Study on management strategy of the on-street parking in Urban Residential Area - Taking Harbin as an Example

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Abstract. On road parking is a necessary supplementary form to solve the urban parking problem, which plays an important part in alleviating the parking demand pressure in residential areas. However, due to the poor management and use of on-road parking, there are problems such as parking confusion and illegal occupation of road resources, which affect the road capacity. Therefore, this paper takes Harbin residential area as an example to explore and explore on-road parking management strategy. Firstly, the status of on-road parking in residential areas is examined, and the deficiencies of on-road parking management in residential areas are analyzed. Referring to advance management experience and mode of on-road parking in residential areas abroad, and combined with the actual parking situation of Harbin residential areas, this paper puts forward the corresponding optimization strategy of on-road parking management.

1. Introduction

At present, the parking problem in residential areas of some large and medium-sized cities in China is increasingly prominent, and parking resources are generally tight. On the one hand, because of the short construction period, low cost and fast capital turnover, on road parking has become an important measure to alleviate the parking difficulty, mainly playing the role of short-time parking for service vehicles and supplementing the shortage of parking spaces at night; on the other hand, the setting of on road parking facilities will affect the road traffic capacity. Therefore, how to manage on-road parking is particularly important[1-3].

For the study of on-road parking in residential areas, foreign scholars have focused on the parking management policy and parking balance[4]; now they focus on the development and use of advanced parking management equipment, such as meter charging system and three-dimensional automatic parking garage[5-7]. Domestic research is mainly reflected in the impact of on-road parking on dynamic traffic, on-road parking planning and management, and on-road parking charges[8-9].

As far as Harbin is concerned, the residential area in the old urban area is out of balance in supply and demand for on-road parking due to the earlier construction period and unreasonable planning and design. Moreover, the on-road parking in the residential area of Harbin lacks necessary and reasonable management measures, which leads to frequent parking and disorderly arrangement, seriously interfering with the normal traffic order, and bringing great trouble to the residents' life.

2. Investigation and analysis of on-street parking in residential areas
2.1. Investigation of on-street parking in residential areas
In order to formulate effective on-road parking management measures in residential areas, six residential areas with different built years and different housing prices in Harbin were selected to carry out a 7-day parking survey, mainly investigating illegal parking and zombie vehicles in the residential areas. The survey method is manual field survey, supplemented by inquiry survey. Specific survey contents are shown in Table 1.

| Community                | The construction of the year | Own a vehicle (vehicle) | Vehicles per household (vehicles) | Illegal parking (%) | Zombie car * (%) |
|--------------------------|------------------------------|-------------------------|-----------------------------------|--------------------|-----------------|
| Liaohe District          | 1993                         | 558                     | 0.41                              | 38.5               | 7.0             |
| Liaohe New District      | 1999                         | 980                     | 0.39                              | 35.8               | 7.6             |
| Zhongzhi Fangzhou Court  | 2001                         | 2160                    | 0.54                              | 15.4               | 5.1             |
| Xinheng Modern City      | 2004                         | 362                     | 0.65                              | 18.7               | 4.8             |
| Mengke era               | 2003                         | 517                     | 0.85                              | 1.7                | 5.1             |
| Time Square              | 2000                         | 600                     | 0.80                              | 2.2                | 5.2             |

* Note: Zombie vehicles refer to vehicles that have been continuously parked for more than 7 days

2.2. Analysis of on road parking management in residential area
(1) Serious illegal parking Il-legal on-street parking in a non-on-street parking section will have a serious impact on road traffic in the section and cause traffic congestion in the section.
(2) Serious overtime parking Part of the parking spaces on-street parking at night has also been changed to all-day on-street parking, and there are zombie vehicles, which seriously interfere with the utilization of parking space.
(3) The parking fee system is not standardized In most residential areas of Harbin, on-street parking is free, and there is no maximum parking time limit, which forms the phenomenon of inverted parking fees on and off roads, which further stimulates the demand for on-street parking.
(4) Lack of guidance from advanced policies and regulations Parking management involves planning, construction, public security, transportation and other departments. Each department often performs its own duties and cannot work together, and there are often management loopholes. The on-street parking charges in Harbin are mainly manual, which is inefficient and has the phenomenon of arbitrary charges.
(5) Low punishments for violations The management department has no clear punishment method for the widespread illegal parking phenomenon of motor vehicles, and the punishment is low, which promotes the illegal parking phenomenon from the side.

3. On-street parking management strategy in residential area
According to the investigation and analysis of the status quo of on-street parking in residential areas in Harbin, the sale rate of parking spaces in residential areas is not high, the rate of on-street parking spaces is high, overtime and illegal parking are serious, the parking fee system is not standardized, and the lack of advanced under the guidance of policies and regulations, the following management measures are proposed.

3.1. Improve the on-street parking supervision system in residential areas
While improving the supply of on-street parking in residential areas, it is essential to improve the on-street parking management system in residential areas. The built parking spaces cannot be sold, but the public parking lot is overcrowded; parking fees are unknown, and the price is arbitrarily increased; the
number of parking spaces is not enough, and the allocation is difficult to make clear. Such problems are caused by the imperfect management system.

(1) Strengthen penalties for illegal parking on the road
For communities where parking spaces are unused and random parking on the ground is prominent, the property company should strengthen management, relevant departments should supervise and guide the property company, and the urban management department should strengthen patrols to ensure that the above guidelines can be thoroughly implemented.

(2) Change side parking policy
For neighborhoods where parking spaces are already tight, the existence of zombie cars is a headache. In view of the serious overtime parking in the residential area, it is recommended to adopt a side-by-side parking policy, that is, use different parking routes on single and even days. The specific requirement is to park on the left side of the road on odd days and on the right side of the road on even days, and the street cleaning (side-to-side parking) rule will be suspended for major statutory holidays and religious holidays. For vehicles that remain in this period, law enforcement agencies can tow the vehicle away and contact the owner to criticize and educate the owner and pay fines and points before the vehicle can be recovered.

(3) Standardizing the choice of on road parking spaces
Some drivers don't consider the choice of parking space, but park randomly. Therefore, we can prohibit the behavior of random parking by improving the design of guidance signs in parking area, dispatching management personnel for supervision, increasing punishment and other measures, and correctly guide drivers to choose appropriate parking spaces, so as to maximize the benefits of on-road parking spaces.

3.2. Optimize the layout of parking spaces in residential areas
(1) Issuance of residential parking permits
In view of the imbalance between the supply and demand of parking spaces in residential areas and the high rate of on-street parking spaces, it is recommended to issue parking permits to residents in residential areas to regulate the parking space ownership rate of residents in residential areas. In some residential areas, entry and exit management is relatively loose, foreign vehicles park overnight in residential areas, and outsiders do not comply with residential on-street parking regulations like residents in residential areas, which may easily have a negative impact on on-street parking in residential areas. The residential area is divided into several areas. Residents must hold a residential parking permit for the designated area to park for a long time in this area. Vehicle owners who have not purchased a residential parking permit are only allowed to park temporarily during the day and need to pay parking fees.

(2) Manage visitor vehicles
In view of the imbalance between the supply and demand of parking spaces in residential areas and the high rate of on-street parking spaces, it is recommended to strengthen the management of visitor vehicles in residential areas. In order to facilitate the management of on-street parking in residential areas, a corresponding visitor vehicle entry and exit management system should be established to record the number of visitors' vehicles, entry and exit time, and visit targets. In order to improve the efficiency of vehicles entering and leaving the residential area, temporary parking cards can be issued to visitors' vehicles and the license plate information can be recorded at the same time. In order to meet the parking demand of visitors' vehicles, special visitor parking spaces need to be set up. At the same time, in order to prevent visitors from staying and looking for parking spaces because they are not familiar with the on-street parking spaces in residential areas, the form of centralized parking on the ground can be adopted. Visitor parking spaces are arranged near the entrance of the community, and signs are set to guide visitors to park smoothly. In order to prevent foreign vehicles from entering the community at will, and parking vehicles for a long time, parking fees should also be charged for visitors’ vehicles.

(3) Establish a shared parking system with priority for residents
In view of the insufficient parking spaces in Harbin residential areas, the high rate of on-street parking spaces and the uneven distribution of parking lots, it is recommended to establish a parking lot sharing system with priority for residents. As part of the "Shared City" project, the area shares idle parking resources. It operates by submitting parking information via smart phones. The system provides rewards to the owners of parking space usage rights, but also provides visitors with convenience and preferential parking fees—increasing attractiveness. Its workflow is shown in Figure 1.

3.3. Establish an effective on-street parking fee system

Parking charging is an effective means of parking management. A reasonable charging system can reduce the phenomenon of long-term parking by car owners, increase the turnover rate of parking spaces, and alleviate the relatively long distribution of parking time in residential areas.

(1) Automatic charging for video recognition

Install cameras at on-street parking spots. After the owner's vehicle enters the parking space, the license plate recognition system automatically recognizes the vehicle information and starts billing; after the owner drives the vehicle out of the parking space, the billing system automatically stops billing and performs liquidation. Video recognition automatic charging has many advantages such as low cost, easy maintenance, low failure rate, expandable functions, and no retention issues. Adopting this kind of charging method has the advantages of time-saving and fast speed, and saves the financial expenditure of the management department. At the same time, the management department connects the charging system to the mobile APP, and regularly announces the usage of parking charges. Users can also self-check free parking spaces, charging standards and details of deductions.

(2) Parking Metre charge

In view of the serious phenomenon of overtime parking of vehicles on the road, in addition to video charges, metre charges can also be used. A parking metre is a parking time limit device, and usually one parking metre manages a parking space. Its meaning is to manage the temporary parking spaces occupied by the minute and hourly fee, remind people to shorten the working time when parking in this berth, and to drive the car away as soon as possible to increase the utilization rate of the parking space, reduce the queued vehicles waiting for parking, and reduce the parking And additional road traffic. The parking time sold by electronic parking metres is fifteen minutes as a unit (parking time unit). When the user purchases the parking time in the electronic parking metre, if the remaining time deducted from the parking time unit is less than 13 minutes, the remaining time cannot be accumulated. The parking time for the first purchase will only be a full 15 minutes parking time unit replacement.

Taking the parking metre with a maximum limit of 1 hour as an example, there are 4 parking time units as follows.
The metre adopts a touch screen design. You only need to choose a parking space and parking time according to simple instructions, and then use the metre card to pay. The steps are simple and easy to understand.

3.4. Introduce advanced on-street parking control strategies
(1) greatly improve on public transport
While improving the service capabilities of existing public transportation facilities, it also provides differentiated and detailed public transportation services, improves the level of public transportation services in all directions, and meets the needs of public transportation at different levels. The vigorous development of public transportation also requires policy support and coordination in terms of traffic operation management and road rights.

(2) Make full use of economic leverage to restrain parking demand
Specific policies include: increasing the use cost of on-street parking spaces in areas with higher public transport service levels; increasing the cost of commuting parking spaces; and increasing the cost of vehicles to achieve a balance between parking supply and demand.

(3) Guide and regulate ride-sharing behavior
For areas where the contradiction between the supply and demand for parking in residential areas is more prominent, shared parking spaces are an effective way to reduce parking demand. It guides car users to shift from driving alone by providing convenient, preferential or even free parking spaces for shared passengers. Travel with multiple people.

(4) Integrate parking resources and build a regional management platform
Within a certain scope, build a parking resource sharing platform and parking guidance system, integrate all parking resources in the area on the platform, and a social parking management company will uniformly manage and allocate the usage of all parking spaces on the platform. And cancel all fixed parking spaces at the same time. Vehicles entering the area can on the one hand check the available parking spaces through the platform, and at the same time can select parking spaces suitable for the purpose of travel under the prompt of the parking guidance system.

(5) Advanced parking enforcement technology
The competent government departments should formulate detailed parking codes and clearly mark the punishment methods for various parking violations that may occur, and then strengthen the enforcement of parking law enforcement. Mature parking management technology or equipment is a
law enforcement vehicle that integrates a variety of advanced technologies and equipment. The requirements include cameras, image processing systems, data transmission systems, wireless networks, parking order scanning and identification systems, etc. to automatically detect illegal parking vehicles identify and timely transmit the violation information to the management center.

4. Conclusion

It is very necessary to study the management measures of on road parking in residential areas for solving the parking problem in residential areas and alleviating traffic congestion, and it plays an important part in solving the livelihood problems. This paper analyzes and studies the problems of on road parking management in residential areas of Harbin. In the study of on road parking management strategy in residential areas, it focuses on improving the supervision system of on road parking in residential areas, optimizing the layout of on road parking space in residential areas, establishing an effective on road parking charging system and introducing advanced on road parking control strategy, and obtains a series of practical results Feasible improvement strategies. Management measures of on road parking in Harbin residential area are shown in Table 3.

Table 3 The summary of the problems and countermeasures in this paper

| Serial number | problem | On road parking management strategy |
|---------------|---------|-------------------------------------|
| 1             | Illegal parking is serious | ➢ Standardize the selection of parking spaces on the road (3.1)  
➢ Strengthen the punishment of illegal parking on the road (3.1) |
| 2             | The phenomenon of overtime parking is serious | ➢ Implementation of side change parking policy (3.1)  
➢ Implement advanced parking law enforcement technology (3.4) |
| 3             | Parking charge system is not standardized | ➢ Automatic charging for video recognition (3.3)  
➢ Meter charge (3.3) |
| 4             | Lack of guidance of advanced laws and regulations | ➢ Vigorously develop public transport (3.4)  
➢ Using economic leverage to curb parking demand (3.4)  
➢ Guide and standardize carpooling behavior (3.4)  
➢ Construction of regional management platform (3.4)  
➢ Implement advanced parking law enforcement technology (3.4) |
| 5             | Low punishment for violations | ➢ Strengthen the punishment of illegal parking on the road (3.1)  
➢ Implement advanced parking law enforcement technology (3.4) |

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