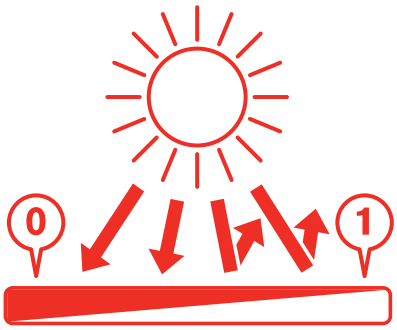
MIT CONCRETE SUSTAINABILITY HUB

ALBEDO: A MEASURE OF SURFACE REFLECTIVITY

TO LEARN MORE: **CSHUB.MIT.EDU/PAVEMENTS/ALBEDO**



How is albedo measured?
Albedo is a ratio expressed on a scale from 0 to 1. A surface with an albedo of 0 would be impossibly dark, taking in 100 percent of solar energy. A surface with an albedo of 1 would be completely reflective.

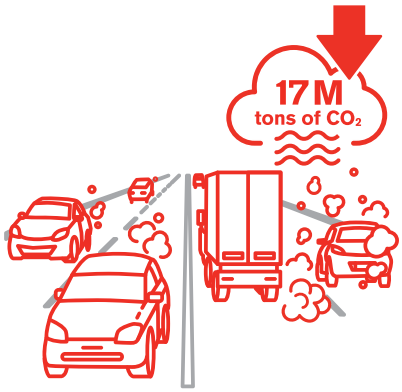
As global temperatures increase, reducing heat on roadways and in cities can help to lower emissions that contribute to climate change, and to improve quality of life.

Energy constantly enters the atmosphere as sunlight. Some sunlight reaches the Earth's surface, where it is either absorbed or reflected. The energy entering, reflected, absorbed, and emitted from the Earth makes up what amounts to a radiative budget. An out-of-balance budget impacts the climate by causing atmospheric temperature to increase or decrease.

Albedo is the measure of solar energy reflected by the Earth's surface. Lighter colored surfaces reflect more light, and have a higher albedo. Darker surfaces absorb light and have a lower albedo. Surfaces that absorb heat keep temperatures elevated longer, releasing heat that keeps nearby areas hot even long after the sun has set.

Increasing pavement albedo can help mitigate climate change

CSHub researchers developed a method to quantify global warming potential (GWP) savings related to increases in pavement albedo, finding significant potential for pavements to mitigate climate change impacts by increasing albedo.



- If all urban and rural roads in the continental U.S. were converted to higher albedo pavements, one study found, GWP savings would equal 17 million tons of CO_2 emissions per year–equivalent to removing roughly 3.7 million vehicles from our nation's roads for one year.

- In Texas alone, a 0.2 albedo increase to all urban and rural roads would create an estimated 1,574 kton CO_2-equivalent savings per year, akin to removing over 340,000 passenger vehicles from the road for a year.

This research was carried out by CSHub@MIT with sponsorship provided by the Portland Cement Association and the Ready Mixed Concrete Research & Education Foundation. CSHub@MIT is solely responsible for content. Published February 2019.

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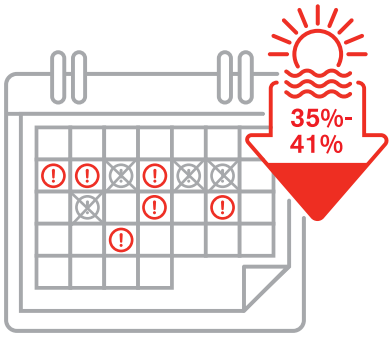
Tackling "Urban Heat Islands" through higher pavement albedo

Increasing pavement albedo in urban areas helps fight urban heat island (UHI) effects that can noticeably decrease our quality of life. When pavement albedo is increased, lower urban temperatures and fewer extreme heat days and heat waves can result. UHI events have been directly tied to increased mortality in urban areas.

CSHub researchers ran large-scale climate models for twenty years to understand the effects of a 0.2 increase to urban pavement albedos in the U.S. Their results show urban temperature decreases on average of over one degree Celsius.



- Under this scenario, extreme heat days and the total number of heat waves decreased an average of 35% and 41%, across all U.S. urban areas.

- In Houston, for example, research shows that a 0.2 increase in pavement albedo would cause a 55% decrease in the number of days when the heat index exceeds 41°C/105°F – levels that constitute a danger heat advisory.

ABOUT MIT CONCRETE SUSTAINABILITY HUB

The MIT Concrete Sustainability Hub, CSHub, is a dedicated interdisciplinary team of researchers from several departments across MIT working on concrete and infrastructure science, engineering, and economics since 2009. The MIT CSHub brings together leaders from academia, industry, and government to develop breakthroughs using a holistic approach that will achieve durable and sustainable homes, buildings, and infrastructure in ever more demanding environments. To learn more, visit **https://cshub.mit.edu/**.

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