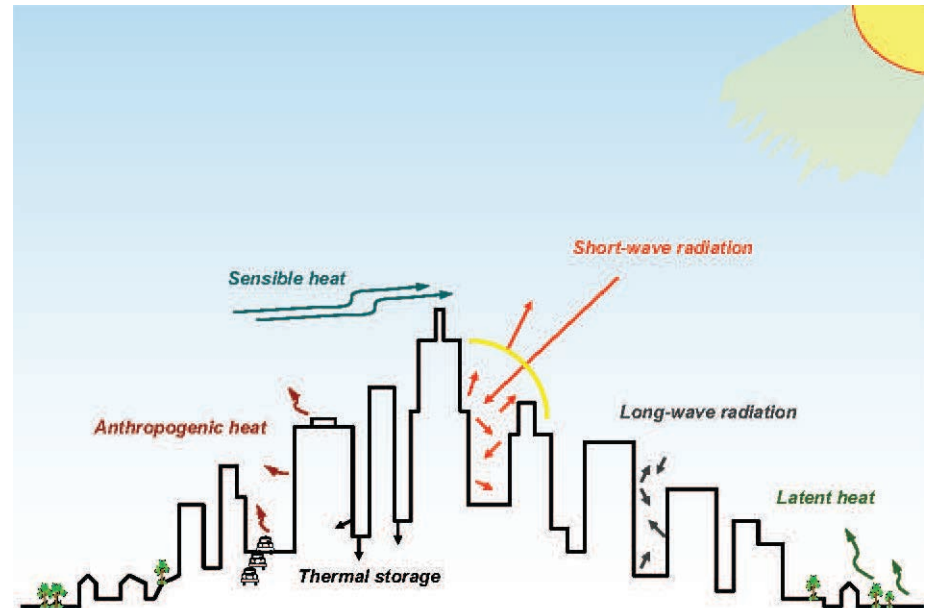
**City Plants distributed/
planted 80,000 trees
saving nearly 21 GWh
of energy in about 3 ½
years**

Barriers, Challenges, and Lessons Learned

- Barriers/Challenges
 - Cool Roofs:
 - Lacking precedents
 - Understanding & reaching marketplace
 - Trees: matching locations with needs, drought
- Lessons Learned
 - Cool Roofs: phasing, incentives, collaboration
 - Trees: orienting around energy savings ensures funding

Contact

- Craig Tranby, craig.tranby@ladwp.com, 213.367.2795
- www.ladwp.com/rebatesandprograms
- www.cityplants.org



Question and Answer Session



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Overview of Cool Pavements for Heat Island Reduction - Supplemental Slides

Kurt Shickman
Global Cool Cities Alliance



Cool Coatings Products



Plexipave Acrylotex – acrylic coating
California (CA) cost (\$/m²): \$7.50 - \$12 (installed)
SR: 0.2 - 0.4



GAF Streetbond Durashield – acrylic coating
CA cost (\$/m²) - \$1.70 (material)
SR: 0.36



GAF Streetbond 120 & 150 – epoxy-modified acrylic coating
CA cost (\$/m²) - \$6 - \$9 (materials)
SR: 0.30 – 0.60

Seal Coat Products



Western Colloid Armor Top – asphaltic coating
CA cost (\$/m²): \$1.50 - \$2 (material)
SR: 0.19 - 0.25



Guard Top Cool Seal – water-based asphaltic coating
CA cost (\$/m²) - \$1.90 - \$2.60 (material)
SR: 0.27 – 0.33

Overlay Products



Polycon E-Krete – Polymer Composite Micro Overlay
CA cost (\$/m²): \$4.00 - \$4.80 (material)
SR: 0.36 - 0.42



E-Pave I and II – cold applied Polymer Enhanced Composite
CA cost (\$/m²) - unknown
SR: unknown



Acrypave Tuff Seal – Portland-based Polymer Micro Overlay
CA cost (\$/m²) - \$5.40 - \$10.80 (material)
SR: 0.34

Resin Products



Soil Stabilization Services NaturalPave – resin asphalt additive
CA cost (\$/m²): \$21.50 - \$54.00 (material)
SR: Up to 0.45 (depending on aggregate color)