

# A field study on use of urban office building external space during winter in winter cities and relating planning inspirations

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## Abstract

**Office building external space is an important spacial carrier of the activities of office workers, which can play a positive role in promoting physical and mental health of office workers and improving their job and life satisfaction. External space of office buildings is often regarded as the background elements of office buildings to design and construct, and related research on the demand of office workers still needs to be explored. Affected by climate, the activities of office workers in the external space of office buildings in winter cities are more restricted, while the support of external space for activities is very insufficient. In this paper we chose the external space of typical office buildings in winter cities in China as the research objects, investigated and analyzed the use of the external space in winter and the demand and satisfaction of the office workers. At last optimization strategies were put forward.**

**Key words: winter city; office building external space; use characteristics in winter; planning inspiration**

## 1 Introduction

A sedentary lifestyle has become a serious problem threatening the health of office workers. According to the report of the Asia-Pacific Metropolitan Workforce Health Survey, 73% of Chinese workers moved too little and

83% sat for more than six hours a day, ranking the first in the 11 Asian-Pacific countries<sup>[1]</sup>. The White Paper On Sedentary Behavior in the Chinese Workplace (2019) showed that Chinese white-collar workers spent up to 8 hours a day per capita, even over 12 hours in some cases<sup>[2]</sup>.

The external space of office buildings is closely related to the use of external space and the occurrence of communication and physical activities of office workers. Existing theories and empirical studies have provided support for the positive role that the external space environment of office buildings may play in promoting the activities of office workers in different degrees, such as attention recovery theory<sup>[3]</sup>, stress recovery theory<sup>[4]</sup>, and empirical research on the correlation between the external space of office buildings and health status and life satisfaction of office workers. It should be recognized that although the external environment in the workplace may be relatively small in size, it is a valuable asset for the health and welfare of the labour force<sup>[5]</sup>.

The duration of winter in severe cold regions is up to half a year, which has a great impact on the implementing of outdoor activities of residents. Research from winter cities showed that the proportion of physical activity deficiency of urban residents over 18 years old was 21.53%, which was 4 percentage points higher than the national average level. While medical research found that outdoor activities in winter played an important role in reducing weight and fat, enhancing immunity and reducing the occurrence of chronic

diseases<sup>[6][7]</sup>.

Due to the harsh winter climate, the activity safety and comfort in the external space of office buildings in winter cities is poor. Office workers spend most of the day in the workplace, so research of improving the external space environment of the buildings may play a long-term and key role in weakening the adverse climate impact, providing activity support, and improving the health and well-being benefits of office workers. In view of this climate background, the use characteristics of external space of office buildings, the attractiveness and obstacles of activities, and the corresponding planning strategies still need to be further explored.

In this paper, we chose representative office building external space in winter cities for investigation and analysis, in combination with the use of space and office workers' demand and satisfaction, analyzed the problems and put forward targeted optimization strategies.

## 2 Method

### 2.1 Study site

According to the dividing standard of the General Principles of Civil Architectural Design of China (GB 50352-2005), the northeast severe cold region is located in the main climate area I. The area has the following climate characteristics: (1) long and severe winter lasting for six months; (2) average temperature with -10°C in January, average daily temperature with -5°C for 145 days, extreme temperature to -40°C; (3) strong wind and abundant sunshine, and low solar altitude angle in winter.

Combining with the information research, three typical office buildings were selected to conduct field surveys in the representative winter cities in severe cold regions. The research objects include: Architectural Design Institute of Harbin Institute of Technology, Harbin Bonded Zone Complex Building, and Department of Architecture of Inner Mongolia Institute of Technology.

### 2.2 Field survey methods

#### Field observation

Through field investigation, observation and recording, the spatial and environmental information of external space layout, functional

composition, streamline organization, landscape and environmental facilities were obtained.

#### Questionnaire surveys

The surveys were carried out from December 2017 to May 2018, and 390 questionnaires were distributed, of which 288 were valid, and the response rate was 73.8%. The contents of the survey were divided into three parts: basic information of users, layout and use of external space, and landscape of external space of buildings. The basic information of users included: gender, age, education level, income level, and whether or not to live near here. The part of external space layout and use included: use characteristics; satisfaction with external space environment; activity requirements. The part of external space landscape included: the satisfaction with the landscape environment, and the improvement requirements of landscape elements. Among them, satisfaction surveys were conducted by Likert five-grade scale.

#### Open-ended interviews

The study used open-ended interviews in three selected sites, including managers and property management personnel. Five interviews were conducted, each of which took about 15 minutes. The interview mainly included two aspects. The first aspect was about the users and the use of the external space. The second aspect was about the maintenance of environmental facilities in different seasons.

## 3 Results

### 3.1 External space profile

The external space of office buildings had the following characteristics: most of the layout modes were like "L" and "I", taking office buildings as the center; the density of buildings inside and around the site was low, the space was relatively open, and there were bus stations nearby. The layout orientation was mainly south, south-east and south-west. In addition to the office building, there were ground parking lots, trails, activity area, greening and environmental facilities (such as street lights, seats) and so on. Among them, the activity area was usually located in the transition area between the building and the parking lots, or relying on greening as the form of small squares, linear paths, forming comprehensive space. Both closed and semi-open management were applied in the external space. The former

external space was mainly used by office workers, and the latter included office workers and outsiders.

### 3.2 External space use

The majority of respondents were middle-aged persons aged 30-60 (67%). The proportion of male respondents was higher (72%). The majority of respondents had undergraduate education (57%) and relatively high income level (69%). About 48% of respondents live near office buildings, and most of them worked more than eight hours a day.

The main activity types of office workers in the external space were walking, chatting and sitting except passing by. Walking was the main activity in winter, followed by basking (Fig.1). In terms of activity time, there were differences in different seasons. In winter, it mainly concentrates on 8:00 and 12:00; in summer, it mainly distributed at 8:00, 12:00 and 18:00-19:00; in transition seasons, it concentrated on 8:00, 12:00 and 17:00 (Fig.2). In terms of activity duration, most users (81%) spent less than 1 hour in winter, while the

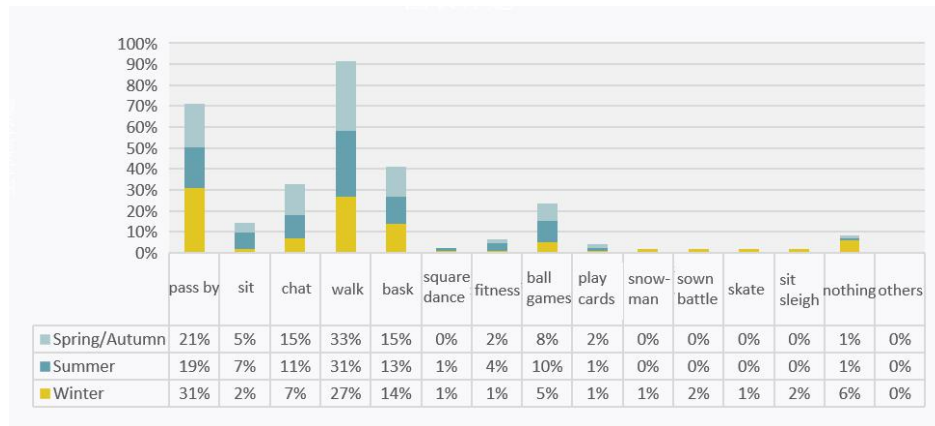


Fig. 1. Activity type

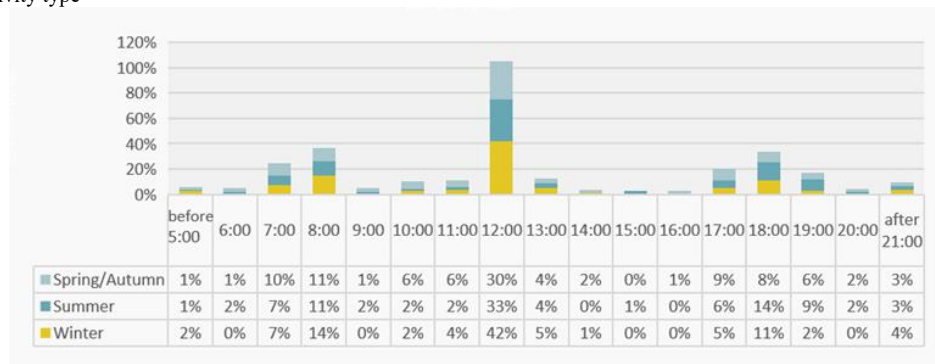


Fig. 2. Activity time

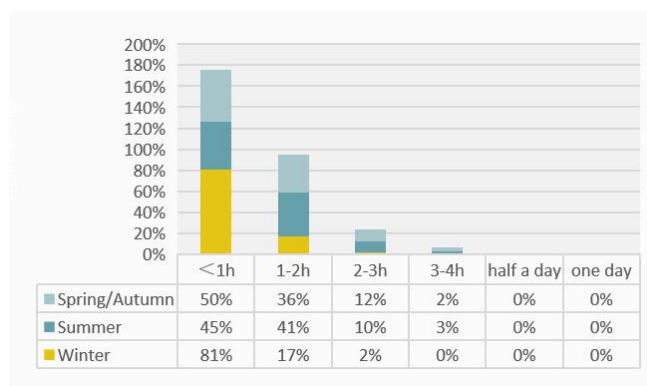


Fig. 3. Activity duration

proportion of respondents who spent more than 1 hour in summer and transitional seasons was significantly higher, about five times as much as that in winter (Fig.3). In terms of the number of peers, the majority of them were 3-4 persons, accounting for 46% . In terms of activists, office workers were the most important activity group, compared with fewer outsiders. Combining with seasonal comparison, it can be found that the spatial and temporal use rate of external space for winter activities of users was low.

### 3.3 Office workers' satisfaction and demand analysis

Taking 80% as the satisfaction standard, the layout and use of external space and landscape environment need to be further improved. In terms of layout and use satisfaction, 40% of respondents showed low satisfaction with the non-interference of pedestrian traffic. 30% of the proportion of respondents showed low satisfaction with spatial location, and activity safety and comfort. In terms of landscape satisfaction, the proportion of respondents who showed low satisfaction with oddments and functional facilities was about 50%. About 40% of the office workers showed low satisfaction with the overall visual comfort, night lighting comfort and clarity of the visual environment in the evening.

The demands for external space activities were mainly reflected through the specific activity type, activity comfort and attraction factors. In terms of the demand of activity type, respondents had the highest demand for walking, ball games and fitness. In addition, some respondents also hoped to bask, chat and

sit (Fig 4). In terms of attraction factors, the most important factors were rich greening and activity support, aesthetic sense of visual environment and shelter from the wind.

## 4 Discussion

### 4.1 Summary of the Problems and Analysis of the Influencing Elements

#### Activity Safety and Comfort

Due to the severe cold climate, activity safety and comfort in external space is the primary reason for the low participation in outdoor activities in winter. Influencing factors can be summarized into three aspects: planning layout, environmental facilities materials and site construction and management.

In terms of planning layout, the building density inside and around the site was low, the windshield was less, and the climate defense capability of the activity area was insufficient. Meanwhile, the scale of activity area was small. Both the paths and venues available for activities and green space were few, but the scale of ground parking lots was quite large. In addition, there was crossing between car and pedestrian streamlines, which had a negative impact on the convenience and comfort of walking.

There were some problems in material selection of facilities such as facilities for rest, placing and activities. The proportion of metal, concrete and stone materials used in seats reached 60%, resulting in poor comfort and low utilization rate. In addition, the use of white or light-colored materials in large areas was quite common, increasing the cold feeling of the external space, and producing snow

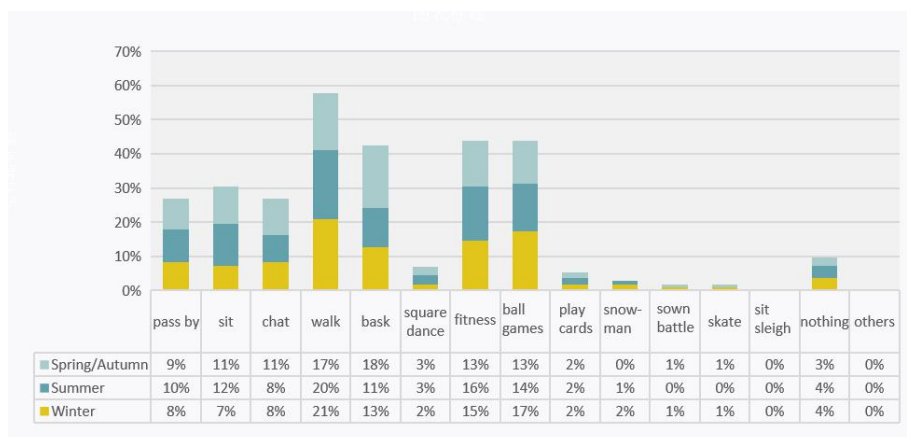


Fig. 4. Demand for activity type

reflection in winter, which was not conducive to the safety of winter activities.

In terms of site construction and management, the pavement was wet and slippery after snow in winter. The choice of pavement materials in some external space for activity area has taken the problem of anti-skid into account. However, it was common that ice and snow were not cleaned up in time in activity area.

**Activity Attraction**

Office workers had needs for outdoor activities, but activity attraction of external space was insufficient. The influencing factors mainly included the landscape and environmental facilities. In terms of landscape, under the cover of snow and ice in winter, the landscape vitality of the external space was relatively lacking, and the form and color of the landscape were easy to appear monotonous, reducing the activity attraction to a certain extent. Ice sculptures and plants with colored branches (such as white and red) can play a positive role in enriching the winter landscape, attracting workers to stay and take activities.

In terms of environmental facilities, the quantity and quality need to be further improved. The existing external space was less equipped with seats and fitness facilities, lacking support for activities such as walking, sports and communication. The compatibility of different activities was low, and the possibility of taking activities adapted to different seasons was also insufficient.

**4.2 Optimizing strategies**

Based on the above analysis, using the site planning and design means with cold climate adaptability, the following optimization strategies for the external space environment of office buildings are proposed, specifically including two aspects, one is planning layout and the other is landscape and environmental facilities configuration.

In the aspect of planning layout, optimization strategies include the comprehensive layout of wind shielding area, ground parking lots, office buildings, trails and activity area, as well as the targeted climate adaptability design, so as to facilitate the site towards the sun and kept from wind in winter and improve the safety and comfort of activities. In the aspect of landscape and environmental facilities configuration, optimization strategies involving landscape include planting mode and plant species selection. And optimization strategies involving environmental facilities include oddment design, material selection of trail pavement, and sites and facilities setting which can meet the activity needs (such as setting up seasonal adaptive activity sites, which can be used as skating rink in winter and as activity square in general seasons), so as to improve the visual environment and activity support conditions of the external space in winter, and enhance activity attraction (Figure 5).

**5 Conclusion**

The harsh winter climate in winter cities makes it difficult for office buildings to support office workers to take outdoor activities in winter.

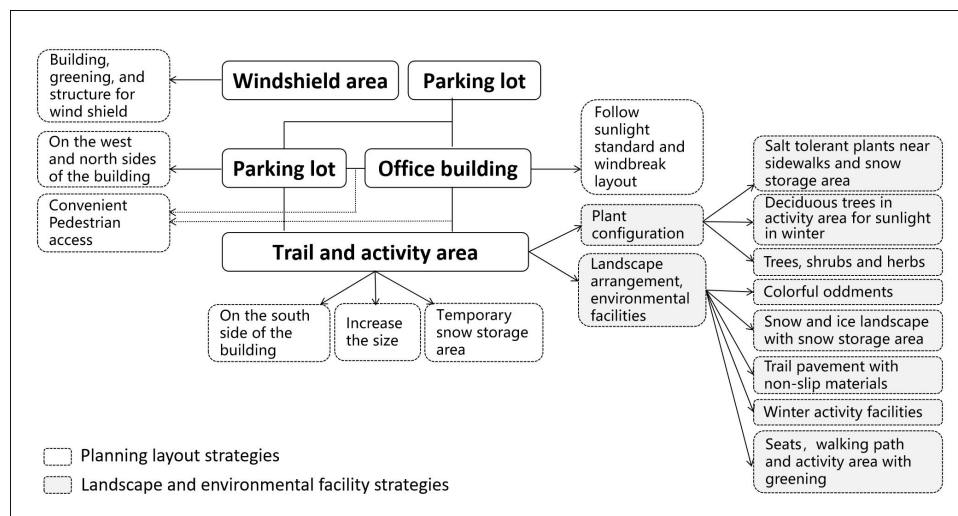


Fig. 5. Optimizing strategies

Planners and architects should put forward to corresponding planning and design countermeasures according to the needs of office workers, and improve the overall spacial environment of office buildings, guiding the livable, occupational and healthy development of winter cities.

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### **Endnotes**

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