The feasibility study of corridor system in the commercial downtown area of winter cities based on behavioural architecture——A case study of Harbin Qiulin commercial area

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Abstract. The commercial centre area is a critical part of urban land and it is public space which integrates shopping, leisure and entertainment. Due to the severe weather, winter cities have some problems such as inconvenient behaviours and lack of commercial vitality in winter. From the perspective of behavioural architecture, this paper adopts several methods of field observation, questionnaire survey, and instrumental measurement to study on the renovation design of Harbin Qiulin commercial area. Through this study, an implementable scheme for adding corridor system to activate commercial vitality in the commercial centre of winter cities has been obtained. It is expected to provide a reference for the commercial area design of winter cities in the future.

1. Study of behavioural architecture

Behavior study is about the relationship between the purpose of human and the movement of body and the significance of the continuous movement of body. The key to behavior study is the behavior itself not the idea produced by the behavior. It is not guided by the designer's subjective ideas and it is more persuasive. The history of design is very short. Therefore, other professional scientific and technological achievements are strongly needed. Only by interpreting the building from a higher-than-architecture perspective, research can reach a certain depth. Moreover, the help of behavior study for architecture design is very straightforward. The application process is very simple, easy to understand, easy to learn and verify. Furthermore, there are many disciplines involved in behavior study: the study of human settlements in the planning of social relations, the psychology which explains the way of foreseeing behavior, and ergonomics of human characteristics and abilities, etc.

In the process of architecture design, research methods of behavior study can be regarded as “Under the architect’s control, listen to the opinions of owners and users as far as possible, and let the public participate in the process of design and discussion. In particular, it is necessary to collect information and feedback from the use and investigation to understand the social effects and test it.” [1]

It is another way of saying that participatory design is a method of behavioral research.

2. The survey

The research will be divided into two parts: Minneapolis, USA and Harbin, China.

2.1. Skyway System in Minneapolis, USA
Skyway System is a new trend in the design of pedestrian paths for urban centers in the United States and it has first formed the city characteristics in Minneapolis. [2] (Figure 1) First of all, this form is mainly for the warmth of pedestrians in cold climates. It uses skyways to connect adjacent large-scale department stores with a corridor across the street to facilitate customer go through on the second floor. Then, various types of buildings such as shops, restaurants, banks, hotels, parking lots, and even office buildings in neighboring blocks are connected with corridors to form a perfect aerial walking system and solve pedestrian traffic problems in the downtown area. [3] This system not only provides convenience for customers, but also enhances business vitality. On the basis of the original commercial vitality of the first floor, the commercial openness of the second floor or even the third has been increased, which has promoted the vitality of the whole region.

Figure 1. A photo of the skyway taken by author.    Figure 2. Minneapolis Skyway System.

Due to the arrangement of the school curriculum design, it was fortunate to visit Minneapolis, USA, at the beginning of 2016. The research group, including me, had four members. The details of the investigation are as follows:

Research address: RBC Plaza. Because there are two fast food shops nearby and the passenger flow is relatively large, the location is chosen for investigation. (Figure 2)

Research object: People who pass through the three corridors connected to the square.

Research time: Lunch time 13:30-14:00.

Research method: Observations, counting, questionnaires, inquiries, etc.

Research result: By collating and summarizing the survey data, histograms and line charts are drawn. It can be found that the vitality and attraction of the commercial space near the skyway for people have an impact on the number and direction of incoming and outgoing. Near the dining hours, there is a strong directionality for the flow of people, and the flow of people entering and leaving the corridor is relatively large. Away from lunch time, the number of people moving decreases. (Figure 3)

Figure 3. Data analysis.

While observing the statistics on the number of people entering and leaving the corridor, it can be found that most of the pedestrians are in suits, walking in a hurry. A few hold papers to discuss as they walk in parallel, most of them are internal office staff. Through interviews with pedestrians across the
streets of the whole city, it’s found that citizens’ feedback on the skyway system is different, and it is highly appraised by people who have higher rates of using skyway system.

In summary, the success of the Minneapolis Skyway System is that it is able to fight against the cold and bring great convenience to internal office workers. Furthermore, it can form a two-story street and bring passenger flow to the second-floor merchants. In addition, perfect facilities for the disabled reflect humanistic care. But there are still several problems as follows: the guidance system needs to be improved and there is a tendency to weaken the geographical advantage of the first floor.

2.2. Design base
As one of the earliest commercial area in Harbin, China, Qiulin district contains dozens of department stores in different grades. In the base, Yuanda and Songlei are multi-dimensional and modern shopping malls attracting superior crowds. Therefore, in the design of commercial space for winter city, the site including Songlei and Yuanda in Qiulin commercial area is selected as the design site. Moreover, it’s designed as a microcosm of the commercial centre in winter city. It is expected that the research results can be extended to the entire Qiulin commercial circle and other commercial districts in Harbin and even provide possibility for the transformation of all the commercial central areas in all winter cities. (Figure 4)

The base is located in Harbin Qiulin commercial area, adjacent to Dazhi Street, with convenient transportation. The area belongs to the commercial centre of the city. The buildings inside the base are all commercial buildings. The surrounding buildings have perfect functions, including residential buildings, protected buildings, transportation buildings, medical buildings, etc. (Figure 5)

In this survey, a total of 40 questionnaires are issued and 35 questionnaires are valid. According to the survey questionnaires, most of the interviewees are dissatisfied with this walking block, mainly due to the microclimate, sense of direction and comfort. The pedestrian flow in Qiulin commercial area mainly depended on the individual charm of shopping malls and lacks a comfortable walking space. So it needs renovation design.

Pedestrian behavior is counted by using the observation method.
(1) Research time
(1) January 15, 2016, Thursday, sunny, 14:30-17:00 p.m.
(2) January 18, 2016, Sunday, sunny, 10:00-12:00 a.m. and 14:30-17:00 p.m.
(3) March 13, 2016, Friday, sunny, 10:00-12:00 a.m. and 14:30-17:00 p.m.
(4) March 15, 2016, Sunday, sunny, 10:00-12:00 a.m. and 14:30-17:00 p.m.

(2) Observation on the behavior of pedestrians walking on survey streets. (Figure 6)

Behavior Record One: Position 6. There are always pedestrians buying snacks.

Behavior Record Two: Position 1 and 2. Pedestrians often stop to take pictures, but most of them leave quickly.

Behavior Record Three: Position 7. There are many seats here. But basically no pedestrians stay, only temporary weights are placed on these seats.

Behavior Record Four: Position 3, 4 and 8. There are few pedestrians staying.

According to the statistics on the number of people entering and leaving within ten minutes of each entrance, the traffic volume of the Entrance C close to Dazhi Street is the largest and the volume of Entrance E is the smallest. The number of people entering and exiting of Entrance B near Songlei is relatively balanced. Through observation and statistics, it makes sense that Entrance E’s micro environment is poor. There are the fewest people entering and most of them are couriers working for shoe shops. Therefore, the replacement of business format should be carried out and the shoe shops removed. As the flow of people changes, it is necessary to do the corresponding design and processing. (Figure 7)

(Figure 7. Entrance and exit flow analysis. & Survey results)

Besides, in order to verify the accuracy of behavior observation and questionnaire interviews, professional instruments are used to measure temperature, humidity, wind speed, sound pressure, and other physical environment. Thus, the following measurement results are obtained. According to the
statistics of wind speed, it can be known that the wind speed in the central mall of the site is small, and the wind is too large to stay in the northwest of site. Landscape sketches stand in the wind without shelter, causing fewer people to stay. It is also found that the noise volume is related to wind speed. The higher the wind speed, the greater the noise. In addition, the main source of noise is stores’ horns. (Figure 8)

In summary, through questionnaires, interviews, on-site instrument measurement, observation and other research methods, as well as analysis of pedestrian behavior, some problems are discovered. First of all, there is a lack of contact among shopping malls in this commercial area. Second, Harbin’s severe weather in winter causes inconvenience to the customers. In winter, wind direction is northwest and wind speed is high, making it impossible for people to stay outdoors. Third, insufficient supply of municipal facilities in the base makes it difficult to meet the needs of a large number of people. Therefore, it can be found that the base lacks a catalyst for outdoor activities.

3. Design conception and results
After the above analysis, the following design ideas come up. Firstly, due to the lack of parking space in Qiulin commercial area, parking buildings are built to meet customers’ need. Secondly, the three shopping centres of Songlei, Yuanda and Golden Sun share one square but could not communicate with each other. They need to be connected to provide convenience for customers. Thirdly, as a winter city, Harbin has a long winter, a low temperature, and high-speed wind. No measures implemented in this base so that vegetation or shelter can be added to solve this problem. Fourthly, some branch roads are narrow and without direct sunlight, resulting in low space utilization. It is proposed to build a second floor space to stimulate space vitality. (Figure 9)

![Figure 9. Design concept.](image1.png)

![Figure 10. Site plan.](image2.png)

Above all, a coherent indoor walking system is formed by adding the "skyways" (red parts in Figure 10) connecting several commercial buildings. As well as, the second-floor commercial dynamism can be enhanced. Secondly, a square shed is added to the centre of the site, not only forming a central landscape node, but also improving the problem that pedestrians cannot stay outdoors in winter. The shape of the shed (green parts in Figure 10) is designed according to wind direction, while the design preserves the continuity of the street. Finally, a sinking square is designed in conjunction with the shed and leisure facilities can be arranged in it.

The focus of the design is the Skyway System. It is designed to connect various commercial spaces and form a connected business complex. (Figure 11) Besides, in order to enrich the interest of space in the vertical direction, a T-shaped pocket park is set up at the junction of three corridors. As the most direct solution, the Skyway System connects the entire block. In addition, a refraction device can be installed over the T-shaped pocket park to bring sunlight into the street through refraction and reflection. (Figure 12)
4. Conclusion
Through the investigation and analysis of the “Skyway System” in Minneapolis, USA, the advantages and disadvantages of air corridors are summarized. Furthermore, the possibility of applying the Skyway System to the renovation design for Harbin Qiulin commercial area in a Chinese winter city has been proposed. In the processing of scene investigation and behaviour study theory, China’s national conditions are considered and the characteristics of the cities in winter city are combined. It is reasonable that the Skyway System can improve the commercial vibrancy as well as alleviating the travel inconvenience in winter, which also makes the connection among the entire block to provide possibilities for the implementation of a “big” commercial complex. When making designs, adjustments and coordination should be combined with local situation. For example, a shed is set on a square, then a sinking square is formed under the shed, and the skyway system is closely connected with the ground floor traffic. Through the renovation design of Harbin Qiulin commercial area, it makes sense that as long as the local conditions in winter cities are considered, the integration of the “Skyway System” into the commercial centre in China’s winter cities is entirely implementable.

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Images Source
Figure 1: Taken by author.
Figure 2, 4: From website, repainted by author.
Figure 3, 5-12: Painted by author.

References
[1] Qianfei Shi 2001 Study on Behavior, Behavioral Science and Behavioral Architectural Design Tech-information Development & Economy 6 63-5
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