NevadaDOT, LAS VEGAS NEVADA USA HEAT ISLAND COOLING TESTS USING COOL PAVEMENTS

TERRA PAVE COOL PAVEMENT TEST RESULTS

Heat Island Cooling Strategies of Nevad Department of Transportation and City of Las Vegas, Nevada

Many communities are taking action to reduce urban heat islands using five main strategies: 1) increasing tree and vegetative cover, 2) installing green roofs, 3) installing cool—mainly reflective—roofs, 4) using cool pavements, and 5) utilizing smart growth practices.

NevadaDOT has completed the test of 4 suppliers for the COOL PAVEMENTS and Terra Pave Cool Pavement (Terra Pave CP) was one of a product from Terra Pave International.

Location of test: Nevada Department of Transportation 6610 S Ullom Dr, Las Vegas, NV 89118

Test Results showed:

A. Bare Asphalt: 2 PM LV, NV – 127.2 degree F

B. Terra Pave Cool Pavement: 2 PM LV, NV - 109.2 degree F **Terra Pave CP reduced 18 degrees F**

C: Supplier 2: 2 PM LV, NV – 124.1 degree F

D: Supplier 3: 2 PM LV, NV – 122.3 degree F

E: Supplier 4: 2 PM LV, NV – 113.5 degree F

The City of Las Vegas, Nevada, USA, and the Nevada Department of Transportation (NevadaDOT) have taken action by increasing tree and vegetative cover, however, the trees are not growing fast enough and the majority are dying according to CouncilWoman-Ward 4 Francis Allen-Palenske. CouncilWoman Francis Allen-Palenske supports the strategy of using cool pavements to combat Heat Islands in the City of Las Vegas, Nevada. The CouncilWoman also saw that Terra Pave Cool Pavement was the clear winner with a significant 18 degrees F reduction of temperature of the pavement.

Using paving materials on sidewalks, parking lots, and streets that remain cooler than conventional pavements (by reflecting more solar energy and enhancing water evaporation) not only cools the pavement surface and surrounding air but can also reduce stormwater runoff and improve nighttime visibility.

What are Heat Islands? [1]

Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. Urban areas, where these structures are highly concentrated and greenery is limited, become "islands" of higher temperatures relative to outlying areas. These pockets of heat are referred to as "heat islands." Heat islands can form under a variety of conditions, including during the day or night, in small or large cities, in suburban areas, in northern or southern climates, and in any season.

A review of research studies and data found that in the United States, the heat island effect results in daytime temperatures in urban areas about 1–7°F higher than temperatures in outlying areas and nighttime temperatures about 2–5°F higher. Humid regions (primarily in the eastern United States) and cities with larger and denser populations experience the greatest temperature differences. Research predicts that the heat island effect will strengthen in the future as the structure, spatial extent, and population density of urban areas change and grow.

Causes of Heat Islands

Heat islands form as a result of several factors:

Urban Material Properties is one of the leading causes of heat islands. Conventional human-made materials used in urban environments such as pavements or roofing tend to reflect less solar energy and absorb and emit more of the sun's heat compared to trees, vegetation, and other natural surfaces. Often, heat islands build throughout the day and become more pronounced after sunset due to the slow release of heat from urban materials.

Characteristics of Heat Islands

Heat islands are usually measured by the temperature difference between cities relative to the surrounding areas. Temperature can also vary inside a city. Some areas are hotter than others due to the uneven distribution of heat-absorbing buildings and pavements, while other spaces remain cooler as a result of trees and greenery. These temperature differences constitute intra-urban heat islands. In the heat island effect diagram, urban parks, ponds, and residential areas are cooler than downtown areas.

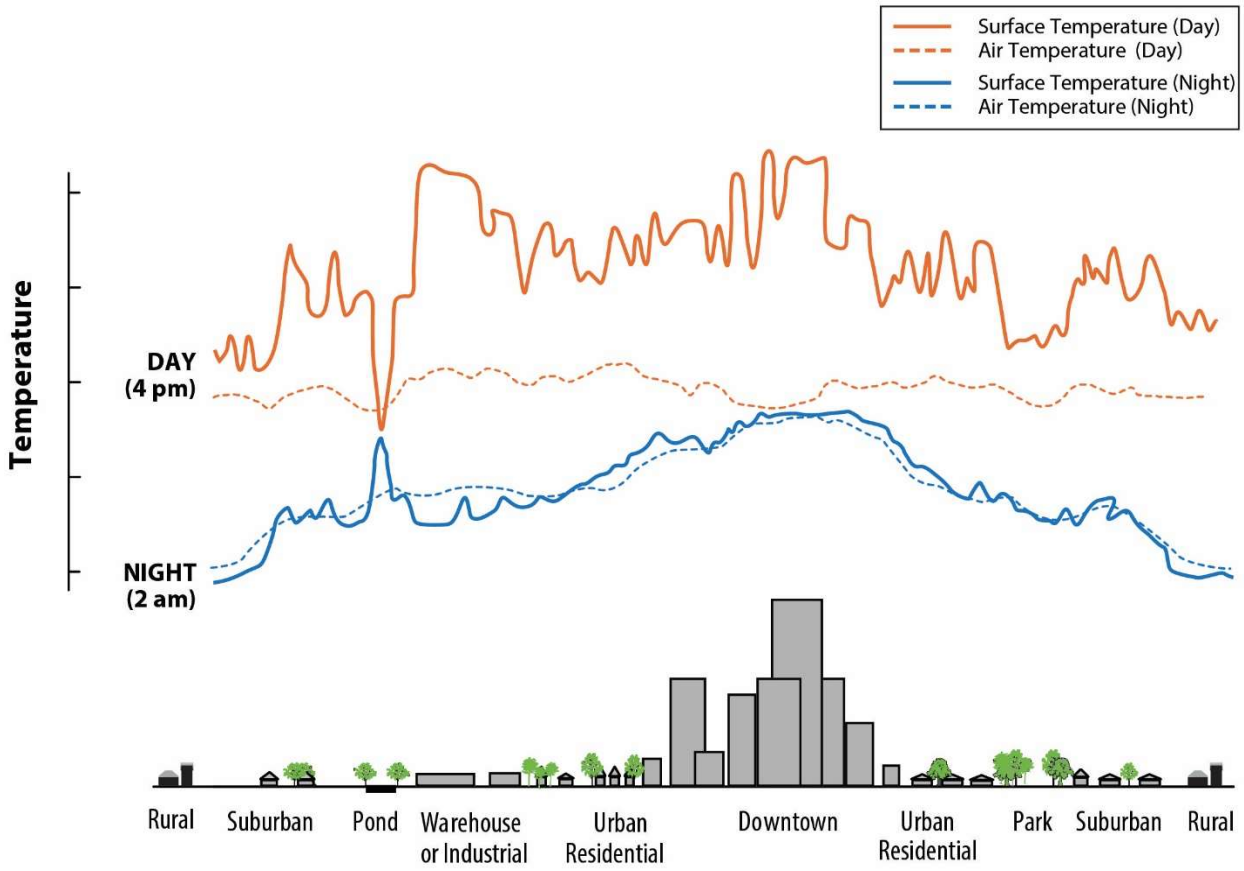
Heat Island Effect Diagram

In general, temperatures are different at the surface of the earth and in the atmospheric air, higher above the city. For this reason, there are two types of heat islands: surface heat islands and atmospheric heat islands. These differ in the ways they are formed, the techniques used to identify and measure them, their impacts, and to some degree the methods available to cool them.

Surface Heat Islands. These heat islands form because urban surfaces such as roadways and rooftops absorb and emit heat to a greater extent than most natural surfaces. On a warm day with a temperature of 91°F,

conventional roofing materials may reach as high as 60°F warmer than air temperatures.[2] Surface heat islands tend to be most intense during the day when the sun is shining.

Atmospheric Heat Islands. These heat islands form as a result of warmer air in urban areas compared to cooler air in outlying areas. Atmospheric heat islands vary much less in intensity than surface heat islands.



Heat Island Impacts

Heat islands can contribute to a range of environmental, energy, economic, and human health impacts.

Climate Change and Heat Islands

Climate change and heat islands interact in important ways. In many areas of the U.S., steadily increasing warming trends are intensifying already higher temperatures in heat island areas. This continued warming is expected to worsen heat islands in the future. As urban population densities increase and natural land areas decrease, heat islands will strengthen.

A series of unusually hot days is referred to as an extreme heat event or a heat wave. Annual heat wave counts and heat wave season length have steadily increased in U.S. cities over the past several decades. As global temperatures continue to rise due to climate change, heat wave frequency and severity are expected to continue to increase. Areas already impacted by heat islands will likely bear the brunt of these heat waves and their associated harmful health and environmental effects.

We thank you to the City CouncilWoman – Ward 4 Las Vegas, Nevada Francis Allen-Palenske for her time and support in mitigating Heat Island in the City of Las Vegas and the Nevada Department of Transportation.

- Dr. Yetkin Yildirim President/CTO
  Terra Pave International
- Francis Allen-Palenske
  City CouncilWoman – Ward 4 Las Vegas, Nevada
- David Pham CEO/CTO
  Eco Estates International

[1] https://www.epa.gov/heatislands/heat-island-cooling-strategies

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Awards for Terra Pave Products:

- USA Department of Energy NREL Round 2 Winner 2020 Solar Prize top 10 finalists: https://www.cmu.edu/energy/news-multimedia/2020/solar-prize-finalists.html
- Web-Summit Energy De Portugal, Lisbon, Portugal top 10 products in the world 2021 award: https://www.youtube.com/watch?v=EDz9zTpS_Js&t=1s
- Cade Prize top 1 in the category of Ag and Environment August 2023: https://www.businesswire.com/news/home/20230822523938/en/National-Cade-Prize-for-Innovation-Names-21-Finalists https://cademuseum.org/inventivity/cade-prize/

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