Research on the optimization strategy of street space in the post epidemic era

2022, Vol.3 No.3
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DOI: 10.37420/j.adr.2022.015
https://masonpublish.org

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Abstract
In the post-epidemic era, great turbulence has taken place in the field of human life, especially the travel rate of people has been greatly reduced, but the requirements for urban public space required for travel are constantly improving.As the main social life space carrier of street space requires carrying more functions to meet the requirements of the outbreak era.Through literature search and social investigation, the optimization design strategy is proposed for the problems of weak slow traffic use right, monotonous space function, lack of commercial management, and random public facilities of urban streets. Then, through the legend analysis, the optimization effect of street space in four levels of environmental comfort, functional diversification, management order and facilities refinement can be achieved to improve the residents' street life experience and return to the public space essence of "people-oriented" street.

Keywords:
Post epidemic era; Street space; Humanism; Slow moving system; hommization

Introduction

From the end of 2019 to the beginning of 2020, the COVID-19 broke out, and countries around the world faced a huge test. Up to now, the epidemic has not been completely eliminated, and the society has gradually entered the post epidemic era of epidemic normalization.According to Wang Zhuli's earliest definition of the "post epidemic era", it does not mean that the epidemic has been completely eradicated and everything has returned to normal, but refers to the era of sporadic outbreaks, periodic ups and downs and a long period of delay, which has a profound impact on various fields, of which the most obvious impact is in the field of human social life[1].

In the post epidemic era, epidemic prevention policies such as home isolation and keeping social

distance have reduced the frequency of people's travel, resulting in the lack of outdoor activities and social interaction, highlighting the dependence of social life on urban public space.As a key component of urban public space, streets are not only space carriers serving basic transportation, but also important public spaces bearing multiple functions such as activities and ecology.Therefore, high-quality street space is a strong guarantee for rational planning of urban traffic and creating a comfortable living environment.At present, the research on post epidemic streets mainly proposes optimization strategies from the aspects of imperfect facilities, messy space, uneven distribution of right of way, traffic congestion, while the research on the comfort of street traffic environment, compatibility of space functions, diversity of business management models, safety and interaction of facilities is less[2].In the era of normalization of the COVID-19, the new street space should not only provide the public with suitable physical activity space, but also provide the public with psychological space that can release anxiety and boredom. The traditional street space is lacking in space security and diversity of space activities, so the traditional street space model needs to be optimized and upgraded.

1 The development trend of street space in the post epidemic era

During the normalization of the epidemic situation, street space not only meets the needs of people for safe travel, but also carries the social needs of residents in special periods. Foreign cities have introduced a series of measures such as car free streets, widening sidewalks, building slow traffic systems, and reducing and exempting various fees[2].In fact, these measures have always been the driving force of urban sustainable development, and also the key measures to reduce urban carbon emissions, get rid of the concept of "car centered" and reduce urban congestion.The outbreak of the epidemic has turned the street space into a model that can be reshaped under specific conditions. The social distance during the epidemic period has exposed the problems of limited urban street space, blocked streets, and lack of social and cultural attributes of streets.The emergency measures in many cities have a profound impact on the design concept, governance, planning and other aspects of street space, and thus promote the development of street space[2](figure 1).

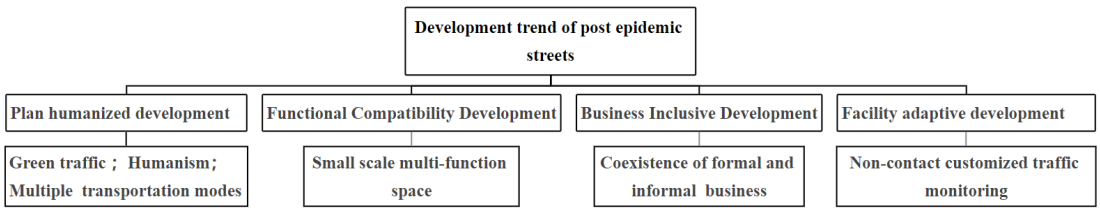


figure 1 Overview of the development trend of epidemic streets

1.1Humanized development trend of planning

As an open, barrier free and shared public space in the city, the street should serve the urban residents, put people first, and build a humanized street space. In the post epidemic era, street space planning is returning to the people-oriented concept, and street design guidelines in many cities are also showing a trend of humanization, such as emphasizing green traffic and attaching importance to pedestrians. This concept needs to be further developed and deepened in the future, promoting the research on public health development[2].

At the same time, streets are an important part of the urban road traffic system and should meet the travel needs of various groups and modes of transportation. With the arrival of an aging society and the widening gap between the rich and the poor in cities, according to the investigation of the travel mode of vulnerable groups, from the perspective of fairness, street space should meet the needs of more people. Optimizing urban street space should focus on public transport and slow traffic according to the travel modes of different people, and provide multiple transport modes[3].

1.2Compatibility development trend of functions

Some temporary measures during the epidemic promoted the mixed use of street functions to some extent, and some of them are evolving into long-term street optimization strategies.In the post epidemic era, urban streets need to improve space compatibility, establish small-scale, interconnected and multi-functional public street space, and provide convenient open space for citizens.People can also participate in various activities and communicate on the street, such as chatting, taking a nap, shopping, walking, etc.The humanized development of street space and road planning does not mean completely limiting the travel development of cars, but changing the concept of "valuing things over people", "returning" streets to pedestrians, and calling for "people-oriented" street space to be reflected through road right optimization.

1.3 Inclusive development trend of business

Commerce is the most active economic activity in the street space. In addition to formal stores, informal commerce often appears on the city streets.Informal commercial space refers to the commercial space generated spontaneously due to changes in the external environment during the development of streets. This space is usually spontaneous, dynamic and temporary, and cannot exist independently. It is the result of low-income social groups actively seeking livelihood or business opportunities, and it is a potential functional space.The informal commercial activities in streets usually adopt two modes of fixed operation and mobile operation, of which the most common form is the commercial space formed by street vendors' operation[4].

In the post epidemic era, employment has become the people's livelihood that the country pays close attention to, and the inclusive development of informal commerce is one of the good solutions to employment.First of all, urban streets should include informal commerce, giving them some space to meet the basic living and development needs of low-income people.The informal commerce, similar to the "stall economy", has the advantages of low threshold for entrepreneurship, low commodity cost and low risk of failure, and can better meet the employment needs of low-income people and society.Secondly, informal commercial activities can not only alleviate employment pressure, but also stimulate consumer demand and promote economic development[5].Finally, "stall economy" is also a unique street culture. Consumers can experience the unique customs, consumption patterns and vibrant culture of the city, attract tourists from all over the world, and stimulate the vitality of the city.In short, urban streets containing informal commerce can not only add vitality to the city, but also bring convenience to residents.

1.4 Adaptive development trend of facilities

The epidemic situation has raised people's attention to environmental health, health and safety, and also triggered the designers to rethink the street space facilities.In addition to meeting people's use needs, the relevant facilities of the future streets should also meet people's real guarantee of safety and health.Therefore, non-contact street facilities will become a trend and attract more attention.
The safety of materials used in street furniture and the reduction of touch risk should be a priority. Antimicrobial coating shall be added to articles (faucets, blackout curtains, doors, hardware, etc.) that people often touch in public places to improve the sanitation and safety of facilities.During the epidemic abroad, automatic signal, induction door, voice control equipment and other automatic equipment are widely used, which will be more widely used in public places in the future.Finally, the development of customized public transport, ride booking and monitorable travel information systems will be explored to improve the efficiency of street while ensuring public safety and providing more on-time, faster and more comfortable travel[2].

2 Main problems of street space in the post epidemic era

2.1 Slow traffic access is weak

The epidemic policy requires people to keep social distance, which leads to an increase in people's demand for urban public space. Many details of street space design are also emerging one by one, and people's right to use slow traffic is ignored[2].Most of the public space in the streets, which is dominated by slow-moving traffic such as walking and cycling, is gradually being encroached upon by street space dominated by motor vehicles, and some business activities are neglecting slow-moving space by negligent management, resulting in some streets having limited slow-moving space

and obstructing walking activities. The predominantly motorized street traffic undoubtedly adds to the problems facing the urban environment (desertification of urban streets, exhaust pollution, noise from cars, etc.) and poses a serious threat to the sustainable development of cities[6] .

2.2 The space is monotonous in function

In the contemporary urban street space, people communicate visually with strangers in a shuttle way and express freely through occasional activities, thus stimulating the vitality of street space. However, relevant departments pay more attention to vehicular traffic in urban street design and ignore public activities of people in street space. To a certain extent, this kind of planning has accelerated the trend of simplification of street space functions, ignored people's various public activities in the street space, and reduced the street space to a monotonous traffic space, lacking in-depth human thinking. In addition to the lack of aesthetic feeling and vitality, such streets are unable to carry out various public interaction activities, and environmental safety issues are also worrying. As a ubiquitous public space, the street is not only a traffic passage, but also a container for people to live in public life. It should exist as a place of communication.

2.3 Lack of business management

In the post epidemic period, repeated outbreaks occurred in many places, making it difficult for people to find jobs, doubling the pressure on their lives, and the long-term closure and control situation made all kinds of businesses suffer a major blow.In order to make a living, roadside stalls appear in large numbers.Because of their many negative impacts (encroaching on sidewalks, interfering with road traffic, destroying the surrounding environment, affecting residents' lives, etc.), urban management departments believe that street stalls are illegal and take a "one size fits all" approach to suppress informal commerce.Although this method quickly eliminated informal street trading, it sacrificed the interests of low-income urban residents and the vitality of urban streets, and even brought some restrictions on economic development.

However, some formal commercial operators of street shops will also extend the street public space into a debris display area.The articles that should not have appeared in the street space are stacked in some areas in front of the shops at will, occupying the pedestrian walkways, and also destroying the order of the streets.The urban management department did not come up with long-term effective management measures.

2.4 Loose public facilities

The epidemic also triggered a series of psychological changes, such as anxiety, fear and insecurity,

and people became more cautious in public places.As time goes on, these bad emotions will make people feel tired or even negative. At this time, the guidance of public facilities to people is particularly important[7].

First of all, the early streets did not pay too much attention to the space environment and the quality of public facilities.For example, the mechanical and electrical boxes, garbage cans, fire-fighting equipment, signal control boxes, signboards, indicators and other public facilities in the street area can not be arranged in an orderly manner due to the impact of underground pipelines, but some facilities and equipment are still not arranged in an orderly manner and placed at random, seriously affecting the aesthetic order of the street space;The pedestrian area in the street space lacks rest facilities such as seats.Even if public seats are designed for rest, they are placed at random, and their radiation range is not safe, which is not conducive to promoting people to communicate with each other[8].

Secondly, people are repelled by the impact of the epidemic situation on touch type public facilities, and the safety performance and diversity of facilities are improved.As a public facility on the street, it is basically characterized by being contacted by different people. Some users may carry viruses and bacteria.At the same time, some people may take away viruses and bacteria due to contact with public facilities.Therefore, loose contact facilities will make disinfection time-consuming and labor-intensive[9].

3 Optimization strategy of street space in post epidemic era

3.1 Comfortable traffic environment

Building a comfortable traffic environment does not mean completely restricting the development of motor vehicles[10]. Optimize from two aspects: motor vehicle traffic and slow traffic (see Table 1). In terms of motor vehicle traffic, change the street plane, such as appropriately reducing the lane width, or reducing the turning radius of the road to shorten the sidewalk spacing, so as to reduce the speed of vehicles and ensure the safety of pedestrians on the road; in urban living areas, some traffic calming treatment methods are adopted. The design of street intersections should be kept as compact as possible, the pavement of intersections should be changed or raised, and small deceleration strips or piles should be installed in the middle of intersections to make all kinds of traffic modes use the street space equally as much as possible, so as to ensure the safety and comfort of traffic areas[3]. In terms of slow traffic, first of all, wide and clean sidewalks should be provided for pedestrians, pavement reconstruction should be used to improve the utilization rate of non-motor vehicle roads, expand the range of walking and rest, and create more road gaps for pedestrians, so as to establish a more complete and smooth slow traffic network[11]. Secondly, special signal lights

should be installed at intersections with large traffic volume for cyclists to judge the road conditions; non-motor vehicle lanes can be marked with special pavement and color stripes to avoid conflicts between non-motor vehicles and motor vehicles. In addition, electric vehicles are common in all cities. To create a comfortable traffic space, it is necessary to handle the driving environment of electric vehicles and coordinate the relationship between electric vehicles and other traffic. On the roads with high bicycle and electric vehicle flow, non-physical isolation can be used to separate the two kinds of traffic to prevent interference between them[3]; At the same time, a certain number of charging facilities can be provided for electric vehicles on both sides of the street in combination with the parking layout of non-motor vehicle lanes.

Table 1 Traffic environment optimization strategy

Optimization category	Optimization strategy	Legend
Motor vehicle traffic	reduce lane width	
	reduce the turning radius of the road	
	change the pavement of intersection	
	raise the intersection	

Slow traffic	wide and tidy sidewalk	
	expand the range of walking rest	
	installation of riding signal lamp	
	special pavement for non motorway	
	some charging facilities are set on both sides of the street	

3.2 Diversified spatial functions

As an important activity space in the city, streets should be a place full of vitality and change, which can bring people passion and fun, and also a public place to promote people's interaction and provide people with a variety of activity experience functions[6]. Especially in the post epidemic era, in order to stabilize the public mood, alleviate social anxiety, provide a street space with diversified functions, which can activate the street functions and stimulate communication between people. Public art activities can be promoted in streets, street art performances can be carried out, public activities that interact with pedestrians can be organized, and urban streets can be beautified and activated by organizing varied activities in limited street space[6]. But at the same time, the organization of activities should also be effectively managed. In addition, pedestrian rest stations can be set up. There is a cool space under the shade of the street trees. If conditions permit, outdoor

dining spaces such as New York Open Restaurant can be set up on both sides of the street (see Figure 2 and Figure 3). This measure not only ensures the economic benefits of restaurant operation and brings employment opportunities, but also provides space for pedestrians to communicate with each other[12]. Finally, movable street facilities can be used to separate different functional spaces, reducing the construction cost of transforming temporary functions of streets; Cancel the height difference between walking and driving, create a shared plane, and provide more space for compatible activities[2].

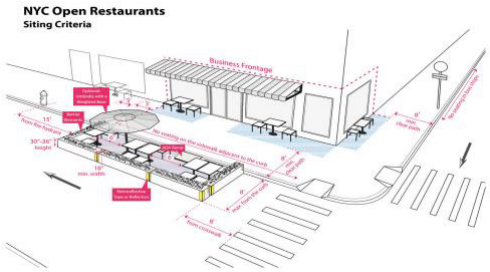


Figure 2 Site selection requirements for outdoor dining area



Figure 3 Street view after the implementation of the temporary outdoor dining plan in New York

3.3 Ordered mode management

In the post epidemic era and even in the economic development in the future, we should build streets where multiple business models coexist. Among them, the effective way to promote the development of street economy is to bring informal commerce into planning and management, and coordinate the relationship between the formal commerce operated by shops and the informal commerce such as street stall operation and opening stores through breaking walls[3](see Table 2). In the face of a large number of informal businesses on both sides of the street, we should take some optimization strategies to build an orderly and diversified business model street. First of all, in the management of street vendors, the local government should combine the local actual situation and formulate reasonable humanized measures to manage street vendors. Through positive guidance, improve the overall quality of stall owners and make management more orderly[3]. For example,

qualified street vendors can obtain permits, register, and check on time. Fixed stall space shall be set aside in the designated area of urban streets for vendors to apply for stalls, and attention shall be paid to time-sharing management[3]. Secondly, with the rapid development of information technology, the Internet, an advanced management tool, can be used to regulate various problems in stall management, and to query and trace all aspects of stall management through big data. Stimulate the positive development of street economy and build streets that are more inclusive of various business models, so as to promote urban economic development.

Table 2 Characteristics and Optimization Strategies of Business Operation Mode

Management model	Category	Characteristic	Optimization strategy
Formal commerce	market restaurant hotel exclusive shop	mandatory high-risk high income	Improve interactivity
Informal business	stall management broken wall stores	low threshold low cost influence the surrounding environment flexible	Improve the quality of stall owners License issuance Regular assessment Separate time operation Fixed the place for operation Information management

3.4 Refined public facilities

In order to create a more comfortable and healthy street space, public street facilities should be optimized according to the current situation[13](see Figure 4). In terms of epidemic prevention and control, the streets should be equipped with necessary disinfection, sterilization and testing facilities to deal with seasonal diseases and sudden epidemics in a timely manner[8]. In addition, disin-

fection function can be added to the design of innovative products to "supplement" the functions of products. Physically, to avoid direct contact between people and equipment, intelligent robots are used to complete disinfection. Induction design is often used, such as sensing doors, sensing faucets and other intelligent, non-contact facilities to actively respond to people's resistance psychology[8]. At the same time, local positive culture can be transmitted to people through public facilities, so that public facilities can play a dual role of physical epidemic prevention and psychological relief. In view of the sudden nature of the epidemic, it is important that the increased epidemic prevention function will not cause unnecessary obstacles to the use of existing facilities[14]. Therefore, we can consider the concept of "combination of peace and disease", that is, the added function modules can be hidden through the invisible structure when not in use[9]. This not only avoids the negative impact on the appearance or perception of facilities, but also plays an appropriate role in epidemic prevention[15].

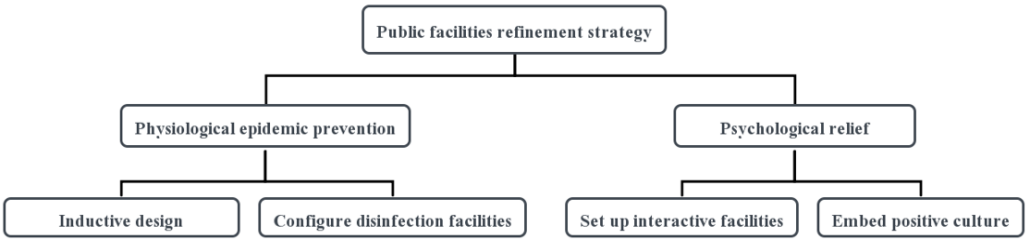


Figure 4 Public facilities refinement strategy

4 Results

The street space design in the post epidemic era should follow the objective law of the development of the times and re-examine the traffic space distribution, diversified functions and refined management design of the street based on people's diversified needs. It is hoped that this paper can provide some new ideas for the optimization and transformation of street space in the post epidemic era, change the previous concept of "car based", attach importance to the slow traffic environment, and provide a comfortable slow traffic environment for residents; use flexible thinking to increase the compatibility of street public space, improve the diversity of street business operation modes through coordinated management, and build a people-oriented, diversified, fair and sustainable healthy street.

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