

Japanese Ways of Developing Urban Underground Recreation Space

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Abstract

This paper defines the concept of urban recreation space at first, and then focuses on the six aspects of experience in functional orientation, joint development, business planning, environment designing, recreational route designing, operation and management based on reviewing the development process of the underground street in urban recreation space in Japan. The results show that the overall planning and detailed design of urban recreational space in Japan is worth learning and drawing lessons for all countries in the world.

Keywords

Japanese Way, Develop, Urban, Underground Recreation Space, Tourism

1. Introduction

Recreation space is an important component of leisure culture and a place where people engage in leisure activities. It originated from the restroom in the western developed countries in 18th century because of the development of the city. It was extended from the original library, cafe and music room to the later city street park, sports field and holiday tour. In the early 20th Century, recreational space became an essential part of urban construction and planning. After 60 and 70s of 20th Century, the planning and design of recreational space and the diversity of modes became one of the criteria for measuring the quality of life in a country. In particular, with the rapid development of urbanization and the increase of leisure time, it is becoming more and more important for developing the recreation space to meet the growing cultural and spiritual needs of the people, and it is significant to enrich the people's leisure life.

Urban recreation is a concept different from tourism, which is formed along

with the development of cities. According to the form of space, there are two ways to divide urban recreation: one is inside recreation and outside recreation; the other is ground recreation and underground recreation. Among them, underground recreation is the most easily ignored but the most important concept. As everyone knows, the significance of a city lies in gathering. When the city reaches a certain level, it will inevitably appear underground recreation space. The underground recreation space plays a key role in enriching the recreational life of urban residents, improving the quality of urban residents' life, improving the image of urban tourism and prolonging the stay time of tourists.

Japan is the first country to develop the urban underground space, beginning with the underground street of Tokyo Ueno railway station, which was built in 1930 and opened the curtain of the large-scale development of underground space. At first, the purpose of developing underground street was to solve the traffic problems on the ground and to accommodate vendors who were out of business on the ground [1]. During the Second World War, Japan's exploration of underground space remained basically in basement and underground air raid shelter construction. After the war, Japan's economy developed rapidly. Under the macro background of urban renewal, transformation and redevelopment, the construction of underground space had developed rapidly.

The territory of Japan is small, with a large population and uneven distribution, and nearly half of the population in the country is concentrated in the three metropolitan areas with the core of Tokyo, Osaka and Nagoya. The exploration of underground space has gone through more than 80 years in Japan. It has begun in the developing of underground shopping street, starting from the underground passage setting simple commercial facilities, and has developed into an underground space system with gradual expansion of construction scale, gradual improvement of function, and more systematic and more open space [2]. Up to now, Japan has formed the underground space development model composed of subway, underground city complex, common ditch and deep underground space development, and the three-dimensional city image formed by the design and design of underground space has obtained very excellent achievements. All countries in the world deserve to learn from Japan's successful experience. Therefore, this paper will discuss the developing ways of underground recreation space in Japan.

2. Development Process of Underground Recreation Space in Japan

The development of underground recreation space in Japan originated from underground pedestrian passageways for pedestrians crossing the street, and its development process can be roughly divided into three periods.

Period 1: Before the World War Two

At first, there were no commercial facilities in the underground passageway. Later, a number of advertisements and indirect commercial applications appeared. Then, a counter on both sides of the street was added to the streets to

start selling goods and increased the function of the trade. The monotony and darkness of the underground streets became prosperous and vibrant like the streets on the ground. In 1930, the first underground street appeared in Japan, namely, Ueno Railway Station Underground Street.

After 1930s, railway transportation was transferred to the underground with the form of subway in many large cities in Japan. Many stations brought unlimited business opportunities, promoted the joint construction of subway stations and commercial facilities, further stimulated the development of underground streets, until the outbreak of the Second World War.

Period 2: from the World War Two to 1980s

After the Second World War, the underground shopping street in Japan was once depressed, but the street vendors were increasing, and even a lot of street vendors were illegally occupying ground public places. The government had to make decrees to manage the ground square of the station, and the street vendors began to move underground, thus let the underground shopping street keep developing.

Since 1960s, Japan began to enter the period of rapid economic growth. With the rapid development of vehicle traffic and the serious shortage of urban public parking lots, the high land price limited the construction of the ground parking lots. People put the parking lot underground, and unified planning and unified construction with the underground street, so the underground street had been widely built, and it had entered the boom period of the construction of the underground street [3]. Tokyo YAESU Underground Street is one of the representatives (**Figure 1**).

At the beginning of 1960s, in order to meet the needs of the increase of railway passenger, the New YAESU Station was built on the other side of the Marunouchi station. As the main station, it was named Tokyo station. At the same time, a three-dimensional redevelopment near the two stations was redeveloped, and the YAESU Underground Street was built at the YAESU Station Square and a section of the YAESU Avenue leading to the Ginza. The underground street was built within two periods (1963-1965 and 1966-1969). It was once a large underground street in Japan with a total area of more than 70,000 square meters, plus a connected basement, with a total building area of 96,000 square meters. There were 4 recreation space: "Flower Square", "Stone Square", "Light Square" and "Water Square" in the underground street.

Period 3: from 1980s to the present

In 1980, a gas explosion occurred in the golden underground street in Shizuoka, Japan. This disaster prompted the Japanese government to set up a series of standards and system to restrict the construction of underground streets and reduce the number of underground streets in the newly developed cities, but the scale of the single underground street was increasing, the quality of the design was better, and the disaster resistance was becoming stronger and stronger. At the same time, in the legislation, planning, design, management and other



Figure 1. Streetscape of Tokyo YAESU Underground Street. Source: Official website of Tokyo YAESU Underground Street.

aspects, a sound underground street development and utilization system has been gradually formed.

For example, CRYSTA Nagahori was one of the few underground streets built in 1990s in Japan. It was located in the city of Osaka, with a total length of 760 meters, a total of 82,000 square meters, and 4 floors in the underground. It was one of the largest underground street in Japan so far. There were 100 shops in the shopping street, and 1030 parking spaces in the underground parking lot. Although the function and content of CRYSTA Nagahori Underground Street are not much different from the traditional underground street, it emphasized the construction art, safety and disaster prevention and various service quality (Figure 2).

From the beginning of the 21 century, the underground recreation space was developing in a more systematic and orderly way with the progress of construction technology and the maturity of management methods (Table 1). The relationship between underground space and ground space had been changed from subsidiary and complementary to interdependent and harmonious symbiosis, such as Tokyo Roppongi Hills.

Tokyo Roppongi Hills, also known as Newtown of Roppongi Hills, is an urban complex which is built on the slope of the city core of Tokyo, covering an area of 11.6 hectares and gathering many buildings and landscape facilities, such as hotels, houses, movie cities, TV stations, art centers, residential squares, parks, business, culture and so on. It also integrates elements of culture, leisure and entertainment in addition to meeting the basic functions of cities such as work, residence and transportation. It combines the terrain with the stairs, ramps, platforms, corridors, courtyards, roof garden and other facilities to integrate the



Figure 2. Streetscape of CRYSTA Nagahori Underground Street in Osaka. Source: Official website of CRYSTA Nagahori Underground Street.

Table 1. An overview of underground recreation space development in Japan.

Name	City	Completion year	Scale/m ²
Ueno Railway Station Underground Street	Tokyo	1930	unknown
Ikebukuro Underground Street	Tokyo	1957	16,000
Namba Walk Underground Street	Osaka	1957	unknown
YAESU Underground Street	Tokyo	1966	6400
Kabukicho Underground Street	Tokyo	1973	38,000
Tenjin Chikagai Underground Street	Fukuoka	1976	22,000
Central Park Underground Street	Nagoya	1978	56,000
Diamor Osaka Underground Street	Osaka	1995	40,500
Crysta Nagahori Underground Street	Osaka	1997	81,800
Yokohama MM 21 (urban complex)	Tokyo	1997	496,000
Chikaho Underground Street	Sapporo	2001	Unknown
Sakae Underground Street	Nagoya	2002	Unknown
Tokyo Roppongi Hills (urban complex)	Tokyo	2003	760,000

Source: Compiled from public information.

underground space, ground space and upper space into the multi-layer basic public space. In addition, it has promoted the cultural taste of the whole environment by combining environmental facilities such as landscape sketches, rest seats and other environmental facilities and public art, so it is called “city mall”, “three-dimensional city” and “art city” [4].

3. Japanese Experience of Developing Underground Recreation Space

3.1. Functional Orientation

Urban recreation space is a city space with recreation function and certain recreation facilities, which is a part of urban public space. From the literal meaning, recreation function should be the primary function of urban recreation space. However, the concept of recreational function is very rich. It includes many functions, such as sightseeing, leisure and entertainment, commercial shopping, cultural dissemination, and so on. In the previous discussion, the urban underground recreation space in Japan is evolved from the underground street. Its original function is mainly the function of the channel, which is convenient for people to cross the street. Later, with the continuous development of urban construction, the development of urban underground street in Japan is gradually transferred from channel function to commercial, parking, transportation, exhibition, leisure and entertainment, cultural communication and other functions, which are the main functions of the modern urban underground recreation space [5]. Therefore, the typical underground streets in Japan are composed of three main parts, such as the part of the walking traffic, the part of the store and the parking lot, and the auxiliary parts of the machine room and the management room. The pedestrian traffic part includes the passageway, square, entrance and exit, and the auxiliary parts, such as the air conditioning room, power generator room, distribution room, pump room, central control room, disaster prevention center, computer room, value class room, warehouse, toilet and so on.

The underground recreation space dominated by underground streets is actually an underground complex, including the main facilities such as walking passages, shops, parking lots, and the underground space of some surrounding buildings, subway stations, or railway stations. The underground street is usually set up with the parking lot and the subway station, forming a network of pedestrians and parking lots between the underground street and the surrounding large-scale buildings, railway stations and so on, thus forming a large gathering point of the city. Now the underground street is in 21 major cities in Japan, with a total area of about 1 million 100 thousand square meters, of which about 8 are concentrated in the metropolitan area. In the underground streets of Tokyo, the proportion of parking places is like that of public pedestrian passages and shops. The construction of underground walk and underground car parks combined with underground streets can improve the surface traffic under the condition of less expansion and expansion of urban roads. Because of the underground transfer, shopping in the underground, parking in the underground, the underground street attracts a lot of people to underground activities, the problems of mixing people and cars on the ground is easily solved. The urban underground recreation space has developed into the underground city from the simple underground street, and the recreation function has also expanded into the com-

prehensive function mentioned earlier, which is more in line with the needs of the development of modern urban recreation space.

3.2. Jointly Developing

At the beginning, the urban underground recreation space in Japan is completed by the government, and it is taken to cooperate with the large public construction of the city, such as the reconstruction of the station, the expansion of the subway, the construction of the underground parking lot, or the relaxation of the ground traffic to carry out the underground street development. Because the underground street is a public facility aimed at traffic and safety, it is not for commercial interests, so there are not many development institutions in the society, and the development of underground recreation space is completed by the government directly. At that time, the development cost mainly focuses on the construction cost of underground streets, and the cost of land has not yet become the main reason for the impact. However, the government led situation had changed since 1955, and the large-scale project based on the underground street was beginning to appear. The underground street is no longer just for the construction of the city. The people begin to think that the investment in the underground street is profitable, and it takes an active part in the project of the underground street. The underground street has become a popular business of the government and the private sector for a time and has promoted the large-scale development of the underground street. Since then, the joint development of the government and the society or the joint development of social capital has begun to develop the underground recreational space of the city. The government has special departments and special budgets to develop underground recreation space. At the technical level, there are other special teams to manage. Japan's development of underground recreational space is very strict. Approval of certain projects needs to be deliberated by the Congress and decided by the prefectural or municipal councils step by step. After the approval of the government, specific planning, design, review, licensing, and construction procedures are introduced, and the programme is to be submitted to the Urban Planning Commission for consideration by the Urban Planning Commission.

For example, during the developing Fukuoka's underground street (**Figure 3**), a joint development company was set up at the time when the government developed the underground street of Tenjin Chikagai, including 41 companies and shareholders, and the government took up 50% of the shares. In the construction step, the government dispatched 30 teams to the joint company by various departments. These people were professionals of various departments of the government, including funds plan, planning and design, engineering technology, project construction, administrative things and so on. From the plan to construction, the project will be supported by the technical support, not only to carry out the government's intention, but also to assist the joint company to deal with the relevant approval and licensing procedures. These people had been



Figure 3. Environment designing of Diamor Underground Street. Source: Official website of Diamor Underground Street.

working until the project was completed and put into operation, and then went back to the government departments or follow up another project. During the construction of underground streets, their wages were paid by the joint company.

Another example, during the development of Tokyo YAESU Underground Street, the Tokyo government used the bidding to sell the underground space franchise at first, a total of 7 companies to bid to invest in the construction of the project. Because of the number of bidders, the Tokyo government suggested that 7 companies jointly set up the project for a company to invest in the project, and 7 to bid by negotiation. The company co-sponsored the establishment of an enterprise legal entity, YAESU Underground Street Co, to jointly invest in the construction of underground streets, sharing interests and risks.

3.3. Business Planning

The underground recreation space, which is based on the underground street, is a collection of small and medium retail stores and middle and low grade dietetic stores, which are arranged in the form of shopping street, different from the underground stores in the large department stores, and the management mode is mainly distributed by the dispersed lease. In general, the proportion of business in urban underground street is very small, because the number and scale of the underground street are limited after all, compared with the whole city, but from the local area of the underground street, the commercial agglomeration plays a rich and complementary role in the business of the underground street. Underground streets are very attractive to consumers because they are convenient and comfortable, especially if they are not affected by climate conditions, and more customers are on rainy days or snowy days.

The biggest consumption characteristics of Japanese underground street are immediacy and convenience. All types of service facilities are visible everywhere, and tourism consultation is especially developed. The main types of shops are clothing, shoes and hats, cosmetics, groceries, cultural supplies, leisure food, food and beverage, bookstore, supermarket, western cake house, coffee shop, electric store and so on. Because of the different location, the proportion of commercial types may be different. For example, in the underground street in Osaka, Crysta Nagahori, the proportion of food and beverage is 35.3%, while in the underground street in Nagoya, the proportion of clothing is 35.3%. Even in the same city, there may be great differences in the layout of business types (Table 2).

3.4. Environment Designing

The comprehensive recreational function of the urban underground recreation space attracts a large number of people. For example, Crysta Nagahori Underground Street in downtown of Osaka has an average of 1 million 500 thousand people every day (more than half of the population of Osaka) to shop, walk-through, wander, and so on. It is also due to a large number of people walk in and out of the street every day, the effect of the business of the underground shops is very good and the rent income is high, which attracts the investment to develop underground street to show the financial, technical and new design ideas. In order to make the underground street be a bright, spacious, changing and interesting space, the Japanese city breaks the original closeness of the underground street and let the natural light enter into the underground street. Nowadays, the most successful point of Japanese underground street is that it has the same environmental level as the ground.

For example, Diamor Underground Street in Osaka has a safe and comfortable recreation space that meets people's diverse needs for roads. Spacious roads, high wells, 14 meters wide passageway, towering skylight form a personalized underground space, and blue sky and white clouds can be see through the

Table 2. Comparison of business types in underground streets between Nagoya and Osaka.

	Nagoya		Osaka	
	Sakae	Central Park	Diamor	Crysta Nagahori
Clothing	22(18.0%)	52 (47.3%)	52 (19.5%)	72 (23.3%)
Shoes, hats and cosmetics	10 (8.2%)	15 (13.6%)	43 (16.2%)	41 (13.2%)
Cultural supplies	8 (6.6%)	20 (18.2%)	22 (8.3%)	42 (13.5%)
non-staple foodstuff	39 (32.0%)	3 (2.7%)	38 (14.3%)	34 (11.4%)
Restaurant food & beverage	35 (28.7%)	17 (15.5%)	97 (36.4%)	109 (35.3%)
Others	8 (6.5%)	3 (2.7%)	14 (5.3%)	10 (3.2%)
Total	122 (100%)	110 (100%)	266 (100%)	308 (100%)

Source: compiled from public information in Japan.

skylight, so as to feel the natural warmth of the underground space. Although it is under the ground, it has a strong sense of openness; 4 streets are decorated with different colors of marble and stone bricks, such as store street, leisure street, comprehensive shopping street, fashion street, etc., and there is a wide circular square at junction point of the 4 streets. In the round square, there is a service center in Osaka, where you can get a lot of travel information. There are more than 100 stores which are popular fashion-oriented grocery stores and restaurants. Shops have a uniform and bright decoration style, most shops have no doors except some catering facilities, newspapers and other service facilities. Besides, landscape sketches that highlight the local culture of Osaka can be seen everywhere in the underground streets, and the marble patterns on the ground also indicate the direction.

Another example, Tenjin Chikagai Underground Street in Fukuoka, creates a comfortable shopping environment with the tone of iron carving, brick and stone, reminding consumers of the style of southern Europe in 19th century (Figure 4). Street 1-6 creates a very comfortable and noble business atmosphere with color glass of the style of North Central Europe. In the new underground street of No. 7 - 12 street, there are natural lighting squares and the roof of the road like tree shaded trees. With the appropriate brightness, the whole street is filled with the atmosphere of southern Europe. All these aims to leave a deep historical and cultural atmosphere for the next generation, so the whole underground recreation space looks like a big theater. The road and shop are stage, and the commodity and shop staff are the supporting role, while the customers are the leading roles to enjoy the performance. The stone passage of southern European wind is complementary to the vaulted ceiling with a creeping pattern, achieving a harmonious and unified effect. The 5 squares provide customers with conversation and enjoyment, reducing the tired communication space. In the space full of sunlight and shadow, it is suitable to make customers feel more beautiful. Here, there is no need to say shopping or eating, because walking on this street is also a happy enjoyment.

3.5. Recreational Route Designing

The development of underground recreation space in Japan is always been guided by urban planning, which attaches great importance to the concept of humanized design. Crisscrossed underground transportation network provides convenience for residents to travel, and also provides conditions for urban rational layout and urban environment improvement [6]. Tokyo, Osaka, Nagoya, Sapporo and other cities all take the subway station as the starting point, and then develop to the air, underground and surrounding areas of radiation development, and form a larger scale of the underground city with their own characteristics. Because of the integration of underground commercial city and ground underground transportation, it provides guarantee for people's shopping, meeting friends, entertainment, leisure and public affairs, thus promoting the



Figure 4. Environment designing of Tenjin Chikagai Underground Street. Source: Official website of Tenjin Chikagai Underground Street.

prosperity of the city. Such as Nagoya Sakae Underground Street, located in the center of Central Park underground, completed in 1978, is the distribution center of traffic and traffic. The underground street has solved the transition problem of bus and subway transfer, making more than 20 terminal stations located on the ground floor and entering the central area without vehicles on the ground. Its commercial area is 9300 m², mainly with stores, 8 meters wide underground passage, 29 exit and entrance, the maximum distance of 30 meters from any point to exit and entrance, linked the park and the surrounding facilities by 2 sink square, the flow of people and traffic are introduced into the underground, and how the city center is in the process of development. The combination of traffic and traffic provides a way to deal with it.

Another example, Tokyo YAESU Underground Street covers an area of 0.35 hectares, building area of 69,200 m², commercial space area of 18,400 m², public underground passage of more than 5000 m², shop corridor nearly 12,000 m². The total number of entrances and exits is 42. The average service area of each entrance is 435 square meters, and the maximum distance from any point to the entrance is 30 meters. This not only facilitates pedestrian entry, but also meets disaster prevention requirements. At the same time, the underground street is directly connected with the surrounding underground parking lots, and parking and transfer are very convenient. The underground streets are equipped with various facilities, including banks, public toilets, inquiries, maternal and child rooms, disaster prevention centers and other facilities to provide tourists with comprehensive and convenient services (Figure 5).

3.6. Operation and Management

The management of underground recreation space is mainly accomplished by the consortium of the government and social capital. Operating income mainly

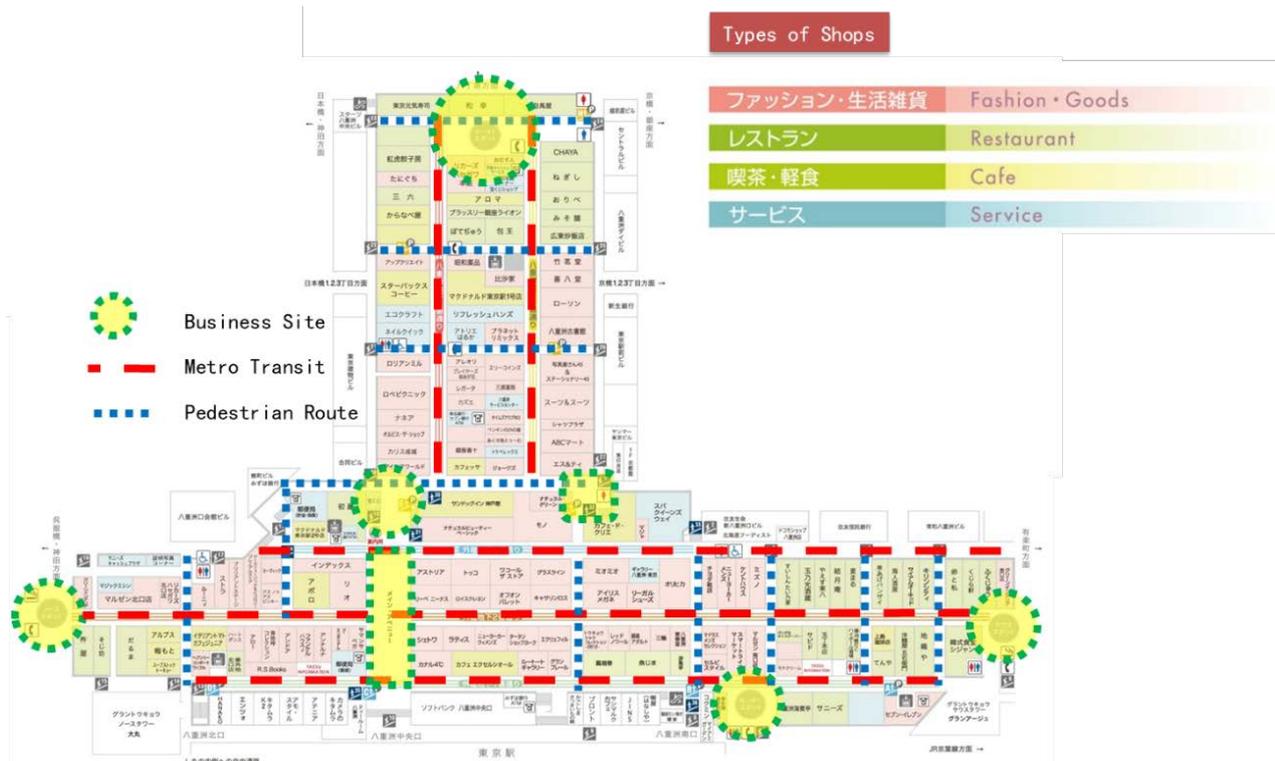


Figure 5. Recreational map of Tokyo YAESU Underground Street. Source: Official website of Tokyo YAESU Underground Street.

depends on the rental of shops, management fees and the income of ancillary facilities. Some underground space will also get the government’s operating subsidies, such as the Tokyo YAESU Underground Street Company pays the government fees to the government every year, but the government pays compensation for the daily expenses of the public passages of the underground street, such as lighting electricity and air equipment; the operation cost of the Tenjin Chikagai Underground Street is 300 million yen a year and the government subsidy is 15%, about 45 million Japanese yen. The expenditure of underground street mainly includes equipment maintenance, environmental maintenance and personnel management. The recovery cycle of underground street is closely related to the area of underground street, such as the YAESU Underground Street in the busy area of Tokyo, so the investment cost is successfully recovered in 10th years.

Japan not only attaches importance to the development of underground commercial space, but also formulating perfect laws and regulations and fire safety measures. There are many laws and regulations on underground space resources in Japan, such as “the great depth law” involving the rights and interests of underground space, as well as the urban planning law of the underground space, “the building datum law”, “the parking lot law”, “the road law”, “the fire law”, and “the water law”, etc. How to prevent disasters is a huge problem to underground recreationspace, and all the underground shopping streets in Japan have taken strict measures. For example, the largest underground shopping

street Tokyo YAESU Underground Street with a floor area of about 140,000 square meters have taken the following measures: 1) Fire prevention. 8000 “pyrotechnic sensors” are installed at the top of the streets, which automatically sprinkled at temperatures of up to 72 degrees Celsius. Every 50 meters there are hydrants and dozens of access to the ground. 2) A sudden outage of a fire and an earthquake. In this case, the automatic generation of power generation equipment will normally supply power in about 1 minute. 3) Shockproof. Eight kinds of earthquake resistant building structures are used in the underground streets. At the same time, the underground commercial streets have also formulated various strict rules and regulations.

4. Conclusion and Discussion

Urban underground street is the main carrier of the underground recreation space in Japanese cities. At the beginning, it is not designed to meet the needs of the citizens’ recreation and recreation but is developed to solve the traffic problems. With the development of the city, its transport function has gradually expanded to sightseeing, leisure, shopping, catering, entertainment and other comprehensive recreational functions. Accordingly, the development of the urban underground recreation space in Japan is first developed by the government, and then gradually evolved into the joint development of urban and social capital or the joint development of social capital. No matter what form is, Japan pays attention to supervision or guidance from planning, design, construction and technology, with strict constraints and safeguards of laws and regulations. The urban underground recreation space in Japan is fully connected with the transfer of traffic and business office [7], which provides the best recreational experience for people to travel, leave after work, shopping after dinner, rest, catering and entertainment. Japan has fully considered the integration of underground space and nature when developing underground recreational space in cities, so the design of lighting, ventilation, sanitation and safety as well as the design of recreation facilities, guidance system and background lighting is all the best. Underground streets provide people with comfortable, safe and convenient underground recreation space, while prolonging their stay time. No matter how specific the situation is, the overall planning and detailed design of urban underground recreation space in Japan are worth learning and drawing lessons for all countries in the world.

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