

# The Microclimate of Open Spaces in Urban Blocks: Simulation of an Urban Block in Athens and Improvement Potential by the Redevelopment of Adjacent Open Spaces

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## Scope

Modern cities are characterized by the lack of open spaces and the poor quality of the urban environment. This fact has made it necessary to improve and exploit all uncovered spaces of the city. This project investigates the strategies to improve thermal comfort conditions in urban outdoor areas, focusing on the open spaces of building blocks. At the same time, it examines the possibility of the extension of thermal comfort above the user level, in the light of the need to improve the microclimate outside and inside the buildings.

**Keywords:** microclimate, urban design, thermal comfort, ENVI – met simulation

## Methodology

In the uncovered area of an urban block in Athens, four alternative scenarios are studied and simulated with ENVI – met, which is an environmental microclimate simulation software, in order to improve the thermal comfort of the space at the user level. At the same time, the effect of interventions on microclimatic conditions at different levels above ground is examined.

	PMV index		change of PMV index compared to the Base Case	
	min	max	min	max
<b>Σ.B.</b>	2,75	5,40	-	-
<b>Σ1</b>	2,72	5,38	-0,07	+0,06
<b>Σ2</b>	2,70	5,35	-2,36	-0,03
<b>Σ3</b>	2,60	5,37	-1,67	+0,04
<b>Σ4</b>	2,51	5,28	-2,54	-0,08

## Results and Discussion

- Replacing paving materials with soil reduced the air temperature from 0.17K to 0.35K locally, and up to 0.08K in the surrounding area.
- Planting trees reduced the temperature to 0.82K.
- Green roofs reduced the air temperature by 0.26K.
- Green roofs and green walls maintain the reduction of the PMV index in higher height. At height of 19.00 m the reduction is 0.92 to 0.97.
- Green roofs and green walls reduce the PMV index more than 2 points.

## Conclusions

Planting outdoor areas is not the only way to improve thermal comfort conditions. Alternative practices give similar results and at the same time contributing to the improvement of microclimatic conditions in the interior of buildings. The upgrading of the urban environment is a complex and multidimensional process, which must take care of the whole city, the structured and unstructured environment.

## References

- Zoras, S., Veranoudis, S. & Dimoudi, A., 2017. Micro-climate adaptation of whole building energy simulation in large complexes. *Energy and Buildings*, Issue 150, pp. 81-89.
- Chatzidimitriou, A. & Yannas, S., 2015. Microclimate development in open urban spaces: The influence of form and materials. *Energy and Buildings*, Issue 108, pp. 156-174.

