

# Investigation and Optimization Strategies for Comprehensive Management of Transportation around Primary and Secondary Schools —Taking the Ocean Campus of Jingshan School in Shijingshan District, Beijing as an Example

Leyi Yuan

School of Architecture and Art, North China University of Technology, Beijing, China

**Abstract:** *The management of the transportation environment around the campus has achieved some results, but the bottleneck problem still exists and needs further optimization and adjustment. Taking the Ocean Campus of Jingshan School in Shijingshan District, Beijing as an example, through site research, questionnaire surveys, and resident interviews, the traffic situation around the school and the satisfaction level of citizens were understood. The analysis found that there were problems such as chaotic traffic order in front of the school gate, a high proportion of motor vehicle pick-up and drop off, and inconvenience in waiting for public transportation. In response to the current problems, strategies such as promoting the deep integration of schools into the city, innovating governance policies and reward and punishment measures, adding parking bays, and clarifying school protection channels are proposed to provide reference for similar governance projects in the future.*

**Keywords:** Campus congestion control, Beijing city, Optimization strategy.

## 1. Introduction

Comprehensive management of transportation around campuses is an important aspect of current traffic management. The surrounding areas of schools, with their characteristics of short-term spatial concentration and overlapping with urban commuting rush hours in terms of time, have become heavily congested areas, prone to safety hazards, and may even cause larger scale traffic bottleneck effects. Therefore, relevant transportation policies need to be continuously optimized and adjusted in order to adapt to future development directions and better serve the people. The Beijing Municipal Party Committee and Government have launched the "Comprehensive Management Plan for Traffic around Primary and Secondary Schools" for six consecutive years, gradually expanding the scope of governance from the five districts of the city to the whole city, refining the content of governance, and establishing an assessment and evaluation system. Among them, the 2023 Work Plan has included kindergartens and campus interiors in the scope of governance. However, the above measures focus on management dimensions such as collaborative governance among various departments, improvement of transportation facilities, and regulation of surrounding order. It is still worth studying how to implement governance policies at the spatial level.

This article takes the East Campus of Jingshan School's Ocean Campus in Shijingshan District, Beijing as an example. The school is located on the comprehensive development axis along the west side of Chang'an Avenue, with a dense surrounding transportation network, complete transportation facilities, and good basic conditions. And the school is the only one that has been on the list of key transportation management for five consecutive years, with certain governance difficulties and typicality. This article aims to

analyze the current situation and evaluate the effectiveness of governance through field research and resident interviews, and propose implementable optimization strategies to provide reference for similar traffic policy research and traffic governance work.

## 2. Experience Reference for Optimizing Transportation Around Schools at Home and Abroad

Japan first proposed the concept of "Tongxue Road" in 1963 and has gradually improved its institutional guarantees and implementation measures over the past 60 years. The main measures include: 1) clarifying the pedestrian space on roads and dividing the spatial range for various groups to pass through; 2) Fine setting of road traffic signs to improve the transmission of information on traffic space allocation; 3) Enhance the installation of safety protection facilities, emphasize the separation of people and vehicles, and speed management; 4) Strengthen the creation of a safe traffic atmosphere through skillful use of road paving, motor vehicle speed limits, and improving the atmosphere of chronic traffic. This type of measure has had a very positive effect, and the national implementation rate has almost reached full coverage. The implementation of the "PDCA" working mechanism has effectively improved the speed and optimization efficiency of the establishment of educational roads in various regions.

Vienna has always advocated for a proactive approach to education that promotes "healthy walking and safe schooling", and has taken relevant measures such as improving the safety of the streets in front of schools and adjusting school curriculum plans with the goal of ensuring overall school safety. In 2018, Vienna launched a temporary traffic control pilot project at Vereinsgasse Elementary School, where

vehicles are prohibited from passing through the school gate during the morning hours when students enter. The project aims to fully safeguard children's right to walk and reduce safety hazards on the way to school. Nowadays, the project has received widespread support from the government, schools, and parents, and has reduced over 50% of children's school safety accidents. Vienna has received a lot of resource guarantees in terms of child safety education. In 2014, the city council approved the "Pedestrian Traffic Principles", and from 2022, all districts in the city will fully implement the "Pedestrian Master Plan" and receive financial support.

On the Chinese side, Kunshan City wrote a research report titled "Analysis and Improvement Suggestions for Traffic Problems around Schools in Kunshan City" in 2016, and formulated the "Guidelines for School Planning and Design in Kunshan City" in 2020, providing design guidance around three aspects: school layout scale and site selection, surrounding transportation facilities, and internal transportation facilities. The Guidelines are aimed at the whole city and mainly apply to newly built and expanded kindergartens and primary schools. The main content includes: 1) forming a continuous road network, clarifying road rights through appropriate isolation measures, and promoting the stabilization of traffic around the campus; 2) Intersection channelization design, adding signage and monitoring facilities; 3) Adjust the public transportation system to match the characteristics of commuting to and from schools, encourage school bus transportation and customized public transportation; 3) Creating a slow-moving environment through measures such as setting up safety islands and raising intersections. The Guidelines have made the first systematic attempt to alleviate traffic problems in schools and their surrounding areas, and to build child friendly schools.

The Ministry of Housing and Urban Rural Development issued the "Guidelines for the Construction of Child Friendly Spaces in Cities (Trial)" in 2022, which regards "building a suitable travel environment for children" as the current key point, and carries out child friendly transformation of school path spaces, road spaces around schools, roads around children's main activity areas, and waiting spaces. The "Guidelines" advocate: 1) combining the slow walking system to open up dedicated study path spaces, forming systematic and interesting designs through color painting, signage, etc; 2) Promote the construction of various transportation infrastructure around the campus, with a focus on regulating parking issues; 3) Improve the safety of the surrounding areas and waiting spaces for children's activities. The "Guidelines" implement the "14th Five Year Plan" and elevate the issue of transportation around campuses to the level of rules and expand it to the national level, providing important reference and guidance for promoting the construction of child friendly spaces.

The above practical activities have shown that traffic management around campuses can effectively improve the safety of education. Clear road rights, construction of slow traffic, and resolution of motor vehicle issues are of paramount importance in promoting the improvement of the transportation environment. With the inclusion of traffic management issues around the campus into the regulatory framework, there are still shortcomings in China's current

policies and measures, and school traffic safety issues occur frequently. There is still a long way to go in related governance.

### 3. Sample Study

#### 3.1 Overview of the Research Subject

This article focuses on the Ocean Campus of Jingshan School in Shijingshan District, Beijing and its surrounding areas. The Ocean Campus of Jingshan School was established with the policy support of the municipal government's prestigious schools, and is a key school in Shijingshan District. The school has one campus and two locations, divided into east and west campuses. The west campus is the high school department and is not within the scope of this study; The East Campus is a primary and junior high school, and is a nine-year compulsory education school. The school has 40 classes with about 1500 teachers and students, covering an area of approximately 37000 square meters. The Ocean Campus of Jingshan School has two gates, with the main gate located on Lugu East Street and shared by people and vehicles. The south gate is a fire escape located within the Yuanyang Shanshui community. It is only accessible to people and non motorized vehicles on a daily basis and is only opened after school.

The surrounding area of Jingshan School's Ocean Campus is mainly for residential purposes, with a pedestrian overpass on the north side of the main school gate and a complex external traffic environment. The Lugu East Street at the boundary of the site is an urban main road (urban secondary road) with strong traffic and high road grade. And there are 5 schools including kindergartens and primary and secondary schools on both sides of the road, with a large traffic volume and severe traffic congestion during peak hours.



Figure 1: Location Map

#### 3.2 Research Method

The research method includes GIS spatial analysis, site investigation, questionnaire statistics, and interview methods, which explore the existing problems of the site through three steps. Firstly, through site research and resident interviews, we aim to understand the foundation of the site, the general learning patterns of students, and the usage of the space. Secondly, a survey questionnaire was distributed to residents within the living circle where the school is located to investigate the distance, mode, time, and implementation of school traffic management methods among students. Multiple regression analysis was used to analyze the relationship

between the questionnaire results and residents' satisfaction. Finally, using GIS data to assist research, taking Jingshan School's Ocean Campus as the starting point, a 15 minute living circle was divided according to walking speed, the school service area was delineated, schools and residential areas within the range were marked, the congestion problem was analyzed, and the differences between the desired route and the actual route were compared.

### 3.3 General Characteristics

Jingshan School's Ocean Campus has two peak periods for commuting: school and school (with relatively fewer students entering and leaving the campus during lunchtime), which basically overlap with the morning and evening peak hours. At the end of the school day, the school adopts a management measure of releasing students at the wrong time by grade level. Even numbered grades use the main gate, while odd numbered grades use the south gate. During school hours, there are faculty, traffic coordinators, and traffic police in front of the main school gate for management, while there are none at the south school gate. In terms of the characteristics of school transportation, parent transportation is the main mode of transportation, with a high proportion of parents using motor vehicles for transportation. In the case of students independently going to and from school, public transportation and walking are the main modes of transportation.

### 3.4 Main Issues

Based on site research, questionnaire statistics, and interviews, it can be found that there are several transportation problems around the campus of Jingshan School Ocean Campus, including:

1) The relationship between schools and cities is not close. There are 8 schools and 17 residential areas within the living circle where the school is located, with a large daily flow of people and vehicles, which can easily lead to congestion. At the same time, the school is located within the Yuanyang Shanshui community and has not fully connected with the urban road system. The surrounding road network density is low, and all traffic is concentrated on Lugu East Road. There are also many bottleneck roads and dead end roads, which have not formed a regional micro circulation.

2) The traffic order in front of the school gate was chaotic during the first and second semesters. There are no parking areas within 50 meters on both sides of the school gate, but there are still motor vehicles temporarily parked during the first and second semester, causing traffic congestion on the road. Although the road in front of the school gate is clearly marked with isolation measures and traffic signs to indicate the right of way for motor vehicles, non motor vehicles, and pedestrians, there are still situations where motor vehicles occupy non motor vehicle lanes, non motor vehicles park on non motor vehicle lanes, and non motor vehicles occupy sidewalks. At the same time, the main gate of the school is shared by people and vehicles, and there are still large vehicles entering and exiting during the after-school hours, which also poses a safety hazard.

3) There is inconvenience in waiting for public transportation.

Although there are roadside harbor style bus stops around the school, the platform width is small and there is a lack of waiting halls, making it difficult to accommodate student capacity during commuting hours. At the same time, the distance between the bus stop and the school gate is within 50 meters, and combined with the non motorized vehicle lane, it is greatly affected by the parking during commuting. Students need to pass through heavily congested roads to reach the platform, which poses a safety hazard.

4) Unclear allocation of responsibilities among departments. The ownership of the responsibilities of traffic coordinators, parent volunteers, on duty teachers, and school security personnel in front of the school gate during the after-school period is unclear, and there is a phenomenon of overlapping duties and responsibilities in terms of standing guard. The focus of each department's work is on guiding the behavior of motor vehicles, while neglecting situations such as student road teams, whether they are going to and from school along the protective passage, and illegal parking of non motor vehicles.

## 4. Optimization Strategy

### 4.1 Clarify Land Ownership and Optimize Traffic Order

Jingshan School's Ocean Campus was built later than the Ocean Mountain and Water Community. After its establishment, in order to solve the problem of traffic congestion in front of the school gate, the roadside parking spaces originally serving residents in the community were designated as no parking areas. Due to insufficient parking spaces within the community and underground garages, residents still choose to park on the roadside, resulting in serious violations of motor vehicle parking on the south side of the main school gate. On the one hand, it is suggested to clarify the ownership of land use rights and strengthen control; On the other hand, solving the parking problem of motor vehicles and non motor vehicles from a spatial perspective, optimizing the traffic environment and order in front of the school gate.

Firstly, clarify the prohibited parking areas for motor vehicles and strengthen law enforcement against violations. According to the "Comprehensive Management Plan for Traffic around Primary and Secondary Schools" issued by the Beijing Municipal Education Commission, Municipal Public Security Bureau, and Municipal Transportation Commission, and the "Guidelines for the Construction of Child Friendly Spaces in Cities (Trial)" issued by the Ministry of Housing and Urban Rural Development, the regulation of "prohibiting the parking of motor vehicles within 100m in front of the campus gate (50m on both sides of the school gate)" is strictly implemented to standardize parking management in the surrounding area and control the disorderly parking of motor vehicles and non motor vehicles in front of the school gate. Electronic monitoring devices can be installed on both sides of the school gate to strengthen law enforcement and punishment efforts.

Secondly, in terms of traffic organization, considering the congestion situation in front of the school gate, we will increase the number of motor vehicle parking facilities in



front of the school gate, strictly control the prohibition of parking on both sides of the road 50 meters away from the school gate, and redefine the temporary parking area. It is recommended to construct a harbor style loading and unloading area 50 meters north of the school gate to moderately meet the temporary and short-term parking needs of shuttle vehicles, and to manage it through price regulation. To solve the problem of non motorized vehicle parking, the non motorized vehicle parking area in front of the main school gate can be moderately extended, and a temporary non motorized vehicle parking point can be set up in front of the south school gate. At the same time, further standardize the parking behavior of non motorized vehicles, increase management efforts, and allow on campus teaching staff to park non motorized vehicles in the on campus carport, while students consider parking non motorized vehicles outside the campus.

#### **4.2 Promote Policy Innovation and Consolidate Multi-party Responsibilities**

Since its introduction in 2018, the Comprehensive Management Plan for Traffic around Primary and Secondary Schools has been listed as a key focus of work in Beijing. As of now, the governance scope has covered 16 districts in the city, and a total of nearly 200 schools have been monitored and governed. However, the 'Plan' still has three issues: unclear core control, incomplete reward and punishment mechanisms, and unclear responsible parties.

From a policy perspective, the issue of traffic management around the campus has arisen during the usage process, therefore, the core control content should be updated based on the annual situation. Secondly, the current policy only sets up monitoring and evaluation standards, which cover two assessment bonus points, and has not formed a complete reward and punishment mechanism. Measures such as increasing subsidies for campus traffic management achievements and adding traffic regulation courses to schools with poor traffic management effectiveness can be adopted. Finally, accountability mechanisms should be reflected in policies, listing the scope of work of each department and consolidating their responsibilities.

In terms of responsible parties, the issue of traffic management around the campus involves multiple parties such as schools, parents, students, and governments. It is necessary to promote consensus among various parties, clarify their respective responsibilities and obligations, and improve mutual cooperation. For the government, the core lies in policy support and coordination, incorporating pain points into policy formulation, and encouraging "one school, one policy". For schools, it is necessary to innovate governance ideas, strictly implement the "vice principal of transportation" system, integrate multiple forces, and maintain order in front of the school gate. For parents, students, and members of society, green travel should be encouraged, traffic regulations should be strictly followed, and relevant governance should be actively cooperated with.

#### **4.3 Encourage Public Transportation and Create a Slow Driving Environment**

There are frequent violations between the main gate of Jingshan School's Ocean Campus and the south bus stop, which poses a safety hazard due to congestion issues. To address this issue, traffic behavior can be restricted on the road from the school to the platform, and stop lines and traffic management intelligence can be used to prohibit shuttle vehicles from entering the non motorized lanes inside the platform, thus solving the related problems. For the platform itself, it is necessary to optimize its form and size, widen the width of the waiting island and platform capacity, and add facilities such as rain shelters and waiting seats. In terms of bus operation, during students' commuting time, the frequency of school and surrounding bus routes can be appropriately increased, and suitable bus models can be configured to increase bus transportation capacity. If conditions permit, consider setting up school buses for transportation or opening dedicated bus routes.

In the urban comprehensive transportation system, slow traffic is a general term for pedestrian and non motorized vehicle systems. To promote the construction of a slow traffic environment, on the one hand, we should optimize the slow traffic system and improve the safety of slow traffic; On the other hand, it is necessary to resolve the right of way conflict between pedestrians and non motorized vehicles. Firstly, consideration should be given to widening the pedestrian paths within 200 meters on both sides of the school gate, and optimizing the walking environment through color, paving, and landscape continuity. Secondly, use markings to divide the protective pathway on the pedestrian walkway. During school hours, students must follow the "Little Yellow Hat Road Team System" under the guidance of teachers or class leaders, and can disband 30 meters outside the school gate on either side; And set up on duty personnel on the road section to ensure the safety of students going to and from school and reduce the concentration of crowds in front of the school gate. Finally, install fences between pedestrian and non motorized vehicle lanes, keep parents away from school gates when picking up and dropping off, and prohibit non motorized vehicles from parking on non motorized vehicle lanes and sidewalks, allowing the right of way to return to pedestrians.

#### **4.4 Improve Transportation Facilities and Achieve Traffic Stability**

At present, the transportation infrastructure around the Ocean Campus of Jingshan School is relatively complete, but it is possible to introduce command traffic facilities, monitor traffic behavior in real time, and improve traffic safety protection. For example, setting up speed check sensors and variable indicators on road sections allows drivers to adjust their speed in a timely manner through the sensors; Install pedestrian perception systems on both sides of the school gate, using LED signs to alert drivers of nearby pedestrians and bicycles, in order to yield to pedestrians or suppress vehicle speed; Install intelligent signs at the entrance of the parking bay to track real-time parking information.

The traffic calming measures aim to reduce the negative effects of motor vehicles, change reckless driving behavior, improve the surrounding environment of schools, and achieve coordinated development of various functions of roads through systematic hardware and software facilities (such as

policies, legislation, technical standards, etc.), in order to achieve traffic safety and feasibility. In terms of hard facilities, physical deceleration can be achieved by adding raised areas, speed bumps, three-dimensional obstacles, pedestrian crossing protrusions, intersection protrusions, etc. around the school. In terms of soft facilities, on the one hand, one-way management and tidal lanes can be used to organize motor vehicles to pass in one direction, reducing traffic conflicts in front of the school gate; On the other hand, it is recommended to implement traffic control and speed limit management to ensure the priority right of passage for slow-moving corridors, regulate motor vehicle behavior, and ensure the safety of schools. Finally, a no honking area for cars can be set up around the school to reduce the impact of traffic noise on students and further ensure the living environment in the surrounding area.

## 5. Conclusion

This article summarizes advanced experiences in traffic management at home and abroad, and reflects on the existing "Comprehensive Management Plan for Traffic around Primary and Secondary Schools" in Beijing. Specific measures that can be promoted include the following aspects: 1) adjusting school site selection to ensure that schools fully integrate into the city and reduce congestion probability from the root; 2) Optimize the urban road system to ensure the rationality and continuity of road network density; 3) Clarify road rights, regulate traffic behavior, and reduce conflicts among various traffic organizations; 4) Pay attention to the planning and management of the space in front of the school gate, consider measures such as traffic control, one-way management, and speed limit management, and achieve traffic calming; 5) Improve the safety and walkability of nursing school passages, and encourage students and parents to walk slowly in a green way; 6) Optimize the public transportation system, introduce smart concepts, and improve transportation facilities; 7) Clarify the functional ownership of each unit, consolidate the responsibilities of all parties, and promote policy and institutional innovation.

However, the school studied in this article has certain peculiarities in terms of site selection, and after 5 years of governance, the surrounding traffic congestion problem has been greatly improved, with few existing problems. At the same time, there are differences in the evaluation of satisfaction with traffic management results among individuals, and the current evaluation mechanism should be further improved to rationally deal with parental public opinion. In short, the root cause of the problems in campus transportation around primary and secondary schools is that the schools have not fully integrated into the city, lack a good chronic environment, resulting in unhealthy behavior of parents in picking up and dropping off, difficult parking, and chaotic traffic. Therefore, on the basis of meeting safety conditions in the transportation environment, the slow traffic system should be improved, public transportation and green travel should be encouraged, so as to truly improve the quality of education and solve congestion problems. China has made relevant attempts in this field, but still lacks universal experience and further exploration is needed in the future.

## References

- [1] Zu Yongchang. Analysis and Suggestions on the Causes of Traffic Congestion in Primary and Secondary Schools [J]. Road Traffic Management, 2011 (05): 47-48
- [2] The Enlightenment of Japan's Comprehensive School Road on the Fine Design of Road Traffic Organization in China <https://mp.weixin.qq.com/s/xUtYrFHQ5qMQwBnBlwQUvA>
- [3] Global Gathering | Towards Child Friendly Cities (Part 1) International Conference on Child Friendly Cities and Vienna Practice [Series] [https://mp.weixin.qq.com/s/7Ukt3sFE0-jIWqX\\_\\_fvulg](https://mp.weixin.qq.com/s/7Ukt3sFE0-jIWqX__fvulg)
- [4] Schulstraße Vereinsgasse: Pilotprojekt gestartet [EB/OL]. Mobilitäts Agentur Wien. (2018-09-10). <https://www.wienzufuss.at/news/schulstrasse-vereinsgasse-pilotprojekt-gestartet/>
- [5] Guidelines for School Planning and Design in Kunshan City
- [6] Exploration of the Compilation of School Planning and Design Guidelines from a Child Friendly Perspective: Taking the "Kunshan City School Planning and Design Guidelines" as an Example <https://mp.weixin.qq.com/s/lr9RF2wVOcRrYIrl9pfLvw>
- [7] Guidelines for the Construction of Child Friendly Spaces in Cities (Trial)
- [8] Fei Chenyi, Jiang Yang, Zhao Xuyang et al. Traffic Environment Improvement around Primary and Secondary Schools: A Case Study of Two Schools in the Beijing Sub center. Urban Transportation, 2020,18 (02): 37-45+14. DOI: 10.13813/j.cn11-5141/u. 2020.0011