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A Study on the Mixed-Use and Spatial Cognition of Mixed-Use High-rise Complex in an Urban Downtown in Japan

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Biography¹

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Abstract

The urban regeneration projects have been built many high-rise building complex in urban areas. In the future, it is expected that increase the need to update tenant and renovation. To prepare for such a situation, we need investigate the current status and the actual use of the high-rise building complex. Therefore, the purpose of this research is to clarify, to focus on "mixed-use and spatial-cognition", the actual situation of facilities user and spatial cognitive process. The result is the following;

- 1) It was clear that the ripple effect is different between Roppongi Hills and Tokyo Midtown. As the cause of this difference, it can be considered from the main target, facility configuration and spatial configuration.
- 2) Significant differences are clarified between Roppongi Hills and Tokyo Midtown in terms of easy to confuse. In general, the number of visits increases as the confusion decreases. In spite of this phenomenon, the number of visits increases as the confusion increases in Roppongi Hills. It is the reason that the many choice of moving facility are existing and complex.

Keywords: Urban Regeneration, high-rise Complex, Mixed-use, Spatial-Cognition, Japan

1. Introduction

1.1 Background

The ongoing cubic and mixed-use space refers to dimensionalize the constructional space or urban space vertically and horizontally and combine each space with a different use. The word dimension implies advanced land use for vertical unification between different uses. However, in a systematic sense, it is restricted to dimensional sectioning of urban facilities including urban building, road, railway, park, and green belt.¹⁾ Particularly, as the increased land price or the absolute lack of urban space characterizes the high-rises, efficient use of underground space, or functional complexation, high-rise complexes are being constructed in urban redevelopment projects. Even if not many large-scale new development projects are expected in the future amidst the transitional period to the stock-type society from the scrap & build one, more needs for such improvements as renovation or tenant renewal are speculated. In these cases, it seems to be necessary to carry out identification of constructional situation of or survey and analysis of utilization status of the cubic and mixed use high-rise complex constructed until now to be prepared for the future. Additionally, this study focuses on 2 issues of the cubic and mixed-use high-rises including 「mixed-use」 and 「spatial cognition」.

1.2 Objectives and Scope

This study aims at suggesting considerations for planning in the development of mixed-use high-rise facilities in order to create a synergy effect in a wider range of functional mixed-use and to provide a successful cubic and mixed-use complex. First of all, many previous studies on mixed-use complex laid emphasis on environmental engineering which includes factors of establishment, management system, facility, or energy overloading. Studies on spatial cognition have been bringing light on the spatial cognition process using a myriad of investigation methods. This study focused on 2 issues of cubic and mixed-use high-rise complex including 「mixed-use」 and 「spatial cognition」. For the study objective, this study organized the user status or method of cognition of overall facilities and clarified the followings; 1) Connectivity between facilities, 2) Required function, and 3) Spatial cognition process. The three elements clarified were also set up to be offered as basic data to support new development projects or improvements.

2. Trend of High-rise Construction²⁾

2.1 Status of high-rise construction by country

An analysis of high-rises over 40-story in the cities around the world in an effort to identify the utilization of the building showed that total 3,143 buildings were completed, under construction, or approved (2004). In terms of the construction status, completion 2,180 (69.4%), under construction 601 (19.1%), and under approval was 362 (11.5%). Status of high-rise construction by country showed high ratio of China 1,260 (40.1%) and US 775 (24.7%). Countries from top to 10 included China, US, UAE, Japan, Austria, Korea, Taiwan, Canada, Singapore, and Brazil. More than 5 Asian countries involved in the top 10 demonstrate booming of high-rise construction in the Asian region.

Table 1. Status of construction by country

No.	Country	F(%)	No.	Country	F(%)
1	China	1260(40.1)	15	Russia	23(0.7)
2	U.S.A.	775(24.7)	16	United Kingdom	21(0.7)
3	United Arab Emirates	161(5.1)	17	Panama	19(0.6)
4	Japan	132(4.2)	18	Germany	18(0.6)
5	Australia	97(3.1)	19	Taiwan	16(0.5)
6	South Korea	87(2.8)	20	Argentina	15(0.5)
7	Thailand	81(2.6)	21	France	13(0.4)
8	Canada	67(2.1)	22	Qatar	13(0.4)
9	Singapore	58(1.8)	23	Spain	13(0.4)
10	Brazil	38(1.2)	24	India	12(0.4)
11	Philippines	36(1.1)	25	Venezuela	12(0.4)
12	Malaysia	33(1.0)	26	Turkey	11(0.3)
13	Israel	28(0.9)	27	Bahrain	10(0.3)
14	Indonesia	26(0.8)	28	Others	68(2.2)
Total			3143(100.0)		

2.2 Yearly construction trend

Yearly trend of high-rise construction was also investigated. Construction of high-rises has been increased rapidly since 1990s. The number of high-rises between 1990 and 1999 was 597, which was twice more than 315 between 1980 and 1989. The number of high-rises which completed construction or under construction after 2000 was 1,361, which were over twice than the 80s. This proves progressive enlargement of the high-rise construction market and increased demands over time. It is estimated based on the previous study in 2004, at this point 7 years(2011) later, that the status of high-rise construction at home and abroad will be developed on a larger scale, more concentrated, high-risen, and multi functional gradually in the future than in the past.

3. Outline and Methods

3.1 Subjects

The subjects were located in the central area of Tokyo in Japan and are newly developed cubic and mixed-use high-rise complexes. The buildings were selected as the subjects because they had the following reasons; 1) More number of primary facilities, 2) Large plane and cubic scale, and 3) equal location requirements. As a result, Roppongi Hills and Tokyo-midtown in the downtown of Tokyo were selected.

Table 2. Subjects of survey

Facility	Roppongi Hills				Tokyo Midtown			
Image								
Address	6, Roppongi, Minato-ku, Tokyo				9-7, Akasaka, Minato-ku, Tokyo			
Mixed-use	Residence, Commerce, Office, Hotel, Others				Residence, Hotel, Commerce, office. others			
Area	Land	84,000m ²	building	728,900m ²	Land	68,900m ²	building	563,800m ²
Floor	53 F				54 F			
Completion	2003 years				2007 years			
Type	Urban regeneration				Urban regeneration			

3.2 Methods

3.2.1 Survey

This survey was carried out in collaboration with the users we met when we visited Roppongi Hills and Tokyo-midtown from October to December in 2010. After handing out the survey questionnaires to the participants the goal, intention, and utilization method were described in detail. When they finished answering the questions according to the self-evaluation method for each question, the questionnaires were collected. This study has been conducted through the 1st and the 2nd coding processes. First of all, the 1st study has been carried out in Roppongi Hills 113 questionnaires (96 questionnaires) and Roppongi Hills mid-town 82 questionnaires (76 questionnaires), while the 2nd study has developed, recomposed, and analyzed the questionnaire with general contents and without non-response in Roppongi Hills 107 questionnaires (96 questionnaires) and mid-town 81 questionnaires (76 questionnaires).

3.2.2 Sketch map

It is a method for an investigation collaborator (architecture student) to use the facility in the subject location freely without informing the investigation content. After using the facility, the student sketches the whole facility and the elements involved freely as much as he or she can on a blank A3-size sheet of paper without looking at the actual building or a map before going back home.

4. Analysis of Utilization Status of Cubic and Mixed-use High-rise Complex

4.1 General features of users

While there was a gender difference among users in Roppongi Hills and mid-town, the range of age and job was similar among them. It is, however, necessary to pay attention on an inclination of the user age and job in mid-town as there is a gap between the actual impression we had during the investigation and the outcome of the survey. It is interpreted that the gap is derived from the fact that mid-town is targeting the affluent middle age and elderly whereas Roppongi Hills is planned for varying age groups in general. (Table 4)

4.2 Number of visit · Number of person · Companion

Compared to the low '7~9 times' visit of the samples there was even distribution of the number of visit. While mid-town had a high rate of first visit Roppongi Hills had more repeaters. The survey outcome showed a high rate of a frequent visit by '2 persons' while a female group or a family of 3 and more was actually seen on-site. (Table 5)

4.3 Purpose of visit [in order]

The biggest purpose of visiting Roppongi Hills was 'tour and field trip' which included 'movie' and 'eating-out' in goal 1. For goal 2, 'shopping' took the majority of the answers and most people visited a store for the purpose of goal 1 rather than visiting a different store for a different goal. More responds on 'rest and walking' for goal 3 are interpreted to have a relation to the sufficient resting areas in the region which meets the user satisfaction. Meanwhile, mid-town had the highest number in 'event and exhibition.' The result implied that it was involved in the popular Christmas and illumination events during the period. The high rate of 'shopping' in goal 2 with the high number of 'next' goal users is interpreted that it had a relation to the characteristics of the large mixed-use complex like it was in Roppongi Hills. (Table 6)

4.4 Location and facilities of visit

The number of 2~3 places where most people visited is interpreted to be resulted from the ripple effect of mixed-use complex. As Roppongi Hills had a larger single-purpose independent facility like a theater or an arts gallery than mid-town, it had a higher rate of a single place visit. It is hard to pinpoint a core facility in mid-town considering that it has high-density stores or restaurants but it had a higher tendency of ripple effects. Taken the number of restaurant, café, and store from the results of user facilities in Roppongi Hills, an observatory or a theater showed a significant user rate. The findings showed that the observatory or the theater is the core facility of Roppongi Hills that help promote a differentiated planning of the area from mid-town. Additionally, an arts gallery or Hills Arena is variable depending on the period since the facility can be easily influenced by an event or the content of an event. Mid-town had many store users but not many purchasers. The stores were clustered around the area where frequent users go. The visitors were using the place as it offered 'the only' limited stores in one location. The mid-town garden in the illumination venue was also one of the favorite spot of the frequent users.

5. Analysis of Mixed-Use

5.1 Analysis of utilization pattern

Overall user ratio was analyzed after preparing several utilization patterns based on the facilities used at the survey locations. The analysis, however, only included those who visited 3 and more places (Roppongi Hills 65, mid-town 47) without asking the order of visit.

The top 3 utilization patterns in mid-town were restricted to the Christmas season only and different patterns can appear during a different period of time. Typical patterns regardless of the season in addition to a store and resting space include a snack bar or a café where people can eat out. This pattern is derived from the concept of eating take-out food in a resting space and there are possibilities of having more similar patterns.

It is hard to compare the utilization patterns of a theater or an observatory in Roppongi Hills with mid-town but there are user demands. To arrange a café or a restaurant in the circulation of such primary facilities could create a synergy effect. Roppongi Hills also had some of the same utilization patterns of the resting space as mid-town, which can be interpreted to be resulted from the increased demands for take-out facilities. (Table 8)

Table 4. Characteristic of the user F(%)

Sex	Roppongi Hills	Tokyo midtown		
Man	59(55.1)	20(24.7)		
Woman	48(44.9)	61(75.3)		
Total	107(100)	81(100)		
Occupation	Roppongi Hills	Tokyo midtown		
Student	25(23.4)	30(37.0)		
O.W.F.T	50(46.7)	21(25.9)		
O.W.P.T	9((8.4)	10(12.3)		
P.E	6(5.6)	1(1.2)		
Housewife	11(10.3)	15(18.5)		
Unemployment	1(0.9)	1(1.2)		
Others	5(4.7)	3(3.7)		
Total	107(100)	81(100)		
Example	Area Site	Total	Man	Woman
	Age			
Roppongi Hills	Inside tokyo	70(100)	41(58.6)	29(41.4)
	Outside tokyo	37(100)	18(48.6)	19(51.4)
	Total	107(100)	59(55.1)	48(44.9)
	10s	4(100)	2(50.0)	2(50.0)
	20s	62(100)	38(61.3)	24(38.7)
	30s	20(100)	12(60.0)	8(40.0)
	40s	7(100)	5(71.4)	2(28.6)
	50s	7(100)	1(14.3)	6(85.7)
	More than 60s	7(100)	1(14.3)	6(85.7)
	Total	107(100)	59(55.1)	48(44.9)
Tokyo midtown	Inside tokyo	49(100)	13(26.5)	36(73.5)
	Outside tokyo	32(100)	7(21.9)	25(78.1)
	Total	81(100)	20(24.7)	(75.3)
	Teenage	11(100)	2(27.3)	8(72.7)
	Twenties	42(100)	13(31.0)	29(69.0)
	Thirties	12(100)	4(33.3)	8(66.7)
	Forties	3(100)	0(0.0)	3(100)
	Fifty	9(100)	0(0.0)	9(100)
	Sexagenary	4(100)	0(0.0)	4(100)
	Total	81(100)	20(24.7)	61(75.3)

Table 5. N. of Visit, P. Visited, P. Accompanied F(%)

NV / PV / PS	Roppongi Hills	Tokyo midtown
First	21(19.6)	23(28.4)
2~3 times	20(18.7)	18(22.2)
4~6 times	27(25.2)	18(22.2)
7~9 times	7(6.5)	6(7.4)
More than ten times	30(28.0)	16(19.8)
Residence and work	2(1.9)	0(0.0)
Total	107(100)	81(100)
single	0(0.0)	0(0.0)
Two peoples	81(86.2)	60(80.0)
Three peoples	6(6.4)	7(9.3)
Four peoples	4(4.3)	4(5.3)
Five peoples	1(1.1)	1(1.3)
More than Six peoples	2(2.1)	3(4.0)
Total	94(100)	75(100)
One	13(12.1)	6(7.4)
Family	10(10.6)	10(13.3)
Friend	49(52.1)	45(60.0)
Couple	31(33.0)	18(24.0)
Others	4(4.3)	2(2.7)
Total	107(100)	81(100)

Table 6 Purpose of the visit(regarding the ranking)

Purpose	Roppongi Hills				Tokyo midtown			
	P1	P2	P3	Total	P1	P2	P3	Total
Sightseeing_Visit	30	6	4	40	17	13	8	38
Shopping	10	20	3	33	6	17	10	33
Meal	13	16	6	35	16	15	11	42
Promise	4	3	4	11	1	1	2	4
Date	12	5	6	23	10	2	4	16
Event, Exhibition	11	7	5	23	21	5	6	32
Movie impression	16	6	3	25	0	0	0	0
Rest, Walk	3	7	14	24	9	12	10	31
Duty	7	1	1	9	1	0	1	2
Lodging	0	0	0	0	0	0	0	0
resident	0	0	0	0	0	0	0	0
Others	1	0	1	2	0	0	0	0
Total	107	71	47	225	81	65	52	198

O.W.F.T : Office worker (full-time) O.W.P.T : Office worker (part-time) P.E : Public Employee
 NV / PV / PA : Number of visit, People visited, People accompanied

Table 7. Questionnaire items on the target subjects

F(%)

Roppongi Hills							
n=107							
Landmark	F(%)	Attractive place	F(%)	Desired facility equipments space	F(%)	Locations where people got puzzled	F(%)
Separation		Separation		Separation		Separation	
Mori Tower	54(53.5)	66 Plaza	18(19.4)	various type of restaurants	17(25.0)	Underground Space	8(15.7)
Spider	9(8.9)	Observatory	13(14.0)	Guide facilities	13(19.1)	In over all	7(13.7)
Observatory	8(7.9)	Mori Tower	10(10.8)	Rest Space	10(14.7)	Connection to the subway	7(13.7)
66 Plaza	7(6.9)	Mori Garden	8(8.6)	Cafe	6(8.8)	People did not know which floor they were at	4(7.8)
↓ omit		↓ omit		↓ omit		↓ omit	
Others	16(15.8)	Others	27(29.0)	Others	17(25.0)	Others	15(29.4)
Total	101(100)	Total	93(100)	Total	68(100)	Total	51(100)
No answer	6(5.6)	No answer	14(13.1)	No answer	39(36.4)	No answer	56(52.3)
Total	107(100)	Total	107(100)	Total	107(100)	Total	107(100)
Tokyo Midtown							
n=81							
Landmark	F(%)	Attractive place	F(%)	Desired facility equipments space	F(%)	Locations where people got puzzled	F(%)
Separation		Separation		Separation		Separation	
Midtown garden	14(18.2)	Midtown garden	30(39.5)	Rest Space	15(28.8)	Connection to the subway	10(24.3)
Galleria	12(15.6)	Galleria	11(14.5)	various type of restaurants	8(15.4)	Current location unidentified	4(9.8)
Midtown tower	12(15.6)	Plaza	6(7.9)	Cafe	7(13.5)	Near the garden	4(9.8)
illumination	11(14.3)	Courtyard	5(6.6)	Guide facilities	6(11.5)	Underground Space	4(9.8)
↓ omit		↓ omit		↓ omit		↓ omit	
Others	10(13.0)	Others	16(21.1)	Others	11(21.2)	Others	11(26.8)
Total	77(100)	Total	76(100)	Total	52(100)	Total	41(100)
No answer	4(4.9)	No answer	5(6.2)	No answer	29(35.8)	No answer	40(49.4)
Total	81(100)	Total	81(100)	Total	81(100)	Total	81(100)

Table 8. Analysis of utilization patterns

Pattern Ex		F(%)	Pattern Ex		F(%)
Model	Restaurant×Shop×Resting Space	12(18)	Model	Garden×Cafe×Shop	13(28)
	Multiplex ×Shop×Resting Space	11(17)		Garden×Shop×Cafe	11(23)
	Cafe×Shop×Resting Space	10(15)		Garden×Restaurant×Shop	9(19)
	Multiplex×Restaurant×Cafe	8(12)		Deli×Shop×Resting Space	8(17)
	Observatory×Restaurant×Shop	7(11)		Cafe×Shop×Resting Space	8(17)
Characteristic	Mori art museum×Observatory	13(20)	Characteristic	Deli×Resting Space	9(19)
	Observatory×Restaurant	13(20)		Supermarket×Resting Space	5(11)
	Roppongi Hills (n=65)			Tokyo Midtown (n=47)	

5.2 Connectivity by multi-access analysis table

The highest connectivity in Roppongi Hills was not the core facility but the combination of 'store x resting space.' The lower user rate of Mori Art Museum and the observatory than expectations prior to the survey showed that the facilities had less ripple effects compared to their profile as the symbol of Roppongi Hills. As of mid-town, the illumination event held at the mid-town garden seemed to have a great stimulating effect. The subjects in both areas commonly favored the connectivity with other facilities with respect to the 'resting space', and an effective facility or a space was arranged at the entrance or circulation of the building.

Table 9. Multiaccess analysis table

Roppongi Hills												n=96
Function	Mori Art museum	Observatory	Mori art enter	Multiplex	Hills Arena	Hotel	Asahi TV	Restaurant	Cafe- Bar	Shop	Resting space	
M.art museum	-	13(13.5%)	0(0.0%)	3(3.1%)	1(1.0%)	0(0.0%)	3(3.1%)	7(7.3%)	6(6.3%)	6(6.3%)	6(6.3%)	
Observatory	-	-	1(1.0%)	7(7.3%)	2(2.1%)	0(0.0%)	6(6.3%)	14(14.6%)	9(9.4%)	13(13.5%)	13(13.5%)	
Mori art enter	-	-	-	3(3.1%)	0(0.0%)	0(0.0%)	1(1.0%)	4(4.2%)	2(2.1%)	0(0.0%)	1(1.0)	
Multiplex	-	-	-	-	4(4.2%)	0(0.0%)	2(2.1%)	15(15.6%)	16(16.7%)	18(18.8%)	14(14.6%)	
Hills arena	-	-	-	-	-	0(0.0%)	1(1.0%)	5(5.2%)	3(3.1%)	4(4.2%)	2(2.1%)	
Hotel	-	-	-	-	-	-	0(0.0%)	0(0.0%)	1(1.0%)	0(0.0%)	2(2.1%)	
Asahi TV	-	-	-	-	-	-	-	3(3.1%)	3(3.1%)	8(8.3%)	6(6.3%)	
Restaurant	-	-	-	-	-	-	-	-	16(16.7%)	22(22.9%)	24(25.0%)	
Cafe- Bar	-	-	-	-	-	-	-	-	-	16(16.7%)	15(15.6%)	
Shop	-	-	-	-	-	-	-	-	-	-	35(36.5%)	
Resting space	-	-	-	-	-	-	-	-	-	-	-	

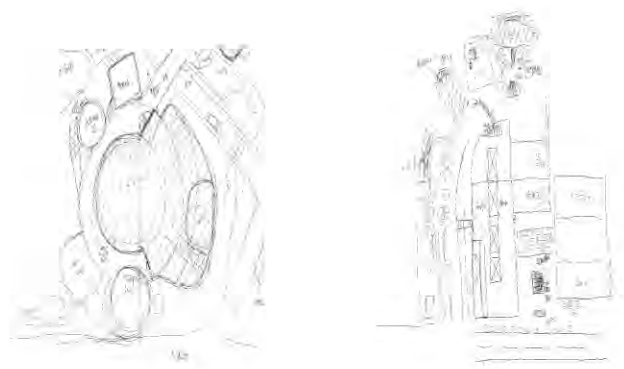
Tokyo midtown												n=76
Function	21_21 design	Santori Art center	Super	Midtown hall	Midtown garden	Hotel	Deli	Restaurant	Cafe- Bar	Shop	Resting space	
21-21 Design	-	1(1.3%)	0(0.0%)	1(1.3%)	8(10.5%)	0(0.0%)	1(1.3%)	4(5.3%)	4(5.3%)	9(11.8%)	1(1.3%)	
S. Art center	-	-	0(0.0%)	0(0.0%)	1(1.3%)	0(0.0%)	1(1.3%)	1(1.3%)	3(3.9%)	3(3.9%)	1(1.3%)	
Super	-	-	-	0(0.0%)	4(5.3%)	0(0.0%)	4(5.3%)	4(5.3%)	3(3.9%)	6(7.9%)	5(6.6%)	
Midtown hall	-	-	-	-	1(1.3%)	0(0.0%)	0(0.0%)	1(1.3%)	1(1.3%)	0(0.0%)	0(0.0%)	
M.D garden	-	-	-	-	-	0(0.0%)	8(10.5%)	10(13.2%)	18(23.7%)	29(38.2%)	14(18.4%)	
Hotel	-	-	-	-	-	-	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
Deli	-	-	-	-	-	-	-	3(3.9%)	4(5.3%)	14(18.4%)	10(13.2%)	
Restaurant	-	-	-	-	-	-	-	-	9(11.8%)	18(23.7%)	9(11.8%)	
Cafe- Bar	-	-	-	-	-	-	-	-	-	20(26.3%)	14(18.4%)	
Shop	-	-	-	-	-	-	-	-	-	-	23(30.3%)	
R. space	-	-	-	-	-	-	-	-	-	-	-	

6. Analysis of spatial cognition

6.1 Inconsistency of cognition by sketch map

Cognitive distortion was detected in every collaborator around the West Walk in Roppongi Hills. The reason was that it was difficult to recognize the distance between the curvy pathways continued from the outside to the inside in the form of completely different environments and landscapes at the entrance and the exit. Moreover, the measurements showed a difference as it was hard to understand the façade of the hotel standing behind. The collaborators who got lost or were almost lost at the Keyakizaka Complex had to do with the complicated vertical movements in the area where a myriad of buildings were clustered together.

Those who could sketch an area or a building where they didn't walk on the day clearly indicated that they were frequent visitors of the area or the building and they could recall the fragmentary map or a scenery in the past memory of their visit for a sketch. However, it showed that they could have a cognitive distortion easily in the part of the memory connection.



Roppongi Hills

Tokyo Midtown

Fig. 1. Investigation of sketch map

「Post-investigation Introspective」

· Roppongi Hills has a varying gap of height and curvy elements, which makes it difficult to understand the area, but it offers different attractions each time of visit.

Mid-town has a linear shape and easily understandable at the first visit.

The center of Roppongi Hills is recognized at a glance but the users get hesitating while they are moving.

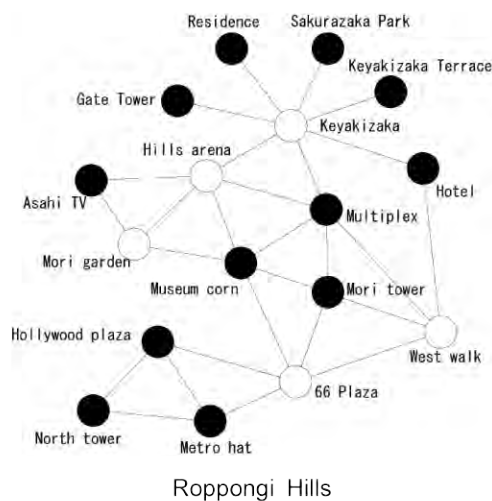
Although mid-town missed a core facility and drawing a map wasn't that easy, there was no hesitation.

Table 10. Use investigation of sketch map

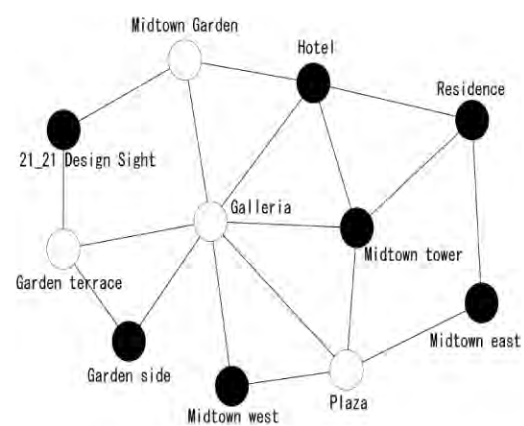
Student		Number of visit	
		Roppongi Hills	Tokyo midtown
Man	T.H	2~3times	2~3times
Man	G.H	7~9times	2~3times
Man	D.K	7~9times	4~6times
Woman	N.Y	More than ten times	4~6times
Man	S.T	More than ten times	More than ten times

6.2 Analysis by neighborhood graph

Roppongi Hills is in a circular shape structurally for sightseeing centering the Mori Tower and has a moderate curve, round circulation, 19 m of gap of the height, and middle story structure on artificial ground. As Mr. Mori Minoru in the Mori building once said, "I wanted to reedit the pleasure walking along the return way or detour, or the diversity or unpredictability occurring spontaneously in the streets with a high quality", the area is designed to lead the visitors to hesitate or get lost unintentionally. We prepared a neighborhood graph to describe this hesitation in a simple way (Fig 2). As it is shown in the graph, Roppongi Hills and mid-town demonstrate a noticeable difference in the number of node (●, ○) or the link (-) coming from the node. It can be interpreted that, in a structure like Roppongi Hills, hesitation increases along with the increase of node and the link in number so that multiple selections in movements between facilities could exist.



Roppongi Hills



Tokyo Midtown

Fig. 2. Neighborhood graph

● : Building · facility
○ : Area · Space

6.3 Relation between number of visit and hesitation

The connectivity was analyzed focusing on the number of visit and hesitation. Generally, it may look like the occurrence rate of hesitation is reduced as the number of visit is increased as it was in mid-town, the users who visited Roppongi Hills 10 times and more showed the highest rate of hesitation, which was the only case when the hesitated users surpassed the non-hesitated users. Furthermore, while it was expected that the hesitation rate with the low rate of visit in a large mixed-use complex in Roppongi Hills and mid-town would be high, the outcome in Roppongi Hills indicated almost equal or more non-hesitated users except for the users of '10 times and more.' (Table 11.) The result implies that as the rate of visit increases, the users are likely to show the following behavior patterns: 1) Add more destinations, 2) Unwilling to check the map while walking, and 3) Responds more on their past experience basis. It's because most of the visitors who went to the location for the purpose of shopping or eating and the visitors who went there to use a café, restaurant, or a store answered '10 times and more' according to the cross sum (Table 12.) of the number of visit, user facilities, and the goal of visit.

Table 11. The relation between the number of visit and hesitation

Number of visit	Roppongi Hills (n=107)			Tokyo midtown (n=81)		
	Got lost			Got lost		
	Y	N	Total	Y	N	Total
First	9(42.9)	12(57.1)	21(100)	14(60.9)	9(39.1)	23(100)
2~3 times	9(45.0)	11(55.0)	20(100)	12(66.7)	6(33.3)	18(100)
4~6 times	11(40.7)	16(59.3)	27(100)	7(38.9)	11(61.1)	18(100)
7~9 times	3(42.9)	4(57.1)	7(100)	4(66.7)	2(33.3)	6(100)
M.than 10 times	17(56.7)	13(43.3)	30(100)	4(25.0)	12(75.0)	16(100)
Residence & work	2(100)	0.0	2(100)	0(0.0)	0(0.0)	0(100)

Table 12. Cross sum of the number of visit and user facilities & the purpose of visit

Roppongi Hills											
Number of visit	Use facilities (Got lost Y)										n=153
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	Total
First	11.1	22.2	3.7	3.7	0.0	0.0	14.8	18.5	3.7	11.1	27(100)
2~3 times	0.0	5.0	0.0	5.0	0.0	0.0	5.0	25.0	10.0	25.0	20(100)
4~6 times	7.5	12.5	2.5	17.5	7.5	0.0	2.5	12.5	15.0	12.5	40(100)
7~9 times	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	16.7	50.0	6(100)
M.than 10 times	3.6	5.5	0.0	14.5	3.6	0.0	3.6	14.5	16.4	20.0	55(100)
Residence&work	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	20.0	20.0	5(100)
①Mori art center ②Observatory ③Art center ④Muxplex ⑤Hills arena ⑥Hotel ⑦Asahi TV ⑧Restaurant ⑨Cafe-Bar ⑩Shop ⑪Resting space											
Number of visit	Purpose of the visit (Got lost Y)										n=116
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	Total
First	38.1	19.0	9.5	0.0	4.8	9.5	4.8	14.3	0.0	0.0	21(100)
2~3 times	31.6	21.1	15.8	5.3	10.5	5.3	5.3	5.3	0.0	0.0	19(100)
4~6 times	12.0	8.0	4.0	4.0	20.0	12.0	24.0	8.0	4.0	0.0	25(100)
7~9 times	14.3	28.6	14.3	0.0	0.0	0.0	0.0	28.6	14.3	0.0	7(100)
M.than 10times	5.1	15.4	23.1	12.8	5.1	10.3	15.4	10.3	0.0	0.0	39(100)
Residence&work	33.3	16.7	0.0	0.0	0.0	16.7	0.0	16.7	16.7	0.0	5(100)
①Sightseeing-Tours ②Shopping ③Meal ④Promise ⑤Date ⑥Event, Exhibition ⑦Movies ⑧Rest, Walk ⑨work ⑩Lodging ⑪resident ⑫Others											

Tokyo Midtown											
Number of visit	Use facilities (Got lost Y)										n=116
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	Total
First	4.5	0.0	2.3	0.0	25.0	0.0	9.1	11.4	15.9	20.5	44(100)
2~3 times	5.6	5.6	2.8	0.0	11.1	0.0	8.3	8.3	11.1	27.8	26(100)
4~6 times	12.5	0.0	12.5	0.0	20.8	0.0	4.2	8.3	8.3	25.0	24(100)
7~9 times	0.0	0.0	8.3	0.0	8.3	0.0	16.7	8.3	0.0	25.0	12(100)
M.than 10 times	10.0	0.0	10.0	20.0	20.0	0.0	10.0	0.0	10.0	20.0	10(100)
Residence&work	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0(100)
① 21_21 Design sight ② santori art center ③ Super ④ Midtown hall ⑤ Garden ⑥ Hotel ⑦ Deli ⑧ restaurant ⑨ Cafe-Bar ⑩ Shop ⑪ Resting space											

Number of visit	Purpose of the visit (Got lost Y)											n=103
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	Total
First	30.3	18.2	27.3	0.0	3.0	15.2	0.0	6.1	0.0	0.0	0.0	33(100)
2~3 times	22.2	22.2	25.9	0.0	0.0	14.8	0.0	14.8	0.0	0.0	0.0	27(100)
4~6 times	15.0	10.0	20.0	5.0	10.0	20.0	0.0	15.0	5.0	0.0	0.0	20(100)
7~9 times	8.3	16.7	25.0	0.0	16.7	16.7	0.0	16.7	0.0	0.0	0.0	12(100)
M.than 10 times	9.1	18.2	9.1	0.0	0.0	27.3	0.0	36.4	0.0	0.0	0.0	11(100)
Residence&work	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0(100)

① Sightseeing-Tours ② Shopping ③ Meal ④ Promise ⑤ Date ⑥ Event, Exhibition ⑦ Movies ⑧ Rest, Walk ⑨ work ⑩ Lodging ⑪ resident ⑫ Others

7. Conclusion

This study analyzed the mixed-use and spatial cognition of the cubic and mixed-use highrise complex in Japan. It is intended to provide basic data for further studies on and planning of mixed-use and spatial cognition of the cubic and mixed-use complex. This study can be concluded as below:

Verification of mixed-use : It was clear that the same mixed-use complex Roppongi Hills and mid-town had different ripple effects by mixed-use. Roppongi Hills showed a wide variety of connectivity with such core facilities as a theater or an observatory, whereas mid-town had a connection with stores and restaurants around the galleria only. The reason of the difference can be attributed to the three factors: 1) Main target, 2) Spatial composition, and 3) Facility composition. In terms of investigation and analysis of the utilization patterns, moreover, new possibilities of a large mixed-use complex are recognized in the future as it is proven in the apparent increase of mid-town take-out users in number.

Verification of spatial cognition : There was a huge gap of hesitation between Roppongi Hills and mid-town. The general notion that the more frequent user the less likely to hesitate wasn't good to apply in this case of Roppongi Hills. It was considered based on the distorted cognition, the number of facilities in the neighborhood graph, and selections for movements obtained from the sketch map.

Meanwhile, the common responses on the lack of information facility and easy hesitation in the underground space in both areas for questions on the hesitated location or favored space or facilities (Table 7.) indicated more improvements in the future large mixed-use complex.

Finally, although this study generated a category of mixed-use and spatial cognition and identified each characteristic it had limited number of cases. Thus, further studies need to analyze more global cases using basic data in the future. Additionally, it is required to focus on multilateral and continued studies on the design of the cubic and mixed-use high-rise complex with the expert advisory service in the future as well as permanent research on systematic and technical approaches.

Notes

1) MOON Jung-In and LEE Sang-Ho.(2009) A Study on the Characteristics and Types of Intermediate Space in a Large Mixed-use Complex, J. Archi Plann. Environ. Eng., AIK, p.75(3-1); Recomposition of study contents.

2) KANG Boo-Seong and KIM Jin-Wook.(2007) A Study on the Usage Composition Characters of Super high-rise Buildings, J. KCDS, p.191(2.1 and 2.2); Reciting of study contents.

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