

Vegetation in Urban Street Canyons and its Impact on Air Quality

Christof Gromke

Laboratory of Building and Environmental Aerodynamics
Institute for Hydromechanics
Karlsruhe Institute of Technology (KIT)

Presentation, NTUA, 13/07/2023



The talk covers two types of plant structures common in urban environments and their influence on pollutant dispersion in street canyons. First, the implications of avenue-trees and second the implications of hedge-rows on traffic pollutant dispersion and concentrations are addressed. Both plant structures were studied in an atmospheric-boundary-layer wind tunnel at a reduced-scale model of an urban street canyon. The focus was on flow approaching perpendicular to the street canyon length axis as this is the most critical condition in terms of natural ventilation and consequently results in the highest pollutant concentrations.

The results show that dense plantings of avenue-trees impede the natural ventilation of urban street canyons. They inhibit the air exchange between the canyon space and the surroundings and result in lower wind velocities. This leads to an increased accumulation of traffic pollutants and exacerbates the situation in particular at locations with already high concentration levels. Local increases in concentrations of 40 to 70% were found. The contrary was observed for roadside flanking hedge-rows. They led to an improvement in air quality in the canyon at street level. Their impact consists in a favorable modification of the flow field near the ground without significantly affecting the overall air exchange between the street canyon and its surroundings. The hedge-rows resulted in local reductions in pollutant concentrations of up to 60% in regions that otherwise experience the highest levels of pollution, making them particularly attractive for urban planning and street design.

www.codasc.de

https://www.ifh.kit.edu/english/211_1473.php