

Traffic Accessibility Research for Daily Activities of Davos Square in Dalian, China

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Abstract-Coastal open space is an important public place where people take various activities, and it plays a great role in urban culture and leisure. Dalian Davos International Conference Center completed in 2012 has become new urban landmark owing to its high exquisite architectural design and vast marina square, and all these exhibit the urban modern features. As the focus area of Dalian East Port renewal area, the Dalian Davos International Conference Square provides leisure space for citizens. But it is generally thought that the traffic is not convenient for local residents in this area. In order to clarify this issue, an special investigation for the local residents' daily activities traffic survey carry out. Based on the survey data, the author analyses the traffic characteristics of the public in the square. The paper points out that the Davos Square traffic inaccessibility is related to the remote geographical location, lacked public transport service and interlaced road pattern etc.

Keywords- *Traffic Accessibility; Traffic Survey; Davos Square*

I. INTRODUCTION

Dalian Davos International Conference Center was completed in 2012. It located at the end of the People Road which is the city's main traffic arteries and also an important landscape axis support by Davos Square, Friend Square, Zhong Shan Square and Harbor Square (Fig. 1).

East Harbor district where Davos located is a renewal area where has built up the Wanda Center, Hilton Hotel, East Watertown and Green Center etc. The International Cruise Port is located next to the Davos Square in the west. An industry cultural centre named Fifteen Library is also an important buildings group in this area. As the main venue of the summer Davos, it has hold two sessions Davos conferences and several international and domestic meetings successfully. In addition, Davos Center, the huge buildings also hold large business and exhibitions, and the Poly Theatre inside the building is one of the ten theaters in China.

Davos Square covers an area of 18 hectares from reclamation. The square has 766 meters length from east to west, and 650 meters width from north to south. Its outline resembles a seagull, and surrounded by sea on three sides with 2.3 kilometres coastline.

The Davos Square includes a marine landscape platform and the second largest musical fountain in China (Fig. 2). During the night, the Davos and surrounding have created a rich scenery, music fountain and waterfront activities attracting a large number of tourists and local residents. The Davos has become a great landmark, and its square which has largest scale in the eastern coastline is also an important place for public recreation and leisure.



Fig. 1 Davos square location



Fig. 2 Davos square plane

II. DAVOS SQUARE TRAFFIC SURVEY

A. Square Usage

Davos square has attracted foreign tourists and local public with its excellent landscape environment and musical fountain performance. Research group interviews with local residents to clear the square usage and traffic characteristics. The investigators carry out the work during the weekends in March and April that suit for outdoor activities. The founding are as following:

(1) The crowded activity time is at the period from 2 to 9 PM., during 18:00-20:30 it reaches the peak with the music fountain performance time at 19:30-20:00. Visitors gather together to square from 6 PM, and leave there after the fountain performance at 8 PM.

(2) The crowd and activities show lots of features as follow:

- When some important international conference held at the very place, public transport in this area will be restricted. Not only the vehicle is limited, the local public are also need to show identity card to enter the square. Traffic congestion is controlled in this way, and graceful landscape environment is maintained also.
- Participant crowds visit the square at lunch break by individual activities, or watch the square fountain show and night view organized by conference.
- Foreign tourists usually take tourist buses arrive the Davos Square before the fountain performance begins.
- Local tourists mainly enjoy to watching the fountain show at night, whose transport modes include taxi, private car, and bus etc.
- The Leisure time of nearby residents is scattered, people often attend the activities on foot, as shown in Table 1.

TABLE 1 DALIAN INTERNATIONAL CONFERENCE CENTRE USAGE

Crowd	Main activities	Square usage time	Traffic modes
Foreign tourists	coastal recreation	fountain open time	tourist bus, taxi
	fountain performance		
	night scene view		
Attending Exhibitors	walking in square	short time, at lunch break time	conference bus
Farther residents	fountain performance exhibition shopping, theater performance	shopping in the afternoon, theater view concentrated in 18:30-21:00	private cars, taxis, buses
Nearby residents	fishing, walking, jogging, skating, kite etc.	multiple time periods	on foot

B. Traffic Survey Statistics

The questionnaire covers issues including the traffic distance, traffic ways, traffic time, activity types, traffic environment satisfaction and the metro travel intention etc. The survey team hands out 160 questionnaires and there are 146 valid, and the effective rate is 91.25%

34% of respondents are come from the Zhong Shan District, and the remaining 66% are evenly distributed in Xi Gang District, Ganjingzi District, Shahekou District in Dalian(Fig. 3-a). Activity crowd data reflect the appeal of the square for the city's four districts. In terms of traffic tools, the proportion of private car is up to 45%, followed by the bus travel accounting for 31.5%, and 16.4% by taxi, while nearby residents go to square on foot (Fig. 3-b).

In terms of traffic time, 16.4% of the crowds are within 15 minutes who are the nearby pedestrian residents and a little further resident take private cars and buses travels. 41.1% of the crowds spending 30-60 minutes travel by bus, and the average traffic distance is 7.5 kilometers. In addition, more than 11% of people should take more than 60 minutes to get there whose traffic distance is over 10.2 kilometers (Fig. 3-c). These data show that the square has a strong attraction for the public even live further away.

The main reason of the traffic environment satisfaction is concentrated on the beautiful pedestrian landscape (Fig. 3-d). However, about the dissatisfied aspect of traffic term, 45.2% of the respondents point out that the bus station is too far, which leads to pedestrian take over 15 minutes to reach the bus station from the square; while still 37% of the respondents tell that they have great difficult in taking a taxi at the place. What is more, there are 17.8% respondents who take private cars consider that road congestion is one of the main reason to decrease the satisfaction (Fig. 3-e). Through the interview, respondents say that even though the traffic situation is relatively good in normal times, but it is also another big trouble to be solved for lack parking spaces during the holidays.

In term of square activities, the respondents are more likely to visit exhibit shopping, watch fountain performances and enjoy leisure walking, among all of them, 39.7% watch the exhibition and fountain, 35.6% for the surrounding, whereas residents focus on walking exercise (Fig. 3-f).



Fig. 3 Traffic survey statistics of Davos Square

In addition to the questionnaires, the survey also interviews various groups and management departments, the followings are part of the contents:

- Nearby residents: It is convenient on weekdays, but serious traffic congestion during music fountain performance.
- Farther residents: Compared with nearby residents, it is not so convenient because it takes much time by bus; to make it worse, there are not enough bus stations around the square.
- Foreign tourists: The Davos Square is spectacular but lack of rest facilities.
- Taxi drivers: The traffic situation is good during the daytime, but they are unwilling to drive after 4:30 PM because the traffic jam is so severely.
- Private drivers: The traffic situation is fine on weekdays, but road congestion is serious during holidays because there is no enough parking spaces at the square.
- Transportation department: The public transport passenger number is small during non-peak period, and the only station around square service too few users.

III. TRAFFIC ACCESSIBILITY ANALYSIS

Traffic accessibility is an important factor affecting the open space using efficiency. Accessibility is a kind of convenient degree which is based on a specific traffic system to arrive location from other areas. It means traffic route, time and cost factors are all convenient [1]. The factors that affect the accessibility of open space include: accessibility, open space attraction and activity characteristics of urban residents [2, 3].

Davos has become an important open space in Dalian; especially the music fountain show has a strong attraction for citizens. The survey team interview residence community of more than 15 kilometres distance from Davos Square, and most of the residents have the willing to watch the fountain performance, even 15 kilometres distance is so long that residents need to take bus over an hour and transfer 1 or 2 times at least.

Weather has an important impact on outdoor activities. The climate in Dalian is pleasant on the whole, except sometimes it has big windy in winter, yet the weather is suitable for residents to take outdoor activities such as jogging, fishing, swimming and square dancing etc. In recent years, with the urban construction, port renewal and industrial relocation from the city core area, public coastal space has been developed greatly therefore the beach is a hot place to go. At present, Davos Square is the largest coastal activity area in Dalian East Port area even eastern bay seashore.

Considering the coastal open space attraction and the public activities characteristics, the author suggest that the main reason influence the Davos Square accessibility is the traffic convenience.

A. Remote Geographical Location

Davos Square is located in the easternmost of Dalian where the coastal landscape is beautiful, but the distant is too far from the main residential land to arrive easily. The straight distance from nearest residential building to the square is more than 1.0 kilometers, and the path distance is over 1.3 kilometers. There is about 2.7 kilometers from nearby Zhong Shan Square which is Dalian's largest CBD and owning a large number of staff.

Although the urban construction departments have already planned residential and commercial mixed land and even some project have completed, but the population is small under construction scale limited. For most citizens, it should take more than 45 minutes or even 1 hour to arrive the Davos Square. Due to the slightly remote location of the Davos Square, it is really difficult to decrease the traffic time to improve the traffic accessibility.

B. Lacked Public Transport Facilities

Public transportation is the main vehicles to most citizens. Contrary to the wide attractive, it has only three lines passing this area including 11, 13 and 708 routes currently. The 11 and 708 routes' nearest station to the square is more than 1.4 kilometers, and only 13 route bus sets up a special station at Davos Square, yet the distance is about 800 meters and this route buses is not a full day operation also.

With investigations from the relevant transport departments, transport bureau explain that the demand for the Davos Square travel is relatively small, so the traffic requirement is insufficient, and the bus in this area do not need full time operation. All these are contrary to our findings. In our surveys, the responses point out that the fewer buses and the shorter operate time restricts the square travel. The relationship between square use and public transport services which should be promote each other take the phenomenon of mutual restriction at present.

Dalian metros have been operated since May 2015, and Metro Line 2 sets up a station at Davos Square. Although the nearly 800 meters distance problem is still there, it improves the convenience of public transport services, and meets the needs of daily traffic to some extent. As the second largest musical fountain in China, the Davos fountain performance attracts so many tourists that the existing public transports are difficult to solve, and even has the traffic paralysis tendency during the fountain show time. Moreover, released metro traffic data show that the passenger reaches more than 86 thousand at the Davos station during the show time [4]. Passenger traffic has increased 4 times than usual. In addition, large numbers of tourists flood to the surrounding roads cause great traffic pressure. Thousands of travellers stranded across square until midnight, and the square had to close the fountain show for a few days in July, 2015 [5].

C. Interlaced Road Pattern

The Davos Square is located at the end of People Road which is the most important traffic arteries in Dalian. To the west of Zhong Shan Square is the largest CBD in Dalian. In this section located are People Road, Friendly Square and Harbor Square, all these square take on the circular and radiation roads layout. For example there are 10 roads intersect at the Zhong Shan Square. These entire multiple circular and radiation roads networks enrich the city space, while these roads make the traffic lines become more complex and reduces the traffic accessibility in this area.

Survey shows many people tend to take a taxi; while during 16:30-21:00 period, the taxi unwilling to drive toward this area; some taxi drivers say that road layout is a clu-de-sac, and it's hard to drive in or out. Some taxies even turn back straight at the Harbor Square nearby, and the passengers have no choice but to walk 1.5 kilometres. After the fountain, visitors confront the funny and awkward situation where on the one hand, there is no taxi at all; on the other hand, there are some taxi carpools but the fee is so expensive after the tourists walk 1.5 kilometres distant out from the congested and jammed area.

IV. CONCLUSIONS

Dalian Davos Square has exposed traffic travel inconvenience, road congestion and other traffic issues ever since it open to the public. At present, the construction and environment of this area is becoming more and more perfect, and the exhibition,

theatre, fountain performance and other activities take strongly attractive to citizens. But traffic accessibility has sharp contrast with lively cultural activities.

Through the investigation, we have learned about the public traffic dissatisfaction of Davos Square. These deficiencies are related to the remoted location, inconvenient public transportation, and the diversity road network pattern. Among these disadvantages, only the public transport facilities can be improved through late construct. Yet other problems are difficult to solve, and it has a great challenge to improve the traffic accessibility. With the further development, how to improve traffic accessibility and improve service efficiency of the square should be resolved urgently.

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