KIEAE Journal, Vol. 23, No. 3, Jun. 2023, pp.13-24.

KIEAE Journal

Korea Institute of Ecological Architecture and Environment

121

Analysis of Three-dimensional Park Space Planning Using Downtown Urban Planning Facilities

- Focusing on the Analysis of Development Cases Using the Three-dimensional City Park System in Japan -

Seung-Kwan Baek*

* Assistant Professor, Dept. of Architecture, Cheongju Univ., South Korea (backguy100@cju.ac.kr)

ABSTRACT

Purpose: In this study, a three-dimensional park complex development case study was conducted in Japan that efficiently utilizes the space above and below the land by utilizing the three-dimensional city park system. **Method:** First, the overlapping decision, three-dimensional decision, and spatial scope setting of domestic urban planning facilities were identified. Second, three-dimensional park development cases utilizing the Japanese three-dimensional city park system, such as Americasan Park, Meguro Tenku Park, Mizutanibashi Park, and Miyashita Park, were analyzed. Third, during the analyses, the number of entrances before and after the development of the three-dimensional park, location of the park, area of the park, and facilities below the park were examined. **Result:** First, the lower park facility became an intermediary space, providing users with a lively space, simultaneously increasing the number of entrances to the park and improving accessibility to the park. Second, as the location of the park rises after development, the time to access the park from the ground level slightly increases. However, it is possible to use the park differently from general ground level parks, which is highlighted as an advantage. Third, there is a park on the roof and facilities are installed on the lower part, thus, there is a disadvantage that it cannot remain open 24 h owing to facility security concerns. However, during the day, you can move to the park through the facility, and there is a scenery advantage owing to constructing a rooftop park.

KEYWORD

도시계획시설
입체도시공원제도
입체공원
공간계획

Urban Planning Facilities
Three-dimensional City Park System
Three-dimensional Park
Space Planning

ACCEPTANCE INFO

Received Feb. 23, 2023
Final revision received May. 17, 2023
Accepted May. 22, 2023

1. Introduction

1.1. Research background and purpose

The integration of green spaces in urban areas has become increasingly important owing to the accelerated urban heat-island phenomena and increased level of particulate matter caused by recent climate changes. However, the ratio of parks is decreasing owing to the sunset law of city parks. Because securing lands available for creating parks in urban areas where population concentration is increasing has many restrictions from spatial and cost perspectives, the necessity for establishing three-dimensional parks utilizing urban planning facilities is increasing. Thus, this study aims to investigate the characteristics and problems of national legal systems related to the development of three-dimensional parks targeting urban planning facilities, for which available lands can be acquired relatively more easily than private lands by national and local governments. Accordingly, this study also aims to analyze the features of space planning regarding the three-dimensional park development in Japan, where the spaces above and beneath the land have been efficiently utilized by introducing a three-dimensional city park system since early on, to assess the feasibility of introducing such park development in Korea and underline corresponding implications.

1.2. Research method and scope

As shown in Fig. 1., the viewpoint of this study will be established by reviewing prior research conducted on the

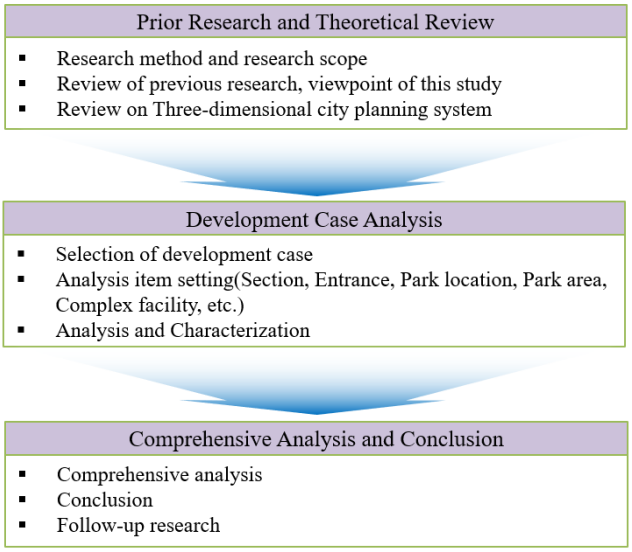


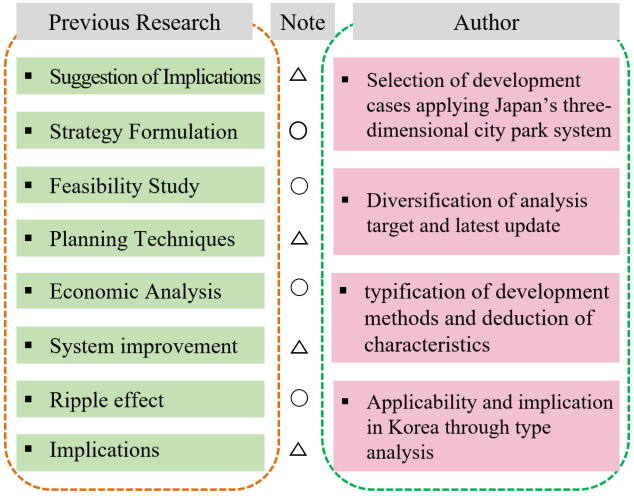
Fig. 1. Research process

pISSN 2288-968X, eISSN 2288-9698
https://doi.org/10.12813/kieae.2023.23.3.013

formation of three-dimensional parks. Accordingly, this study will examine the standards for overlapping and complexing of urban planning facilities (revised December 2021) including the duplicate decision, three-dimensional decision, and determination of a spatial extent with respect to the three-dimensional urban planning system of Korea. Regarding the analysis of three-dimensional park development cases utilizing the Japanese three-dimensional city park system, the Americasan Park was analyzed using the data provided by Parks, Green Spaces and Landscape Division in City Bureau of the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT), while the Meguro Tenku Park, Mizutanibashi Park, and Miyashita Park were analyzed using the public data disclosed by relevant government institutions. Because no statistical data are provided in a list form by public institutions including the Japanese MLIT for the cases developed with the three-dimensional city park system, the researcher investigated and gathered the related data available through the Japanese MLIT or other public institutions to select four analysis targets that are highly applicable and satisfy the conditions for the future development of three-dimensional city parks in Korea. In terms of analysis items, this study focused on analyzing the spatial planning characteristics in three-dimensional park development cases, such as the development history of three-dimensional city park system in Japan, current status of lands and facilities, cross-sectional changes before and after the formation of three-dimensional parks, and park circulation system after the formation of three-dimensional parks.

1.3. Prior research and viewpoint of this study

As shown in Table 1., prior research can be categorized into various research themes including three-dimensional city park, three-dimensionalization of parks and green spaces, three-dimensional city planning, three-dimensional complex development, three-dimensional redundancy utilization, and three-dimensionalization of downtown, as well as various research types including suggestion of implications, strategy formulation, feasibility study, planning techniques, system improvement, and ripple effect. Song et el. (2009) suggested an implication of developing three-dimensional city parks[1], while



※ Note : The relationship between previous research and the author's research was set in three stages. (●-High, △-Middle, ○-Low)

Fig. 2. Differentiation from previous studies

Table 1. Prior research

Researcher	Year	Title	Research Theme	Research Type	Note
J.Y. Song et al.	2009	A Suggestion for Multi-Dimensional City Park Development	Three-dimensional city park	Suggestion of Implications	△
W.J. Kim et al.	2010	Strategy for Making Multi-dimensional City Park according to Multi-dimensional Land Use	Three-dimensionalization of parks and green spaces	Strategy Formulation	△
KICT	2011	A feasibility study for the creation of a three-dimensional urban park	Three-dimensional city park	Feasibility Study	○
S.H. Hong et al.	2013	Three-Dimensional Urban Planning: Double Use Zoning Methods in Japan	Three-dimensional city planning	Planning Techniques	△
S.Y. Park	2016	Economic Analysis of multi-dimensional city park Program	Three-dimensional city park	Economic Analysis	○
HAUD Report	2017	Mixed-use Development of Urban Planning Facilities	Three-dimensional complex development	System improvement	△
J.H. Lee et al.	2019	A Study on Improvement of Multi-Dimensional Urban Planning Policies as Private Initiated Urban Regeneration Methods	Three-dimensional city planning	System improvement	△
B.H. Lee et al.	2019	Improvement of Multi-Dimensional Urban Planning System for Urban Regeneration	Three-dimensional city planning	System improvement	△
S.H. Hong	2019	The Ripple Effect of Three-Dimensional Double Use Modifications on the Regional Economy	Three-dimensional redundancy utilization	Ripple effect	○
S.H. Hong	2021	The Implications After the Development of a Complex Private Station for Three-dimensional Urbanization in Korea	Three-dimensionalization of downtown	Implications	○

※ The Note column sorted the studies with respect to Three Phases by Association and the Utilization Value with the Study (●-High, △-Middle, ○-Low)

Kim et al. (2010) conducted a study on the strategy for three-dimensionalization of parks and green spaces based on multi-dimensional land use[2]. KICT (2011) conducted a feasibility study on the creation of a three-dimensional urban park[3], Hong et al. (2013) conducted a study on three-dimensional urban planning based on the double use zoning methods in Japan[4], and Park (2016) analyzed the economic feasibility of three-dimensional city park formation programs[5]. Furthermore, HAUD Urban Architecture Agency (2017) reviewed the system improvements for the three-dimensional complex development of urban planning facilities[6], and Lee et al. (2019) conducted a study on system improvements of private-initiated multi-dimensional urban planning systems[7], as well as the system improvements of a three-dimensional urban planning system[8]. Additionally, Hong (2019, 2021) conducted a study on the ripple effect of three-dimensional double use modifications on regional economy and analyzed the complex private station development regarding three-dimensional urbanization[9, 10].

As shown in Fig. 2., prior studies have been conducted on legal and systematic reviews and institutional application, such as system improvement, strategy establishment, and implication suggestion for multi-dimensional urban planning and city parks. However, research focusing on analyzing the characteristics of spatial planning for the development cases of three-dimensional city park system of Japan are lacking. With respect to the trends of prior research, this study differs in terms of concretizing analysis targets and applying the latest development cases when selecting the cases to which the three-dimensional city park system of Japan has been applied. Moreover, it suggests improvements for applying the spatial planning characteristics of multi-dimensional parks in Korea.

2. Theoretical Discussion

2.1. Three-dimensional urban planning system in Korea

1) Overview

Concerning the system related to multi-dimensional utilization of urban planning facilities in Korea, Article 61, Subparagraph 1 of the National Land Planning And Utilization Act stipulates the basis for determining the spatial extent of urban planning facilities, while Articles 3 and 4 of the Rules on Determination, Structure, and Installation Standards of Urban or Gun Planning Facilities stipulate the basis for duplicate decision and three-dimensional decision of urban planning facilities. In particular, the Seoul Special Metropolitan City, experiencing a growing need for multi-dimensional development for efficient utilization of land, is planning to introduce multi-dimensional utilization of urban planning facilities by establishing standards for overlapping and complexing of urban planning facilities.

2) Standards for overlapping and complexing of urban planning facilities in Korea

In December 2021, the City of Seoul improved the standards for overlapping and complexing of urban planning facilities for

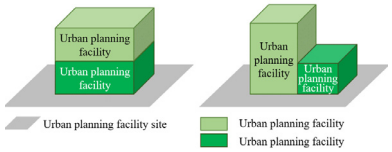
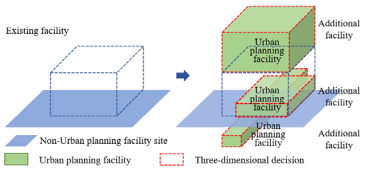
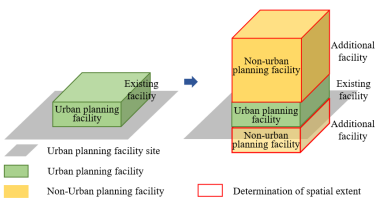
Division	Duplicate decision	Three-dimensional decision	Determination of spatial extent
Concept	▪ Two or more urban planning facilities are determined to overlap horizontally and vertically on the same land	▪ Only part of the space where urban planning facilities are located is determined as other urban planning facilities.	▪ A certain spatial range is determined to allow buildings or structures other than urban planning facilities on the site determined as urban planning facilities.
Diagram	Urban planning facility + Urban planning facility	Non-Urban planning facility + Urban planning facility	Urban planning facility + Non-Urban planning facility
	Vertical duplicate decision (left) Horizontal duplicate decision (right) 		
Problem recognition (Before 2021.12)	-	▪ In the approval of public housing district planning by three-dimensional decision of roads and parks, the park is a facility that does not allow three-dimensional decision.	▪ In determining the spatial scope in the development of happy housing utilizing the upper part of the reservoir, the reservoir is an unacceptable facility.
Improvement (After 2021.12)	▪ All facilities allowed (After 2021.12) ▪ Appropriateness judgment for each case	▪ All facilities allowed (After 2021.12) ▪ Appropriateness judgment for each case	▪ Appropriateness judgment for each case ▪ Parks and green spaces are not permitted.

Fig. 3. Standards for overlapping and complexing of urban planning facilities (Source: [11], Edit by Author)

efficient utilization of limited urban spaces and reflect the changes in conditions according to time, including the changes in demand of urban planning facilities due to the population and household changes, technological advancements, and increased demands for overlapping and complexing. First, a duplicate decision refers to determining to have two or more urban planning facilities overlap horizontally or vertically on the same land as shown in Fig. 3. Vertical duplicate decision can be applied to all facilities, whereas horizontal duplicate decision is limited by the facility depending on the allowable extent through which matrixing the facilities that are overlapped with existing facilities. Three-dimensional decision refers to determining only a part of the space where urban planning facilities being developed are located, which is allowed for all facilities excluding gas supply facilities, cremation facilities, and waste treatment facilities that may have a hazardous impact on general buildings in a neighborhood including parks, elementary, middle, and high schools, and universities. Spatial extent refers to determining a certain spatial extent of existing urban planning facilities for allowing buildings or structures that are not urban planning facilities on the land that has been dedicated to urban planning facilities; operational standards are applied according to interoperability, physical installation feasibility, and spatial availability among facilities. However, unacceptable facilities include parks, plazas, reservoirs, schools, general medical facilities, rivers, and waste treatment facilities[11]. The standards for overlapping and complexing of urban planning facilities specify duplication decision, three-dimensional decision, and determination of spatial extent. However, parks and green spaces related to multi-dimensional city parks are not allowed in the determination of spatial extent; therefore, there remain institutional limitations in the formation of three-dimensional urban parks.

Urban planning facilities increased in number by concentrating on quantitative supply in the past; however, currently, there is a growing need for finding sustainable development directions in the transition period fueled by aging population, infectious diseases, and technological advancements. In line with periodic changes accelerated by technological development, multi-dimensionalization and functional advancements of facilities are needed to meet the demands for various facilities and ensure efficient utilization of limited land resources, considering the changes in type, form, and location of urban planning facilities. Accordingly, various complex projects have been carried out recently as shown in Fig. 4. However, improvements have been consistently proposed because the standards contradicted the existing standards. First, the approval for the Sinnae 4 public housing district was announced in June 2021 based on the decision for multi-dimensionalization of roads and parks; however, parks are designated as unacceptable facilities, thus contradicting the existing standards. In terms of the Jangji garage, B1F – 2F were set as parking lots, while the fourth floor was considered to be designed as a green space; however, parks are unacceptable facilities according to the determination of spatial extent. For the Guui reservoir, determination of spatial extent was announced in December 2015 to introduce happy housing at the upper part; however, the existing standards prohibited a reservoir from being the subject of determination of spatial extent, thus, requiring improvements as well.

Sinnae 4 public housing district | Jangji garage | Guui reservoir

Fig. 4. Case of three-dimensional complex plan (Source: [11])

2.2. Three-dimensional urban planning system of Japan

1) Overview

The three-dimensional urban planning system of Japan specifies the necessary scope for maintaining urban planning facilities, such as roads, rivers, and parks, thus, bypassing the limitations on construction stipulated in Article 53 of the Urban Planning Act within regarding urban planning facilities. However, the three-dimensional urban planning system is not coordinated with the Building Standard Act of Japan, thus, it is not regulated considering the mitigation of the limitations on construction regarding urban planning facilities, such as roads and parks. Therefore, construction cannot be carried out by mitigating the limitations on construction of the Building Standard Act only through the three-dimensional urban planning system. Consequently, multi-dimensional utilization is promoted through multi-dimensional road or city park systems for complex developments utilizing urban planning facilities, such as roads and parks[12].

2) Three-dimensional city park system in Japan

The three-dimensional city park system implemented in Japan was first established through the revision of the Urban Park Act in 2004 for efficient maintenance of urban parks, promotion of complex space utilization along with other facilities, mitigating the urban thermal island phenomena, and recognizing the need for parks that provide a relaxed environment for people. According to Article 20 of the Urban Park Act, a park manager

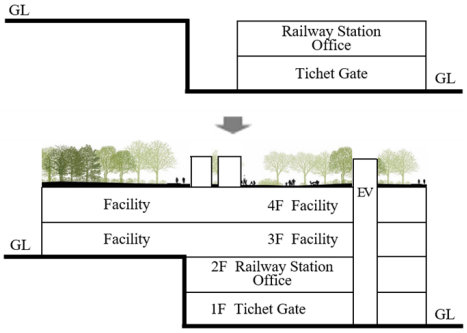
Division	Three-dimensional city park system
Concept	▪ Three-dimensional utilization of complex space with parks and other facilities ▪ Promote the efficiency of land use ▪ A three-dimensional city park system was created by the revision of the Urban Park Act (2004)
Application Case (Section)	
Characteristic	▪ Three-dimensional zoning of city parks ▪ Locating other facilities outside the park area ▪ Integral maintenance of facilities and city parks ▪ Possible integrated maintenance with private facilities
System application	▪ A park manager may designate the area of an urban park three-dimensionally when he/she deems it necessary to promote appropriate and reasonable land use in consideration of the circumstances of the area where the urban park exists. (Article 20 of the Urban Park Act)
Target facility	▪ Existing urban park underground, building rooftop, artificial ground top/new construction, all applicable to existing parks
Installation condition	▪ It should be easily accessible by general users on foot, and if it is installed on the roof of a commercial/business facility, open hours that do not interfere with general use should be set.

Fig. 5. Three-dimensional city park system in Japan (Source: [12], Edit by Author)

must determine a multi-dimensional city park region if deemed necessary to promote appropriate and reasonable land use, considering the situation of the region where city parks exist. The target facilities include underground spaces of existing city parks, building rooftops, upper parts of artificial grounds, as well as existing and newly constructed parks; the installation condition specifies that parks should be easily accessible on foot by general users. In particular, if parks are installed on the rooftop of commercial and business facilities, opening hours are set to be within a range that does not cause inconvenience for general users. As shown in Fig. 5., ample resources and technological expertise of private entities can be sufficiently utilized because integrated maintenance of city parks and private facilities are feasible.

When a three-dimensional city park is installed on building rooftop, any problems with the building structure may also affect the three-dimensional city park. Therefore, to secure the perpetuity of a three-dimensional city park, which is a public facility, regardless of the intention of a building owner, there is an integrated park building system where a park manager and building owner agree on proper building management tasks including the burden of expenses[12].

3. Case Analysis of the Japanese Three-dimensional City Park System

3.1. Selection of analysis targets

Because Korea and Japan have similar physical characteristics of city compositions and legal systems related to urban

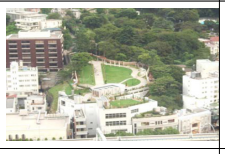
Division	Photo	Significance of selection of development cases and utilization of data	Application of the system
Americasan Park (2009.08), Yokohama City		▪ The first advanced case utilizing Japan's three-dimensional city park system ▪ Utilized data from Parks and Greenery Landscape Division, City Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	▪ Application of the Japanese three-dimensional city park system
Meguro Tenku Park (2013.03) Meguro-ku, Tokyo		▪ Cases integrated with town development through urban redevelopment projects ▪ In addition to the three-dimensional city park system, various systems for three-dimensional space utilization between roads and facilities are applied.	▪ Various systems such as the Japanese three-dimensional road system and three-dimensional city park system are applied
Mizutani-bashi Park (2020.04) Chuo-ku, Tokyo		▪ Examples of administrative policies to expand insufficient nursery school facilities and green spaces ▪ Use of local government open data	▪ Application of the Japanese three-dimensional city park system
Miyashita Park (2020.04), Shibuya, Tokyo		▪ A case of complex development that combines commercial facilities and hotels with existing park and parking lot functions ▪ Utilize open data from related organizations including local governments	▪ Application of the Japanese three-dimensional city park system

Fig. 6. Selection of analysis targets (Source: [13-16], Edit by Author)

architecture and Japan had introduced the three-dimensional city park system earlier than Korea for multi-dimensional complex development using areas above and below available public lands in cities, the selection of analysis targets located in Japan have been easily selected. Since 2004, when the three-dimensional city park system was first established, there have been only less than 10 cases of utilizing three-dimensional city park system in Japan, such as the installation management permission system for installing and managing park facilities based on the Urban Park Act, Park-PFI that selects private businesses for operating and creating parks and park formation based on the urban park renovation agreement system within regions specified by Japanese municipal government.

Because there is no statistical data provided in a list form by public institutions, including the Japanese MLIT, for the application cases of the three-dimensional city park system, the author investigated and gathered the related data available through the Japanese MLIT or other public institutions to select four analysis targets that are highly applicable and satisfy the conditions for the future development of three-dimensional city parks in Korea.

3.2. Case analysis

As the first advanced case of applying the three-dimensional city park system, the Americasan Park was analyzed using the data provided by Parks, Green Spaces, and Landscape Division in City Bureau of the MLIT. Both the Meguro Tenku Park, which was promoted along with the Tokyo urban are redevelopment project, and the Mizutanibashi Park, which was promoted using the three-dimensional city park system as part of administrative policy for expanding green spaces and increasing the insufficient number of nursery facilities in Chuo ward, were analyzed using the public data disclosed by local governments. The Miyashita Park located in Shibuya ward in Tokyo, which has been receiving increasing attention for value creation from multi-dimensional complex development using the three-dimensional city park system implemented in Japan, is a complex development case that has integrated hotels and commercial facilities with existing parks and parking areas, and it is analyzed using public data of relevant institutions including local government bodies. In terms of analysis items, this study analyzed the spatial planning characteristics in three-dimensional park development cases including the current status of lands and facilities, cross-sectional changes before and after the formation of three-dimensional parks, and park circulation system after the formation of three-dimensional parks.

1) Americasan Park

The Americasan Park was the first park developed by applying the Japanese three-dimensional city park system in 2009. Two regions nearby the park, Motomachi and Yamate Districts, are well-known tourist spots in Yokohama; however, improvements are required with respect to accessibility of pedestrians between the two districts which have 18-m difference in altitude. As shown in Fig. 7., the Motomachi/China Town Station of the Minatomirai Line in the Motomachi District, which is located at the bottom of the slope, will be extended and altered from the second to the fourth floor to create a park area. The green spaces in the Yamate District located at the top of the slope will be modified thoroughly to provide easy accessibility from the Motomachi to Yamate District[17]. Moreover, as shown in Fig. 8., the third and fourth floors and the rooftop of the railway station located in a private land are owned by the city of Yokohama; thus, a rooftop garden was installed in addition to stairs, escalator, and elevator to improve users' accessibility and convenience. From the management perspective, convenience and park facilities are managed together leveraging on the resources and technological expertise of private businesses.

The cross-sectional image of the Americasan Park before and after the development depicted in Fig. 9. indicates that the

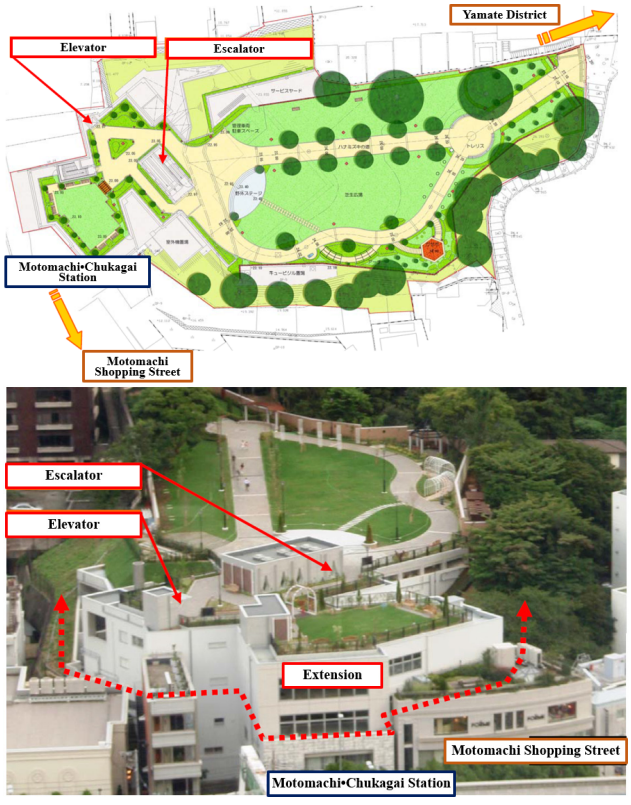


Fig. 7. Layout and bird's eye view (Source: [18], Edit by Author)

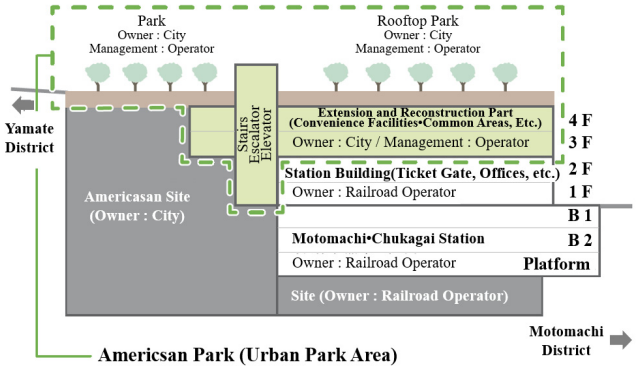


Fig. 8. Park management (Source: [22], Edit by Author)

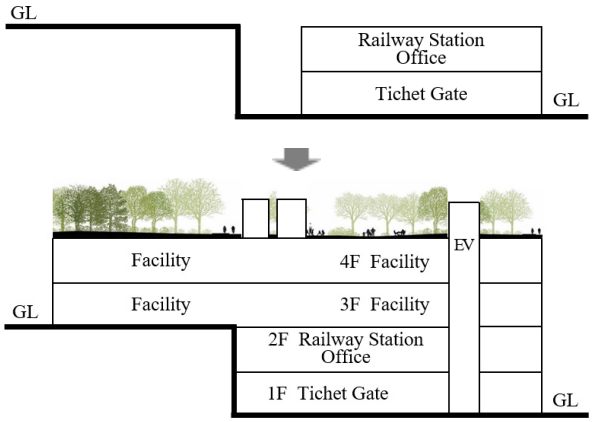


Fig. 9. Sectional change due to the development (Edit by Author)

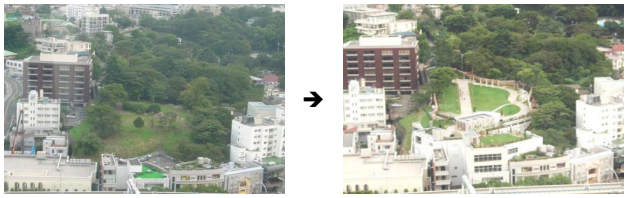


Fig. 10. Changes before and after the development (Source: [18])

number of entrances increased. Accordingly, the building has been integrated with the railway station within the park using the stepped land, and the city park is established at the upper part of the building. As shown in Fig. 10., facilities are installed in lower and upper levels, and the two-story building before the development has been expanded to a four-story building after the development.

2) Meguro Tenku Park

As part of the integrated Tokyo Metropolis downtown redevelopment project carried out along with village formation, the park was created by applying the three-dimensional city park system to the upper part at the junction of the Shuto Expressway. At the downtown center, in which various infrastructures are concentrated on a limited land, the park was created by applying

Fig. 11. Park view (Source: [19])

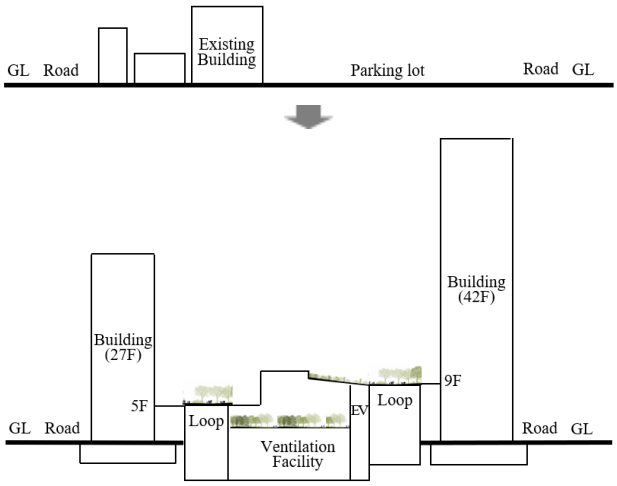


Fig. 12. Sectional change due to the development (Source: [20], Edit by Author)

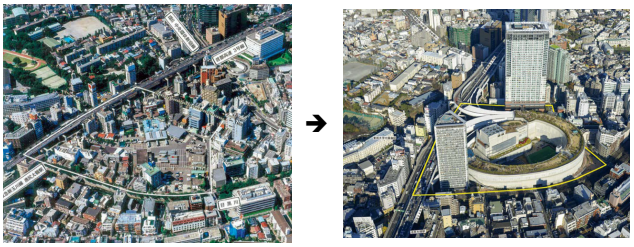


Fig. 13. Changes before and after the development (Source: [21])

multi-dimensional and multi-layer integration with other buildings. Expressways, two redeveloped buildings, and parks are all located within a redevelopment area of 38,000 ㎡. From the perspective of village formation in Japan, residential houses and commercial facilities, such as public libraries, have been established in a balance in the form of a compact city in two redevelopment buildings, namely, the 27-story Prism Tower and 42-story Cross Air Tower constructed by Tokyo Metropolis.

In particular, the upper part of the expressway junction is formed as a park by applying the multi-dimensional road and

Fig. 14. Access route to the park (Source: [21], Edit by Author)

park systems; on the rooftop of the expressway junction located approximately 7–35m high from the ground , the Meguro Park was created based on the sky garden concept on the site of 7,000㎡. As shown in Figs. 12., 13., and 14., this park is accessible from the fifth floor of the Prism Tower and the ninth floor of the Cross Air Tower, or through a pedestrian bridge called Opas Bridge and elevator from the Opas Yumehiroba Square. Inside the junction roof, a multi-purpose square called Opas Yumehiroba Square is formed on the site of 3,000㎡, in which various meeting, sports, and recreation activities take place. This structure has been contributing significantly to the regional vitalization with high utilization rate and satisfaction level among residents along with the Meguro Tenku Park.

3) Mizutanibashi Park

As part of the administrative policy of local governments to expand green spaces and nursery facilities, the park is located on the rooftop as a complex facility formed to integrate park and nursery facilities by utilizing the three-dimensional city park system. Public restrooms are available on the first floor for 24 h, and a wastewater reservoir is created in the first basement floor in case of emergency. The rooftop park consists of a natural lawn square, playground, and relaxation area for residents as shown in Fig. 15. When the cross-sectional image of the Mizutanibashi park before and after the development depicted in Fig. 16. is analyzed, the number of entrances has been increased according to multi-dimensional utilization of the facility. The park used to be directly accessible from the ground level before the development but stairs and elevators have been installed after

Fig. 15. Rooftop park view (Source: [23])

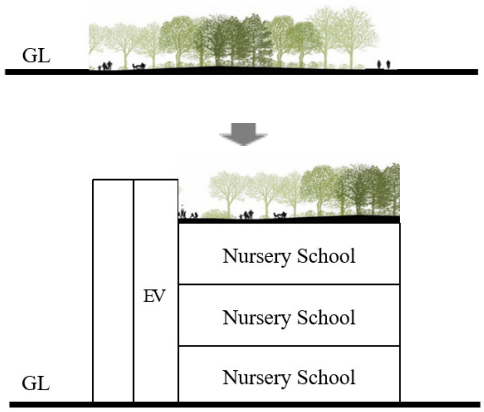


Fig. 16. Sectional change due to the development (Edit by Author)

the development to provide access to the rooftop park because nursery facilities were installed in lower floors of the building. The facilities at the bottom of the park were established to satisfy the needs of the local government.

4) Miyashita Park

As shown in Fig. 17., commercial facilities and hotels are added to the existing municipal Miyashita Park and parking lots. This particular case involves revamping the Miyashita Park into a safer and more pleasant environment to maximize the charms of urban parks throughout the facility, thus adding value to the district.

A private contractor was selected for the Miyashita Park development project in August 2014 who had to proceed with the development project to create a three-dimensional city park by considering the following tasks: improving the seismic performance to prevent possible damage being inflicted on the crossing bridge during disasters, tree collapsing due to strong

wind, securing a barrier-free circulation path when using the facility, and heightening the pedestrian convenience at the Shibuya Station in the case of increased number of users. From the perspective of local governments, the Miyashita Park development project required strengthening of a green base through flexible park usage, creation of a prosper base, formation of a pedestrian network hub, complexing of functions accepting culture, enhancement of disaster prevention function linked with regions, and highly convenient parking lots. The number of facilities in the lower part of the park increased, where the first floor was designated as a parking lot and space above was designated as the municipal park. After the development, commercial facilities of small-scale shops are additionally established up to the third floor.

Fig. 17. Three-dimensional park view (Source: Nakasa & Partners, Japan)

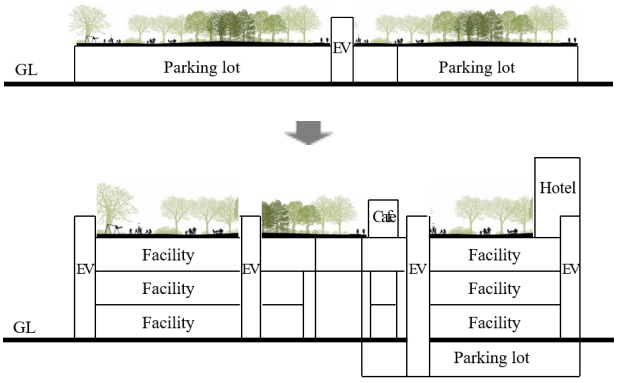


Fig. 18. Sectional change due to the development (Edit by Author)

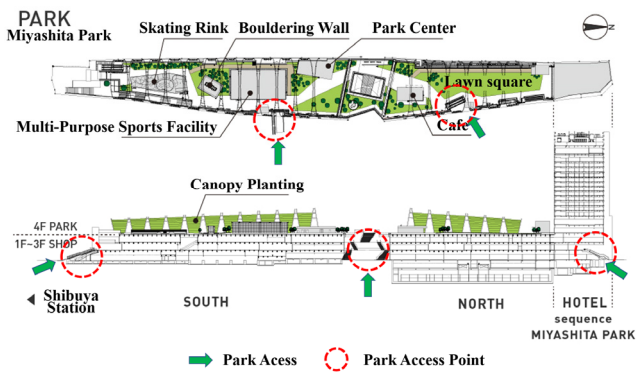


Fig. 19. Access route to the park (Source: [24], Edit by Author)

Analyzing the cross-sectional image of the Miyashita Park before and after the development depicted in Fig. 18., observe that the number of entrances has increased after the development by utilizing the land characteristics. Furthermore, nodes facilitating the new pedestrian networks were created as shown in Fig. 19. through which the accessibility from the Shibuya Station was improved. Facilities are located below the park, which is constructed on the rooftop. The park formation includes the roads, which were divided into two parts vertically and have been unified through the multi-dimensional use of altitude difference of the land. A designated manager system was adopted in the Shibuya ward where Miyashita Park Partners consisting of the Mitsui Fudosan Co., Ltd. and Seibu Landscape Co., Ltd. were chosen as a designated manager in December 2019. Comprehensive management by the designated manager, including maintenance of green spaces and facilities, event planning, and attraction, has been providing a safe park environment while creating vitalized urban spaces.

3.3. Comprehensive analysis

As summarized in Fig. 20., the case analysis found that a notable aspect of the development of three-dimensional city parks by implementing the three-dimensional city park system is that the facilities located under the parks have become mediating spaces to vitalize such areas, while increasing the number of entrances to the parks ultimately improves accessibility to the parks. In terms of position changes, the time required to approach the park from the ground level increases as the park location is changed to a higher altitude; however, the advantage is that other types of differentiated facilities can be accessed and utilized from the ground level. Rooftop parks have other facilities located underneath the park and cannot be open for 24 h owing to facility security reasons. However, rooftop parks can be accessed during daytime through the facilities and provide an excellent view, which can enhance user satisfaction. The number of facilities below the parks increased after the development projects, which differentiated the access to these parks from that implemented at other general parks located at the ground level. Accordingly, diverse circulation systems are configured, allowing park users to experience convenience and dynamic enjoyment in terms of circulating through the parks. The analysis conducted on the development cases utilizing the three-dimensional city park system considering the impact of such a system on the spaces of multi-dimensional parks revealed that three-dimensional city parks are emerging as an alternative form of new urban parks. This is because they

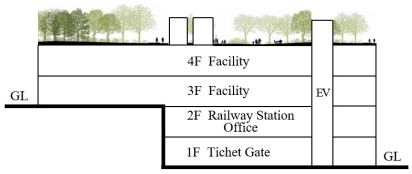
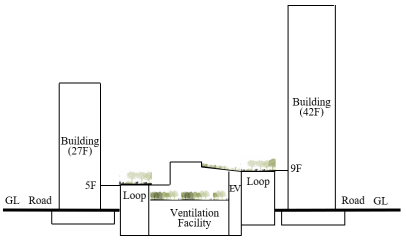
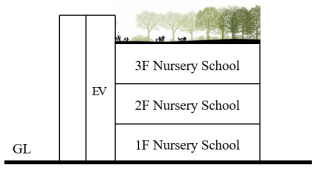
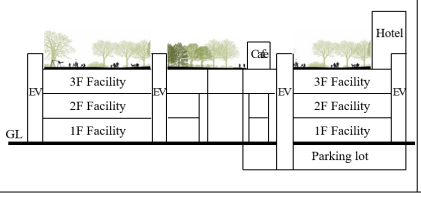
Division	Sectional feature analysis		Entrance		Position change		Park area (㎡)		Number of facilities	
			B*	A**	B	A	B	A	B	A
Americasan Park (2009.08), Yokohama City		▪ Extension from the 2nd floor to the 4th floor of the existing station building ▪ New construction of an underground building integrated with station 3 - 4F in the park area ▪ Maintenance of the entire park including the rooftop	-	4	-	5F	0	5,520	-	4
			Access to the park after development							
			▪ Accessible to the rooftop park via elevators and escalators from facilities on each floor (2nd to 4th floors), including the station gate on the 1st floor							
Meguro Tenku Park (2013.03) Meguro-ku, Tokyo		▪ Public parkcreated integrally with the urban redevelopment project by utilizing the three-dimensional park system ▪ Utilizes the upper space of expressway junctions. ▪ Various approaches to public parks are possible through elevators on the ground level. ▪ Park access is possible through bridges from nearby high-rise buildings.	-	4	-	5F, 9F	0	7,000	-	-
			Access to the park after development							
			▪ Access to the park is available from the 5th floor of the redeveloped Prism Tower and the 9th floor of the Cross Air Tower. ▪ Access to the park is possible by using the elevator from Opas Bridge, which is a pedestrian crossing, and Opas Yumehiroba Square on the ground level.							
Mizutani-bashi Park (2020.04) Chuo-ku, Tokyo		▪ Expansion of childcare facilities while maintaining existing park facilities ▪ A park consisting of resting places and playgrounds for local residents ▪ Elevator installation to improve accessibility	1	2	1F	4F	713	613	-	1
			Access to the park after development							
			▪ Before development, direct access was possible because the park was located on the ground level, but after development, a nursery school was created under the park, allowing access to the rooftop park through stairs and elevators.							
Miyashita Park (2020.04), Shibuya, Tokyo		▪ Complex facilities such as parks, commercial facilities, hotels, and parking lots ▪ Formation of pedestrian network hub and cultural complex ▪ Construction of highly convenient parking lot	6	15	2F	4F	10,500	10,800	-	90
			Access to the park after development							
			▪ Access to the park on the top floor is possible through an elevator from each floor of the facility, including the underground parking lot. ▪ Access to the park is also possible from adjacent hotels.							
Note	* B : Before development / ** A : After development									

Fig. 20. Comprehensive analysis

significantly contribute to the vitalization of parks, facilities, and communities through multi-dimensional use of the land that is differentiated from commonly observed parks.

4. Conclusion

This study investigated the characteristics and problems related to legal and institutional status for the development of three-dimensional parks as urban planning facilities in Korea. Furthermore, it analyzed the spatial planning characteristics of three-dimensional park development cases, such as the current status of development land and facilities, changes in cross-section of three-dimensional parks before and after the development, and park access circulation system before and after the development, based on the multi-dimensional city park system implemented in Japan that has been praised for its efficient use of the spaces above and below the land. As a result, the following conclusions have been drawn.

First, in terms of forming three-dimensional parks utilizing urban planning facilities in downtown areas of Korea, parks and green spaces that are deemed unacceptable in the determination of spatial extent owing to the standards for overlapping and complexing of urban planning facilities need to be included. Moreover, system improvements are required to enable unified maintenance of private and public facilities similar to the Japanese three-dimensional city park system. In particular, the Seoul Special Metropolitan City, which is experiencing an increasing need for multi-dimensional development for efficient utilization of land, is planning to introduce multi-dimensional utilization of urban planning facilities by establishing standards for overlapping and complexing of urban planning facilities. Recently, complexing standards have been updated to allow non-urban planning facilities in addition to urban planning facilities in the determination of spatial extent in the urban planning facility lands. However, there remain institutional limitations in terms of forming multi-dimensional parks because parks and green spaces are still deemed unacceptable in the determination of spatial extent. Furthermore, multi-dimensional

complexing of urban planning facilities in Korea is stipulated by the Enforcement Decree of the National Land Planning and Utilization Act, rather than the Act itself, in terms of determination of spatial extent or determination, structure and installation standards of urban and gun planning facilities. Therefore, systematic improvements are required because there are limitations regarding the participation of private businesses owing to the conflict between related laws including the Road Act and the Building Act without being linked with related laws of other facilities when carrying out development projects. In contrast, the Japanese three-dimensional city park system specifies the spaces of three-dimensional parks and enables integrated management of public and private facilities, thus, suggesting implications for improving institutional limitations of creating three-dimensional parks in Korea.

Second, the spatial planning analysis of the development cases implementing the Japanese three-dimensional city park system showed that the facilities located under the three-dimensional parks have become mediating spaces that vitalize the nearby areas, while increasing the number of entrances to the parks ultimately improves accessibility to the parks. In terms of position changes, the time required to approach the park from the ground level increases as the park location is changed to a higher altitude; however, the advantage is that other types of differentiated facilities can be accessed and utilized from the ground level. Rooftop parks have other facilities located underneath and cannot be open 24 h owing to facility security reasons but they can be accessed during daytime through the facilities and provide excellent views.

Third, three-dimensional parks in Japan are differentiated from typical ground-level parks, in which complex development of public and private facilities through multi-dimensional use of land has been contributing to the vitalization of regional communities and increasing the proportion of green spaces in cities. The standards for overlapping and complexing of urban planning facilities in Korea specify duplication decision, three-dimensional decision, and determination of spatial extent with respect to the introduction of three-dimensional urban parks. However, parks and green spaces are not allowed in the determination of spatial extent; therefore, there remain institutional limitations in the formation of three-dimensional urban parks. Considering these points, spatial characteristics and maintenance techniques demonstrated in the development cases of three-dimensional parks in Japan are expected to be utilized as references for improving systems related to the creation of new and multi-dimensional parks in downtown areas in Korea.

In our follow-up study, a thorough comparative analysis will be conducted on the institutions related to the formation of multi-dimensional parks in Korea and Japan, which was considered a limitation in the scope of this study, to identify the necessary institutional improvements for implementing multi-dimensional urban parks.

Acknowledgement

This study has extended the previous results taken from a study presented at the 2022 Korea Institute of Ecological Architecture and Environment Autumn Conference.

References

[1] 송지영, 김세용, 입체도시공원 개발을 위한 시사점 도출, 대한건축학회논문집 계획계, 제25권 제12호, 2009.12, pp.21-30. // (J.Y. Song, S.Y. Kim, A Suggestion for multi-dimensional city park development, Korea: Journal of the Architectural Institute of Korea Planning & Design, 25(12), 2009.12, pp.21-30.)

[2] 김원주, 유성희, 토지이용의 입체복합화에 따른 공원녹지 입체화 전략, 서울시정개발연구원, 2010. // (W.J. Kim, S.H. Yoo, Strategy for Making Multi-dimensional City Park According to Multi-dimensional Land Use, Seoul Development Institute, 2010.)

[3] Ministry of Land, Transport and Maritime Affairs, A feasibility study for the creation of a three-dimensional urban park, KICT, 2011.12.

[4] 홍석호, 김세용, 중복이용구역 지정을 통한 입체도시계획기법에 관한 연구-일본사례를 중심으로, 대한건축학회논문집 계획계, 제29권 제12호, 2013.12, pp.209-217. // (S.H. Hong, S.Y. Kim, Three-dimensional urban planning: Double use zoning methods in Japan, Korea: Journal of the Architectural Institute of Korea Planning & Design, 29(12), 2013.12, pp.209-217.

[5] 박선영, 입체도시공원 조성사업의 경제성 분석, 한국혁신학회지, 제11권 제3호, 2016.12, pp.217-238. // (S.Y. Park, Economic analysis of multi-dimensional city park program, Korea: Innovation Studies, 11(13), 2016.12, pp217-238.)

[6] Korea Institute of Urban Architecture, Mixed-use development of urban planning facilities, HAUD REPORT, No.47., 2017.09.

[7] 이정형, 이운용, 이동규, 민간주도형 도시재생수법으로서 입체도시계획제도 개선방안 연구, 한국도시설계학회지, 제18권 제1호, 2019.01., pp.35-50. // (J.H. Lee, W.Y. Lee, D.G. Lee, A study on improvement of multi-dimensional urban planning policies as private initiated urban regeneration methods", The Journal of the Korea Contents Association, 18(1), 2019.01, pp.35-50.)

[8] 이범현, 남성우, 김영현, 도시재생 측면에서 입체도시계획의 기능과 제도 개선 방안, 한국콘텐츠학회논문지, 제19권 제2호, 2019.02, pp.516-524. // (B.H. Lee, S.W. Nam, Y.H. Kim, Improvement of multi-dimensional urban planning system for urban regeneration, Korea: Journal of the Korea Contents Association, 19(2), 2019.02, pp.516-524.)

[9] 홍석호, 입체적 중복이용 정비사업이 지역경제에 미치는 파급효과 연구, KIEAE Journal, 제19권 제3호, 2019.06, pp.35-42 // (S.H. Hong., The ripple effect of three-dimensional double use modifications on the regional economy, Korea: KIEAE Journal, 19(3), 2019.03, pp.35-42.)

[10] 홍석호, 한국의 도심 입체화를 위한 민자 복합역사 개발 이후의 시사점 도출, KIEAE Journal, 제21권 제1호, 2021.02, pp.119-126. // (S.H. Hong., The implications after the development of a complex private station for three-dimensional urbanization in Korea, Korea: KIEAE Journal, 21(1), 2021.02, pp.119-126.)

[11] Facility Planning Division, Urban Planning Bureau, Seoul Metropolitan Government, Improvement of criteria for duplication/complex operation of urban planning facilities, 2021.12.

[12] Ministry of Land, Infrastructure, Transport and Tourism of Japan, Urban park act operation guidelines, 2017.

[13] Japan Yokohama City Residential Area Improvement Promotion Council National Conference Reference, (10), 2013.06.

[14] Ministry of Land, Infrastructure, Transport and Tourism of Japan,

References of the basic direction review meeting for urban policies in response to the rapid progress of digitalization and the new normal, 2020.11, pp.32.
[15] Tokyo Chuo-ku Website, “List of park squares-mizutanibashi park”, https://www.city.chuo.lg.jp/a0037/shisetsu/genre/sports/sports00024.html, 2022.11.15.
[16] Tokyo Parking Association, Information Transmission 'Antenna' (6th), Miyashita park-urban planning park and urban planning parking lot redevelopment project.
[17] Ministry of Land, Infrastructure, Transport and Tourism, Urban area development bureau, measures to preserve, pegenerate, and create networks of water and green spaces in existing urban areas, 2008.03, pp.31.
[18] Ministry of Land, Infrastructure, Transport and Tourism of Japan, Americasan park maintenance project using the three-dimensional city park system, City of Yokohama, Environmental Creation Bureau, Environmental Improvement Department, 2009.
[19] Highway Industry Development Organization, Road administration seminar, 2013.07.
[20] Bureau of Urban Development Tokyo Metropolitan Government, Overview brochure of Ohashi district. 2011.
[21] Urban Renewal Association of Japan & Urban Renewal Coordinator Association of Japan, A redevelopment project that draws on the times, 2019.
[22] Pamphlet, The 150 years history of Yokohama greenery and parks, City of Yokohama Environmental Planning Bureau Policy Division, 2017.03.
[23] SAKAE Co.,Ltd., “Sakae Works 2020 #6 - Mizutanibashi Park”, https://www.sakae-kk.com/sakaeworks/works06.html, 2023.01.02.
[24] Tokyo Shibuyakuritsu Miyashita Park Website, “Facility Introduction”, https://www.seibu-la.co.jp/park/miyashita-park/, 2023.03.28.