ROOFING
SIKA COOL ROOF SOLUTIONS

SOLUTIONS FOR ENERGY-EFFICIENT FLAT ROOF BUILDUPS

BUILDING TRUST

CLIMATE-RELATED CHALLENGES

Urban heat islands and increasing energy consumption

URBAN HEAT ISLANDS have a warming effect on the local or micro-climate caused by modification of the land surface in urban areas.

Our **ENERGY RESOURCES ARE LIMITED** and energy consumption of buildings needs to be reduced.

SIKA'S COOL ROOF SOLUTIONS SAVE ENERGY AND REDUCE THE URBAN HEAT ISLAND EFFECT.

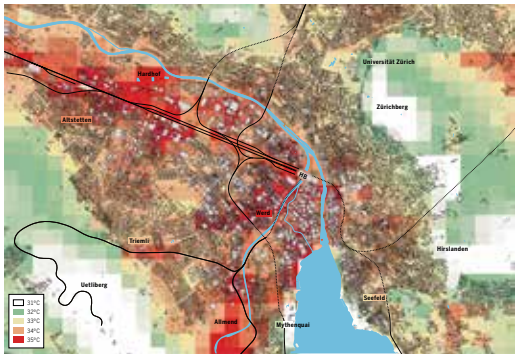
URBAN HEAT ISLANDS

Many urban and suburban areas have higher temperatures than their rural surroundings. This temperature difference indicates that they are urban heat islands. The annual mean air temperature in a city of a million or more people can easily be 1 to 4 °C warmer than in the rural surroundings – and on a clear, calm night the difference can measure 12 °C or more. The main cause of urban heat islands is the modification of the land surface in cities. Natural vegetation is replaced by the built environment, with most surfaces characterized by low solar reflectance and high impermeability along with high-density materials that absorb great amounts of thermal energy and release it as heat.

Warming due to urban heat islands in specific areas such as cities is an example of local climate change. Local climate change fundamentally differs from global warming. The effects are limited to the local scale and decrease with distance from the source. Global climate change, caused by increased solar exposure or greenhouse gas concentrations, is not locally or regionally confined.

Installing cool roofs on buildings is a way to rapidly and sustainably reduce the heat island effect in cities. Flat roofs are generally replaced every 15 – 20 years – a replacement rate of 5 – 7% per year. Thus, administrators and building owners have more opportunities to sustainably upgrade roofs than other surfaces of buildings or sites. The benefits of installing a cool roof go far beyond waterproofing: cooler and healthier cities, better air quality, mitigation of global climate change, and lower energy consumption are four important ones.

Temperature distribution in cities.



Heat Map Zurich, Switzerland (June 22, 2016).

ENERGY SAVINGS

Energy used to cool buildings in summer represents a major portion of the overall energy consumption, resulting in the high CO_2 emissions. This will even increase as the outdoor temperatures rise. Increased indoor temperatures in summer reduces general comfort and people's productivity, so passive solutions like cool roofs can be cost-effective in multiple ways.

Solar reflectance is the most important characteristic of a roofing membrane to achieve the highest energy savings during warmer months. That's why cool roof buildups are most effective in reducing cooling loads in locations with high solar radiation and air temperatures. Annual energy savings of 10% or more are well possible with relatively simple measures.

A/C units on a flat roof.

COOL ROOFS CONTRIBUTE POSITIVELY

Reduction of energy demand and indoor temperature

WHAT ARE COOL ROOFS – HOW DO THEY WORK?

Many vacation photos from the Mediterranean or the Middle East show a townscape of light-colored buildings with white roofs. These have been traditional architectural characteristics for thousands of years – and these roofs are in fact cool roofs. Although cool roofs are one of the most cost-effective ways to reduce indoor temperatures in summer, they have not yet been widely adopted in western architecture.

Cool roofs have the ability to reflect sunlight and repel heat because the roofs are prepared, covered or coated with materials that have special characteristics. These are typically white roofs and they reduce the heat island phenomenon, minimizing thermal impact on the microclimate and on the local environment. Modern cool roofs include highly reflective thermoplastic and liquid-applied membranes and coatings that provide a full range of benefits over a long service life.

White roofs in Greece.

Example of a typical cool roof in the USA.

TECHNICAL BACKGROUND

The California Department of Energy (DOE) began research on the benefits of cool roofs for energy savings and reducing urban summer temperatures in the 1980s. Lawrence Berkeley National Laboratory (LBNL) developed mathematical modeling and pioneered the promotion of cool roofs to reduce cooling energy usage and peak-power demand of air-conditioned buildings. Computer programs can calculate the potential energy savings of buildings with cool roof versus a standard roof. They calculate the thermal energy flow through the roof assembly at a specific geographic location using local weather files that typically cover a period of 10 or 20 years.

BENEFITS OF COOL ROOFS

- Cool roofs minimize heat gain inside buildings, improving occupant comfort.
- They reduce the need for mechanical air conditioning.
- They can help reduce the number of heat-related deaths on top floors of buildings with dark roofs.
- By significantly lowering material temperatures, they enhance the durability and the appearance of roofs.

COOL ROOFS AND GREEN BUILDING CERTIFICATION SYSTEMS

The importance of cool roofs and their value to communities, the environment and building owners is recognized by green building certification systems such as LEED (Leadership in Energy and Environmental Design).

LEED is the world's best known and largest green building certification system, providing third-party verification that a building has been designed and built using strategies to improve its sustainability performance. LEED v4 is the latest version. It recognizes several options for roofing solutions in new buildings or renovation projects that can earn LEED credits: energy-efficient roofing, water run-off management and renewable energy are all important points to consider.

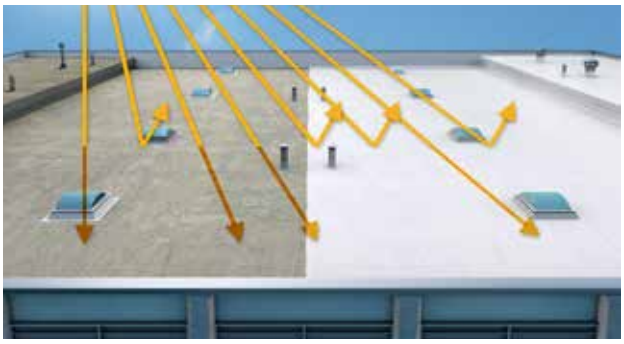
The use of a cool roof membrane can earn Credit 5, Option 1 "Heat island effect – Roofing" in the Site Sustainability category (SS) of the LEED v4 protocol.

SOLAR REFLECTANCE INDEX

Definition and examples

COOL ROOF MECHANISM

The following illustration depicts the energy flow of sunlight hitting a conventional flat roof (left) and a cool roof covered with a white membrane or coating:



Reflection and energy flow on flat roofs with different colors.

SOLAR REFLECTANCE (SR)

The ability of the surface of a material to reflect visible and non-visible solar radiation (infrared and ultraviolet) is known as solar reflectance, or albedo. Solar reflectance ranges from 0 for black surfaces to 1 for white surfaces. White surfaces have high solar reflectance and low absorption, whereas dark ones have low reflectance and high absorption.

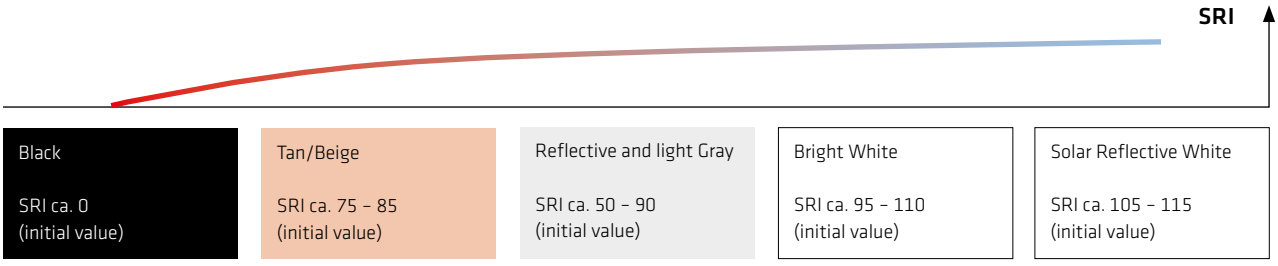
THERMAL EMITTANCE (IE)

The ability of a surface to emit thermal radiation in the infrared (heat) range is known as thermal emittance. Thermal emittance ranges from 0 to 1, depending on the type of material. The higher the emittance, the lower the surface temperature will be. Coatings on metal have lower emittance than polymeric synthetic surfaces.

SOLAR REFLECTANCE INDEX (SRI)

The solar reflectance index (SRI) expresses the ability of a roofing material to reflect solar energy. It is defined such that a standard black color (solar reflectance of 0.05, emittance of 0.90) has a value of 0, whereas a standard white (reflectance of 0.80, emittance of 0.90) has a value of 100. The higher the SRI value, the more suitable the material for use on a cool roof. SRI values can even exceed 100. SRI values are calculated using the SR and IE values defined by the ASTM E 1980 standard "Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces." A similar European standard was issued in 2017: "EN 17190 Flexible sheets for waterproofing – Solar Reflectance Index."

SOME TYPICAL COOL ROOF COLORS AND INITIAL SRI VALUES



Darker colors do not meet the requirement SRI > 82 (initial value) to qualify for LEED credits.

INTERNATIONAL ASSOCIATIONS ON COOL ROOFS (WITH INVOLVEMENT OF SIKA)

CRRC AND ECRC

CRRC (Cool Roof Rating Council) is a nonprofit organization established in the USA in 1998. It has developed a product rating program under which companies can label roofing surface products with radiation property values. CRRC lists the measured radiative property values in its Rated Products Directory (www.coolroofs.org).
The European counterpart is ECRC (European Cool Roofs Council), active since 2011 (www.coolroofcouncil.eu).
It maintains a Rated Product Directory as well.

CRRC COOL ROOF RATING COUNCIL ®
MEMBER

ECRC EUROPEAN COOL ROOFS COUNCIL

Sika products suitable for cool roof applications can be found in the publicly accessible Product Rating Databases of the CRRC and ECRC.

SIKA COOL ROOF SOLUTIONS

Sika roofing systems with high solar reflectance

REGULATORY DEFINITIONS OF COOL ROOF PRODUCTS

	Situation	SR	IE	SRI
USGBC LEED, v4 [2]	Low slope[2] Initial Aged [1]			 > 82 > 64
ENERGY STAR®	Low slope Initial Aged	 0.65 0.50		
Green Globes™	Initial			78 [3]
California Title 24	Low slope Aged	 0.63	 0.75	 75
ASHRAE Standard 189.1	Low slope			78

[1] Three years' exposure.
[2] A roof surface having a maximum slope of 2:12.
[3] Roughly equivalent to e.g. reflectance of 0.65 and thermal emittance of 0.90.

SIKA COOL ROOF SYSTEMS - WHAT MAKES A GOOD PRODUCT?

Our large product portfolio of waterproofing membranes for flat roofs includes suitable solutions for virtually any application:

Requirements	Sika Cool Roof systems available?
High initial Solar Reflectance Index (SRI) values	✓
High reflectance value after exposure (slight reduction of reflectance until constant color is reached) → *The benefits of cool roofs (significantly reduced energy consumption) is maintained throughout the service life*	✓
Good cleaning properties allow regaining SRI values close to 100% of the initial value → *Suitability of all technologies for the specific climate must be respected*	✓
LEED requirements for LEED Credit 5, Option 1 (Heat island effect - Roofing)	✓
LEED requirements for other LEED credit options	✓
Single-ply membranes (FPO and PVC)	✓
Liquid-applied membranes and coatings (several technologies)	✓
Compatibility with the entire roof system, including accessories	✓
Proven performance and reliability, high durability → *Lower surface temperatures increase life expectancy*	✓
Environmental Product Declarations (EPD) available	✓

Life Cycle Assessment (LCA)

Sika roofing membranes and systems are manufactured in ISO 14001 certified production facilities. They contribute to sustainable construction, and they are analyzed and evaluated with a fully comprehensive life cycle assessment (LCA). The following sustainability aspects are relevant for roofing systems and are systematically assessed:

- Energy and carbon footprint
- Durability
- High reflectance
- Recycling
- Air pollution

Energy Consumption Considerations

Tools are available for quantifying the performance of a Sika cool roof solution versus conventional dark roofs. They take project location and energy rates into account, as well as soiling of the membrane or coating over time. The tools show the estimated energy savings during the period of study and the break-even point of the investments.

SIKA TECHNOLOGIES

Single-ply and bituminous membranes

TYPE	PVC	FPO	BITUMINOUS
	PVC membranes	Polyolefin membranes	Bituminous membranes
BRANDS	Sarnafil®, Sikaplan®	Sarnafil®, Sikaplan®	Mineral Flexter Testudo Reflex White
ADVANTAGES	■ Established technology with the longest track record ■ Availability of products for exposed roofing applications with high fire ratings / extended fire resistance ■ Easy to repair ■ Possibility of customized design solutions (colors, profiles, and roof graphics) ■ Homogeneous hot air welded joints ■ Easy to handle on site ■ Suitable for use and exposure in different climatic conditions ■ Fast installation independent of the weather ■ Good vapor permeability ■ Highly flexible ■ Flame free installation ■ Recyclable ■ Proven technology for more than 50 years	■ High chemical resistance ■ Suitability for direct application on such substrates, as old bitumen, EPS and XPS insulation (polystyrenes) ■ Availability of products for exposed roofing applications with high fire ratings / extended fire resistance ■ Long life expectancy ■ Easy to repair ■ Homogeneous hot air welded joints ■ Easy to handle on site ■ Suitable for use and exposure in different climatic conditions ■ Fast installation independent of the weather ■ Outstanding ecological profile ■ Flame free installation ■ Recyclable ■ Proven track record since 1989	■ High chemical resistance ■ Resistant to the most extreme weather conditions ■ Good life expectancy ■ High resistance to mechanical damage and puncturing ■ Fully adhered ■ Easy maintenance ■ Dimensional stability ■ Easy to repair ■ Highly flexible

SIKA COOL ROOF SOLUTIONS

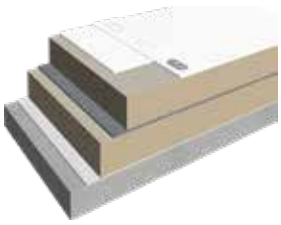
Membrane systems with high solar reflectance

Examples of mechanically fastened systems for new construction or reroofing on steel or concrete decks.

REQUIREMENTS
- Fast and easy installation
- Highly chemically resistant waterproofing layer
- High fire resistance of the thermal insulation

SIKA SOLUTION
FPO membrane with extended guarantee

SIKA SYSTEM
- FPO membrane Sarnafil® TS 77 mechanically fastened with Sarnafast® SF 4.8 mm and Sarnafast® Washer KT
- Mineral wool or PIR insulation
- Vapor control layer Sarnavap® 1000 E, 2000 E or 4000 E SA
- Steel deck

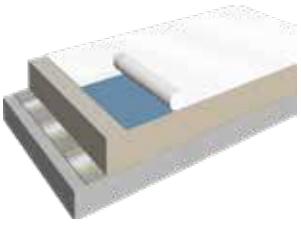


- **REQUIREMENTS**
- Additional thermal insulation
- Highly chemically resistant waterproofing layer

SIKA SOLUTION
FPO membrane with extended guarantee

SIKA SYSTEM
Mechanically fastened build-up
- FPO membrane Sarnafil® TS 77 mechanically fastened to the substrate with Sarnafast® SBF 6.0 mm and Sarnafast® Washer KTL
- New thermal insulation
- Existing build-up on concrete deck

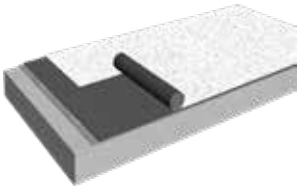
Examples of adhered systems for new construction on steel or concrete decks.



- **REQUIREMENTS**
- Highest aesthetic appearance
- No penetration of the roof deck (when all roof build-up components are adhered)
- Special colors and design (décor profiles)

SIKA SOLUTION
Fully adhered lacquered felt-backed PVC membrane with extended guarantee

SIKA SYSTEM
- PVC membrane Sarnafil® G 410 EL Felt fully adhered to the insulation with Sarnacol® 2142 S
- PIR, EPS/XPS insulation bonded to the vapor control layer with Sika® RoofBond or mechanically fastened to the substrate
- Self adhesive vapor control layer Sarnavap® 5000 E SA or bitumen
- Primer 600 or Primer 610 Spray, where required
- Concrete (or timber/steel) deck



- **REQUIREMENTS**
- Increased thermal comfort inside building
- Fully adhered system
- High resistance to mechanical loads and puncturing
- High flexibility
- Good UV resistance

SIKA SOLUTION
White Mineral bituminous membrane

SIKA SYSTEM
- Top sheet with White Mineral bituminous membrane
- Base sheet with smooth bituminous membrane
- Bituminous Primer (Igolflex P-01 or the appropriate solvent based primer)
- Concrete deck (or prefabricated concrete, metal or wooden deck)

SIKA TECHNOLOGIES

Liquid applied membranes (LAM) / Coatings

TYPE	ACRYLICS	1-C PU	1-C PU	2-C PU/PUA
	Co-elastic Technology (CET) Hybrid Acrylic Coatings	Moisture Triggered Chemistry (MTC) 1 component Polyurethane	SikaRoof® i-Cure systems with Sikalastic® liquid applied membranes	Polyurethane/Polyurea Hybrid 2 component Polyurethane/ Polyurea
PRODUCTS	Sikalastic®-560 Sikalastic®-580	SikaRoof® MTC systems with Sikalastic® liquid membranes	Sikalastic®-641	Sikalastic®-851 R Sikalastic®-701
ADVANTAGES	■ Eco-friendly ■ No odor ■ VOC compliant ■ Easy to apply ■ One component – ready to use ■ Cold applied – requires no heat or flame ■ Seamless waterproofing ■ Compatible with Sika® Reemat Premium ■ Good adhesion to most substrates ■ Vapor permeable – allows substrate to breath ■ Easily re-coated if needed	■ Fast curing – free from rain damage almost immediately on application ■ Proven technology – over 25 year track record ■ One component – ready to use ■ Cold applied – requires no heat or flame ■ Seamless roof waterproofing membrane ■ Compatible with Sika® Reemat Premium – easy to detail ■ Highly elastic and crack bridging – retains flexibility even at low temperatures ■ Easily recoated when needed – no stripping required ■ Good adhesion to most substrates ■ Vapor permeable – allows substrate to breathe ■ Strong resistance to common atmospheric chemicals	■ Minimal odor – suitable for odor sensitive projects ■ High solids ■ One component – ready to use ■ Cold applied – requires no heat or flame ■ Seamless roof waterproofing membrane ■ Compatible with Sika® Reemat Premium – easy to detail ■ Easily recoated when needed – no stripping required ■ Vapor permeable – allows substrate to breathe. ■ Highly elastic and crack bridging – retains flexibility even at low temperatures ■ Good adhesion to most substrates ■ Strong resistance to common atmospheric chemicals	■ Fast application – application with 2-part hot spray equipment ■ Fast curing – walkable on after 4 minutes ■ Solvent free ■ High solids ■ Seamless waterproofing membrane ■ Highly elastic and crack bridging ■ Low viscosity ■ Vapor permeable – allows the substrate to breath ■ Good adhesion to most substrates ■ 12-month shelf life

SIKA COOL ROOF SOLUTIONS

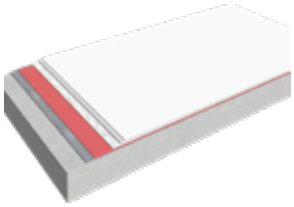
LAM / Coating systems with high solar reflectance

Examples of roof buildups with Sika systems for new construction or reroofing on steel or concrete decks

REQUIREMENTS
- Seamless waterproofing
- Low odor
- Solvent free
- No penetration of the roof deck
- No water underflow

SIKA SOLUTION
Cold roof waterproofing with Sikalastic®-560 and Sikalastic®-580 Systems

SIKA SYSTEM
- 1 – 3 top coats of Sikalastic®-560 / 580
- Reinforcement with Sikalastic® Fleece-120 / Sika Reemat Premium
- Base coat Sikalastic®-560 or -580
- Sikalastic®-560 or -580 diluted with 10% water
- Concrete deck



REQUIREMENTS
- Seamless waterproofing
- Fast curing
- No penetration of the roof deck
- Extended guarantee (from your local Sika organization)
- Increased fire resistance
- No water underflow

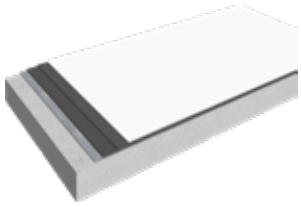
SIKA SOLUTION
Cold roof waterproofing with SikaRoof® MTC Systems

SIKA SYSTEM
SikaRoof® MTC 12/15/18/22
- 1 or 2 top coats of Sikalastic®-621 TC
- Reinforcement with Sikalastic® Reemat
- Base coat Sikalastic®-601 BC
- Sika® Concrete Primer
- Concrete deck

REQUIREMENTS
- Seamless waterproofing
- Low odor
- No penetration of the roof deck
- Extended guarantee (from your local Sika organization)
- Increased fire resistance
- No water underflow

SIKA SOLUTION
Cold roof waterproofing with SikaRoof® i-Cure Systems

SIKA SYSTEM
SikaRoof® iCure-12/15/18/22
- 1 or 2 top coats of Sikalastic®-641 TC
- Reinforcement with Sikalastic® Reemat
- Base coat Sikalastic®-641 BC / Sikalastic®-631
- Sika® Concrete Primer
- Concrete deck



REQUIREMENTS
- Extended life expectancy of the bituminous roof
- Increased thermal comfort inside the building
- Good UV resistance

SIKA SOLUTION
Cold roof waterproofing with White Reflex Ultra

SIKA SYSTEM
- 2 coats of White Reflex Ultra
- 1 or 2 sheets bituminous membrane
- Primer coat: White Reflex diluted with 10% water
- Concrete deck

PROOF OF TECHNOLOGY

Effective solution to improve thermal comfort of buildings in hot climate countries

COOL ROOFS ARE ONE of the most effective and easiest solutions to increase the thermal comfort of buildings and reduce cooling costs in locations with high solar radiation and outdoor temperatures.

Brunel University London, in cooperation with the European Cool Roofs Council, Sika Services AG and the University of Technology in Kingston, evaluated a project in Jamaica to study how the application of a solar roof can affect the thermal comfort of residential buildings in hot climates.

The subject of study was the typical uninsulated cast-in-place concrete roof of a low-income house in Jamaica. The flat roof measures 36 m², and the thermal transmittance (U-value) of the roof assembly was 5.68 W/m²K. Temperatures were monitored before and after the application of Sikalastic®-560, a highly reflective liquid-applied waterproofing membrane for roofs. The monitoring focused on the surface temperature of the roof and ceiling and the air temperature inside the house. Preliminary measurement began in September 2016, and all the monitoring sensors were in place by January 2017.

4 sensors were installed on the rooftop to measure external roof temperatures and 4 on the ceiling to measure surface temperatures inside. In addition, 2 sensors were installed in the living room and the kitchen to measure the air temperatures in those rooms. The Sikalastic®-560 was applied between 22 March and 16 April 2017, and monitoring continued until July 2017.
In first phase of application, Sikalastic®-560, diluted with 10% water, was applied as a primer. Then, 3 coats of the roofing product were applied within the over-coating times. The total system buildup was ~ 1.4 kg/m².

Even though the average solar radiation and average outdoor temperatures are higher in April than in March, a significant decrease in roof temperature and indoor air temperature was measured after the application of Sikalastic®-560.
Figure 2 displays measurements taken on two days: The first day (13 March) was before the cool roof was applied, and the second (24 April) was after the application. Both days had similar air temperatures (37.4°C max. on 13 March and 38.2°C max. on 24 April) and similar average global solar radiation intensity during the day-time (416 W/m² on 13 March and 428 W/m² on 24 April). The indoor ceiling surface temperature was higher on 13 March than on 24 April by a maximum of 18.6°C and by an average of 6.8°C. Indoor air temperature measurements show that after the application of Sikalastic®-560 the living room was cooler by a maximum of 5.1°C and an average of 2.3°C

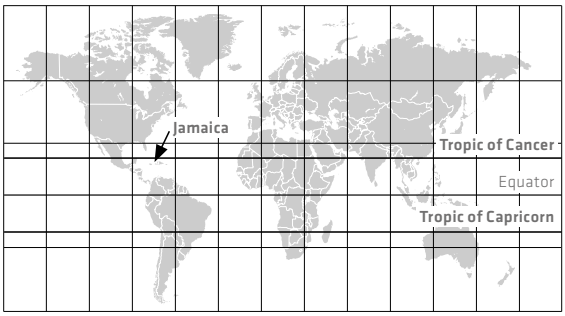


Fig. 1. Location of the case-study.

TEMPERATURE DISTRIBUTION BEFORE AND AFTER THE APPLICATION OF Sikalastic®-560

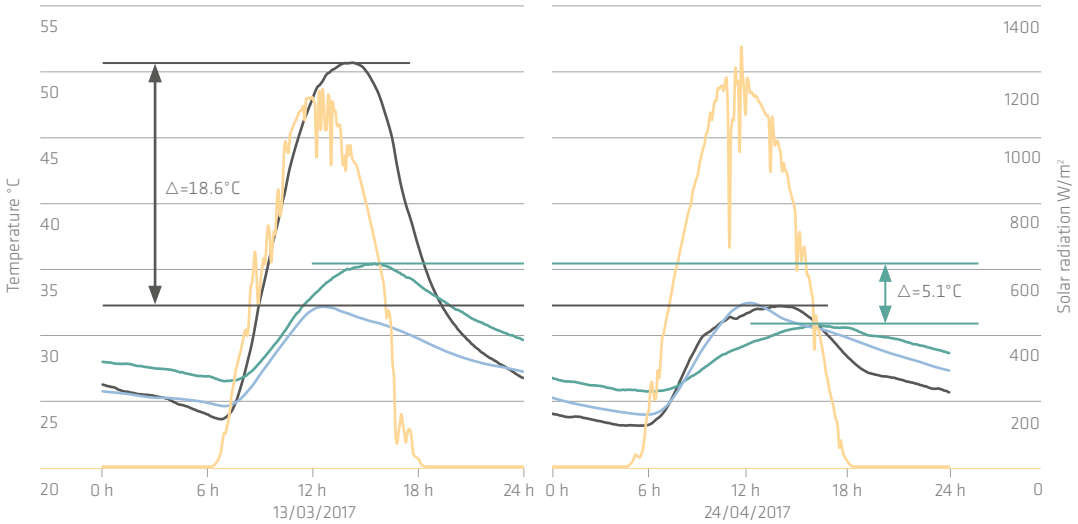


Fig. 2. Measured results of solar radiation intensity, external and internal air and internal ceiling surface temperature before and after application of the Sikalastic®-560.

Internal ceiling temperature
External air temperature
Internal air temperature
Solar radiation

Ceiling profile.

Application of Sikalastic®-560 diluted with 10% water as a primer.

Finished roof with 3 coats of Sikalastic®-560.

This study shows that the application of a cool roof can significantly improve the thermal comfort of houses and thus improve the living conditions of the inhabitants. Chief potential beneficiaries of this type of solution are low-income families who experience overheating of their houses, typically located near the equator in areas with high solar radiation intensity throughout the year (4 – 6 kWh/m^2) and high outdoor temperatures. Effective cooling strategies are urgently needed for these poorly insulated buildings in tropical climates, and upgrading the roof with Sikalastic®-560 is a relatively low-cost option. The product is easy to apply and does not require professional applicators.

This study was conducted as part of the EPSRC Global Challenges Research Fund Institutional Sponsorship Award 2016 – Brunel University (EP/P510749/1). For more information about the project see: Energy and Buildings, Volume 176, 1st October 2018. https://doi.org/10.1016/j.enbuild.2018.07.005

Sikalastic®-560 IS AN ECONOMIC, ECO-FRIENDLY LIQUID APPLIED ROOFING WATERPROOFING MEMBRANE, with high reflectance properties. It is included in the Cool Roof Rating Council (CRRC) with the following initial values:

Solar Reflectance:	0.82
Thermal Emittance:	0.90
Solar Reflectance Index (SRI):	106

Roof before the application.

Roof after the application.

CASE STUDIES MEMBRANES

SHOPPING CENTER CAMPANIA, ITALY

PROJECT
This shopping center in Campania, Italy needed the roof replaced. The owner wanted a long-lasting and high-quality solution for the total roof area of 35,000 m^2. He had high expectations especially for durability, performance and benefits during use.

SIKA SOLUTION
Replacement with a generic roofing solution, a 2-layer bituminous waterproofing membrane, was considered first. Sika showed the owner how a high-performance thermoplastic roofing system would meet all the technical, economical and environmental requirements. The estimated potential energy and carbon savings from reduced cooling/heating of the building by using a white membrane instead of a black roof were calculated, and the energy and carbon break-even point of the roofing system was determined. The results of the evaluation were decisive. The owner chose Sarnafil® TS 77-18 RAL 9016 SR, a white membrane with high solar reflectance. This was chosen over a bituminous membrane due to lower overall environmental impact and thus lower costs (financial and environmental) in the long run.

RESULT
The analysis showed that the white membrane would save nearly 119,000 GJ of energy (CED) over a black roof over a 20-year period. This represents potential savings of 1,600 MWh/year in electricity consumption. In this project, Sika demonstrated its competence and expertise in sustainability, including crucial contributions to a sustainable, high-performance, custom roofing solution to meet the owner's technical, economic and environmental requirements.

FRUIT PACKAGING HOUSE ONDA, SPAIN

PROJECT
A new fruit packing plant being built in Onda, Castellón, Spain required a roof measuring 11,000 m^2. The owner, Frutinter Company, specifically wanted a durable and high-quality roofing system.

SIKA SOLUTION
Black bituminous roofs are typical in Spain. Sika's Global Product Sustainability Group performed a life cycle assessment (LCA) of three roofing solutions with similar performance, including a beige and white membrane, to show the owner the additional benefits of a cool roof. Based on the results, the owner chose white Sarnafil® TS 77-18 RAL 9016 SR roofing membrane over beige thermoplastic or black bituminous roofing membrane. It demonstrated the highest savings through reduced cooling loads.

RESULT
Compared with the beige membrane, the white membrane will save an estimated nearly 8,000 GJ of cooling/heating energy over a period of 20 years. This represents a savings of 110 MWh/year, which translates into lower cooling/heating costs. In terms of GWP, this amounts to an equivalent reduction of 595 tons of CO_2 over the 20-year period. The estimated savings will outweigh the cradle-to-gate energy and carbon impacts of the roofing system in less than 5 years.

NEW MANUFACTURING PLANT
TAINAN, TAIWAN

PROJECT
To expand its production capacity for the Asian market, a manufacturing company planned to build a new 35,000 m^2 factory in Tainan, Taiwan. In consideration of the tropical climate, the roof system was specified to meet strict European standards for high durability and extremely low thermal transmittance (U-value ≤ 0.3 W/m^2K).

SIKA SOLUTIONS
At its factory in Europe, the company used a roofing system incorporating 3 layers of mineral wool insulation (150 mm). But in Taiwan, Sika proposed a roofing system using 2-layer PIR insulation (100 mm). This provided a better U-value than required and the same grade of fire resistance according to FM. What's more, the system is lighter and faster to install than the design used in Europe. During construction in Taiwan it rained frequently, and exposed mineral wool would have absorbed water, dramatically increasing the U-value. Sika's 2-layer PIR system displays very low water absorption, helping to minimize this potential problem and better reach the owner's target. The roofing membrane used was Sarnafil® S 327-15 EnergySmart grey, installed with the RhinoBond securement system with no membrane penetration. The extremely long life expectation of this system is certified by BBA. The system provides excellent weathering resistance, solar reflectance and suitable uplift resistance to withstand typhoon winds.

RESULT
Sarnafil® S 327-15 EnergySmart grey provides an adequate initial SRI, and the U-value of the system (0.27 W/m^2K) with 2-layer PIR insulation reduced the air-conditioning load, saving energy and making for a low GWP. Rigid PIR and high-performance Sarnafil® S 327-15 make for very low maintenance costs and a good life cycle assessment (LCA) – fully meeting the owner's expectations.

CASE STUDIES MEMBRANES

ONE DENVER TECHNOLOGY CENTER, DENVER (COLORADO), USA

PROJECT
The office building at One Denver Technology Center was renovated with the aim to retain LEED Gold certification. With a roof height of 60 meters, subjected to high wind speeds, the location next to Interstate 25 required special measures for safety of the roofers and protecting the environment around the building.

SIKA SOLUTIONS
The old membrane, the thermal insulation and 16,000 pavers had to be removed from the roof. After the tear-off was completed, two layers of two-inch isocyanurate insulation, isocyanurate insulation crickets, and one layer of gypsum board were installed. The white 1.5 mm Sarnafil® G 410 Energy Smart membrane was then adhered to the gypsum board, followed by sheet metal edge strips and counter flashing. The work took place during a very cold winter. Temperatures had to be monitored closely because the adhesive for the membrane and insulation could be used only when temperatures were 2 °C or greater. The roofing site was checked regularly by the regional OSHA (Occupational Safety and Health Administration) office, and all inspections were passed without citation.

RESULT
Despite all the demands and challenges, the roofing contractor completed the installation work on schedule and within budget. Today the roof is LEED Gold certified and performing well.

INDUSTRIAL BUILDING, BRENDOLA, ITALY

PROJECT
An industrial building in Brendola, Vicenza, needed a new 10,000 m^2 roof for installation of rooftop photovoltaic equipment.

SIKA SOLUTION
This reroofing project called for bituminous membrane roofing with long life expectancy because any future roof maintenance required beneath the photovoltaic equipment will be very expensive. The solution was to use Mineral Flexter Testudo Reflex White because it offers long service life. The surface is finished with special reflectance granules that reduce the temperature inside the building, providing a sustainable solution. To avoid unnecessary costs, the new membrane was fully adhered over the old one, which was still in serviceable condition. The result is a double-layer system with greatly enhanced performance and mechanical properties due to the synergy between the two layers.

RESULT
The initial SRI value of Mineral Flexter Testudo Reflex White is about 80, meaning the albedo is increased and roof surface temperatures are decreased. At the same time, radiation is reflected from the roof surface, enhancing the performance of the photovoltaic system even during dimmer daylight hours. The special surface finish with granules makes for high color stability and longevity – helping to further extend the long service life of the roof. This type of membrane can be used to earn LEED credit 7.2: Heat Island Effect: Roofs.

ZONAMERICA BUSINESS PARK, CALI, COLOMBIA

PROJECT
This project is the first free zone in Cali, Colombia that is dedicated to services and technology, and it is to become an important hub to attract businesses. The first building measures 5,000 m^2 and the 17 buildings to follow total 60,000 m^2. Construction of these buildings will take another 3 years. The average annual temperature is 29 °C.

SIKA SOLUTIONS
A main objective was to differentiate the solution from typical roofing systems used in Colombia. A solution with a reflective PVC membrane system was offered, which earns points for the urban heat island credit for LEED certification. The owner chose Sarnafil® S 327 White membrane, which, compared with conventional systems, provides decisive advantages such as high durability and energy saving costs.

RESULT
With this roofing system, boasting an initial SRI value of 104, radiation is reflected from the roof surface and the roof temperature is kept relatively low, allowing the owner to earn a Heat Island Effects credit under the LEED system. Due to the good performance of the first 2 buildings, the remaining buildings will use the same successful roofing solution with Sarnafil® S 327 White.

CASE STUDIES LAM / COATINGS

CONSTANCE BELLE MARE HOTEL, CONSTANCE BELLE MARE, MAURITIUS

PROJECT
Constance Belle Mare Plage Hotel is located in Belle Mare, Mauritius. The old roofing, measuring 8,000 m^2, consisting of bituminous sheets and thatch, needed replacement. Specified was a new cold-applied roofing system on the top of the old roofing, to be applied without using flames. In addition, the owner wanted a solution that would reduce the energy consumption of the building, since the black bituminous sheets significantly heated up the building in summer.

SIKA SOLUTIONS
Sikalastic®-612 liquid-applied membrane reinforced with Reemat Premium and top coated with Sikalastic®-570 TC was evaluated as the most economic, durable and effective system to meet the requirements of the owner. Sikalastic®-612 is a fully reinforced, cold applied, seamless roof waterproofing membrane. In order to increase and maintain the solar reflectivity of the roof, Sikalastic®-570 TC, which has a very high initial SRI value, was applied as the top coat.

RESULT
Thanks to the light color and the high SRI value of the top coat, a cool roof was installed which effectively reflects sunlight in the hot climate of Mauritius. This dramatically reduced the indoor temperature compared with the previous dark roof with bituminous sheets and thatch. The new roof provides energy savings for the whole building. The estimated return on investment for these energy-saving benefits has been calculated at 3 years at the most.

POSTO TOURISMO, LOUSADA, PORTUGAL

PROJECT
The expansion of the Lousada Tourist Office aimed to reflect the unique character of the county, playing an important role in the local tourism sector. The new building is made of concrete, with the insulation layer on the interior. The distinctive design features thinly tapering roof slabs that required a durable high-performance waterproofing solution.

SIKA SOLUTION
A single suitable finish coating was required for the building, including both the roof and the facades, measuring a total area of about 500 m^2. SikaRoof® MTC-15 liquid-applied waterproofing membrane ensures waterproofing, provides long-term durability and meets the special needs of the architectural design.
The buildup consists of 3 layers: Sikalastic®-601 BC (base coat), Sika® Reemat Premium reinforcement and Sikalastic®-621 TC (top coat).

RESULT
The highly sustainable solution admirably met the construction challenges. The high solar reflectance of white SikaRoof® MTC reduce cooling loads of the building. Using an integrated approach for roof and facade, the high expectations for aesthetics and integration of the building within its urban context were fulfilled.

HANGARS AEROLÍNEAS ARGENTINAS, BUENOS AIRES, ARGENTINA

PROJECT
Aerolíneas Argentinas is Argentina's flagship airline and one of the leading airlines in Latin America. The vaulted concrete roofs of Hangars 3 and 4 and the flat roofs of the workshops at the company's Ezeiza Industrial Plant in Buenos Aires required new waterproofing. The old waterproofing was a bituminous-based adhered system. Suffering from cracks and deterioration, the leaking waterproofing needed replacement.

SIKA SOLUTIONS
The vaulted roofs were coated with white Sikalastic® 560 liquid acrylic membrane with polyurethane, applied without reinforcement.
The buildup: primer + 3 layers.Total thickness: ~ 0.8 mm.
Total coverage rate: ~ 2.1 kg/m^2
The flat roofs were coated with white Sikalastic® 560 acrylic liquid membrane with polyurethane, applied with Sika® Tex 75 reinforcement.
The buildup: primer + 4 layers and Sika® Tex 75 polyester reinforcement. Total thickness: ~ 1.5 mm.
Total coverage rate: ~ 2.5 / 3.0 kg/m^2

RESULT
Sikalastic® 560 provides not only waterproofing but a superior SRI value. The satisfied company has since adopted this solution for a number of its other hangars and airports.

CASE STUDIES LAM / COATINGS

INDUSTRIAL BUILDING, BRESCELLO, ITALY

PROJECT
This 4,000 m^2 factory in Brescello, Reggio Emilia produces kitchen equipment. The old roofing system, two layers of bituminous membrane over mineral wool insulation, required upgrading. A chief requirement was to reduce the temperature inside the building, especially since the production activities generates significant heat.

SIKA SOLUTIONS
It was decided to apply a new membrane over the old roofing system. Due to the softness of the mineral wool, the membrane would have to possess good elongation to follow any movement. A 4 mm bituminous membrane, polyester-reinforced and modified with elastomers and polyolefin copolymers, was selected. The requirement for reduced indoor temperatures was met by applying a White Reflex Ultra coating, creating a cool roof.

RESULT
The SRI value of White Reflex Ultra is 110, emissivity is 0.91, and reflectance is 0.86. With these properties, it was possible to reduce the rooftop temperature to 39 °C and the indoor temperature by about 5 °C. This reduced air-conditioning costs so much that the savings realized during the first summer covered the entire cost of the reroofing job. The reduced rooftop temperature also increases the life expectancy of the roofing system. This type of system can qualify for LEED credit 7.2 - Heat Island Effect: Roofs and credit 5 – Heat Island Effect, Green Roofs or High-Reflectance Roofs.

THE OLD FORD FACTORY, LOS ANGELES, UNITED STATES

PROJECT
Built in 1914 to manufacture Model T automobiles, this concrete-and-masonry building was the second Ford Motor plant to be built west of the Mississippi. It has become one of the most iconic buildings in downtown Los Angeles. Honoring the storied past of The Ford Factory, restoration and redevelopment of the site aims to preserve the architectural integrity of this landmark building, which is designated as a historic structure and listed on the National Register of Historic Places. The roof renovation, in particular the parapet waterproofing, was a major challenge for the designers because the waterproofing solution had to be applied over a variety of substrates without transition joints in order to preserve the aesthetic appearance of this historic landmark of the Arts District in Los Angeles.

SIKA SOLUTIONS
The design team determined that a liquid-applied membrane system would be the most suitable solution for this project. Sikalastic®-641 Lo-VOC was chosen because it best met all the specific project requirements. This product is a single-component moisture-triggered aliphatic polyurethane, used here in conjunction with Sika® Reemat Premium random fiberglass reinforcing scrim. Along with appropriate primers for various substrates, these products make up the Sikalastic RoofPro membrane system, a fully reinforced 70 mil DFT membrane system that meets California's strict VOC air-quality standards.

RESULT
Sikalastic RoofPro was fully adhered to the suitably prepared and primed substrate. The waterproofing system admirably meets the project requirements and is covered by a 20-year warranty on material and labor, a requirement by the design team and the building owner. This durable solution nicely renders the architectural forms of the complex roof and respects the historical character the building.

COOPERATIVA C. VALE, BRAZIL

PROJECT

C. Vale is an agro-industrial cooperative operating in Brazil and Paraguay with over 9,000 employees. The second largest cooperative in Brazil, it is active in the production of soybeans, corn, wheat, cassava, milk, chicken and pigs. It provides services and maintains a network of supermarkets with eight stores in Paraná, Mato Grosso and Mato Grosso do Sul. In the industrial segment, C. Vale maintains a poultry complex with a slaughtering capacity of 600,000 chickens per day, with exports to several countries. C. Vale needed to replace the waterproofing of several units of its industrial complex, including the slaughterhouse, industrialized facility and feed factory, totaling more than 23,000 m^2 of coverage.

SIKA SOLUTIONS

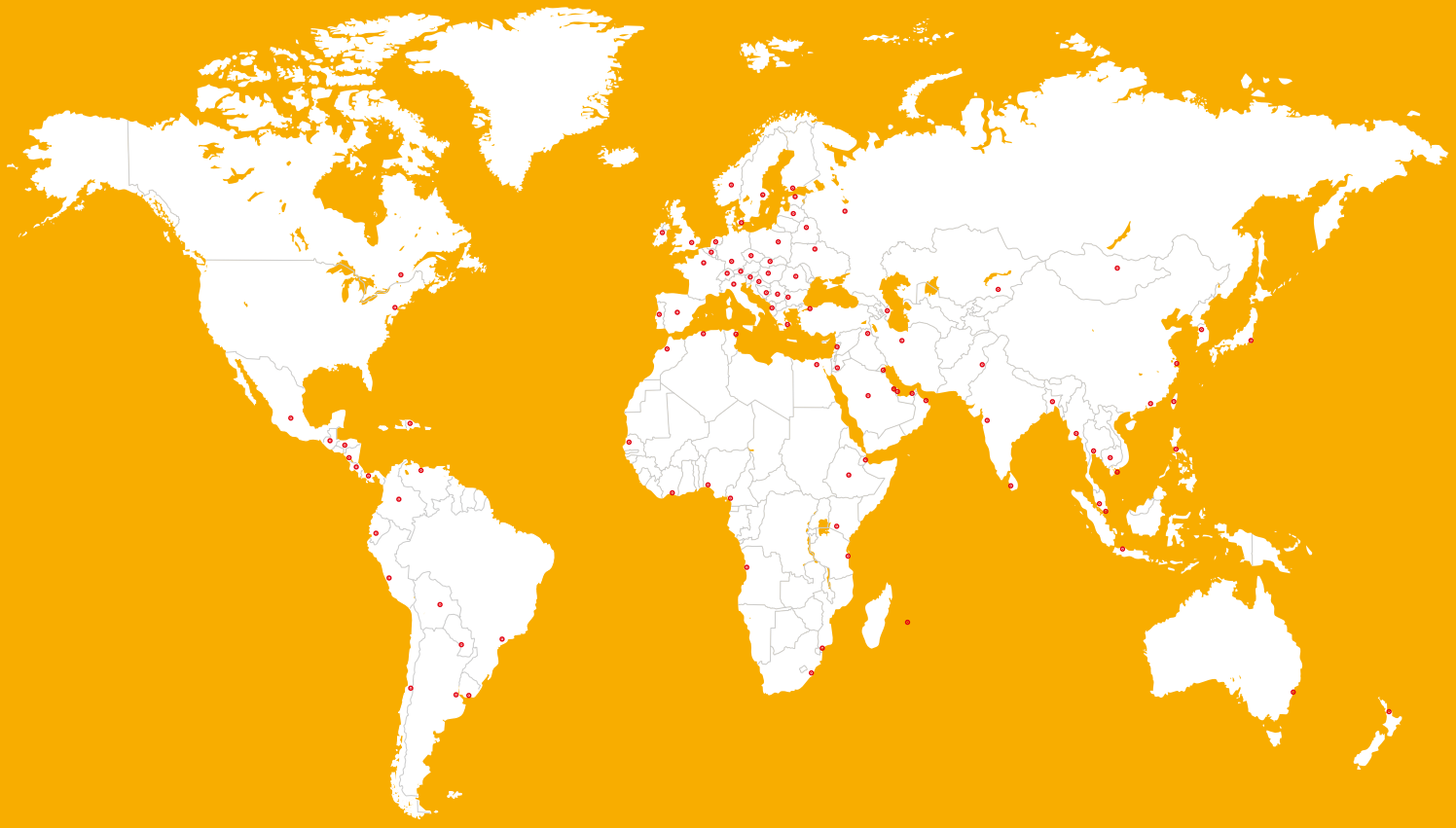
The system chosen was SikaFill® Reflex Pro, applied at a coverage rate of 2.2 kg/m^2, with SikaFleece®-70 BR at details and roof penetrations. The tiles were cleaned with high-pressure spray. Airless equipment was used to increase productivity and maintain regularity between the layers, allowing application of the primer and two layers of SikaFill® Reflex Pro. This product possesses high adherence to metal tile and it cures rapidly.

The high reflectivity and white color enhance thermal comfort within the structure and enhances the building appearance, making the complex more visually appealing.

RESULT

The building complex was designed to European standards, and the waterproofing of the metal cladding required a system with a guarantee of at least 10 years. Aesthetic considerations were also important because aerial photos are used in presentations to customers around the world. The Sika solution met all these requirements and the very short deadline for execution as well.

GLOBAL BUT LOCAL PARTNERSHIP



FOR MORE SIKA ROOFING INFORMATION:

WE ARE SIKA
Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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