

# Phoenix's Experience with Cool Pavement Surfacing

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# PHOENIX COOL PAVEMENT PILOT PROJECT



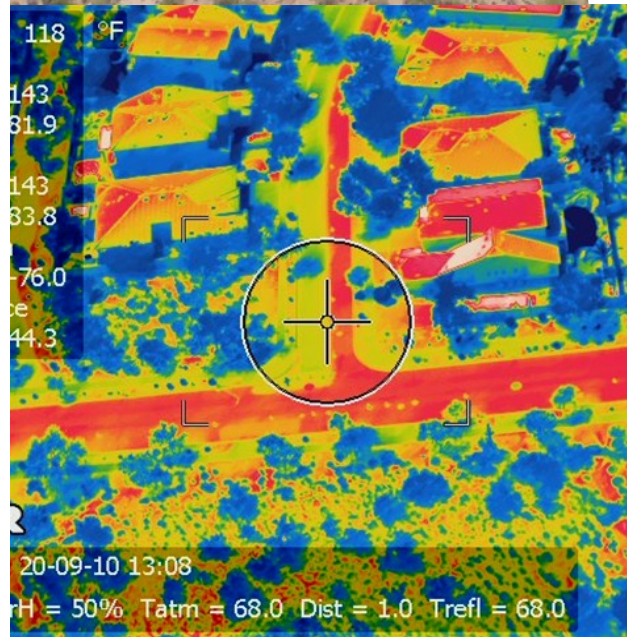
# 2020 Pilot Project



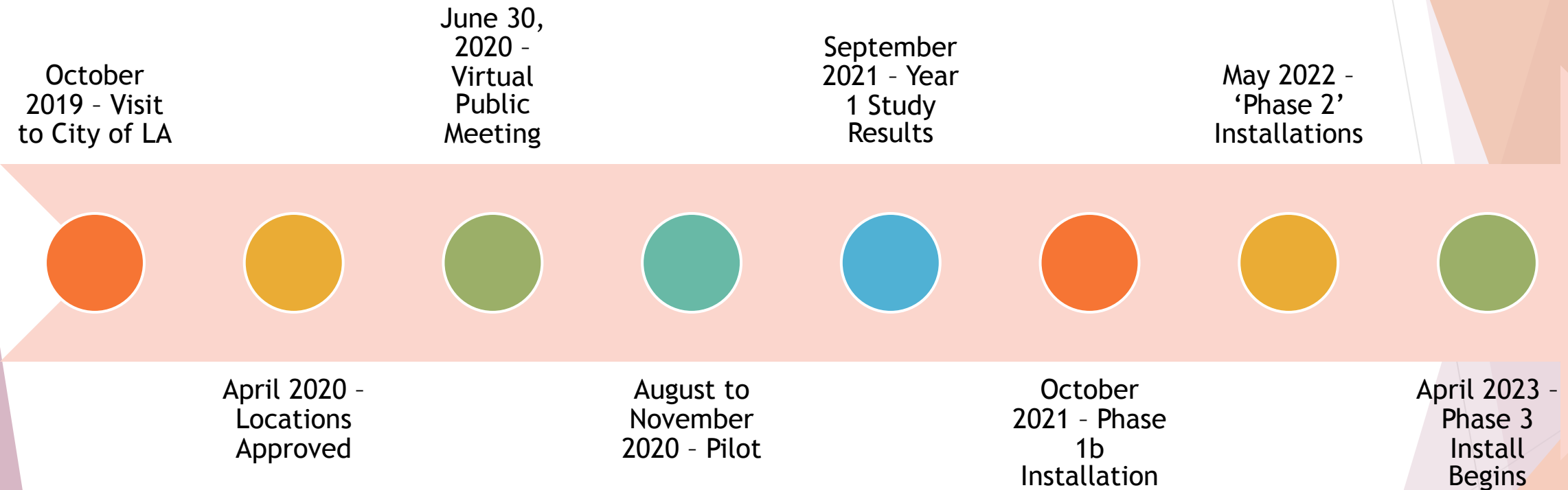
**STREET TRANSPORTATION DEPARTMENT**



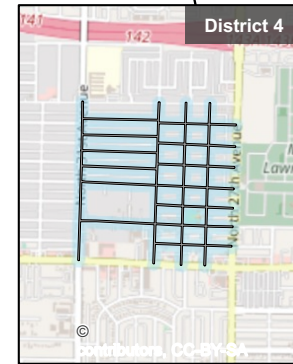
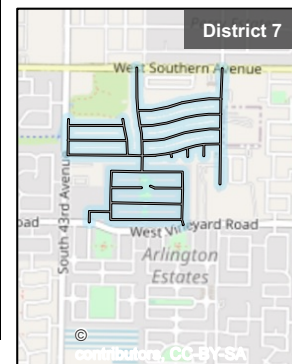
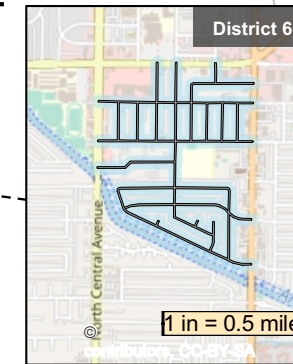
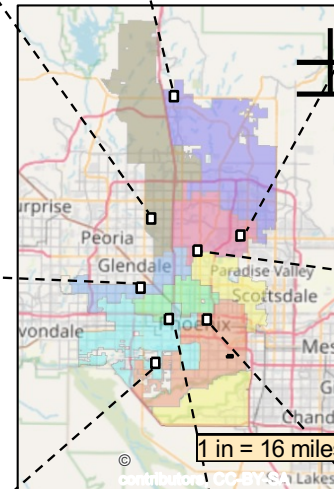
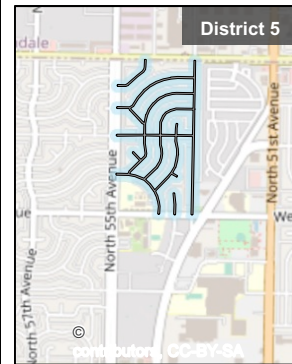
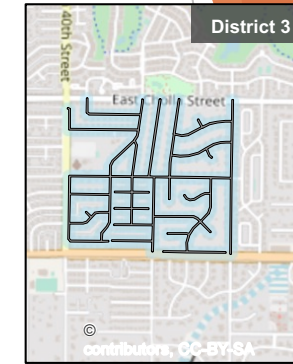
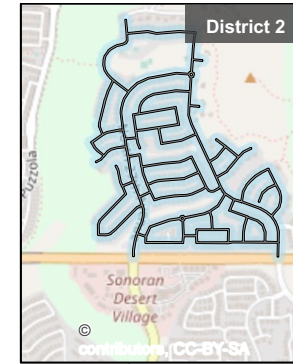
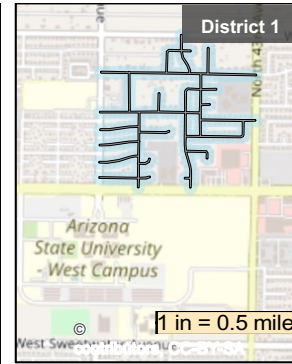
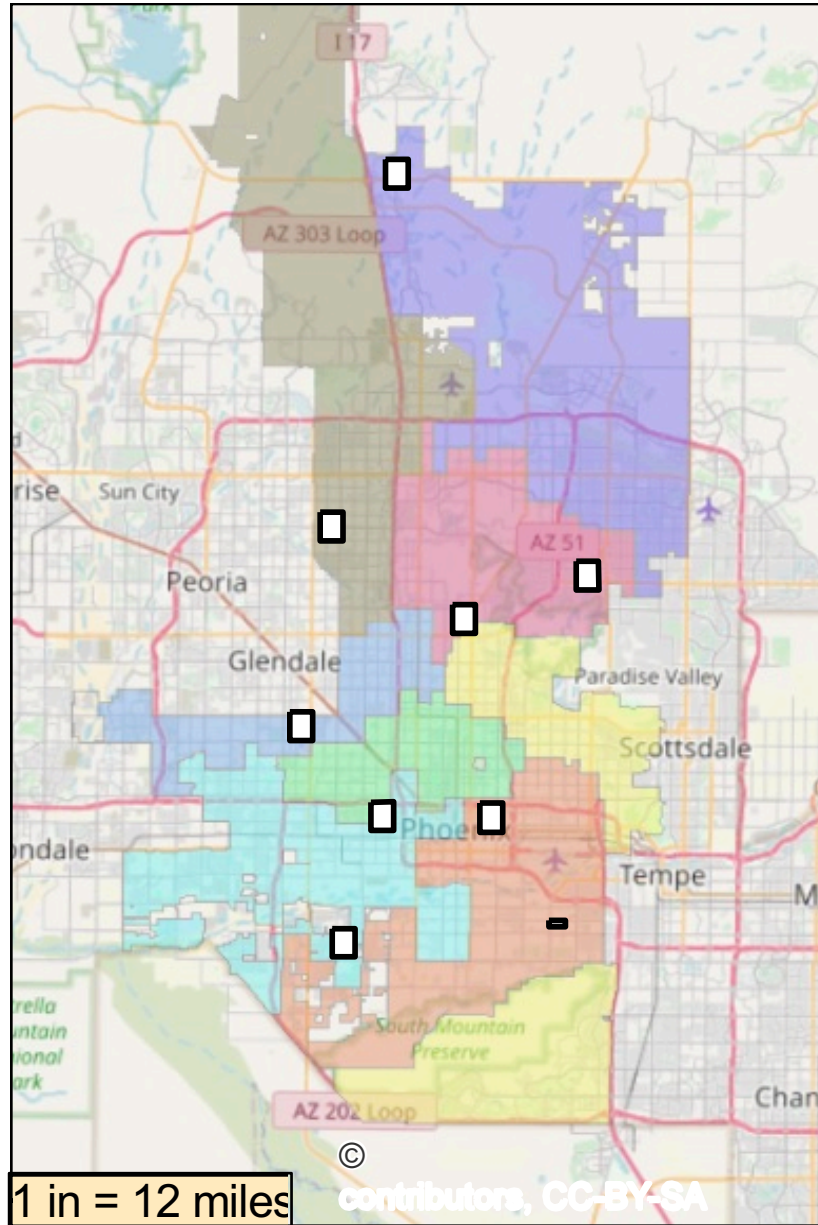
City of Phoenix  
Office of Sustainability



# General Project Timeline



# Pilot Location





- ▶ Asphalt Seal Coat
  - ▶ Asphalt, water, emulsifiers, polymers
- ▶ Safe, non-toxic, suitable for typical activities on a road
- ▶ Light in Color,
- ▶ Enhances reflectivity
- ▶ Applied by spraying or with a squeegee
- ▶ Compatible with existing asphalt surfaces
- ▶ Durable like a regular seal coat, not paint.

# Spray Application in Phoenix



# Project Challenges and Mitigation

## During Construction



## After Construction

Product getting dirty with tire marks





# Cool Pavement Evaluation By ASU



## What is the impact of cool (highly reflective) pavement on urban heat?

Holistic assessment of “Cool Seal” in City of Phoenix residential neighborhoods

### 1. Air temperature & Surface Temperature:

Thermocouples / vehicle traverse



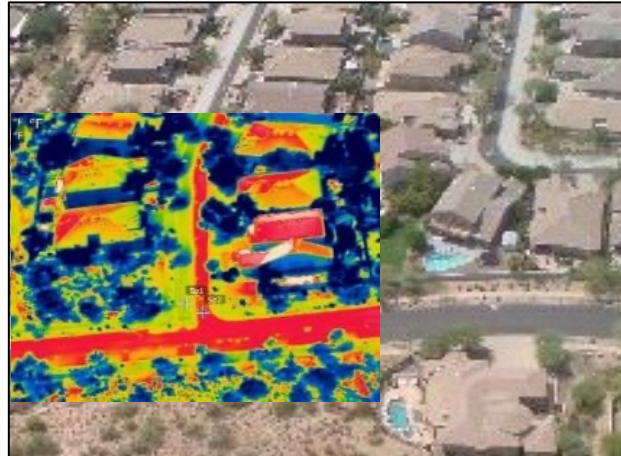
### 2. Mean Radiant Temperature:

MaRTy



### 3. Surface Temperature:

Helicopter overflight/thermal photography



### 4. Subsurface Temperature:

iButtons



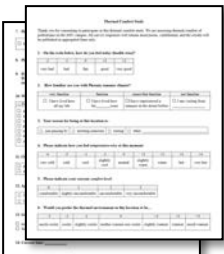
### 5. Reflectivity:

Spectrometer



### 6. Neighborhood Survey:

Residents' perceptions



Phoenix neighborhood, half-coated with CoolSeal

September 10, 2020, 13:08 h

Air temperature: 32°C

Difference in surface temperature:

~7.5°C



# Results

# Results: Surface Temperature

## Surface Temperature

On average, CP was **cooler** than asphalt concrete by:

- **12.0°F** and **10.5°F** at noon and afternoon hours
- **2.4°F** lower at sunrise
- **4.8°F** lower after sunset



# Results: Air Temperature

- **Lower** above the CP than the non-treated surface in the evening by approximately **0.5°F**
- Daytime differences averaged **0.3°F** lower above the CP
  - ▶ Small neighborhoods
  - ▶ **Mixing of air**
  - ▶ Shading variability
  - ▶ Vegetation patterns
  - ▶ Watering lawns
  - ▶ Lawns versus xeriscape
  - ▶ Other factors...

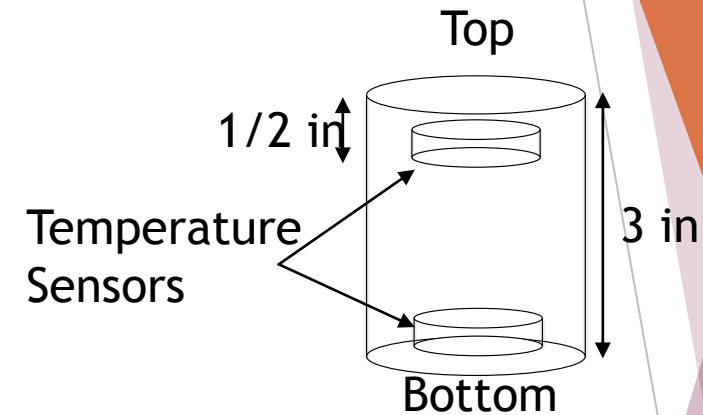
## Results: Mean Radiant Temperature (MRT)

- Human's total radiant heat exposure walking on the surfaces
- CP MRTs were **higher** than the traditional asphalt concrete at noon and afternoon hours by **~5.5°F**, on average
- Lower at sunrise and sunset **~0.5°F**
- **Similar to that experienced if walking over a concrete road**
- Higher values *may be a necessary tradeoff*

# Results: Subsurface Temperatures & Preliminary Performance Tests

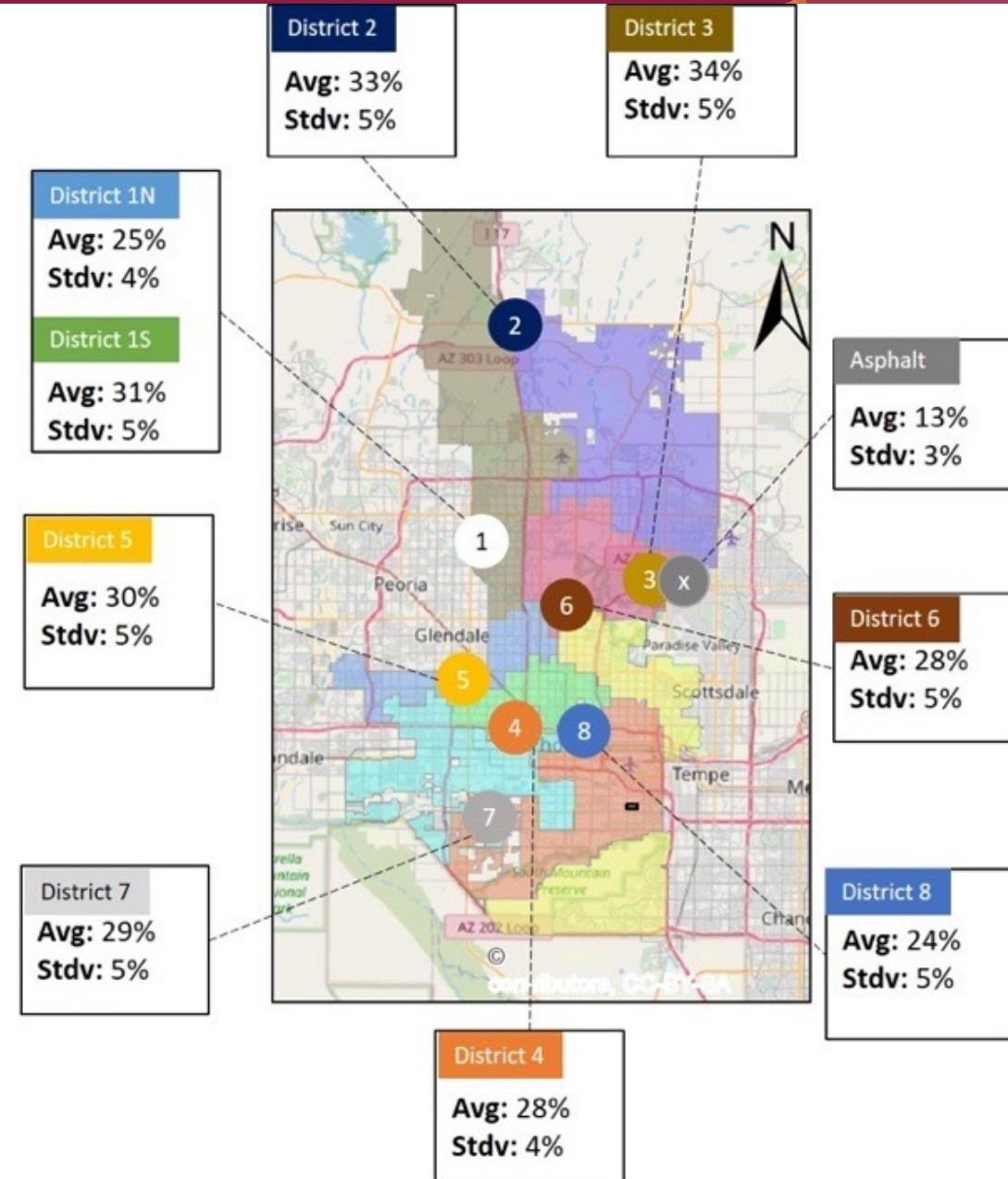
## Subsurface Temperatures

- **5.1°F** reduction in top temperature
- **4.6°F** reduction in bottom temperature
- Temperature differential between the top and bottom is on average **2.1°F** lower beneath cool seal pavements
- *potential reduction* in thermal stresses



# Results: Surface Reflectivity – Nov–May

- **33–38%** installed SRI
- ranged from **19–30%** across the eight neighborhoods 10 months after installation
- Control: untreated asphalt concrete surface had a consistent reflectivity of **12%**



# Results: Resident Survey

## Visual appeal and aesthetics:

### *Positive Comments:*

- *value to the neighborhood*
- *look nicer*
- *a point of interest*
- *“The glaring effect is not as big of an issue.”*

### *Negative Comments:*

- *At first it was very glaring*
- *blinding*
- *looks bad over time*
- *Tire marks and oil stains are obvious*



# Summary

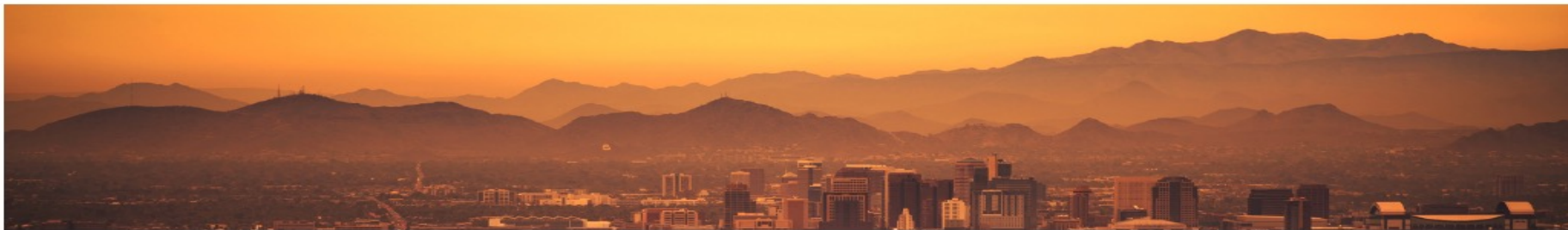
- ▶ Holistic assessment of numerous physical and social indicators of pavement at various timescales provides critical insight for future work, as well as useful information for the City of Phoenix and cities globally with similar goals.

- ▶ **Opportunities:**

- ▶ Longer-term performance testing
- ▶ Additional resident engagement and education
- ▶ High-end air temperature tests
- ▶ New types or colors of CP
- ▶ **Optimal location selection\***



- *Open lots, not shaded*
- *Low-rise residential*
- *Not in playgrounds or parks*
- *Not in places people would spend time midday*
- *Not in already-shaded locations*
- *Not in high-rise downtown areas*



[Fairview Place Cool Pavement Treatment Update](#) >[Fairview Place Cool Pavement Treatment Survey \(open thru March 17, 2023\)](#) >

## Cool Pavement Program

The Phoenix Street Transportation Department and Office of Sustainability announced during a virtual presentation and panel discussion on September 14, 2021 the results of the first year of its Cool Pavement Pilot Program. The program and analysis of the cool pavement process is being conducted in partnership with Arizona State University (ASU).

Year one of the study done by scientists at ASU's Global Institute of Sustainability and Innovation, Healthy Urban Environments, and the Urban Climate Research Center revealed that reflective pavement surface temperatures are considerably lower than traditional roadway pavement.

Cool pavement coating reflects a higher portion of the sunlight that hits it, hence absorbing less heat. Because of this higher reflection, the coating has the potential to offset rising nighttime temperatures in the region.

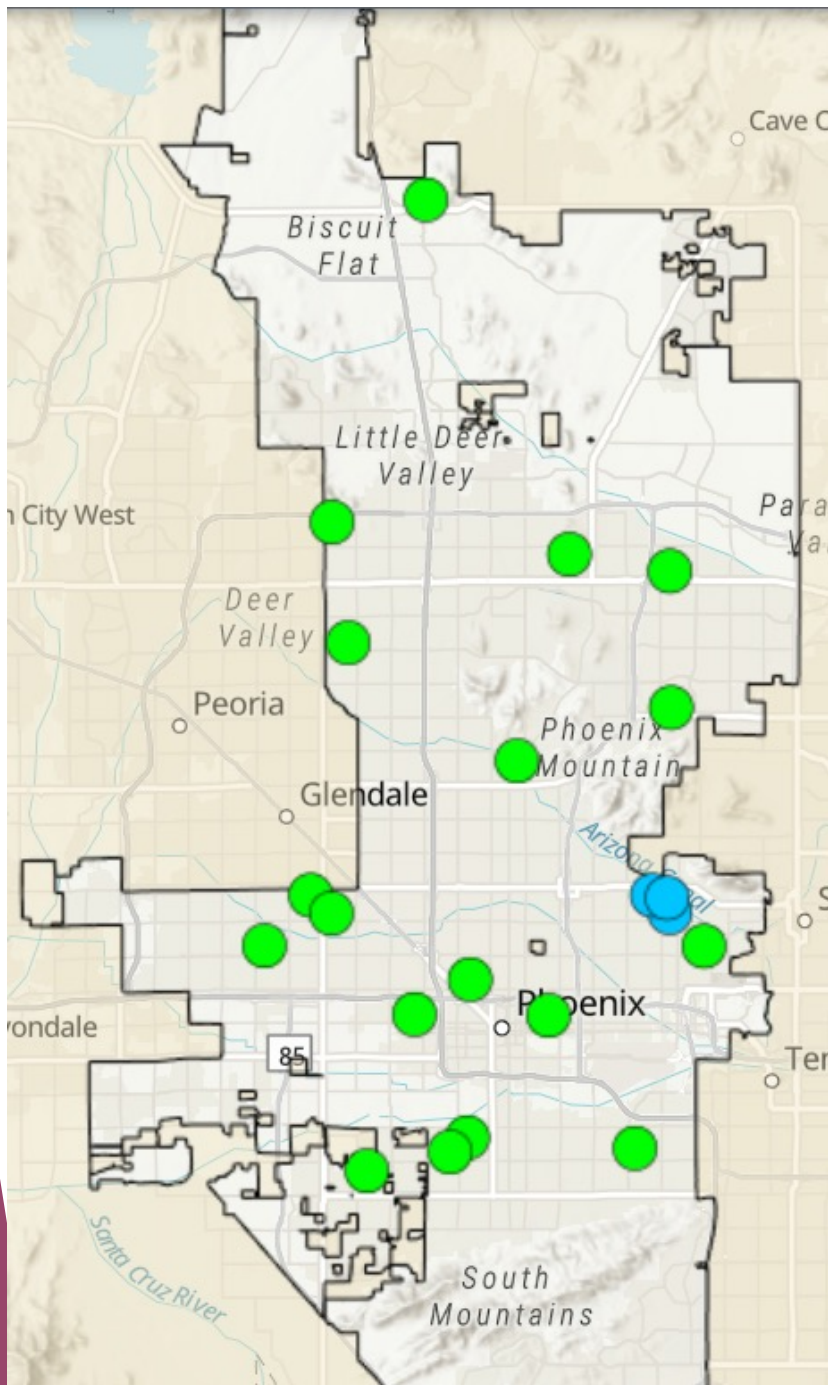
## Cool Pavement Demonstration October 2021



## Cool Pavement Application at Esteban Park



<https://www.phoenix.gov/streets/coolpavement>



- 2023 Projects began in April
  - 7million square feet
- Over 11million square feet installed overall
- City council awarded funding
  - 2 additional projects per year
  - 100 miles in 2023



# What's next?

- Phase 2 Research with ASU - coming soon...
- 2024 Locations Being Identified
- Additional Product Evaluations
- Continued Innovation

