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# Field Research and Study of Campus Thermal Environment in Winter in Severe Cold Areas

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**Abstract**

Choosing the second campus of Harbin Institute of Technology as a study example, the paper tested its outdoor environment variables (air temperature, wind speed, black globe temperature and solar radiation intensity) under different underlying surfaces in winter, and generated the result of how different underlying surfaces influence the thermal environment. Based on the test, the paper reaches the following results: temperature difference between hard surface with solar radiation and hard surface without solar surface is 5 ℃; air temperature changes of ice surface and snow surface are relatively big, and under solar radiation, their average temperatures are a little higher than other surfaces; under the same condition, snow surface's humidity is a little higher than that of ice surface; and architecture arrangement has big influence on wind environment.


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*Keywords: Severe cold area campus*; *thermal environment*; *test.*

## 1. Introduction

In severe cold areas, it is extremely cold and dry in winter. The harsh weather condition restricts the teachers' and students' outdoor activities. People feel uncomfortable or even get frostbite if staying long outside. The paper tests the temperature and humidity changing rules of different underlying surfaces in winter through field test for the purpose of improving outdoor environment quality. Recently, researches have been done with respect to thermal environment and thermal comfort of campus in tropical and subtropical areas. However, there has no systematic research on the indoor and outdoor environment of campus in severe cold areas. It is necessary to conduct relevant researches in order to find the right underlying surfaces and suitable proportion of different underlying surfaces in

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severe cold climate and make the indoor and outdoor environment more comfortable for people by reasonable building design and arrangement.

However, researches of the past have their regional and seasonal limitations. Few have studied on campus insevere cold areas in winter. In addition, the studies of underlying surfaces are mainly about green land's arrangement, proportions of green plants[1], and their influence on campus thermal environment. While campus has various underlying surfaces. In severe cold areas, ice and snow surfaces have their unique influence on thermal environment. This paper studies on the influence of different underlying surfaces, including ice and snow underlying surfaces, on thermal environment, and discusses the relationship between the wind environment and building arrangement and forms. Through analysis of the testing data, this paper intends to propose certain measures of improvement.

## 2. Research Method

### *2.1. Basic information of test site*

The test location is the second campus of Harbin Institute of Technology. The layout of campus is in linear form. Linear space pattern is the most typical pattern in universities of Harbin, accounting for nearly 37.5%. The space is in axial symmetry distribution with the main building as the center. Living areas, sports areas and teaching areas are distributed along the axis. This campus is a representative case in severe cold areas. The test site and distribution is shown in Fig. 1 and 2.

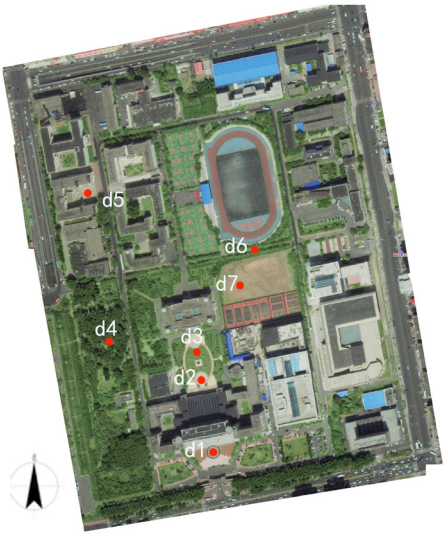


Fig. 1.Test Locations and Distributions.

### *2.2. Principle for choosing test sites*

To measure the influences of different underlying surfaces on microclimate on campus and the impact factors of wind environment, the paper carries the following study: comparative analysis of different underlying surfaces in the same working condition, comparative analysis of the same underlying surfaces in different working conditions, changing rules of different underlying surfaces, comparison of testing data and observatory data, comparative analysis of the wind environments formed by different buildings' geometrical morphology. The test chooses seven testing sites on the campus (see Fig. 1 and Table 1). Based on the functional distribution of the campus and the comparability of underlying surfaces under different working conditions, the test mainly chooses the following underlying surfaces on campus: hard pavement, cement road, mud road, ice surface, and snow surface.