Abstract

of the dissertation entitled " The impact of the architectural form of tall buildings on local air pollution reduction "

One of the important issues in the context of shaping the city is the possibility of its natural ventilation through aeration wedges, currently developed under capital pressure. The problem of smog and accumulation of pollutants occurs in densely built-up city centers, adjacent districts, as well as in suburban areas. In Poland acceptable pollution standards are repeatedly exceeded.

City ventilation can be discussed in the context of horizontal and vertical air exchange. The development of corridors for city ventilation encourages us to explore the possibility of vertical air exchange. Unfortunately, the phenomenon of smog, which is connected with blocking air pollutants by thermal inversion, effectively makes such solutions impossible if the inversion layer, called "smog cap", is not broken.

This paper presents the characteristics and genesis of smog including the problem of thermal inversion, specificity of pollution in Poland and Warsaw, methodology and location of air quality measuring stations. The problem of city ventilation is complicated because it requires a combination of many scientific issues such as: chemistry, physics, meteorology, combustion technology, fluid mechanics and others. With the extension of the research, the picture of the phenomena becomes more and more complicated and at the same time it becomes obvious that multidomain problems must be solved also in a way coordinating solutions from different fields. The dissertation collects the ways of reducing smog in cities in the field of architecture and urban planning, from the scale of central planning to the scale of details with emphasis on systemic solutions.

The dissertation proves that it is possible to disturb the local thermal inversion to induce vertical air exchange, but not by a tall building, which affects locally. With its help, breaking through the inversion layer in Warsaw in order to disturb it and dislocate pollutants is currently impossible, mainly due to its too low height, not reaching the inversion layer appearing in the capital at heights of 300-500 m. However, the occurrence of vertical downward motion, edge vortices and disturbance zones on the leeward side of the building were found, which may be used for dislocation of contaminants vertically, but with the support of other methods.

Keywords: air pollution, smog, aerodynamics, wind engineering, ecological architecture, wind, center of Warsaw, tall building

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