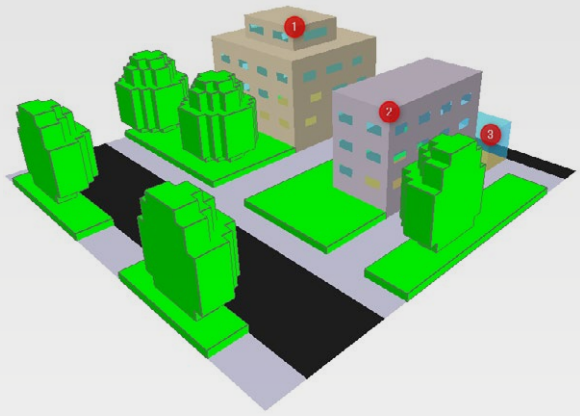
ENVI
_MET

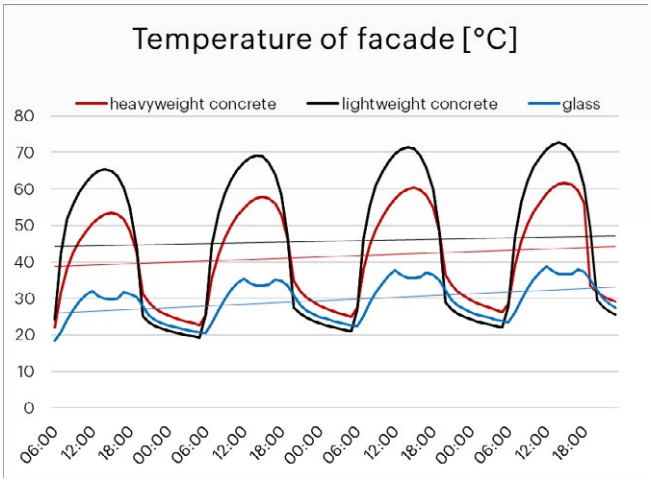
Façade Research



ANALYSIS OBJECTIVE

ENVI-met provides a multitude of tools to simulate and analyze the different behaviors of a variety of façade materials. In an exemplary study, two larger residential houses built out of heavyweight (1) and lightweight (2) concrete and a greenhouse (3) were modeled in a suburban environment.

Physical property	Material		
	heavyweight concrete	lightweight concrete	glass
Thickness [m]	0.3	0.3	0.02
Absorption	0.7	0.7	0.05
Transmission	0	0	0.9
Reflection	0.3	0.3	0.05
Emissivity	0.9	0.9	0.9
Specific Heat Capacity [J kg^{-1} K^{-1}]	840	840	750
Thermal Conductivity [W m^{-1} K^{-1}]	1.3	0.2	1.05
Density [kg m^{-3}]	2000	620	2500

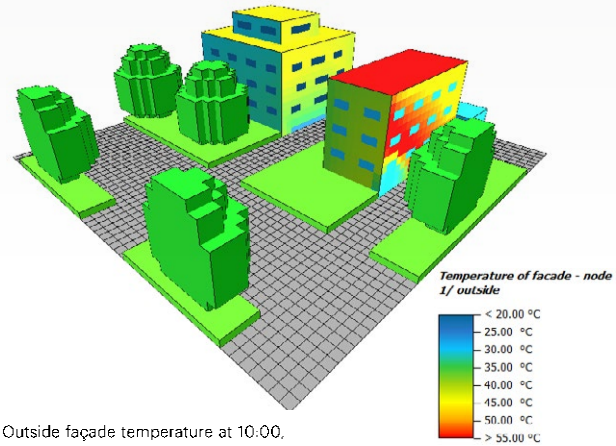


ANALYSIS

Due to the high transmission, the greenhouse generally shows the lowest surface temperatures with values of around 25°C. Since the lightweight and dense concrete buildings have identical properties in regards to absorption, transmission, reflection, and specific heat capacity, it can be deduced that the lower density and thermal conductivity of the lightweight concrete building lead to the observed higher surface temperatures of around 55°C compared to the dense concrete building with around 35°C.

The influence of shadow-casting objects can be well observed on the lightweight building and the greenhouse. The windows with their lower temperatures caused by higher transmission are also clearly visible, corroborating the accuracy of ENVI-met's wall and roof model.
When comparing the façade temperature evolution over time, a small gradual increase as the buildings store more heat is observable. The study shows that ENVI-met is a feasible tool to simulate the interactions between façades and their surroundings.

SIMULATION RESULTS



Outside façade temperature at 10:00, first simulation day

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