Research Article

Commercial Value Assessment of “Grey Space” under Overpasses: Analytic Hierarchy Process

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Although the rise of urban overpasses has optimized the urban transport system and improved the spatial structure of the city, the use of space under overpasses has many problems, and they can be dark, short, unpleasant, and abandoned spaces which are full of girders and include ill-shaped areas in some places. This study aims at the recent study of space utilization under overpasses. Taking the Xudong district in Wuhan as an example, the multistandards weight analysis was conducted to evaluate the value of the commercial form of the “grey space” under overpasses and analyzed the feasibility of commercial forms.

1. Introduction

1.1. Background. Increasing urbanization and technology has increased the need for transportation in the developing and changing world, including overpasses. Although overpasses are technologically important means of transportation, landscape architecture recognizes that they also divide the nature into two [1, 2]. A large number of idle and forgotten spaces under overpasses have been bred. At present, dark and neglected, that is, the kind of derelict space that lurks below most highways and elevated roadways. Usually, these spaces are temporally used as green areas, and less and less areas within them are people-oriented designed by considering the human behavior and demand [3].

Therefore, the definition of “urban grey space” is the transitional space between interior and exterior, the main function of which is to integrate indoor and outdoor environments. This paper combines the current status of space utilization under overpasses to give a new definition of “grey space” under overpasses: a space under overpasses that can connect and integrate the various fragmented environmental space of the city. Architects and urban designers consider that these spaces have potential to be transformed into distinguished space having visual pleasure [2, 4–6].

Designing them properly will reduce their frightening, cold, and dark effect and enable people to use them [7–10]. Optimization of them could improve the utility of grey spaces [11].

In recent years, many papers have studied the “grey space” under overpasses to explore new possibilities for land usages and spatial forms. In this paper, a keyword as “space under overpasses” has been used to search the literature from 2006 to 2018. Data have been collated and analyzed graphically, such as Figure 1. From the table, in the past 10 years, most of the literature has been studied on the transformation and utilization of the “grey space” of overpasses from the perspective of service spaces (parking lots, bus stops, etc.) and public spaces (green spaces and sports venues). However, there are not many literatures that delicate on the transformation and utilization of “grey space” under overpasses with commercial orientation. This shows that exploring the utilization and transformation of the space under overpasses from a commercial perspective has certain theoretical and practical values.

The aim of this paper was to evaluate the value and feasibility of the commercial transformation of the “grey space” under overpasses. The research was used to determine and compare the main social, environmental, traffic

FIGURE 1: Literature data analysis.

deconstruction, and economic criteria that are most important with regard to the “grey space.” The indicators, using data from questionnaire interviews, were used to survey residents and pedestrians in the Xudong area of Wuhan city. Basic data were obtained. The analysis was then performed using the AHP method to obtain the weight of each indicator, so as to explore the value of commercial space transformation and possible solution.

This paper attempts to evaluate the commercial value of the “grey space” under overpasses and propose feasible suggestions to improve the current situation of the space under overpasses. They sometimes play an important role in connecting different areas to each other [12]. Some operations and arrangements for strengthening the spatial identity of these spaces and bringing vitality and variety to them are opportunities to make the environment more beautiful.

1.2. Literature Review. Usually, temporary solutions such as green areas are recommended for the spaces under highway bridges [13]. From the perspective of people’s needs, the walls of the piers of the bridge can be colored artistically or illuminated. Market stalls, stations, plantations, cafes, parking areas, or sports areas can be established [14]. Entertainment, recreation, or education spaces can be established for children. Open-air stages can be founded. Buffets or small shopping malls can be established in these spaces. They also can be used as transit passages [15, 16].

In Japan, the space under overpasses in the center of the Tokyo metropolitan area and the downtown area of Futao city are mainly filled with commercial space. Among them, the use of space around Shinjuku Station, Tokyo Station, and Akihabara Station is most famous (Figure 2). Based on the interaction between the rail transit network and the urban spatial structure, some papers analyzed the dominant

utilization mode, dynamic mechanism, characteristics, and functional composition of the space under viaduct of the railway companies and discussed the feasibility of utilizing the space under overpasses via qualitative research methods [14, 17, 18]. The possibility of diversified development provides a reference for the development and utilization of the space.

In the Netherlands [19], the transformed space of the A8 Expressway Park has not lost its original rustic and rough personality, but it is even more charming on this basis. In the park, parking lots and retail (supermarkets, flower shops, fish shops, etc.) are brought together, and the project reconnects to both sides of the town in a completely new way, bringing new energy to it.

It can be seen from the above foreign cases that foreign countries have given full consideration to the real needs of the people. Although they have not quantified the pedestrian experience like the author of this article, in order to search for commercial forms that best meet the needs of pedestrians, they have also combined the expectations and feelings of local residents. In the form of commercial thinking, some of the commercial space designs in Tokyo [14, 17, 18], for example, are based on the perspective of operators and economic benefits. The lack of some considerations on the needs of pedestrians means that business value still needs to be improved.

In China, cities in the process of densifying, however, can no longer afford to ignore such concrete underbellies [20], and the use of space under overpasses is relatively simple. The use of the literature review is used as service spaces (parking lots, bus stops, etc.) and public spaces (green spaces and sports venues). Moreover, the lack of quantification of surveys and needs of residents caused the irrationality of the space. The space that these pedestrians refused or did not desire to stay was actually a dual waste of economy and space [4, 5]. If a survey concerns about the

Project	Type	Site	Line	Shopping	Area	Count
2K540	Cultural entrepreneurship craftsman crafts	Okachimachi	Yamanote	Uena—Asakusa	Taidong District	Tokyo
CHABARA	Gourmet dining	Akihabara	Yamano	Akihabara	Chiyoda	Tokyo
AKB48	Gourmet dining	Akihabara	Yamano	Akihabara	Chiyoda	Tokyo
GUNDAM MAACH	ECUTE, retail, literary creation industry	Kanda	Yamanote	Akihabara	Chiyoda-ku	Tokyo
Anime street	Literary creation industry, animation industry	Ali Satani	Central line	Get WA	Chiyoda-ku	Tokyo
Mall	Retail, catering, leisure	Shinjuku	Yamanote	Shinjuku	Shinjuku City	Tokyo
Otemachi business town	Retail, catering, leisure	Tokyo	Yamanote	Tokyo station	Chiyoda-ku	Tokyo
Marunouchi commercial street	Retail, catering, leisure	Tokyo	Yamanote	Tokyo station	Chiyoda-ku	Tokyo

FIGURE 2: List of JRUD Tokyo space under overpasses development projects.

affection preferences that will conform to the pedestrian preference design, then that should be noted in space and increase the value of commercial space under overpasses. It will achieve a win-win situation both in space and economy.

2. Research Methodology

2.1. Overview. Classifying and collating the research methods in the papers from 2004 to 2017, most of the papers used literature research methods, field investigation methods, observation methods, questionnaire survey methods, and qualitative analysis methods when studying the programs of space utilization under overpasses. There are also a small number of papers that use mathematical modeling methods for analysis, but few authors will quantify people's perceptions and preferences and use quantitative methods and analytic hierarchy process to analyze the needs of pedestrians, as shown in Figure 3.

2.2. Data Collection. The data collection process included the following stages: determining criteria, quantifying the degree of human perception, and issuing questionnaires to collect data.

2.3. Determining Criteria. By analyzing a large amount of literature content, a standard system for assessing business value was determined, and a total of 16 criteria were determined. The major categories of standards are the four categories of standards for traffic (A), environment (B), economy (C), and society (D). At the same time, each major category has subdivided several subcategories, namely, A1, A2, and so on.

FIGURE 3: Summary of research methods.

2.4. Quantification of Human Perception. As the aim of the article was to determine the commercial value of the space under overpasses, the selected qualitative method helped to reveal common attitudes in terms of each criterion. The respondents evaluated each statement based on a five-point Likert scale. Each statement has “strongly agree,” “agree,” “not necessarily,” “disagree,” and “very disagree” that are recorded as 5, 4, 3, 2, and 1 [21], respectively. For example, “If you are doing commercial space under overpasses in the Xudong area of Wuhan, do you feel that there is a reasonable parking space?” There are five levels of perception to choose from. In addition, respondents also need to fill in the following information: age, occupation, frequency of passing through overpasses, awareness, and demand for the space under overpasses, all of which may reveal people's demand.

TABLE 1: Research questionnaire.

Aspect	Questions	Strongly agree	Agree	Normal	Disagree	Strongly disagree
Traffic influences	I think it is important to arrange parking location reasonably.	☐	☐	☐	☐	☐
	I think it is important to have easy access to public transportation.	☐	☐	☐	☐	☐
	I think it must have a reasonable walking environment.	☐	☐	☐	☐	☐
Environmental influences	I think it is important to have a noise protection in the environment.	☐	☐	☐	☐	☐
	I think air quality should be good.	☐	☐	☐	☐	☐
	I think there are corresponding green plants and landscape settings.	☐	☐	☐	☐	☐
Social influences	I think it is a comfortable and safe space.	☐	☐	☐	☐	☐
	I think it has safety and low crime rates.	☐	☐	☐	☐	☐
	They have night-time street lightings.	☐	☐	☐	☐	☐
	I think a cultural space is essential.	☐	☐	☐	☐	☐
	I think it should have municipal auxiliary facilities.	☐	☐	☐	☐	☐
	Entertainment is necessary.	☐	☐	☐	☐	☐
Economic influences	I think it can service providing community-based activities.	☐	☐	☐	☐	☐
	I think it should have some retail and service industries.	☐	☐	☐	☐	☐
	I think it should have certain time period for business activities	☐	☐	☐	☐	☐
	I think it should have incentives for small and medium businesses.	☐	☐	☐	☐	☐

2.5. Questionnaire Issuance. A total of 150 Wuhan residents were surveyed. The samples were distributed and collected in Xudong district of Wuhan city for data collection. The research questionnaire can be seen in Table 1.

2.6. AHP Based on Questionnaire Data. The data were calculated using YAAHP (Analytic Hierarchy Process Package) and SPSS (Statistical Package for the Social Sciences) software which are suitable for processing and working with collected data, its analysis, and the determination of data correlation. YAAHP uses the analytic hierarchy process (AHP) to provide model construction and calculation through the input decision matrix and analyzes the weight of each standard. The data obtained during the survey were processed with YAAHP V10, SPSS 19, and Microsoft Office Excel 2007.

2.7. Presentation of Data Analysis with SPSS. Obtain data through questionnaires, import SPSS, and assign values to A1, A2, . . . , D2, and D3 through the variable view. "1 = most important, 2 = not important, 3 = important, 4 = more important, and 5 = very important." After the preliminary quantification of the questionnaire in the data view, 200 items of total data and 150 items of valid data were obtained.

Analyze the valid data (150 items) and select analyze to data reduction to factor, descriptives, coefficients under the correlation checkbox, extraction, screen plot in the display checkbox, and scores to select the display factor. Score coefficient matrix; point Rotation, select Varimax under the method checkbox, and finally obtain the result of the principal

component analysis (including frequency, percentage, effective percentage, and cumulative contribution rate).

For example, by obtaining the average value M of each A1, A2, . . . , D2, D3, it is calculated that A1, A2, and A3, respectively, account for the specific gravity of the entire A (B, C, and D are the same), and A1, A2, . . . , D2, D3 are obtained.

2.8. Using YAAHP's Method and Steps. Input 16 items into the hierarchy model, according to the scores of A1, A2, and A3, get the ratio of A1, A2, and A3, list the matrix of standard items of each major class, list the matrix of the major categories, mathematical calculations through the software, and finally get the weight of all the small items, as shown in Figure 4.

3. Results

3.1. Criteria System for Appraising the Value of the Space under Overpasses and Criteria Weights. In the previous discussion on the commercial value of overpasses in Xudong district of Wuhan, we discovered that there are four crucial criteria which play an important role in establishing the commercial space under overpasses through research and search online, paper, and books. The four criteria are traffic, comfortable and entertain environment, economic conditions, and society. Therefore, while we assess the commercial value under overpasses, we used these four criteria of transportation, environment, economy, and society:

FIGURE 4: (a) Matrix of standard items. (b) Rating sheet of a five-point Likert scale.

3.2. Traffic Criteria

A1. Parking Lot. A good parking lot, including reasonable parking space layout and reasonable parking fee, can attract more people and improve the local economic benefits. Therefore, establishing a comfortable business environment requires a certain amount of comfortable parking lots.

A2. Public Transport Accessibility. People always go to the places which are convenient and accessible. Thus, commercial space under overpasses needs to be closely integrated with public traffic which affect people a lot whether they go to the place or not [22].

A3. Reasonable Pedestrian Flow. People can go through under overpasses. However, the path that people walk under overpasses is usually greatly reduced due to the division of the ground road. Reasonable pedestrian flow lines are conducive to the access to the space under overpasses [23]. These are very important to the good open commercial spaces located under overpasses.

3.3. Environmental Criteria

B1. Noise Protection: Protection against Vehicle Noise. Due to growing urban automobilization, city centers have become abundant with cars, which has resulted in noisy streets. Particularly, the space under overpasses which has already tightly integrated with the road is seriously affected by the noise. Good commercial open spaces should be areas where people enjoy spending time and want to return [24], but the noise definitely brings bad influence into these areas. So, successful open commercial spaces should be protected against vehicle noise [25].

B2. Air Pollution: Protection from Road Transport Pollution. Due to growing urban automobilization, city centers have become abundant with cars, which has resulted in streets becoming polluted with dust and gas. According to the European Economic and Social Committee (ECO/273, 2010) [26, 27], air pollution caused by vehicles is considered to be the most severe issue in major cities [28, 29]. So, good open commercial spaces,

especially the places integrated with busy road, should be protected against pollutants emitted by vehicles.

B3. Presence of Trees and Green Zones. The “grey space” under overpasses often plays an important role as beautifying city and mitigates the existence of urban pollution. The spaces under overpasses which are used as commercial spaces are very necessary to plant more green plants for the reason that they can beautify the urban environment and reduce urban pollution, and the other reason is it can make people feel more comfortable.

B4. Clean Environment: Recycling Bins [30] and Tidy and Clean Streets and Footpaths. good pedestrian zones are comfortable. Comfort encompasses cleanliness among other things while recycling bins are required to conserve the environment; thus, they are important for the sustainable use of the places, no matter where they are.

3.4. Social Criteria

C1. Comfortable and Safe Space. Open commercial environment is the space adapted for relaxation and recreation [31]. And many people believed that those places should be comfortable and convenient. Comfort also encompasses the understanding of safety as well as the areas for walking, recreation, sitting, and watching.

C2. Safety and Low Crime Rates. A good public space must ensure the feeling of security and have protection against traffic and possible crimes [32].

C3. Night-Time Street Lighting. Lights provide a sense of safety and protect against accidents (such as stumbling on the footpath) in the night time and help to find the way. Thus, good pedestrian shopping zones should be lit.

C4. Cultural Space. Aesthetic appearance of the streets and buildings and architectural and cultural heritage monuments and their preservation—good public spaces should be of high aesthetic quality. And these high-quality public spaces will directly affect people's experience.

C5. *Municipal Auxiliary Facilities.* Most of the municipal auxiliary facilities in China are temporarily located at some places which are always narrow or not eye catching because of the limited land use [33], for example, some small-scale administrative office buildings, warehouses, equipment rooms and other auxiliary houses. And the space under viaduct can solve this situation.

C6. *Entertainment.* Attractive space for entertainment, culture, art projects, city festivals, fairs, and other events—a good public space, should offer meaningful activities. This means entertainment things encourage people to return. The review of various studies has shown that people depend on the functional, social, and leisure activities provided on the streets as well as their attractions.

C7. *Developing Communities.* The space under overpasses can be used as a complement and extension of urban public services providing community-based activities, encouraging community residents to interact, and improving neighborhood relations. As an interactive space, these spaces further enhance community exchange and provide opportunities to discuss and improve.

3.5. Economic Criteria

D1. *Retail and Service Industry.* Some overpasses are located on busy places which have lifestyle roads on both sides and which mean that people have great demand of retail and service industry. And the utilization of the under space of overpasses can develop the business environment. On the other hand, it can also provide variety of shopping modes.

D2. *Certain Time Period for Business Activities.* Some business activities have certain time limited, such as small business units, food and beverage stores; both of this need a relatively stable and maintained environment [34, 35]. Turn the point to bazaar, it is more time-critical and it is not strict with external sound and the light environment. No matter what activities it takes place, all of this business activities tend to densely populated, which means that this situation is more suitable for the busy environment.

D3. *Incentives for Small and Medium Businesses.* Business zones contain many business opportunities since frequent visits by people and walkability allow businesses to grow.

3.6. Evaluation of Commercial Value of “Grey Space” under Overpasses in Xudong Area

3.6.1. *Investigation and Use of Space under Overpasses.* In order to determine how city resident use and view space under the Xudong overpass in Wuhan, a survey was conducted with 150 residents.

The basic information of the respondents is as follows.

FIGURE 5: Age distribution of respondents.

FIGURE 6: Occupational distribution of respondents.

As is illustrated in Figures 5 and 6, respondents' ages involve various stages, and they also have different occupations. The majority of respondents are students who are the main group of consumers in this area and the representative of young ideas. Students may be more capable to express the rational utility of the “grey space” under overpasses.

First, we tried to determine which sociodemographic groups visit space under overpasses and for what purposes.

It was found that only 26% of the respondents had passed the space under Xudong viaduct three times a week, while 24% said they had three to five times. At the same time, almost half of the residents visit the space only three to five times a year, as shown in Figure 7.

The data provided in Figure 8 show the purpose of the interviewee's visit to the Xudong district. Thirty percent of residents come here for leisure, entertainment, and

FIGURE 7: Distribution of respondents by frequency of passing overpasses.

FIGURE 8: The distribution of the purpose of the route to Xudong area.

participate in cultural activities. 20% of residents come here for shopping. At the same time, 30% of the residents are driving through the area or transferring here. The remaining 20% is for work needs or other factors to come to the Xudong area.

3.7. Data Analysis of Questionnaire Survey. In order to determine how the respondent perceives the commercial value of the space under overpasses based on the above criteria, it is necessary to determine the importance of the standard. Respondents' evaluation criteria determine the importance of the five-point Likert scale, with 1 being the "least important" and 5 being the "most important."

In terms of traffic factors, according to Figure 9, the respondents generally value the traffic factor, and public transport accessibility (A2) is considered to be the most important factor, and the effective percentage reaches more than 60%. Secondly, it is considered that the appropriate population streamline (A3) is more important.

FIGURE 9: Evaluation of traffic factors.

In terms of the environment, according to Figure 10, the respondents also attached great importance. The cleanliness of the commercial space (B4) among many environmental factors is what the most people care about, and the percentage is as high as 56%. Secondly, it is considered that the appropriate tree planting (B3) and clean air quality (B2) are more important.

In terms of society, as shown in Figure 11, most respondents believe that safety and low crime rate (C2) and night-time street lighting (C3) are more important, and the effective percentage is more than 40%; secondly, it is considered suitable for relaxation and leisure (C1), cultural space (C4), and municipal ancillary facilities (C5) are more important; a few interviewees think that social public activities (C6) and development community activities (C7) are more important.

In summary, in terms of society, the respondents are more concerned with security, low crime rate, and night-time street lighting, followed by leisure and cultural space and municipal facilities.

In terms of economy, according to Figure 12, most respondents believe that the retail and service sector (D1) is the most important, with an effective percentage of more than 30%; secondly, it is more important for time-consuming business activities (D2) and incentives for small and medium enterprises (D3). The effective percentage is about 20%.

In summary, the procedure determines that public transport accessibility (A2) and appropriate pedestrian flow (A3) are the most important traffic standards; clean environment (B4), presence of trees and green spaces (B3), and air pollution (B2) are the most important environmental standard; safety and low crime rate (C2) and night-time street lighting (C3) are regarded as the most important social standard; retail and service industry (D1) is regarded as the most important economy standard.

After integrating the evaluation scores in the questionnaire, the author used YAAHP to formulate a value weight evaluation and entered the data of 4 categories and 16 subcategories into the software, as shown in Figure 13.

Table 2 presents the assessments of the importance of traffic, environmental, economic, and social criteria. From

FIGURE 10: Evaluation of environmental factors.

FIGURE 11: Evaluation of social factors.

FIGURE 12: Evaluation of economic factors.

the table, it can be seen that the traffic criteria are most valued by the respondents, which account for 0.34 of the total criteria. The second is the environmental criteria. The final weight of the economic and social criteria is basically the same.

Then, compare the criteria in each subcategory by two to get the matrix table, such as Tables 3–6.

Finally, the weighting criteria of the 16 categories are integrated, and the ranking of all the subcategories from the highest to the lowest is given in Table 7.

According to the ranking table of weights, the top five criteria determining commercial values are suitable

pedestrian flow (A3), public transport accessibility (A2), clean environment (B4), retail and service industry (D1), and safety and low crime rates (C2). The use of commercial forms to transform the “grey space” under overpasses, convenient parking and arrival methods, and the sale of retail-based spaces with a safe sense of experience is an effective commercial space to attract people.

4. Summary

Through the above investigation and analysis, from the perspective of residents’ needs, some conclusions relating to the use of commercial space in the utilization of the “grey space” under the Xudong Viaduct were obtained.

The purpose of the residents to the Xudong area: according to the survey, the purpose of residents near to Xudong is primarily entertainment and shopping; this is because the Xudong area itself is located in the city center area and has a mature business environment [36]. However, this also proves to some extent that the utilization of grey space under Xudong viaduct has great potential for economic value.

The result of standard weights from the perspective of residents: residents think that the four elements of the commercial space under the elevated framework are more concerned with the transportation and environmental factors. Among them, the pedestrian flow line suitable for A3 is the most important, followed by A2 public transport accessibility.

FIGURE 13: Evaluation system.

TABLE 2: Comparison of criteria importance.

Criteria	Weight
Traffic criteria	0.3465
Environment criteria	0.2463
Economic criteria	0.2036
Social criteria	0.2036

TABLE 3: Matrix of traffic criteria.

Traffic	A1: parking lot	A2: accessibility of public transport	A3: right line of people
A1: parking lot	1	0.3333	0.3333
A2: accessibility of public transport	3	1	1
A3: the right line of people	3	1	1

TABLE 4: Matrix of environment criteria.

Environment	B1: noise protection	B2: air pollution	B3: existence of trees and green spaces
B1: noise protection	1	0.5	0.5
B2: air pollution	2	1	0.5
B3: the existence of trees and green spaces	2	2	1
B4: clean environment	8	7	2

Impact of traffic factors on the use of commercial space under overpasses: when using elevated grey space, the control of pedestrian flow lines is very important.

At present, the pedestrian line is very simple under the elevated frame, and the grey space under the elevated frame provides a horizontal traffic flow for people as the function of the traffic island [37, 38]. This paper will further illustrate the need to pay attention to pedestrian flow to make a better and suitable commercial space overpass [39, 40].

Impact of environmental factors on commercial space utilization under overpasses: residents believe that the environment has a greater impact on the value of commercial space under overpasses, and the B4 which is the clean environment is considered to be the most important factor.

This has some implications for thinking about how to set up trash sites and trash transport. Since the grey space under overpasses is generally due to the use of motorway roads on both sides, there are many restrictions on its use. If a clean environment has a significant impact on its commercial value, special waste site design is necessary.

The impact of economic and social factors on the use of commercial space under overpasses: despite the economic and social factors as a whole, the weights are basically the same, but the D1 retail and service industries in the economic factors are more important than the weights.

In other countries, shopping opportunities attract more tourists, and the retail industry and service industry have a pivotal position in numerous shopping opportunities. As mentioned earlier, this will also provide opportunities for the development of scattered industries in the urban areas. In terms of social factors, C2 security and crime rate ranked fifth. The weights of these five factors are all in the range of 0.09–0.15, and there is a leapfrog in the sixth factor. Therefore, we consider these five factors (A3 is suitable for the pedestrian flow, A2 is accessible for public transportation, B4 is a clean environment, D1 is retail and service

TABLE 5: Matrix of social criteria.

Social	C1: space for relaxation and leisure	C2: security and low crime rates	C3: night-time street lighting	C4: cultural space	C5: municipal ancillary facilities	C6: public activities	C7: development of community activities
C1: space for relaxation and leisure	1	0.1667	0.3333	2	2	1	3
C2: security and low crime rates	6	1	3	7	7	6	9
C3: night-time street lighting	3	0.3333	1	4	4	3	7
C4: cultural space	0.5	0.1429	0.2500	1	1	0.5	3
C5: municipal ancillary facilities	0.5	0.1429	0.2500	1	1	0.5	3
C6: public activities	1	0.1667	0.3333	2	2	1	3
C7: development of community activities	0.3333	0.1111	0.1429	0.3333	0.3333	0.3333	1

TABLE 6: Matrix of economic criteria.

Economic	D1: retail and service industry	D2: period of business activities	D3: incentive measures for SMEs
D1: retail and service industry	1	4	5
D2: period of business activities	0.25	1	2
D3: incentive measures for SMEs	0.2	0.5	1

TABLE 7: Comparison of criteria importance.

Number	Criteria	Weight
A3	Reasonable pedestrian flow	0.1485
A2	Public transport accessibility	0.1485
B4	Clean environment	0.146
D1	Retail and service industry	0.1391
C2	Safety and low crime rates	0.0927
B3	Presence of trees and green zones	0.0536
A1	Parking lot	0.0495
C3	Night-time street lighting	0.0448
D2	Certain period time of business activities	0.0407
B2	Air pollution	0.0276
D3	Incentives for small and medium businesses	0.0238
B1	Noise protection	0.019
C6	Entertainment	0.0184
C1	Comfortable and safe space	0.0184
C4	Cultural space	0.0117
C5	Municipal ancillary facilities	0.0117
C7	Developing communities	0.006

industries, and C2 is the security rate) are the most important.

Based on the results obtained in this study, the conclusions are as follows.

First, due to the large traffic volume under some overpasses, especially in the Xudong area, people pay more

attention to the destination accessibility, that is, vehicle routes and comfortable pedestrian which are crucial. If there is a better view of corridor, pedestrian instructions, and route guidance, it will be more efficient to guide pedestrians to start a purposeful or accidental journey with intensive interests in the space which is fun and convenient to access.

Secondly, the clean environment is particularly important because of the poor air quality in the space under overpasses due to the driving function and the growing awareness of health in modern people. If the space is decorated with green plants or the air purification system, it will visually and psychologically relieve the discomfort of pedestrians and add extra points to the attractiveness of the space.

At the end, since large-scale commercial and catering models are not only spatially unsuitable for space under overpasses but also burden the road on the traffic stream, the retail and service industries are more suitable in the form of business because the space under overpasses is more interesting and contingent for pedestrians who will visit the store with interest and curiosity and prefer the impulsive consumption. Small-scale retail shops in retail form have an advantage in determining purchase time and purchase difficulty, so a variety of small service industries, such as small coffee houses and tea houses, are more attractive to consumers for a short stay and a human-oriented open space, thereby maximizing business benefits.

It is particularly important to note that the Xudong area is regional, which is in the commercial center, and the traffic volume is large. Safety and traffic indicators are particularly important for residents, so two criteria such as A3 reasonable pedestrian flow and C2 safety and low crime rates rank high among 16 criteria. Therefore, the criteria C2 safety and low crime rates can be selectively weakened in the areas where the traffic flow is not large. However, other criteria should be suitable for any region. In the commercial area, the space under overpasses should pay more attention to the traffic criteria (A) and social criteria (D). Meanwhile, economic criteria (C) and social criteria (D) play an important role in the areas near the community. Above all, all areas should value high of environmental criteria (B).

This paper explores five important factors for the commercial space utilization under overpasses in the commercial

area. According to these factors, the corresponding suggestions are given. That is, if the commercial space is used to transform the “grey space” under overpasses, the convenient parking and arrival method will be sold. The space that is dominated by the retail industry and has a safe sense of experience is an effective commercial space that attracts people to use.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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