

05. Urban Transport Investigation on Shared Vehicles

National Urban Transportation Mobility Innovation Competition

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Senior 3

Type

Academic/ Team work

Team Members

Kang yin, Xu yi,Cao shuying

Role in Team

field investigation
data statistics
strategy analysis

Instructor

Zhao Shouliang
2013010007@hust.edu.cn

Transportation, as a reflection of the dynamics of the city, is directly related to the operation of the city. With the sparkling aura of “shared economy” and “new energy automobile”, the time-sharing rent, which relies on the internet, of sharing cars has achieved explosive development. Result from the ability to record the travel path and geographical location, the activities of sharing automobiles continue to accumulate a rich amount of information and database, which can **help us better understand traffic problems in contemporary urban context.**

In order to solve urban traffic problem and improve people's commuting efficiency , we decided to do a research on Shared Vehicles in Wuhan. In the research process, we operated principle components analysis with SPSS to discover the relations between shared vehicles usage frequency and the types of supporting facilities situated in the immediate catchment. Consolidating the analysis, we summarized the key location factors that affect shared vehicles usage the most and promoted a strategic plan for allocating shared vehicles' parking locations based on users' usage pattern. This report was awarded the Third Prize in the National Urban Transportation Mobility Innovation Competition.



references

[1] Wuhan Electric Vehicle Promotion and Application Action Plan

[2] Yin xin, "Sharing the car" to explore a new model of urban traffic construction "China Economic Weekly"

1 INTRODUCTION

1.1 STUDY BACKGROUND

In recent years, it has become a common phenomenon that the problems of traffic congestion , expensive parking fees and exhaust pollution have become more and more serious in many cities, such as Beijing, Shanghai, and Guangzhou.

At the same time, the emergence of "shared-car" powered by new energy has improved the convenience of people's travel and provided a new way of thinking for solving urban traffic problems. In Wuhan, however, there are many problems such as frequent demolition and construction of parking spots, low usage rate of some parking spots, and insufficient battery life of charging piles. In order to solve these problems, we decided to conduct an in-depth investigation on shared-cars.

Since the shared-car parking lots are mainly concentrated in the Forth Ring Road in Wuhan, we decided to choose the area within the Third Ring Road as study area.

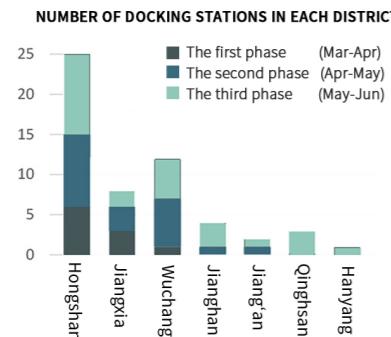


2 CURRENT SITUATION OF SHARED-CARS PARKING SPOTS

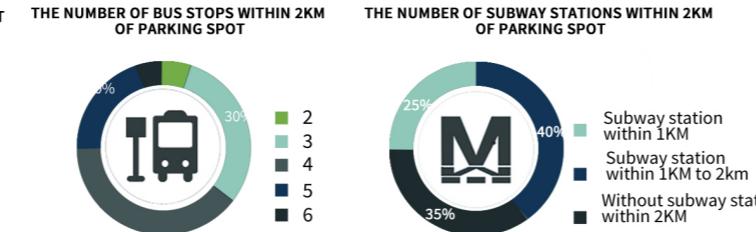
2.1 STATISTICS OF SHARED-CARS PARKING LOTS

Gofun shared-cars were first placed in three districts in Wuchang, and gradually developed to Hankou in the second phase. In the third phase, they were mainly invested in the Qinghai, Hanyang, Jiang'an District.

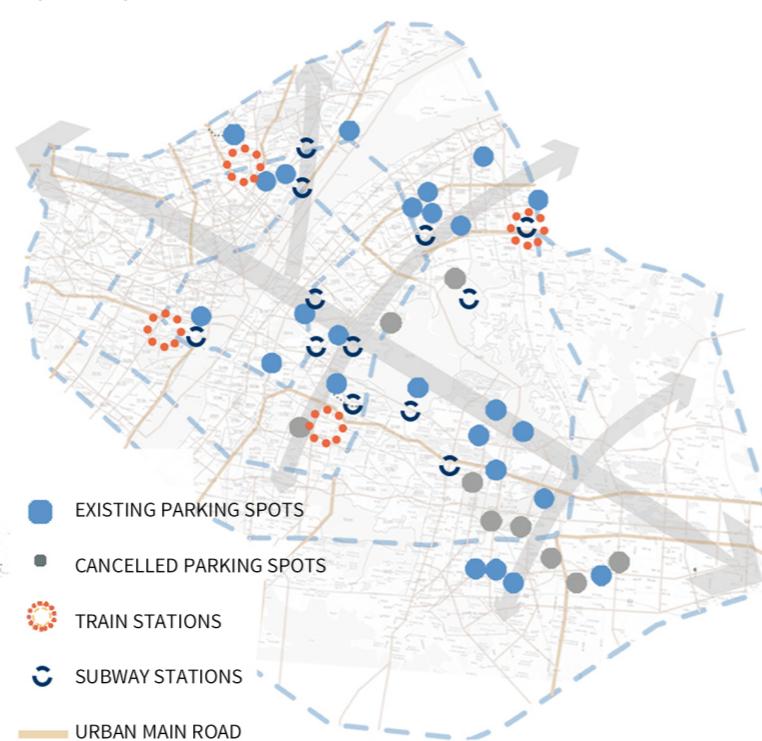
Most of the parking spots have 10-15 share-cars. Only P and R have fewer than 10 vehicles. Only 6 of the 21 parking spots have charging posts, accounting for only 28.6% of the total



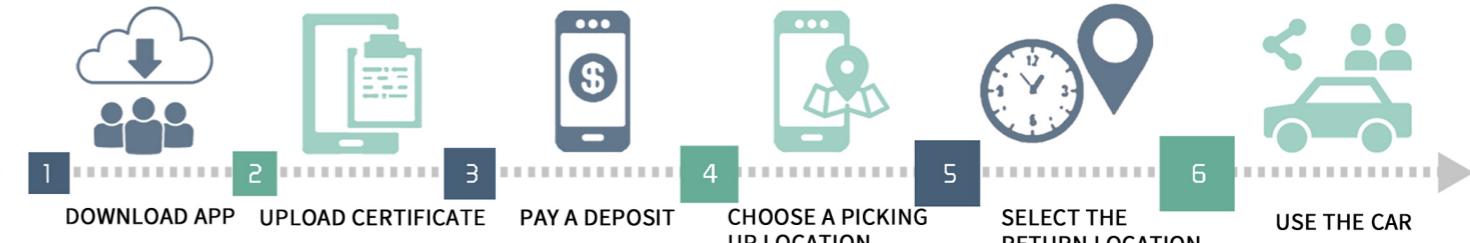
2.2 TRAFFIC SITUATION AROUND PARKING LOTS



Most of the shared-cars' parking spots are located around the main road of the city and are close to the intersection of the roads. In terms of transportation hub , many parking spots are built near the four main train stations in Wuhan(within 2KM), and some of them can also serve nearby subway station.



1.2 INTRODUCTION OF GOFUN SHARE-CARS IN WUHAN

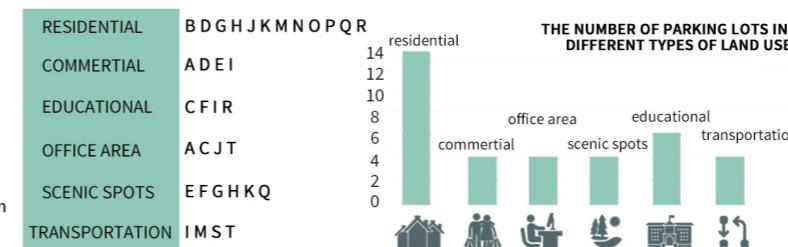


Shared car refers to the provision of new energy vehicle sharing services on campus, subway stations, residential areas, commercial areas, public service areas, etc. It is a time-sharing lease model. People only need to download the app, register their real name and pay a small deposit, then they can use the car at the shared car parking spot. In addition, after the vehicle is used, the driver needs to drive it back to the designated parking location. We selected the Gofun shared car in Wuhan as our survey subject .

1.3 METHODOLOGY

In the research process, we conducted a questionnaire survey and operated principle components analysis to discover the relations between shared vehicles usage frequency and the types of supporting facilities situated in the immediate catchment. Consolidating the analysis, we summarized the key location factors that affect shared vehicles usage the most, and promoted a strategic plan for allocating shared vehicles' parking locations based on users' usage pattern.

2.3 LAND USE AROUND SHARED-CARS PARKING LOTS



It can be seen that most of the parking lots are built in residential areas and educational areas. A small number of parking lots serve the office areas because of the needs for commuting . Some of shared-cars parking spots relies on hotels that are close to the scenic spots .

2.4 HEAT VALUE OF SHARED-CARS PARKING LOTS

HEAT VALUE MEASUREMENT

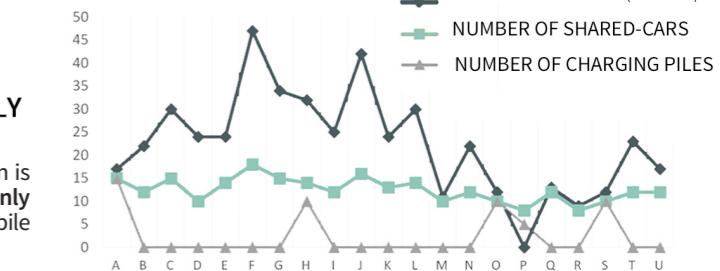
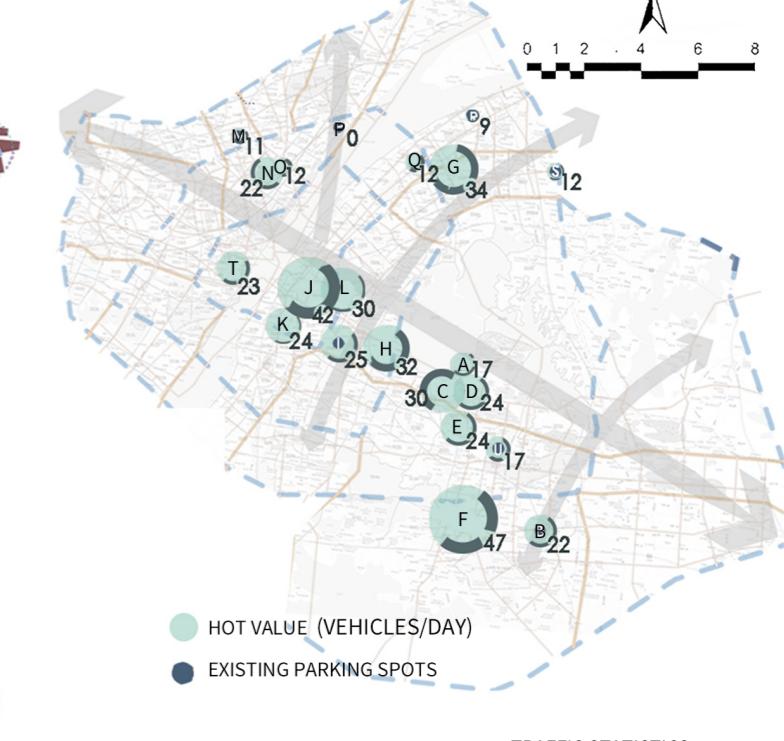
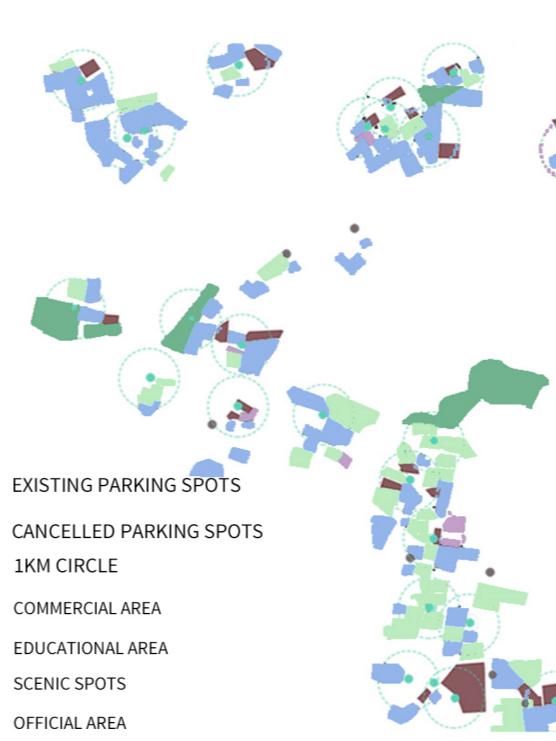
The net change number of shared-cars in the unit time (12 hours) at the parking lot is used as a measure of the heat value.

DATA STATISTICS AND PROCESSING

According to the above criteria, we randomly selected 7 days for testing in a month, and averaged the recorded data (vehicles/day).

HEAT MAP CREATION AND SORTING RESULTS

According to the average value obtained, the heat of each parking lot is proportionally expressed by the area of the circle. The heat value of each parking lot is from high to low: F>J>G>H>L>C>I>E>K>D>T>B>N>A>Q>O>S>M>R>P



3 DILEMMA OF SHARED-CAR PARKING LOTS NETWORK OPERATION

3.1 INADEQUATE INFRASTRUCTURE

LOW RECOGNITION

Most shared-cars parking lots are attached to the existing parking lot, and there are no obvious signs such as "shared car" parking when the parking lots are set up.



LIMITATION OF CHARGING PILES
The configuration of the charging pile is relatively low, and the charging depends on the staff.

3.2 UNSYSTEMATIC PARKING LOTS DISTRIBUTION



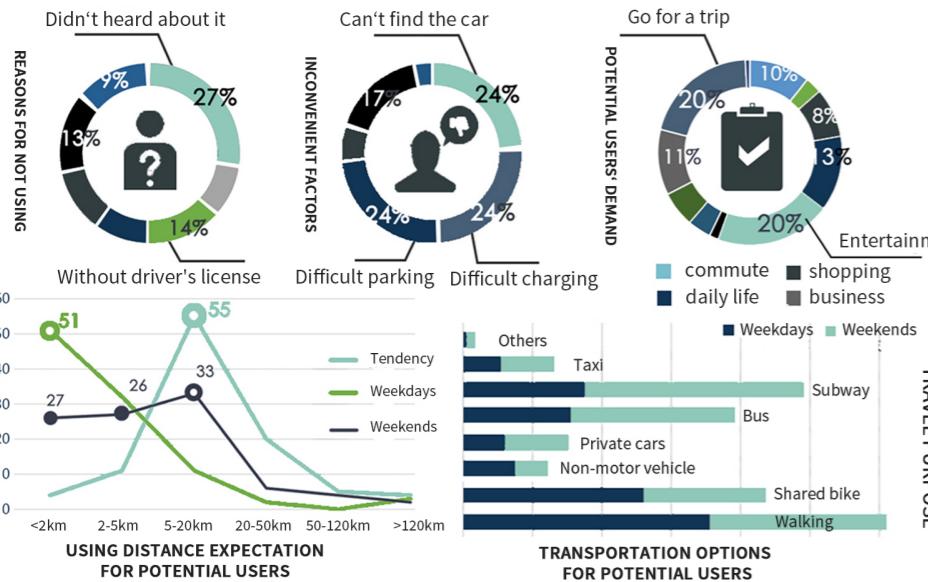
The setting of the shared-cars parking lots does not form an overall network system, and the performance is mostly a block-like centralized distribution setting.

3.3 UNCOORDINATED DEMAND AND SUPPLY

As shown on the right, the shared vehicle configuration is relatively average while the charging piles are not evenly configured. Sites with higher heat, vehicle and charging pile configurations may be insufficient.

4 ANALYSIS OF THE INFLUENCE MECHANISM OF SHARED-CAR PARKING LOTS HEAT VALUE

4.1 POTENTIAL USER DEMAND ANALYSIS



A total of 540 valid questionnaires were used in this questionnaire, of which 243 were valid questionnaires for shared cars. Most people have not used a shared car because they have not heard of it, used to choosing other modes of travel or have no driver's license. The inconvenience is that the number of shared-car is small, and it is hard to find a place to park or charge. Compared with the working day, the number of people who chose walking or non-motorized vehicles decreased at weekend, and more people tend to use public transportation and cars for relatively long distance travel. The "weekend mode" and "entertainment" keywords are more suitable for potential shared-car users.

4.3 PARKING LOCATION OF SHARED-CAR FACTOR

In order to study the impact of commercial facilities, transportation sites, residential facilities, universities, scenic spots, and office facilities on the heat value of share-cars parking spots. We use the heat value as the dependent variable, and the number of facilities within 2km around the parking lots as independent variable. Firstly, using SPSS software to carry out principal component analysis of variables, it is concluded that the number of office facilities, attractions and traffic stations have a significant impact on the heat of the outlets. After the multiple regression analysis of the above three variables, the magnitude of the influence of each variable on the heat of the parking lots can be seen by the p value.

SPSS ANALYSIS RESULTS

MODEL	NON-STANDARDIZED COEFFICIENT		STANDARDIZED COEFFICIENT		T	P VALUE	SIGNIFICANCE
	B	STANDARD ERROR	BETA				
1 (CONSTANT)	-7.12	5.995			-1.188	.280	1.720
TRANSPORTATION SITES	.694	.238	.432		2.909	.270	1.730
SCENIC SPOTS	2.019	.865	.350		2.334	.058	1.942
OFFICE FACILITIES	.730	.147	.677		4.969	.003	1.997
COMMERCIAL FACILITIES	-	-	-		-	-	NUL
RESIDENTIAL FACILITIES	-	-	-		-	-	NUL
UNIVERSITIES	-	-	-		-	-	NUL

According to the analysis results, among the above six spatial location factors, office facilities have the greatest impact on the heat of parking spots, and the second and third are the number of scenic spots and traffic stations. The remaining factors have no significant impact on the operation of the outlets. Therefore, it is important to consider setting up parking spots in areas with more office facilities, classics, and convenient transportation.

5 REPRESENTATIVE OF HIGH HEAT VALUE SHARED-CARS PARKING SPOT

INDUSTRIAL PARK-TYPE

There are intensive workplaces around the parking spots, and the shared-car users are accurately positioned mainly for company employees.

COMMERCIAL CENTER-TYPE

It is mainly based on the city's commercial center. The distance between the parking lot and commercial center is relatively close, and it is also closely related to other transportation sites.

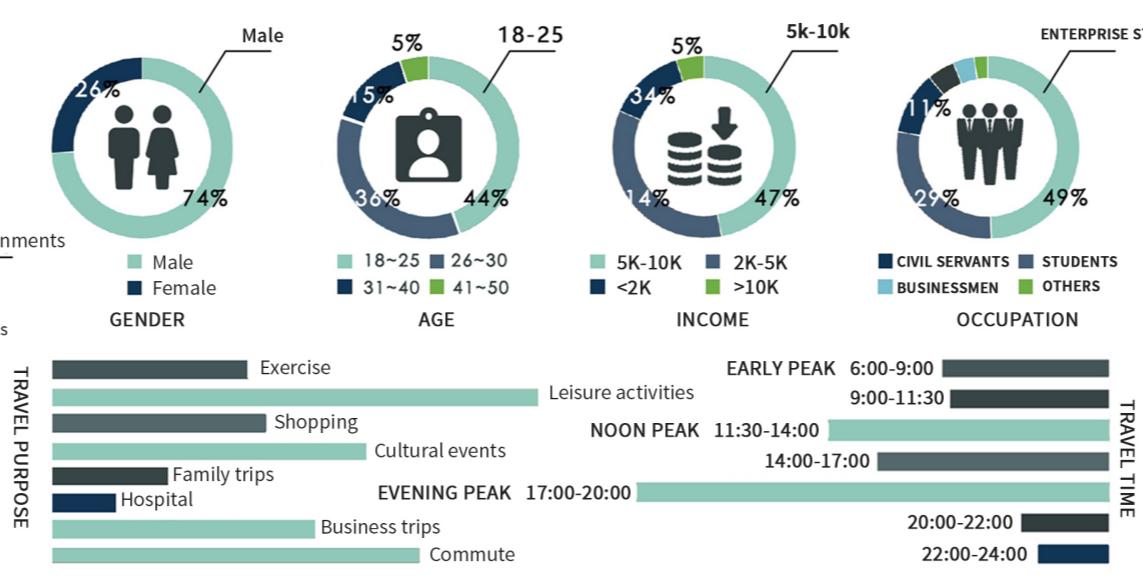
TOURISM SERVICE-TYPE

Tourism service parking lots are mainly located around the scenic spots. Serving tourists who want to travel freely in Wuhan.

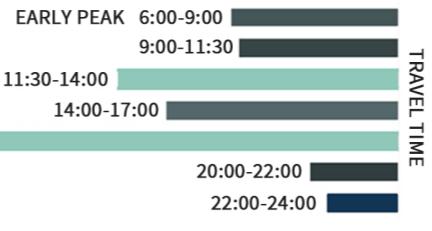
TRANSPORTATION HUB-TYPE

Transportation hub-type parking lots are usually set on important transportation nodes, in order to serve transportation transfer.

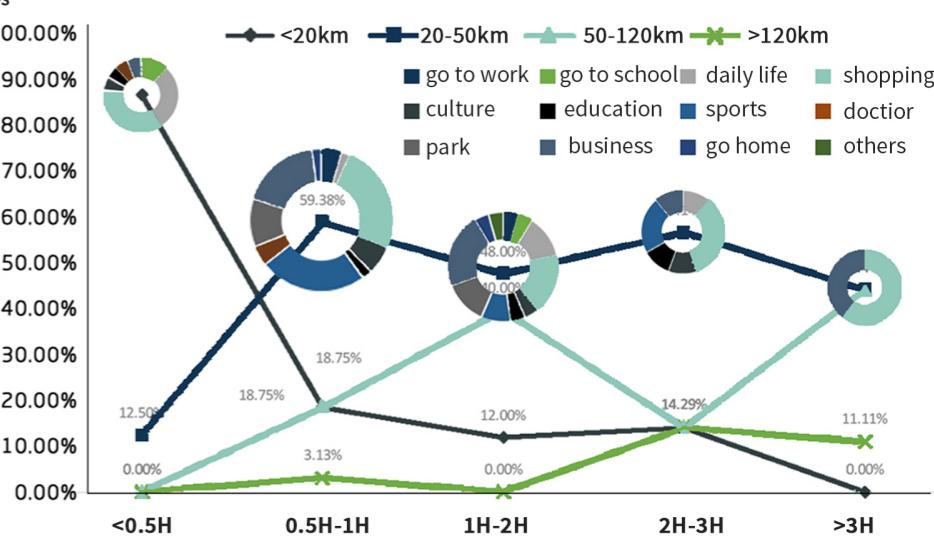
4.2 SHARED-CAR USER DEMAND ANALYSIS



TRAVEL PURPOSE



CROSS-ANALYSIS OF VEHICLE DURATION AND TRAVEL PURPOSE AND DISTANCE



It can be seen that most people who use the shared-car for less than half an hour drive 0-20 km, mainly for shopping and leisure activities; most users who use more than half an hour drive 20-50km, mainly for entertainment, sports activities and business. Only a small number of users use shared-car for commuting or medical treatment, which is a time-critical event. Overall, the shared car is mainly aimed at 20-50km travel (mainly for leisure activities).

6 SHARED-CAR PARKING LOTS LAYOUT OPTIMIZATION STRATEGIES

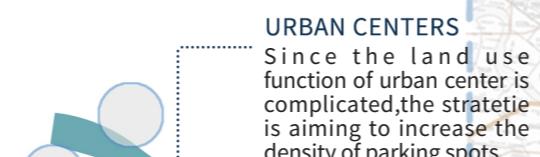
6.1 SPATIAL LAYOUT OPTIMIZATION STRATEGY OF SHARED-CAR PARKING LOTS

MAIN IDEA

By dismantling, adding, and optimizing existing shared-car parking lots, we will build a network of parking lots to further expand the use of shared cars and provide better services for people.

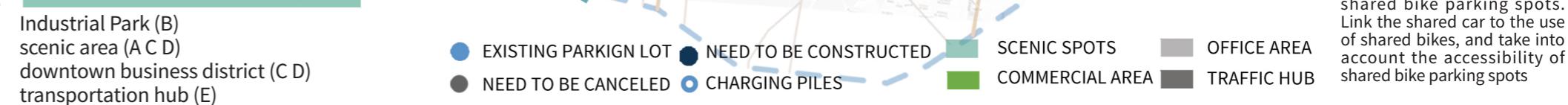
STRATEGIES

The adjustments of the shared-car parking lots are mainly divided into two categories: adding layout points and dismantling outlets.



NEW-CONSTRUCTED PARKING SPOTS

Industrial Park (B), scenic area (A C D), downtown business district (C D), transportation hub (E), and new-constructed parking spots.



6.2 SELF-OPTIMIZATION

PARKING FACILITY

Divide independent shared car parking spaces and add guidance signs. Differentiate shared cars and general private cars to improve the recognizability of shared-cars. Add charging piles to share a charging pile for every 2 parking spaces.

ACCESSIBILITY

The shared-car parking lot is selected in the ground parking lot with better conditions and avoid to be located inside the community or hotel.

When setting up parking lots in the city center, try to choose a public parking lot located in the branch road, and optimize the situation where the entrance and exit of the parking lot and the road relationship are not convenient.

TRANSIT SYSTEM

Enhance the connection between parking lots and public transportation stations. Considering the connection with bus stations and subway stations.

Enhance the connection between parking lots and shared bike parking spots. Link the shared car to the use of shared bikes, and take into account the accessibility of shared bike parking spots.