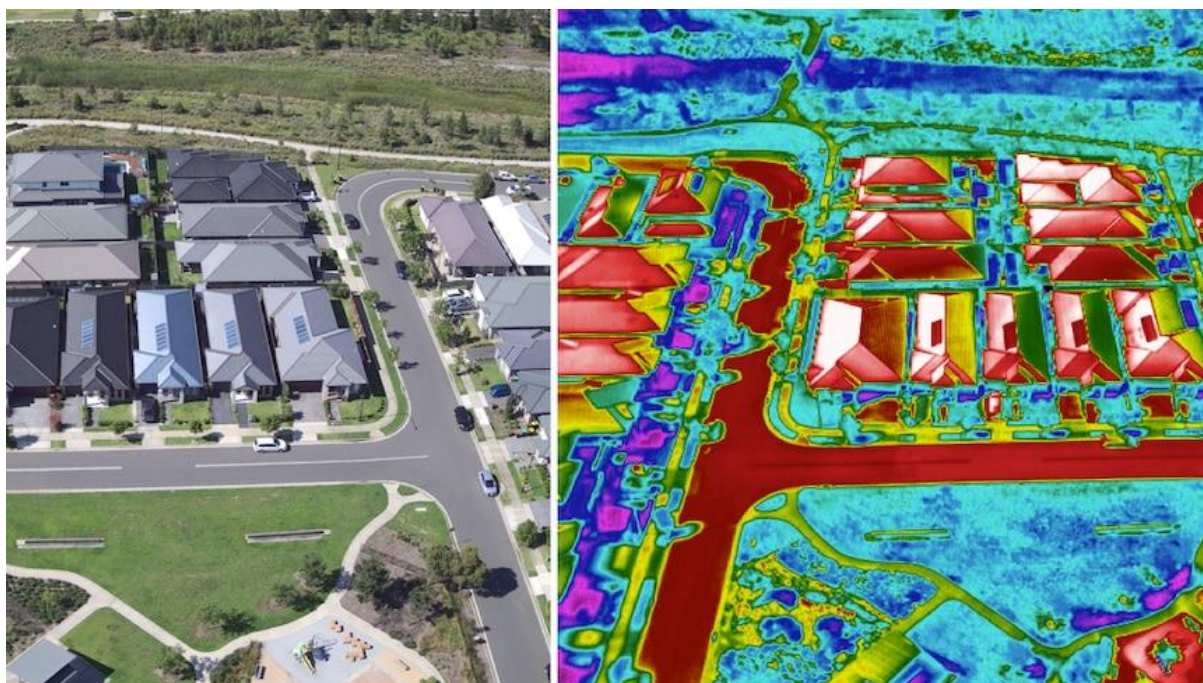


Why hot Australian cities keep laying dark heat-absorbing asphalt, and not pale 'cool roads'

[ABC Science](#)

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Roads and roofs stand out as hot spots in this infra-red drone image from Western Sydney.
(Supplied: Sebastian Pfautsch)

Sebastian Pfautsch doesn't hesitate when asked what he would change first to cool Australian cities in summer. And it's not what you might expect. It's not the seemingly endless expanse of black roofs, soaking up the sun beneath a shimmering haze.

It's the roads. About a third of any outer suburb is thermally dense black asphalt that can reach 75 degrees Celsius, according to Professor Pfautsch, an expert on urban heat at the University of Western Sydney. "If I had a magic wand, I would make the road surfaces lighter in colour," he says.

But despite paler or "cool" roads being proposed and trialled in Australia for the past decade, they haven't been rolled out anywhere at scale. The reasons for this are complex, ranging from council budgets to the glacial pace of reforming road construction standards, to questions over the durability of reflective sealants in Australian conditions.



Some councils are experimenting with lighter-coloured road surfaces. (Supplied: City of Charles Sturt)

But the result is clear to see — and feel — for residents. As heatwaves get worse, putting lives at risk, large centres of the population from Perth to Sydney continue to encase themselves in dense black bitumen.

So, what would it take to install paler, cooler roads?

The broken dream of painting Australia's roads white

In 2014, an episode of the ABC TV program Lateline interviewed sustainability expert Michael Mobbs about an innovative project in the inner Sydney suburb of Chippendale. The Cool Cities Project, with the City of Sydney, was about to resurface two streets with a pale blend of asphalt to create roads that would reflect heat back into space, instead of mostly soaking it up.

At the time, it seemed like the cool roads idea might take off.

Ninety per cent of Australians live in cities and towns, where average temperatures are up to 4C hotter than in rural areas, primarily due to a lack of trees and an abundance of dark heat-absorbent surfaces, like roads, car parks and rooftops. Low socio-economic areas, which are generally further from the coast or rivers, tend to be the hottest, and are often home to older people and others who are most vulnerable to the heat.

Hot weather in Australia [kills more people](#) than bushfires, cyclones and other natural disasters combined.

In 2014, urban designers and politicians were waking up to a future of hotter summers due to climate change.

"My vision is to cool Australian cities by 2 degrees by 2020 by quite simply building cool roads," Mr Mobbs told a reporter at the time. But 10 years later, this dream has not been realised. A scattering of local government areas, such as Charles Sturt and Salisbury in South Australia, have resurfaced their roads with reflective sealant, but progress has generally stalled.

The experience of advocating to councils, which manage local roads, left Mr Mobbs disenchanted. "I don't know what you have to do to change council behaviour," he says, speaking from his off-grid home in Chippendale. "Unless we do this we're just driving up electricity bills and human mortality."

But do cool roads work?

Lighter-coloured roads may make intuitive sense, like wearing a white shirt on a hot day, but how effectively do they reduce surface *and* ambient air temperature? Six years after the Chippendale project, in 2020, two separate cool roads trials in Sydney and Adelaide set out to conclusively answer these questions.

Part of their inspiration came from the US. Los Angeles was rolling out cool roads as part of a plan to lower the city's temperature by 1.67C over 20 years. The product they were using, "*CoolSeal*", was initially developed for military air bases to keep spy planes cool while they rested on the tarmac. This helped them avoid detection by satellite-mounted infrared cameras.

The water-based emulsion was sprayed from tanker trucks, and then spread and smoothed with handheld mops. The scale of the project was unprecedented. Within a few years, LA sprayed sealant on 50 city blocks. The mayor announced a plan to cover an area equivalent to 250 miles (400km) of single-lane roads by 2028. The Australian trials, by contrast, targeted about a dozen streets.

The use of *CoolSeal* at Bowen Street in Adelaide lowered the surface temperature on unshaded roads by [up to 8.65C during the day and 4.2C at night](#).

The Sydney trial, which took place at about 10 sites in the Western Sydney suburbs of Blacktown, Campbelltown and Parramatta, recorded an average surface temperature reduction of [5.6C and 2C for day and night respectively](#).

For context, tree shade reduced the surface temperatures of roads by 16C.

Sebastian Pfautsch, the lead author of the Western Sydney study, says lighter-coloured roads work for areas where street trees aren't an option. "The product worked well," he says.

"Surface temperatures were up to 12 degrees cooler than unshaded, uncoated asphalt."

But neither study recorded a decrease in ambient air temperature, (the temperature of the surrounding environment), which is arguably a more relevant measure of personal comfort for the area's residents.



CoolSeal being installed in Western Sydney in March 2020. (Supplied: City of Paramatta/George Gittany Photography)

Professor Pfautsch said not enough road in Western Sydney was coated to affect ambient temperatures, but [studies in the US](#) showed cool roads lower air temperatures by 1-2C.

"The largest effect is probably on night-time air temperature and that's really important because that's where we see a lot of electricity being used to cool down," Professor Pfautsch says. "Having two degrees lower air temperature during the night in summer would be amazing. "It'd save a lot of electricity and prevent a lot of production of greenhouse gases."

The Adelaide study's [final report](#), prepared for the state government by a private sustainability firm, estimated cool roads at a "whole of city scale" could generate 1C surface cooling. "While this level of surface temperature cooling across the urban area may not seem substantial, it could lead to substantially reduced energy consumption during heat waves," the report's authors state.

Why councils aren't rolling out the reflective sealant

The Western Sydney cool roads trial was a qualified success in Campbelltown, says Kelly Williamson, the city council's sustainability and resilience manager. "We loved the results," she says. Campbelltown is exposed to the hot westerly winds of the interior, but is too far inland to enjoy the cooling effects of the coast or harbour.

As a result, it can be up to 10C warmer than suburbs further east. In the summer of 2018–19, Campbelltown recorded 22 days above 40C.



A housing development in south-west Sydney, where agricultural lands are becoming large estates. (ABC News: Ross Byrne)

"That's when we knew there was a heat problem," Ms Williamson says.

But despite the local government's enthusiasm for the cool roads idea, the local roads of Campbelltown are still plain bitumen.



Large houses mean a typical new suburb has very little tree canopy. (ABC News: Phil Hemingway)

So, what's the hold-up? Partly, it's money. Councils are responsible for managing their local road network. As a result, many governments in low-income areas are in a bind. They may have the worst heat problems, but they often lack the budget for heat-mitigating measures like space-age reflective sealants.

"We do have to be very selective with projects we undertake," Ms Williamson says.

"[Cool roads are] close to three times higher in cost than our normal approach to bitumen."

As a result, Campbelltown has been promoting the idea of cool roads to developers as a way for them to build more liveable and attractive suburbs. "Yes, there's a cost to it, but when you're implementing something that's saving someone's life, it's totally worth it," Ms Williamson says.

Professor Pfautsch agrees that the lack of council funding is a major reason for the low uptake of cool roads. "In Australia, it's \$15 per square metre and when you want to coat a neighbourhood, that's tens of thousands of square metres. "Local governments don't have the cash."

A City of Parramatta spokesperson said cool roads showed "some promise" but was "not as effective as other measures".

'Hoons came to use it as a street canvas'

Then there are the other problems. US-made *CoolSeal* appears to degrade quicker in Australian conditions, where weeks of standing water can follow months of baking heat. Professor Pfautsch says there's a need for more testing. "I wouldn't go out to a council and say this is the greatest product you can find," he says.

There's also [evidence](#) that heat-reflective surfaces can make pedestrians standing on the treated road or pavement hotter, suggesting roads with high pedestrian traffic should stay dark.

Then there's the unknown factor of community sentiment. How will people react?

Ms Williamson expected some in the community would complain about glare from reflective surfaces at the trial sites, but no-one did. "The community were just happy to see we were doing something," she says.

In another Western Sydney local government area, however, some of the community were less happy. Residents demanded the council re-paint their *CoolSeal*-coated road after it became a destination for burnouts. "Hoons came to use it as a street canvas on the day after the sealant install," Professor Pfautsch says. "After the trial, the council painted the white surface black again."

Why not just build light-coloured roads?

At a nondescript industrial site in Western Sydney, Alexandru Let is working on another, potentially cheaper and more durable solution. The technical manager for State Asphalt Services is developing a blend of asphalt mixed with nanoparticles of titanium dioxide, one of the major ingredients in mineral-based sunscreen.



Asphalt is a mixture of sand, aggregates such as gravel, and bitumen. (ABC News: Greg Nelson)

The titanium dioxide reflects and scatters sunlight while also changing the colour of asphalt to light grey. The nanoparticles also trap harmful emissions from car exhaust pipes, and act as a catalyst for ultraviolet radiation to break down the compounds, effectively removing pollution from the air.

"We are working to do some trials," Dr Let says.

"It'll be more expensive than the other asphalt, but only 10 – 15 per cent more."

He says he's in the midst of discussions with a Western Sydney council about trialling the mixture on a public road. Professor Pfautsch says it's a promising idea. "Roads are resurfaced every eight to 10 years," he says. "And of course, that can be done with a lighter-coloured asphalt."

Canopy is being lost as trees cleared for housing

Although Professor Pfautsch would love to wave a magic wand and make the dark roads lighter, he stresses this is only part of the solution to the heat problem. The other parts include promoting tree canopy to shade surfaces and cool the air. They do this by releasing water vapour into the air through their leaves (known as "transpiration cooling").

There are also ideas for using permeable materials for pavements and car parks, which are cooled by ground water evaporating through their surfaces. Then there are plans for more suburban parkland and waterways, which can help soak up the heat.

Progress is slow, Professor Pfautsch says. Some councils are mandating lighter-coloured roofs, and state and federal governments last year funded a Greater Sydney Heat Taskforce to build the city's resilience to heat. But there have been setbacks. In 2022, NSW abandoned a plan to ban dark roofs.

"So many things you could do to keep suburbs cool are being neglected," Professor Pfautsch says. This is partly due to the housing affordability crisis, he adds. To improve housing supply, the NSW government recently announced it would override council planning powers to boost housing density, including allowing the subdivision of smaller lots.

Professor Pfautsch fears this will reduce the canopy cover. "The first thing that will happen when you build a house on these lots is you lose trees," he says. But even without this proposed change, suburbs like Campbelltown have already lost many trees.

Hobby farms and horse studs have been consumed by sprawling housing estates with black roofs and black roads, Ms Williamson says. "Anything we can do to have lighter coloured surfaces, from pale roofs to more trees, we know it's going to reduce the temperature," she says.

But she also acknowledges that, to some extent, these technical measures can't stop what's coming: waves of heat that roll across the interior and break over Sydney every summer. "It's not going to stop the westerly," she says. "You can't fight the wind from Central Australia."

For a fuller report including more pictures, please head to:

[Why hot Australian cities keep laying dark heat-absorbing asphalt, and not pale 'cool roads' - ABC News](#)

