



HEATLAND

# LAYMAN REPORT

LIFE HEATLAND PROYECT

life

## PROJECT DATA

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<b>Project reference:</b>	LIFE16CCA/ES/000077
<b>Total budget:</b>	1,359,221 €
<b>EU Contribution:</b>	730,898 €
<b>Duration:</b>	02/10/2017 — 31/12/2021
<b>Project location:</b>	MURCIA



SCAN TO SEE  
THE PROJECT



SCAN TO SEE  
THE MAP

## PARTNERS

### Coordinating beneficiary

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CONSTRUCTION TECHNOLOGY CENTER OF THE REGION OF MURCIA

<https://ctcon-rm.com/es>

C/ Sol, 16, Nave 2, 30500 Molina de Segura, Murcia.

- Contact details:

**Fran Moral**, [fmoral@ctcon-rm.com](mailto:fmoral@ctcon-rm.com) +34 968355270



### Associated Beneficiaries

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CHM OBRAS E INFRAESTRUCTURAS, SA

[www.chm.es](http://www.chm.es)

C/ Jean Claude Combaldieu, s/n, Pda. Agua Amarga, 03008, Alicante

- Contact details:

**Lorena Palomo**, [lpalomo@chm.es](mailto:lpalomo@chm.es)

+34 965145205



CITY COUNCIL OF MURCIA

[www.murcia.es](http://www.murcia.es)

Glorieta de España, 1, 30004, Murcia.

- Contact details:

**Manuel Valls Sevilla**, [manuel.valls@ayto-murcia.es](mailto:manuel.valls@ayto-murcia.es)

+34 968358600



REGIONAL FEDERATION OF CONSTRUCTION

ENTREPRENEURS OF MURCIA

[www.frecom.com](http://www.frecom.com)

Acisclo Díaz, 5C 4º, 30005 Murcia

- Contact details:

**Alejandro Zamora**, [secretariogeneral@frecom.com](mailto:secretariogeneral@frecom.com)

+34 968 27 52 26



CONSTRUCTION CLUSTER OF SLOVENIA

[www.sgg.si](http://www.sgg.si)

Vaše 41a, Medvode, 1215, Slovenia.

- Contact details:

**Vladimir Gumilar**, [vladimir.gumilar@sgg.si](mailto:vladimir.gumilar@sgg.si)

+38641770482



# 01. INTRODUCTION



The United Nations estimates that the urban population will continue to grow significantly in the coming decades, which will turn cities into the largest population centers.

The relationship between climate and the city is one of the topics of main interest to researchers in recent decades. In the cities, the so-called Urban Heat Island effect occurs, which consists in a temperature difference between the center of the cities and the outer and / or rural areas. Its causes are the following:

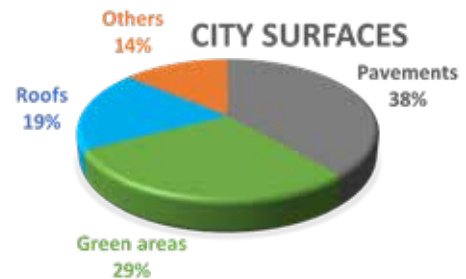
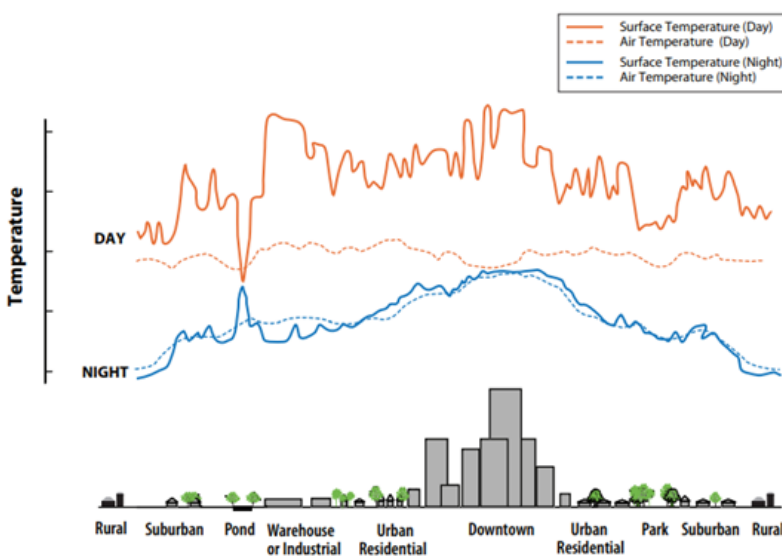
1. Evapotranspiration is lower in cities than in rural areas.
2. Radiation trapped by tall buildings.
3. Elements that release heat (air conditioning, vehicles...).
4. Building materials used in cities absorb solar radiation and release it as heat during the night.
5. Lack of vegetation.

The main methods of reducing this effect, accepted by the scientific community, are the following:

- Increase in shaded areas, mainly with trees.
- Installation of green roofs.
- Installation of cool roofs.
- Installation of cool pavements.

Pavements account for a large percentage of urban surface. In this sense, the LIFE HEATLAND project directly addresses the urban adaptation to this effect, seeking to minimize it through the use of new cool pavements, since these pavements have a lower solar storage than conventional ones.

The difference between this new pavement and the traditional ones is the replacement of the conventional bitumen obtained during the oil refining process by another colorless synthetic binder derived from resins..



# 02. PROJECT OBJECTIVES



- ▷ 01 | Demonstrate the effectiveness of an innovative pavement technology to mitigate the Urban Heat Island (UHI) effect.

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- ▷ 02 | Transfer the know-how generated throughout the project to those entities with the potential to replicate the proposed solution.

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- ▷ 03 | Achieve the installation of the innovative pavement in other urban areas, assisted by the beneficiaries of the project.

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- ▷ 04 | Demonstrate the effect of the new pavement in reducing local energy consumption and its contribution to reducing noise levels and atmospheric pollutants.

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- ▷ 05 | Validate the viability of the proposed pavement solution, evaluating its financial and socioeconomic balance.

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- ▷ 06 | Develop a mathematical model to predict the effect of implementing the proposed pavement technology in different urban areas and apply it in other European cities to assess the replicability potential of the innovative solution.

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- ▷ 07 | Develop useful materials and activities that allow each interested entity or person to have quality information about the project and how to adequately replicate it.

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- ▷ 08 | Educate public bodies, technical and business environments, and citizens, at a European level about UHI phenomena and adaptation to climate change and present the proposed technology as a viable adaptation solution to mitigate the UHI effect.



# 03. THE PROJECT

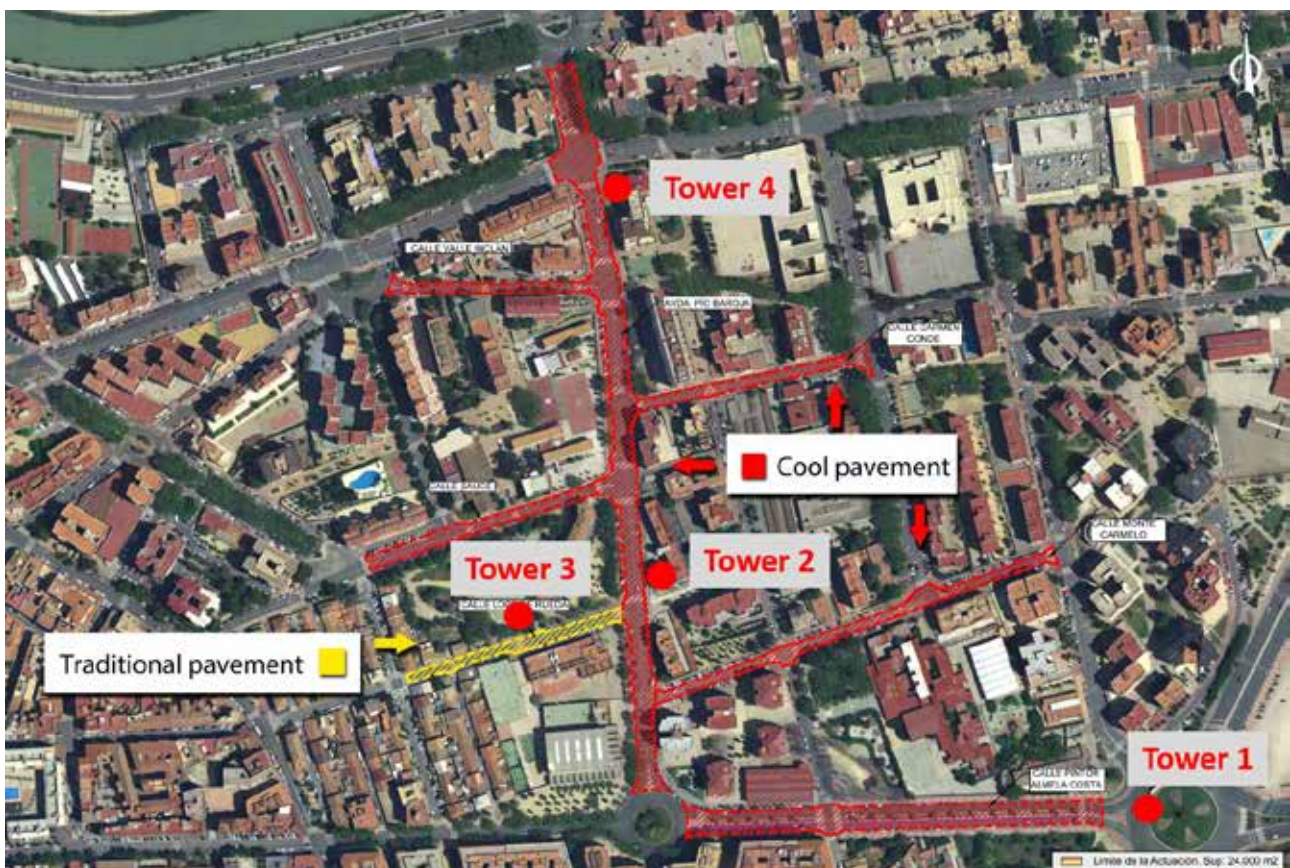


LIFE HEATLAND project directly addresses urban adaptation to mitigate the Heat Island effect using cool pavements, taking advantage of the lower solar storage of these compared to traditional ones, which, in addition, due to its lighter color, greatly improves night visibility.

## DEMONSTRATION AREA

To develop the demonstrator prototype, 22,000 m<sup>2</sup> of reflective pavement and 2,000 m<sup>2</sup> of traditional pavement were implemented to compare the behavior of both types based on a situation identical. The Barrio del Infante of the city of Murcia was the selected area to carry out the test because its characteristics allowed to cover a greater number of streets and thus create an “anti-Heat Island” effect.

One year before the implementation of the pavement, four measuring towers were installed to monitor pavement surface temperature, ambient temperature, relative humidity, air pollutants and noise level.



Map of the implementation area and location of the measuring towers.

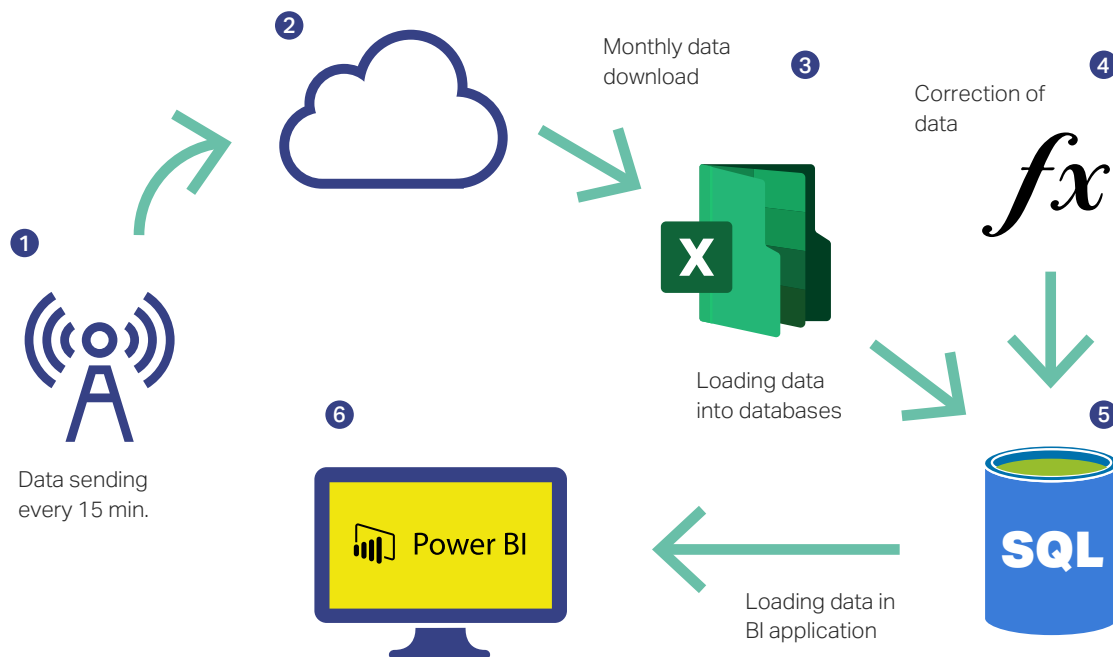
## MEASUREMENT TOWERS



The objective of the towers was to characterize the Heat Island effect of the selected area in a first phase and obtain the baseline on which to demonstrate in a second phase the effectiveness of the reflective pavement after its implementation. The first stage lasted one year and the second began after implementation in February 2020 and continued until the end of the project in December 2021.

In total, the towers have collected approximately 9 million pieces of data. Due to the huge amount of data, it was necessary to develop a Business Intelligence tool that, combined with the database, would allow a quick handling of the information and facilitate the extraction of conclusions.

### 9 million data collected



## COOL PAVEMENT IMPLEMENTATION

In February 2020, the implementation of the 24,000 m<sup>2</sup> of new pavement was completed. Six streets were paved with the cool pavement (C / Monte Carmelo, C / Sauce, C / Carmen Conde, C / Valle Inclán, Avenida Pío Baroja and C / Pintor Almela Costa) and one (C / Lope de Rueda) with the traditional one, to be able to compare the results obtained from an identical initial situation.





# PILOT PROJECT RESULTS

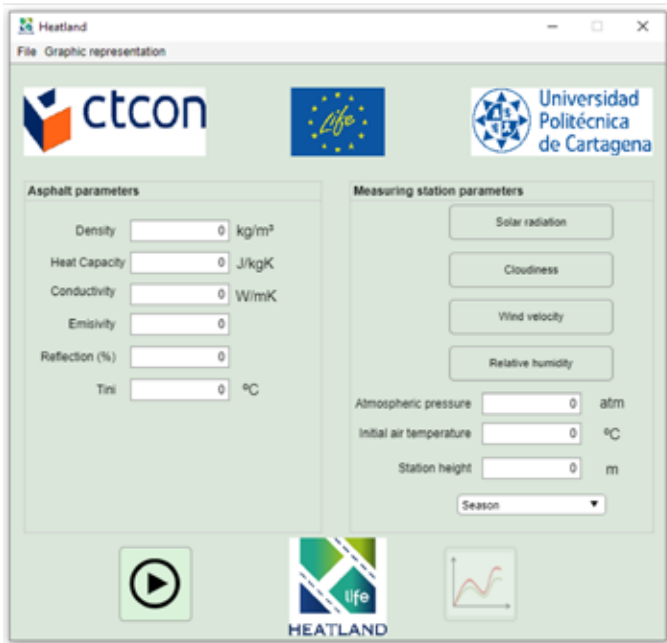
SUHI: Software for calculating Urban Heat Islands and their mitigation through LIFE HEAT- LAND'S cool pavement has been developed with the aim of facilitating the replication of the project by simulating the impact that supposes to substitute in any city of the world the traditional pavement by the cool pavement of the LIFE HEATLAND project.

SUHI simulates pavement behavior and thermal gradients in both ambient air and pavement surface. The mathematical model developed is complex, non-linear, and consists of a coupled system of partial differential equations with their corresponding boundary conditions, which have been solved with the Network Simulation Method since it allows to obtain very precise results in non-linear coupled problems and has already been successfully applied to numerous problems in science and engineering.

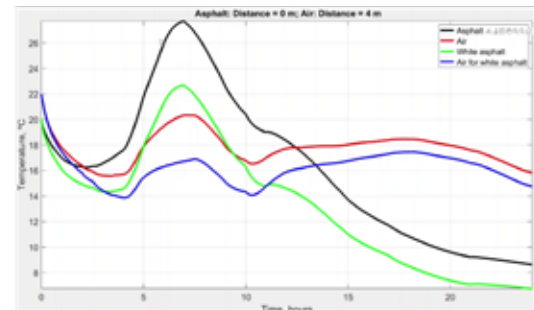
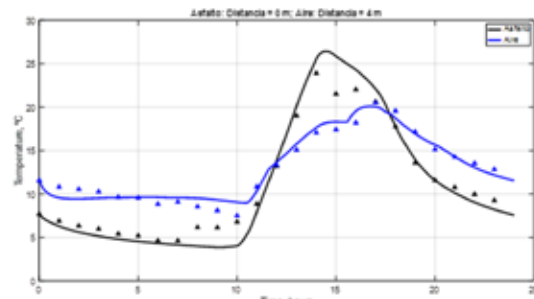
The development of the mathematical model is not easy since the physical mechanism that occurs is complex by the coupling of the radiation and re-radiation flows with the natural or forced convection flows of the air on the pavement surface. All this, in turn, together with the conduction flows within the asphalt layer.

The software is available for download on the LIFE HEATLAND project website.

SUHI graphical interface



Model validation



Simulation of the impact of replacing the pavement

# PILOT PROJECT RESULTS



**Reduction of noise**

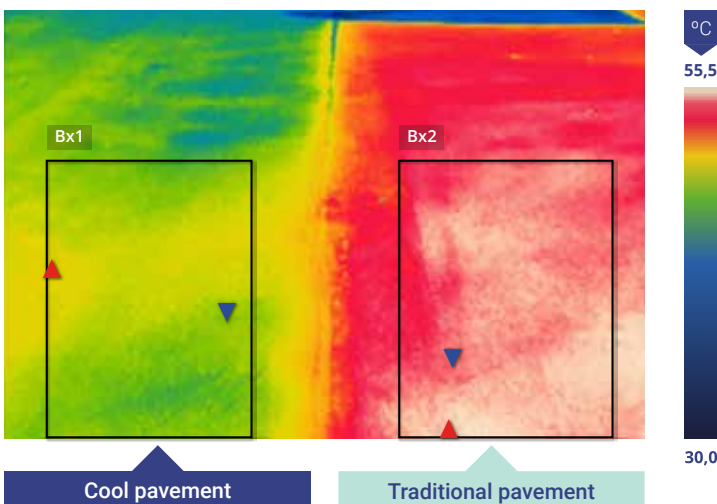
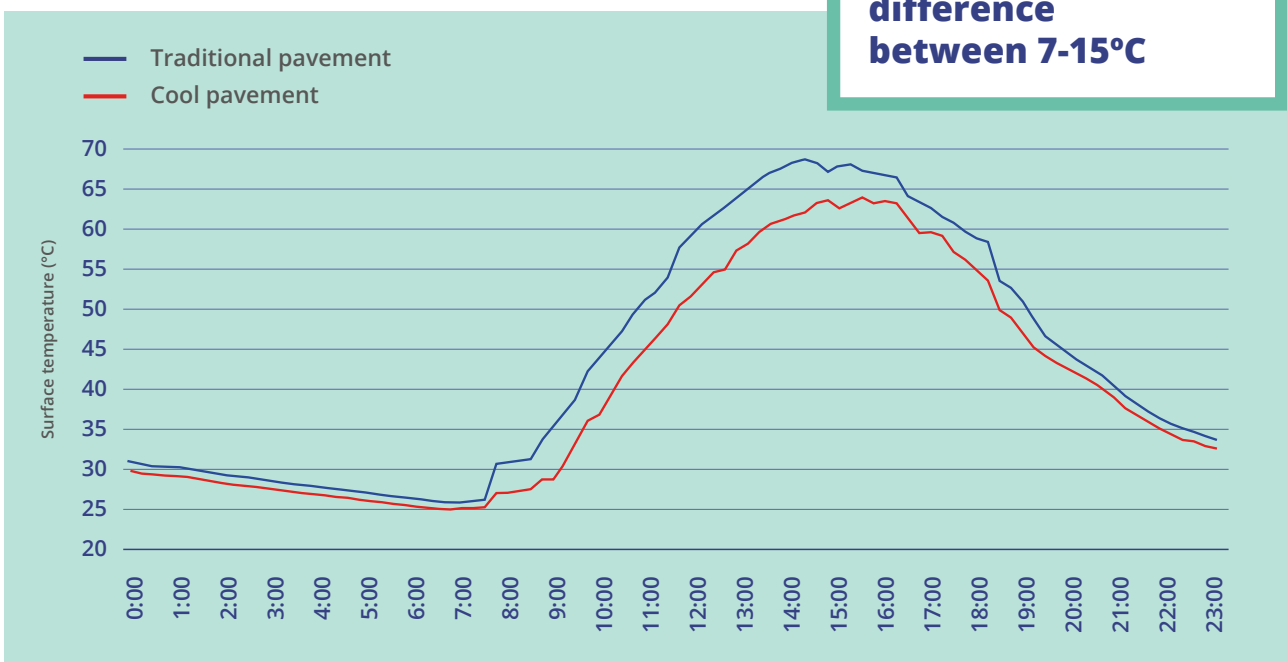


**Reduction of surface temperature**



**Increase of luminance**

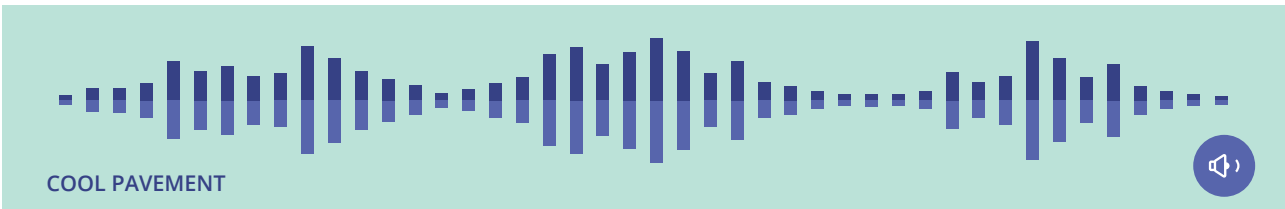
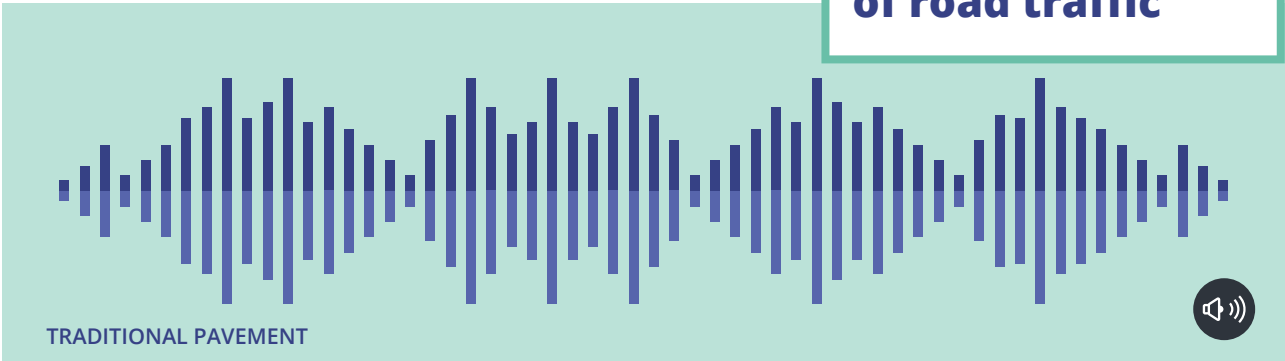
Results obtained in Barrio del Infante (Murcia)



THERMOGRAPHY PERFORMED BETWEEN THE TWO TYPES OF PAVEMENTS

**2°C decrease in ambient temperature**

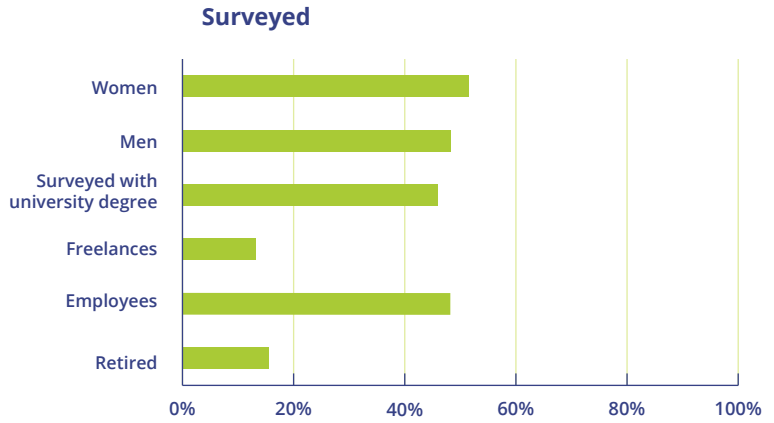
**3 dB(A) decrease  
in acoustic impact  
of road traffic**



**Luminance increases  
up to 150% ▶ Energy  
savings and  
neighbourhood comfort  
improving health and  
well-being of citizens**

# 750

Surveys conducted in 2021



**84%**

Visit the target area daily

**74,9%**

Have noticed the change in the pavement.

**66%**

Live in the area object of analysis.

**25,8%**

Stroll

**24,7%**

Use of parks or gardens in the area.

**16,2%**

Work reasons.

**14%**

Take the children to the school.

**10,4%**

Visit the study area one or more times a week

**24,6%**

Indicate having a deep knowledge of the characteristics of the new pavement.

**33%** →

Visit the area under analysis.

**11,6%**

Do sport.

**11,1%**

Visit friends or family.

**10,4%**

Go shopping.

**10,9%**

Go to restaurants.

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The aspects that neighbors value most of the new reflective pavement are:



Temperature reduction



Noise reduction



Luminance increase

The aspects that drivers value most of the new cool pavement are:



Driving Confort



Less tire wear



Luminance increase

**75,8%**

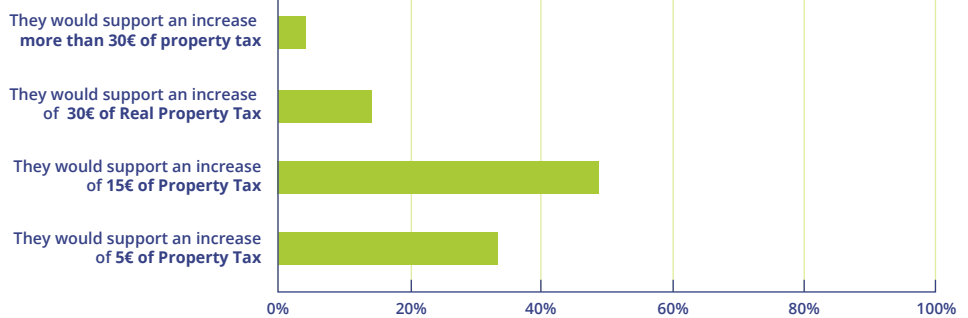
Overall satisfaction with the new cool pavement

**94,2%**

Prefers it in front of to the tradicional pavement

**86,4%**

Would recommend it to friends and family.



Predisposition to increase the IBI for the installation of the new pavement

Does it contribute to improved health?



Will it improve well-being?



## PROJECT REPLICATION

Due to the dissemination work of the LIFE HEATLAND project and after the benefits shown by the cool pavement, the Barcelona City Council decided to join this initiative, carrying out on November 27th 2021 a trial in one street of approximately 4.300 m<sup>2</sup> in the centric street Torrent of l'Olla.

The first results show an increase of 250% in night luminance compared to the previous situation, with solar reflectance being 33%, compared to 8% of traditional pavement.



Initial situation  
Night time



Final situation  
Night time





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**HEATLAND**

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