

Accepted Manuscript

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PII: S0360-1323(18)30135-5

DOI: [10.1016/j.buildenv.2018.03.006](https://doi.org/10.1016/j.buildenv.2018.03.006)

Reference: BAE 5340

To appear in: *Building and Environment*

Received Date: 12 December 2017

Revised Date: 1 March 2018

Accepted Date: 2 March 2018

Please cite this article as: Shui T, Liu J, Yuan Q, Qu Y, Jin H, Cao J, Liu L, Chen X, Assessment of pedestrian-level wind conditions in severe cold regions of China, *Building and Environment* (2018), doi: 10.1016/j.buildenv.2018.03.006.

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Assessment of pedestrian-level wind conditions in severe cold regions of China

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Abstract

Pedestrian-level wind environment in urban areas has a significant impact on the quality of urban dwellers' daily life. For pedestrian-level wind studies in severe cold regions, the cooling effect of wind and related thermal discomfort in winter is quite significant. However, thermal effects of wind are not considered in most wind comfort studies and wind comfort generally only refers to the mechanical effects of wind on people. Therefore, particular consideration is given to the chilling effect of wind on exposed skin and risk of frostbite in winter, and a wind chill criterion based on the wind chill temperature is proposed in this study. The pedestrian-level wind conditions in seven representative residential areas summarized from cities in severe cold regions of China are assessed based on the wind mechanical comfort criterion of NEN 8100 and the wind chill criterion. CFD simulations are performed to provide the pedestrian-level aerodynamic information, and the simulation results are validated by wind tunnel experiments. The assessment results show that the wind mechanical comfort or wind chill criterion need to be combined when assessing the wind conditions in severe cold regions. From the perspective of wind mechanical comfort and wind chill, the multi-storey residential areas with hybrid-type and the enclosed-type layout are recommended in severe cold regions. Moreover, a strict control of building height in residential areas is important to

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