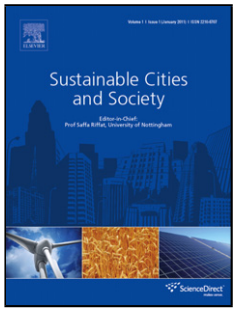

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Pedestrian Level Wind Assessment through City Development: A Study of the Financial District in Toronto

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Highlights

- Study of interaction between wind, city development and safety of pedestrians at street level.
- Using computational and experimental methods, documented different stages of downtown Toronto's growth and the corresponding changes in wind conditions at street level.
- Visualizing these changes, identified design conditions and their related effects on pedestrians in the city.
- Found that initial decisions within the design and planning stages can alter and even reduce wind conditions that affect pedestrian safety.

ABSTRACT:
In the future, cities will be defined by super tall buildings due to an increase in population growth and urbanization. Although there are many benefits to living in dense urban centers, the interactions between buildings and wind affect the comfort and safety of pedestrians at street level. In a few notable instances, tall buildings have directed high speed winds to street levels that have affected outdoor spaces of businesses, the balance of pedestrians or in severe cases the safety of pedestrians when a car flipped over and fatally injured an individual in Leeds, England. The Financial District in Toronto has been selected as a case study, as dense development of the area over the last 70 years has fostered increasingly noticeable high winds at pedestrian level. The stages of development in this district have been divided into six significant construction periods and the changes in wind effects have been assessed with the use of CFD models, water flume and wind tunnel tests. The results demonstrated that tall buildings can alter the flow in unexpected ways and that the effects caused by the buildings in the urban environment are interconnected. The safety and comfort (along with other parameters associated with wind) of pedestrians are factors that must be incorporated into the design of the city. Through visualizing the decade long changes in wind due to the growth of cities, it is possible to create strategies that can incorporate the knowledge of wind issues into the design of future cities. By using accessible methods, whether through visualization or computational means, the highly complex relationships between the built environment, wind and people can be shared with engineers, architects and other designers of cities, to enable a collaborative design of future cities that will reduce wind-related discomfort.

Keywords: pedestrian level winds, comfort criteria, architectural aerodynamics, urban development, visualization, large eddy simulation, wind tunnel, water flume