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A Study on Life Elements Observed in Small Residential Areas in Tokyo—Survey on the Quantity and Quality of Life Elements in the Roadside Space Detached Residential Areas in Bunkyo Ward, Tokyo

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Abstract: High-rise housing is being built in increasingly densely populated urban residential areas in Tokyo, Japan. On the other hand, detached houses are built on small, subdivided sites. In urban residential areas where detached houses are lined up, many elements related to daily life are located near roadside space and spill out onto the road. This is a distinctive modern urban residential landscape. The purpose of this study is to get closer to the reality of urban residential life. For that, we will consider the characteristics and roles of elements related to daily life that can be observed in many areas around roadside space in an urban residential area lined with detached houses, in urban living environments. This study focuses on the detached residential area of Bunkyo Ward. A field survey will be conducted to investigate the amount of elements related to daily life that can be observed from the road. In addition, we will conduct a questionnaire survey of residents in the survey area regarding their use of and awareness of the roadside space. Finally, we will investigate the relationship between lifestyle factors and urban residential life from both quantitative and qualitative perspectives.

Key words: Life elements, small site, roadside space, city life, lifestyle consciousness.

1. Research Objective

1.1 Research Background/Motivation

Contrary to the recent trend of an aging population, declining birthrates, and declining population, urban residential density is increasing in Tokyo, Japan. The urban residential landscape consisting of detached houses and apartment complexes in the central urban areas of the metropolitan area and business core cities is rich in diversity. In particular, the way in which the roadside space of each house is used in detached residential areas allows us to observe and demonstrate the characteristics of urban living. Manifestations of urban dwellers' lives form part of the urban residential landscape.

Cities have various distinctive areas such as commercial, historical, industrial and residential areas. Each region needs a landscape that is appropriate for it. In Japan, the Landscape Act was established in 2004. Article 1 of the Landscape Act[1] aims to "improve people's lives and promote the healthy development of local communities." To create a landscape suitable for urban residential areas, we thought it would also be important to focus on the manifestations of urban dwellers' lives that can be observed in the roadside space.

In 2020, the Pedestrian Accessibility Improvement Road System (Hokomichi System) was established as part of a partial amendment to the Road Act. The space

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[1] Landscape Act, Article 1: The purpose of this Act is to promote the formation of good landscapes in Japan's cities, rural areas, and other areas by formulating landscape plans and taking other measures comprehensively, thereby aiming to create a beautiful and dignified nation, create a rich and fulfilling living environment, and realize unique and vibrant local communities, thereby contributing to the improvement of people's lives and the healthy development of the national economy and local communities.

around the roads will further revitalize the city and increase the attractiveness of the area through sustainable urban development. The practice and research on road utilization conducted by Professor Izumiyama [1] and his colleagues focuses on central commercial areas such as Kanda, Ikebukuro, Kashiwa, and Utsunomiya. In the central commercial district, efforts are being made to create new lively spaces around roads. However, there has been little consideration given to the roads surrounding residential areas.

This study focuses on the manifestations of life in diverse urban residential areas. And, we explored ways to arrange the roadside space of each house that would be appropriate for the residential area, and we also thought that this would contribute to improving the unique appeal of the detached housing area.

1.2 Research Purpose

This study focuses on the elements related to daily life in the roadside space of detached houses in the city, focusing on the detached houses in Bunkyo-ku, Tokyo, Japan.

In urban residential areas where many houses are built on small sites, we conduct a field survey to investigate the quantity of "elements related to the lives of residents" that can be observed in the roadside space. In addition, a questionnaire survey will be conducted among residents of the survey area regarding "how people use and their awareness of roadside space." We will consider the characteristics and roles of elements related to daily life from both quantitative and qualitative perspectives, and grasp the actual state of elements related to daily life.

1.3 The Significance and Usefulness of This Study

In urban residential areas where many houses have small sites, the roadside space is located between the road and the houses. From the roadside, we can see the roadside space of the residential property. On the other hand, residents use the roadside space as part of their daily lives.

There is a wide range of research into the external spaces of detached residential areas. Among these, research on roadside space can be categorized into landscape and architectural planning fields. In the field of landscape, Professor Hayasaka and Professor Suzuki [2] investigated the types of vegetation around roadside space in urban detached housing areas and considered the relationship between vegetation and resident awareness. In addition, Professor Inoue and Professor Senda [3] investigated the types of fences around roadside space in urban detached residential areas and considered the relationship between fences and residents' awareness. These studies focus on plantings and fences along roadsides. In the field of architectural planning, Professor Kitahara and Professor Katsura [4], considered the relationship between housing and outdoor spaces. Professor Hattori [5] studied how outdoor spaces are used and evaluated. These studies consider how external spaces are used from the perspective of the relationship between buildings and external spaces. None of the studies focused on factors related to daily life.

Having a look at the survey sites for research into the outdoor spaces of detached residential areas, Professor Inoue and Professor Senda's [3] research focused on low-rise residential areas in Tokyo. The study on the role of hedges conducted by Professor Ikezoe and Professor Terasaki [6] focused on suburban residential areas in Fukuoka that have building agreements. The research on tourism resources and cityscapes conducted by Professor Kawazu and Professor Tsuboi [7] focused on residential areas in tourist destinations. The research on the relationship between residential space and gardens conducted by Professor Umezu and Professor Sakamoto [8] and the research on the shape and characteristics of outdoor spaces conducted by Professor Noguchi and Professor Adachi [9] were conducted in residential areas in cold regions. In a study conducted by Professor Taniguchi [10] on the conditions for the existence of gardens in detached houses, it was revealed that a site area of 100 m^2 or

more is required for a garden to function. However, both studies focus on outdoor spaces and gardens. The survey did not cover detached residential areas in the city center, where many properties are small.

In recent years, the construction of detached houses on small plots of land less than 100 m2 has been increasing in urban areas. In urban residential areas, the landscape of detached houses standing side by side on small sites is one of the defining features of the urban landscape. This was made clear by Professor Asami [11] in his research on living environments. Professor Kita and Professor Nakamura [12] also clarified this in their study on the characteristics of detached houses on small sites.

The roadside space is located between the road and the building, and is a space that is influenced by both the roadside and the detached houses side. This study focuses on the elements related to daily life within this context. We thought that by understanding the actual conditions of elements related to daily life in the roadside space, we could consider urban living environments from a different perspective than landscape and planning studies (Fig. 1).

1.4 Definition of Terms

The authors have conducted research on elements related to daily life in urban residential areas [13]. Looking at previous research evaluating the components of urban landscapes, Professor Funakoshi and Professor Tsumita [14] classify the spatial components of streetscapes into the following major categories: buildings, greenery, roadways, and facilities. In their study of street landscapes, Professor Nakamura and Professor Shinohara [15] classified the components of a landscape into roads, roadsides, distant views, human activities, underground areas, and factors of change. In these studies, the elements of life that urban dwellers reveal are categorized as devices and human activities. In this study, we will refer to all elements that can be judged as devices and human activities, that is, all elements related to people's urban lives, as "life elements" (Fig. 2).

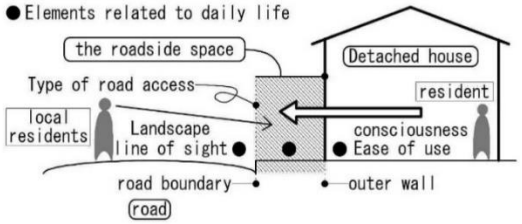

Fig. 1 Spatial characteristics in the roadside space.

The subjects of this study were detached houses in urban areas, and the survey subjects were classified by site area. Previous studies [12, 16] have shown that a small site is defined as one that is less than 70 m^2, while another defines it as one that is less than 100 m^2. Sites of less than 70 m^2 were considered "extremely small sites", and sites of 70 m^2 to 100 m^2 were considered "small sites". According to survey data from the Japan Housing Finance Agency[2], the average site area for those taking out loans for custom-built homes with land in the Tokyo metropolitan area will be 153.8 m2 in fiscal 2022 and 162.8 m2 in fiscal 2023. The average site area for those borrowing for prefabricated housing is 116.7 m^2 in fiscal year 2022 and 119.2 m^2 in fiscal year 2023. A "general site" is defined as an area between 100 m^2 and 150 m^2. In addition, the area between the road boundary line and the building exterior wall is defined as the "roadside space" (Fig. 3).

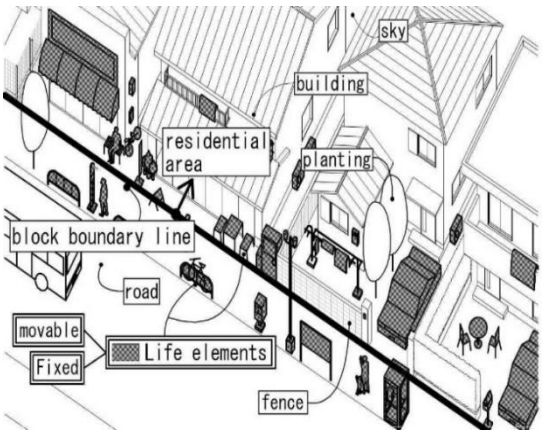

Fig. 2 Schematic diagram of life elements.

[2] Based on Flat 35 loan application data held by the Japan Housing Finance Agency (formerly the Japan Housing Loan Corporation), we referenced data for fiscal 2023 that compiles data on Flat 35 users by loan category and prefecture.

Fig. 3 Classification by site area and definition.

2. Research Plan

2.1 Research Overview

This study focuses on detached residential areas in the city center. The survey targets a detached residential area in Bunkyo Ward, located inside the Yamanote Line in central Tokyo. We refer to areas that have been introduced as detached residential areas in the city center in our previous research [13]. The survey area will be the entire Hakusan 4-chome area in Bunkyo-ku, Tokyo.

The research flow is shown (Fig. 4). A preliminary survey was conducted using map information[3] and field surveys[4] of the target area. We investigated the number of detached houses and the area of each site within the target area. Next, we conducted another field survey[5]. A quantitative survey will be conducted by investigating the type of road access in each detached residential area and the number of observable life elements. In addition, a questionnaire survey[6] will be conducted on detached houses within the target area. A qualitative survey will be conducted to investigate residents' usage and awareness of the roadside space. Next, the quantitative and qualitative survey results will be analyzed. The survey results are compared by the type of road access shapes and three types of site area. Finally, we consider the relationship between life elements and resident awareness in the roadside space in the surveyed areas.

2.2 Survey Area and Preliminary Survey

In our previous research [13], part of Hakusan 4-chome in Bunkyo Ward was introduced as a residential area of detached houses in the city center. Taking this into consideration, the entire Hakusan 4-chome area in Bunkyo Ward was selected as the survey area. As a preliminary investigation, a map of the survey area (Fig. 5) was created based on local map information and field surveys. There were 979 sites in the area, of which 735 were detached houses and 244 were other buildings. Of the 735 detached houses, 576 detached houses with a site area of 150 m^2 or less were the subjects of this study, based on survey data from the Japan Housing Finance Agency[7].

2.3 Quantitative Survey: Survey of Life Elements in the Roadside Space

Through a field survey, we observed all the life elements in the roadside space of the survey site and plotted their locations on a map. We investigated the number of all 24 types of life elements "a" to "x" (Fig. 6) that can be observed in the roadside space. In addition, we will investigate the number of life elements that spill over onto the road from the roadside space. Based on the authors' previous work [13], the survey focused on movable life elements that play a role in creating a sense of life in the urban landscape. When observing life elements, rather than simply focusing on whether they were visible or not, we tried to observe as many of the elements as possible, such as by moving our gaze to various positions and peering at elements that were difficult to see (Figs. 7 and 8).

[3] A map of the survey area was created using Vector Map Maker, which can create DXF format maps using basic map information and basic land information from the Geospatial Information Authority of Japan, national land digital information from the Ministry of Land, Infrastructure, Transport and Tourism, and elevation data from the National Geophysical Data Center, as well as ZENRIN residential maps.

[4] The preliminary field survey will be conducted from April 7th to 9th, 2025.

[5] This field survey will be conducted from April 21st to 24th, 2025.

[6] The questionnaire survey will be distributed from May 7th to 29th, 2025.

[7] Based on Flat 35 loan application data held by the Japan Housing Finance Agency (formerly the Japan Housing Loan Corporation), we referenced data for fiscal 2023 that compiles data on Flat 35 users by loan category and prefecture.

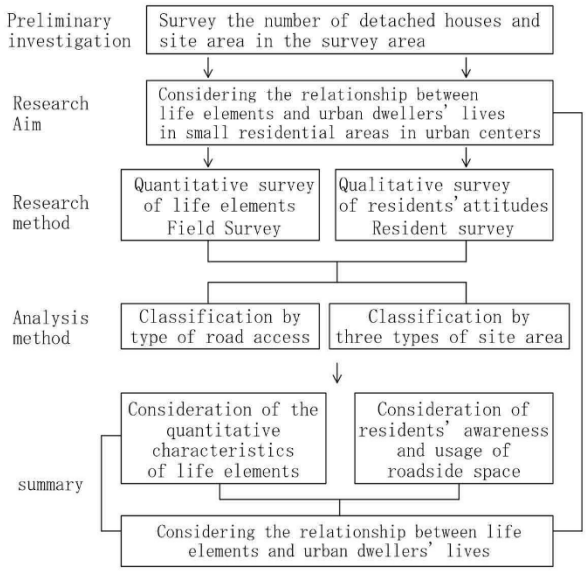

Fig. 4 Research flow.

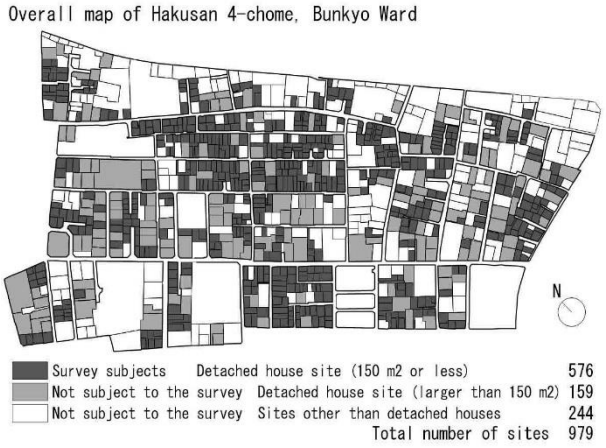

Fig. 5 Map of the survey area.

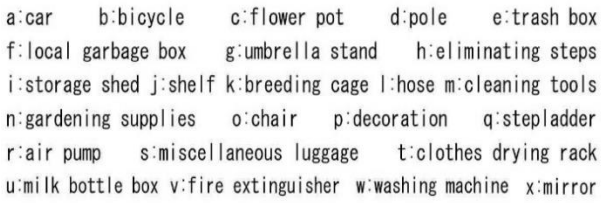

Fig. 6 Types of mobile living elements observed at the survey site.

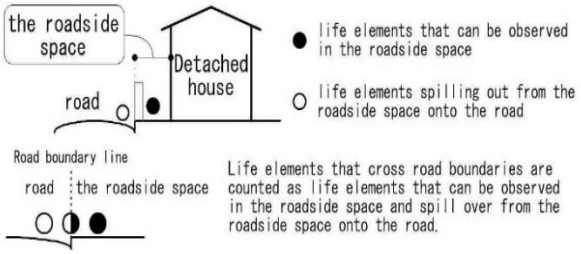

Fig. 7 Schematic diagram of observable life elements.

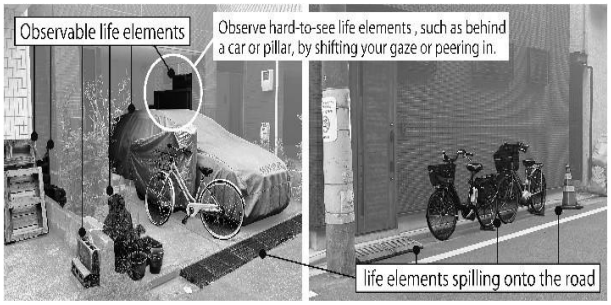

Fig. 8 Examples of observable life elements.

2.4 Qualitative Research: Questionnaire Survey of Residents

In order to understand the usage and awareness of the roadside space of residents in the survey area, a qualitative survey will be conducted using questionnaires distributed individually and collected by mail. The questionnaire items (Fig. 9) were based on previous papers by Professor Ariga and Professor Shimizu [17] on living environments. The questionnaire items were divided into three categories: (1) residents' awareness of the roadside space, (2) how to utilize the roadside space, and (3) awareness of the role of fences. Q1 to Q14 asked for responses on a five-point scale: (1) I think so, (2) I think so somewhat, (3) Neither I nor I think so, (4) I don't think so much, (5) I don't think so, and Q15[8] asked for responses on a two-point scale: (1) I have it, (5) I don't have it.

[8] For question Q15, the subjects were asked to mark whether or not their property had a fence by marking it with a circle or an X, and only answer if they thought there was a fence. There was no awareness of judging the visibility of fences.

3. Survey and Analysis: Entire Survey Area

3.1 Survey Results on Life Elements in the Roadside Space

The number and percentage of life elements that can be observed in the roadside space for all surveyed detached houses are shown below (Fig. 10). A total of 2,104 life elements were identified across all 576 detached houses surveyed. The number of life elements per dwelling unit was 3.65. The number of life elements that can be observed in the survey area is ranked in descending order—b: bicycle: 332, c: flower pot: 317, l: hose: 203, a: car: 183, m: cleaning tools: 180, s: miscellaneous luggage: 178, e: trash box: 117. Over 100 of these were identified. In addition, a scatter diagram of life elements that can be observed in the roadside space is shown (Fig. 11).

1 : residents' awareness of the roadside space
Q1 Do you think it blocks people from the outside?
Q2 Do you think it creates a beautiful cityscape?
Q3 Do you think it protects your privacy?
Q4 Do you think it enriches your relationships?
2 : how to utilize the roadside space
Q5 Do you use it as a luggage storage space?
Q6 Are you placing flower pots to create a streetscape?
Q7 Are you considering a parking space?
Q8 Do you think of it as a place to talk to people you know?
Q9 Do you think of it as a place for light exercise and children to play?
Q10 Do you think the roadside space is being utilized?
3 : awareness of the role of fences
Q11 Do you think that leaving luggage, bicycles, cars, plants, etc. in the roadside space helps prevent crime?
Q12 Do you think that luggage, bicycles, cars, plants, etc. placed in the roadside space can serve as a "substitute for a fence"?
Q13 Are you concerned about not having a fence and having your property visible from the road?
Q14 Do you think having a fence helps prevent crime?
Q15 If there is a fence, do you store items behind it?

Fig. 9 Questionnaire survey items.

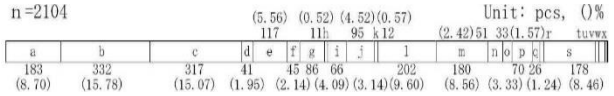

Fig. 10 Percentage of life elements that can be observed in the survey area.

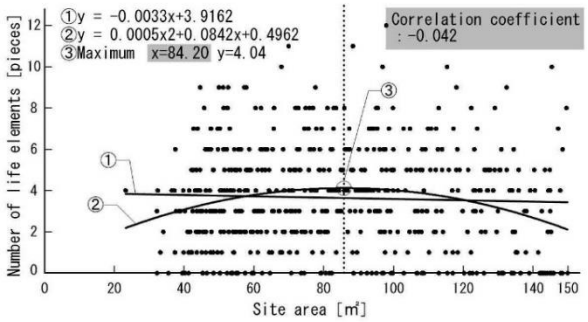

Fig. 11 Relationship diagram between the site area of the surveyed area and the life elements that can be observed.

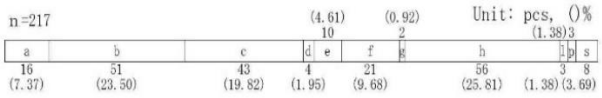

Fig. 12 Percentage of life elements spilling onto roads in the survey area.

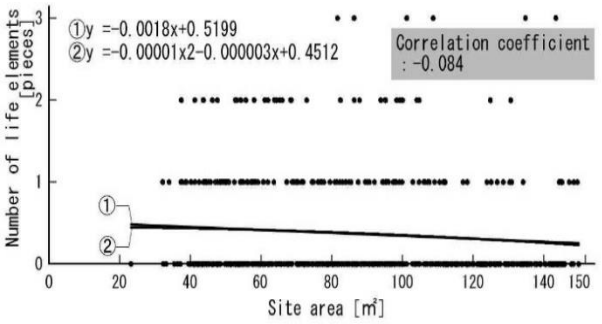

Fig. 13 Relationship diagram between the site area of the surveyed area and the life elements spilling onto the road.

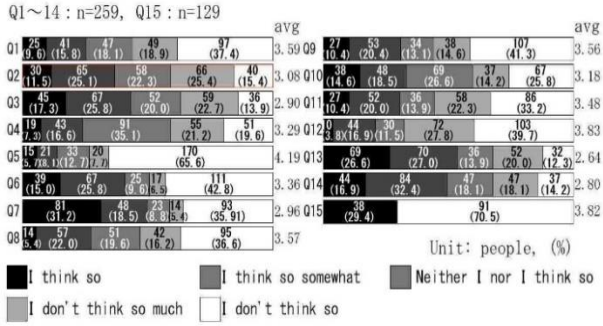

Fig. 14 Overall survey results.

3.2 Survey Results on Life Elements Spilling onto Roads

The number of life elements spilling onto the road from the roadside space of all surveyed detached houses is shown (Fig. 12). The total number of life elements spilling onto the road from the roadside space was 217. The number of life elements per dwelling unit was 0.38. The most common life elements spilling onto the road were—h: eliminating steps: 56, b: bicycles: 51, c: flowerpots: 43. Also shown is a scatter diagram of life elements spilling onto the road from the roadside space (Fig. 13).

3.3 Survey Results for the Entire Survey Area

Of the 576 questionnaires distributed, 259 were returned, for a response rate of 44.96%. The results of the overall questionnaire survey are shown above (Fig. 14).

3.4 Analysis of the Relationship between the Life Elements in the Roadside Space, and the Life Elements Spilling onto the Road and the Site Area

From Fig. 11, we focus on the shape of the linear approximation in line ① and the correlation coefficient: -0.042. The correlation between the number of life elements observable in the roadside space and the site area is extremely weak. We also noticed that the shape of the polynomial approximation in line ② is centered around the site area of 84.20 m^2.

Also, from Fig. 13, we focus on the linear approximation (line ①) and the polynomial approximation (line ②), as well as the correlation coefficient: -0.084. There appears to be an extremely weak negative correlation between the number of life elements spilling onto the road from the roadside space and the site area, but this cannot be determined from this data alone.

When site area was treated as continuous value, the correlation between site area and life elements was extremely low. In the following, Chapter 4 will analyze the relationship between the type of road access shape and life elements, and Chapter 5 will analyze the relationship between the three site area classifications and life elements.

4. Analysis by Type of Road Access Shapes

4.1 Types of Road Access Shapes

In our previous study [13], we compared three distinctive residential areas. We noted that the amount of fencing in residential areas and the amount of life elements present in the roadside space vary from neighborhood to neighborhood. Therefore, the survey areas were classified according to the type of road access shape and the amount of life elements was investigated. Based on Professor Doi's [18] research on the awareness and shape of boundaries between public and private spaces, the shape of road access is classified into eight types (Fig. 15). Regarding visibility into the site, we classified it into two categories: A to D have no visibility, and E to H have visibility. In the following, Sites ABCD with no visibility (units with fences) will be referred to as (i), and Sites EFGH with visibility (units with partial fences) will be referred to as (ii).

4.2 Survey Results for the Type of Road Access Shape in the Survey Area

On the map, the surveyed detached houses were classified by the type of road access shapes (Fig. 16), and the proportion of road access shape types was shown (Fig. 17). The types of road access shapes in the surveyed areas were (i) 28.82% and (ii) 71.18%. The survey area is characterized by the fact that more than half of the dwellings are unfenced.

4.3 Survey Results of Life Elements according to the Type of Road Access Shapes

The number of life elements by the type of road access shapes for the surveyed detached houses (Table 1) and the scatter plots of life elements by type (Figs. 18 and 19) are shown below. Comparing (i) and (ii), the number of life elements per dwelling unit is 3.61 and

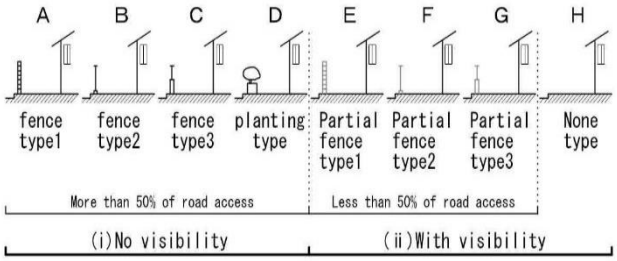

Fig. 15 Types of road access shape.

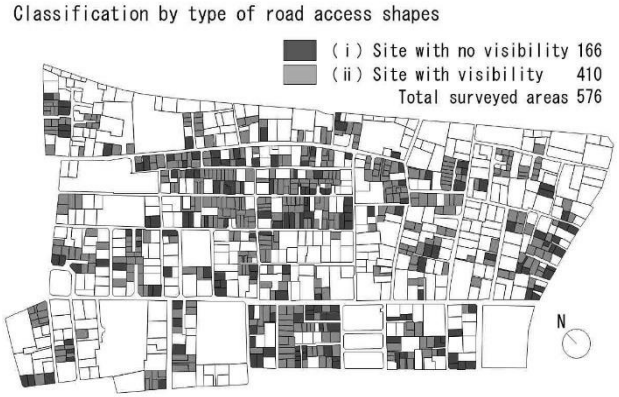

Fig. 16 Map of road access shapes in the survey.

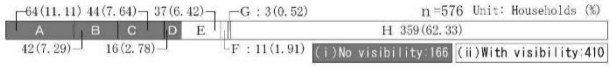

Fig. 17 Proportion of road access shapes.

3.67, respectively, with (ii) having slightly more life elements. The correlation coefficients are 0.065 for (i) and -0.083 for (ii), and the proportionality constants for the linear approximation of ① are 0.0051 for (i) and -0.0067 for (ii), which are slightly different. ② The polynomial approximation (i) is close to a straight line, but (ii) is a curve with a maximum value of ③ x = 87.41 y = 4.44. From the above, (ii) has more life elements than (i). However, the significance of both data was $p = 0.853 > 0.05$, so it cannot be said that there is a relationship between the visibility of road access shapes and the number of life elements in this study area.

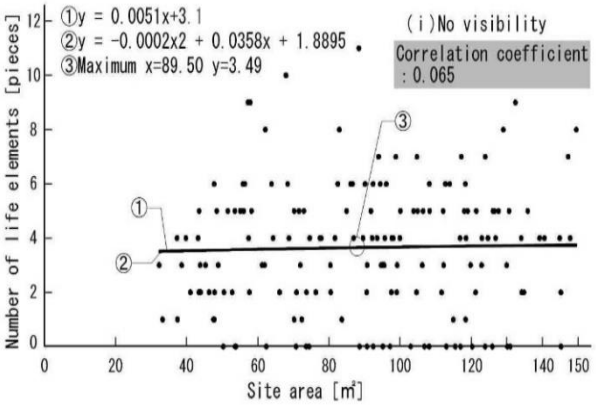

Fig. 18 A diagram showing the relationship between the site area and observable life elements on a site with no visibility.

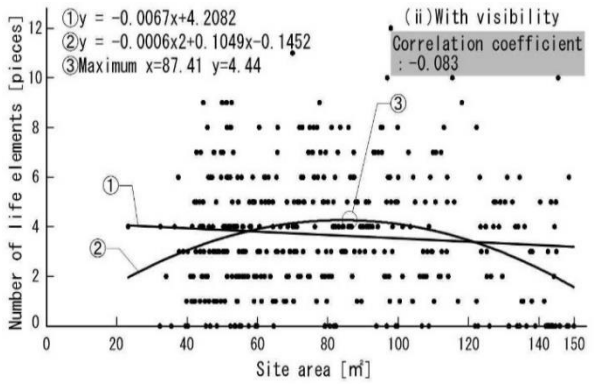

Fig. 19 A diagram showing the relationship between the site area and observable life elements for a site with visibility.

4.4 Survey Results of Life Elements Spilling onto Roads by the Type of Road Access Shapes

The number of life elements spilling onto the road by the type of road access shapes for the surveyed detached houses (Table 2) and the scatter diagrams of life elements spilling onto the road by type (Figs. 20 and 21) are shown. Comparing (i) and (ii), the number of life elements spilling onto the road per dwelling unit is 0.47 and 0.33, meaning that (i) has more life elements spilling onto the road than (ii). The correlation coefficients were -0.129 for (i) and -0.085 for (ii). The proportionality constants for the linear approximation of (i) were -0.003 for (i) and -0.0017 for (ii). The polynomial approximation of (ii) was a downward sloping trend for both (i) and (ii). Furthermore, the significance of both data was $p = 0.021 < 0.05$. From the above, it can be said that in both (i) and (ii), there is an extremely weak negative correlation between the number of life elements spilling onto the road and the site area, and that the negative correlation is stronger in (i) than in (ii).

4.5 Survey Results by the Type of Road Access Shapes

The overall survey results in Section 3.3 were simply cross-tabulated between (i) and (ii) (Fig. 22). Looking at the significance of the survey results for (i) and (ii) (Table 3), Q1: $p = 0.013$, Q3: $p = 0.002$, Q13: $p = 0.001$ were all less than 0.05, and Q14: $p = 0.058$ was close to 0.05. Furthermore, the p values for Q5, Q6, Q10, and Q11 were close to 1.0.

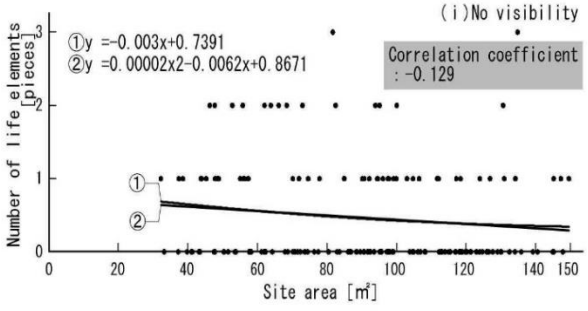

Fig. 20 Relationship diagram between the site area and the life elements spilling onto the road in a site with no visibility.

Table 1 Number of life elements by the type of road access shapes.

Road access shape	Number of life				
	Number of households	Life elements	Elements per dwelling	Deviation	*t*-test
(i): No visibility	166	600	3.61	2.44	$p = 0.856$
(ii): With visibility	410	1,504	3.67	2.47	> 0.05

Table 2 Number of life elements spilling onto roads by the type of road access shapes.

Road access shape	Number of households	An overflowing number of life elements	Number of life elements per dwelling	Deviation	*t*-test
(i): No visibility	166	77	0.47	0.70	$p = 0.021 <$ 0.05
(ii): With visibility	410	137	0.33	0.62	

Table 3 Survey results by the type of road access shapes.

	(i): No visibility				(ii): With visibility				*t*-test
	Arithmetic mean	Geometric mean	Mode	Standard deviation	Arithmetic mean	Geometric mean	Mode	Standard deviation	*p*-value
Q1	3.39	2.99	5	1.43	3.83	3.51	5	1.32	0.013
Q2	3.04	2.75	2	1.25	3.12	2.79	4	1.29	0.628
Q3	2.63	2.33	2	1.20	3.15	2.77	4	1.40	0.002
Q4	3.22	2.95	3	1.20	3.38	3.13	3	1.18	0.288
Q5	4.28	3.94	5	1.31	4.29	4.01	5	1.22	0.953
Q6	3.36	2.88	5	1.60	3.39	2.92	5	1.61	0.911
Q7	3.12	2.56	5	1.72	2.80	2.23	1	1.75	0.147
Q8	3.62	3.29	5	1.37	3.56	3.27	5	1.32	0.742
Q9	3.70	3.31	5	1.46	3.47	3.05	5	1.49	0.224
Q10	3.18	2.81	3	1.40	3.20	2.81	3.5	1.43	0.893
Q11	3.48	3.14	5	1.35	3.49	3.10	5	1.44	0.961
Q12	3.90	3.67	5	1.18	3.79	3.49	5	1.29	0.471
Q13	2.33	1.96	1	1.36	2.93	2.57	2	1.37	0.001
Q14	2.64	2.30	2	1.32	2.95	2.64	2	1.29	0.058
Q15	3.81	3.10	5	1.83					

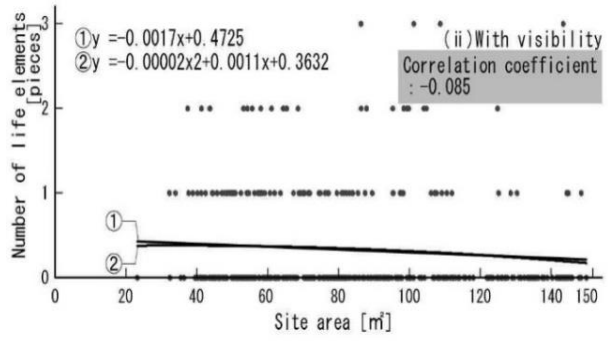

Fig. 21 Relationship diagram between the site area and the life elements spilling onto the road in a site with visibility.

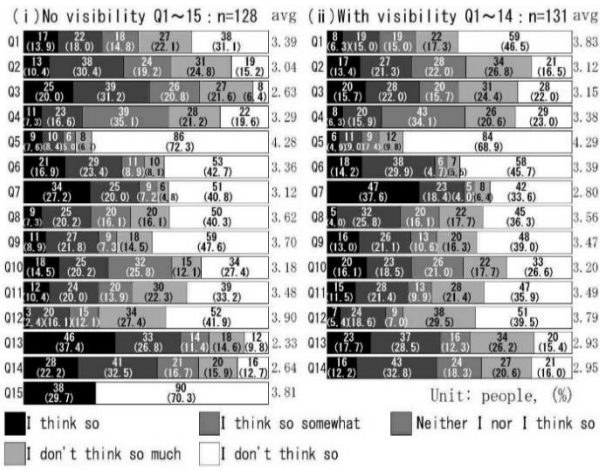

Fig. 22 Survey results by the type of road access shapes.

5. Research and Analysis: Three Types of Site Area

5.1 Three Types of Site Area Classification

Based on Section 1.4, sites with an area of less than 70 m^2 are classified as "extremely small sites", sites between 70 m^2 and 100 m^2 as "small sites", and sites between 100 m^2 and 150 m^2 as "general sites" (Fig. 23). We consider the relationship between site area and the number of life elements. Hereafter, these are referred to as (I) "extremely small sites", (II) "small site", and (III) "general site".

5.2 Survey Results of Life Elements by Three Types of Site Area

The number of life elements by three types of site area for the surveyed detached houses (Table 4) and a scatter plot of the life elements by three types (Fig. 24) are shown below. The number of life elements per dwelling unit was (II) 4.07 > (I) 3.55 > (III) 3.31. 3.1: The relationship diagram (Fig. 11) between the site area of the surveyed area and the observable life elements is divided into (I), (II), and (III) (Fig. 24). The peak of the polynomial approximation, 87.41 m^2, was in the region (II), and the significance of each data was $p = 0.011 < 0.05$.

Therefore, we considered that the comparison based on the categories (I), (II), and (III) was significant.

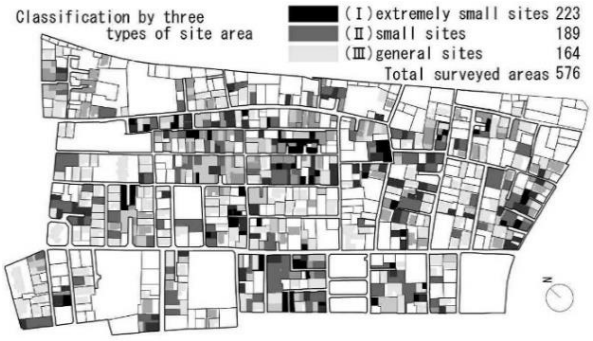

Fig. 23 Map of the three types of site area in the survey area.

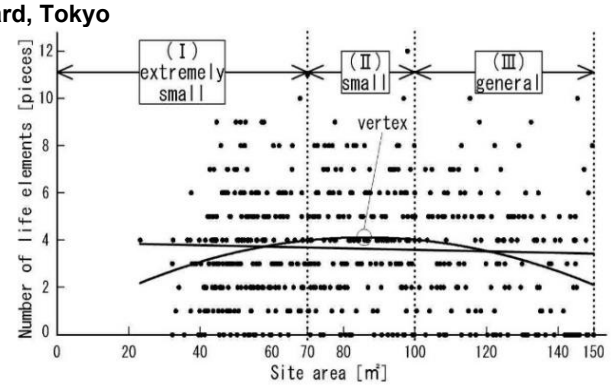

Fig. 24 Relationship diagram between the three types of site area and the life elements that can be confirmed.

5.3 Survey Results of Life Elements Spilling onto Roads by Three Types of Site Area

The number of life elements spilling onto roads for the surveyed detached houses by three types of site area (Table 5) and a scatter plot of life elements spilling onto roads by three types of site area (Fig. 25) are shown below. The number of life elements spilling onto the road per dwelling unit was (I) 0.44 > (II) 0.36 > (III) 0.31. Furthermore, the polynomial approximation is downward sloping in the ranges (I), (II), and (III). The significance of the data from the analysis of variance was $p = 0.118 > 0.05$, so it cannot be said that the classification into (I), (II), and (III) results in decreasing order of (I) > (II) > (III). However, Section 3.2 suggests that there is a strong possibility of a slight negative correlation with site area.

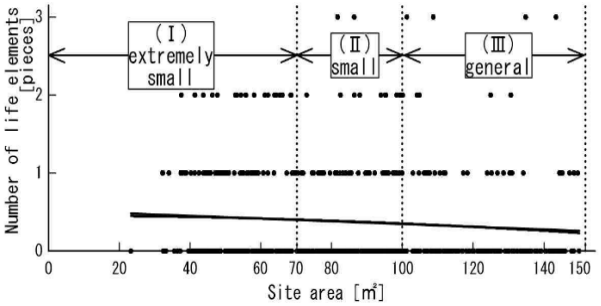

Fig. 25 Relationship diagram of life elements spilling onto roads by three types of site area.

Table 4 Number of life elements by three types of site area.

By area	Number of households	Number of life elements	Number of life elements per dwelling unit	Deviation	Analysis of variance one-way arrangement
I: extremely	223	792	3.55	2.36	
II: small	189	770	4.07	2.42	$p = 0.011 < 0.05$
III: general	164	544	3.31	2.56	

Table 5 Number of life elements spilling onto roads by three types of site area.

By area	Number of households	Number of life elements	Number of life elements per dwelling unit	Deviation	Analysis of variance one-way arrangement
I: extremely	223	99	0.44	0.66	
II: small	189	67	0.36	0.63	$p = 0.118 > 0.05$
III: general	164	51	0.31	0.67	

Table 6 Survey results by three types of site area.

	I : extremely (n I: 83)				II: small (n II: 90)				III: general (n III: 86)				Analysis of variance
	Arithmetic mean	Geometric mean	Mode	Standard deviation	Arithmetic mean	Geometric mean	Mode	Standard deviation	Arithmetic mean	Geometric mean	Mode	Standard deviation	*p*-value
Q1	3.81	3.49	5	1.31	3.51	3.16	5	1.40	3.52	3.11	5	1.45	0.293
Q2	3.31	3.03	4	1.22	3.00	2.68	2	1.30	2.94	2.63	2	1.26	0.138
Q3	3.11	2.81	2	1.27	2.94	2.62	4	1.26	2.64	2.25	2	1.41	0.064
Q4	3.46	3.20	3	1.19	3.33	3.13	4	1.07	3.12	2.82	3	1.28	0.172
Q5	4.05	3.63	5	1.46	4.37	4.10	5	1.18	4.40	4.17	5	1.11	0.159
Q6	3.65	3.25	5	1.49	3.16	2.63	5	1.69	3.34	2.89	5	1.59	0.149
Q7	2.88	2.36	5	1.69	2.63	2.07	1	1.74	3.36	2.80	5	1.71	0.020
Q8	3.54	3.20	5	1.40	3.61	3.37	5	1.21	3.62	3.26	5	1.41	0.911
Q9	3.47	3.01	5	1.55	3.45	3.07	5	1.45	3.83	3.46	5	1.41	0.173
Q10	3.27	2.94	3	1.33	3.02	2.64	2	1.42	3.27	2.85	5	1.47	0.430
Q11	3.83	3.55	5	1.26	3.34	2.98	5	1.39	3.31	2.89	5	1.47	0.028
Q12	3.91	3.65	5	1.23	3.76	3.50	5	1.22	3.87	3.59	5	1.25	0.715
Q13	2.88	2.49	2.4	1.39	2.70	2.31	2	1.39	2.35	1.98	1	1.36	0.004
Q14	2.80	2.53	5	1.20	2.91	2.56	2	1.34	2.69	2.33	2	1.39	0.558
Q15	3.67	2.92	5	1.89	3.76	3.04	5	1.85	3.88	3.20	5	1.78	0.878

5.4 Survey Results for Three Types of Site Area

The overall questionnaire survey in Section 3.3 was cross-tabulated by attributes, broken down by site area (I), (II), and (III) (Fig. 26). When examining the significance of the data from the analysis of variance of the survey results for (I), (II), and (III), the results were less than 0.05: Q7: $p = 0.020$, Q11: $p = 0.028$, and Q13: $p = 0.004$. Furthermore, the p value of Q8 was close to 1.0 (Table 6).

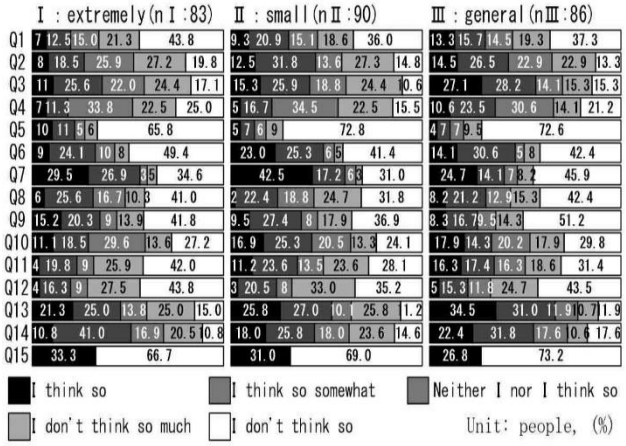

Fig. 26 Survey results by three types of site area.

6. Summary

6.1 Quantitative Characteristics of Observable Life Elements

Section 3.4 shows that there is a low correlation between the number of observable life elements and the site area. Furthermore, as shown in Section 4.3, the observable life elements are hardly affected by the road access shape. However, based on Section 5.2, if the survey site is classified as (I) "extremely small site", (II) "small site", and (III) "general site", the number of observable life elements will be (II) > (I) > (III).

6.2 Quantitative Characteristics of Life Elements Spilling onto Roads

From Sections 4.4 and 5.3, the amount of life elements spilling onto the road is influenced by the type of road access shapes and has a slight negative correlation with the site area. The larger the site area, the fewer the number of life elements that spill onto the road. When the roadside space is not visible (i), there are more life elements spilling onto the road than when the roadside space is visible (ii), and the negative correlation is stronger.

6.3 Residents' Awareness of and Use of Roadside Space

Regarding Q3 "Do you think it protects your privacy?" from Section 4.4, people are aware that privacy is better protected when road access shapes (i) are not visible. From Section 5.4, when looking at the three types of sites, $p = 0.064$. The average values are (III) > (II) > (I). The larger the site area, the more likely people are to feel that their privacy is protected. Regarding Q5 "Do you use it as a luggage storage space?" from Section 3.3, overall, more than 70% of people do not consider the area around the road to be a place to store luggage. According to Section 4.4, visibility of the road access shape does not have an effect. Also, as per Section 5.4, the size of the site area does not have any effect. However, as shown in Sections 6.1 and 6.2, the change in the number of life elements is affected by the visibility of the roadside space and the size of the site area. Therefore, it appears that residents do not treat life elements as mere luggage.

Regarding Q7 "Are you considering a parking space?", Section 3.3 shows that overall there is a strong tendency to think this way. From Section 4.4, the more visible the road access shape is (ii), the more people think this way. However, the p-value of 0.147 makes this uncertain. From Section 5.4, when looking at the three types of sites, the majority of people think this way in the order of (II) > (I) > (III). This is the same order as the number of observable life elements in Section 6.1. This is thought to be due to the fact that bicycles and cars are a life element.

Regarding Q10, "Do you think the roadside space is being utilized?", the overall average was 3.18,

indicating that 40% of people do not think so at look the section3.3. According to Section 4.4, visibility of the road access space does not have an effect. From Section 5.4, (II) residents of "small site" have an average score of 3.02, which is 42.2%, a high figure. However, the *p*-value of 0.430 makes this uncertain.

Regarding Q11, "Do you think that leaving luggage, bicycles, cars, plants, etc. in the roadside space helps prevent crime?", from Section 3.3, 30.4% of respondents overall thought it was helpful, while 55.5% did not think it was helpful. According to Section 4.4, visibility of the road access shape does not have an effect. From Section 5.4, when looking at the three types of site, the tendency to think that (III) is more useful than (II) is more likely to be useful than (I). (I) 67.9% of residents living in "extremely small site" did not think it would be useful.

Regarding Q13, "Are you concerned about not having a fence and having your property visible from the road?", the overall average was 2.64, with 53.6% of people having objections and 32.3% not having objections, based on Section 3.3. From Section 4.4, many people are opposed to (i) the lack of visibility in the road access shape. From Section 5.4, the number of people who are resistant to (III) > (II) > (I) is highest.

Regarding Q15 "If there is a fence, do you store items behind it?", the overall average was 3.82, with a difference of 3.3, meaning that approximately one-third of the respondents answered that they store luggage behind fences. As per Section 5.4, the size of the site area does not affect the property.

6.4 Consideration of the Relationship between Site Size and Life Elements

From Sections 6.1 and 6.2, (I) small sites have more life elements that can be seen in the roadside space than (II) extremely small sites. However, (I) extremely small sites have more life elements spilling onto the road from the roadside space than (II) small sites. From a physical perspective of the size of the site area, one factor that is thought to be the physical lack of space in the roadside space is that extremely small sites (I): sites of less than 70 m^2 are smaller than small sites (II): sites of 70 m^2 to less than 100 m^2.

In addition, general sites (III) have the fewest life elements that can be seen in the roadside space, and the fewest life elements that spill onto the road. From a physical perspective of the size of the site, it is thought that in detached residential areas, the larger the site area, the larger the building area. One of the reasons for this is thought to be the ample interior space within the building where life elements can be placed (Fig. 27).

6.5 Life Elements and Residents' Attitudes in the Roadside Space in Detached Residential Areas with Many Small Sites in Urban Areas

In Fig. 1, the area around the road is a space that is affected by both the road side and the detached house side. We then stated that a distinctive feature of this study is that it focuses on the life elements that are present within it. Based on the results of this survey, life elements are examined from the perspective of quantity. In the survey area, it can be observed that urban residents arrange their various life elements in response to their physical living environment. Life elements may be located on the roadside, in the roadside space, or inside the home. These factors create a living environment unique to cities (Fig. 28).

Urban residents have a variety of attitudes toward roadside space, as shown in survey results Q1 to Q4. Furthermore, as shown in survey results Q5 to Q10, there are a variety of ways to utilize the roadside space. Look at life elements from the perspective of quality. The life elements play various roles, such as "luggage, streetscape design, bicycle parking, car parking, crime prevention, and as a substitute for a fence." Furthermore, residents' awareness of and treatment of life elements differs. In this study, the life elements shown in Fig. 6 were treated as equivalent and investigated in a unified manner. However, residents' awareness of each life element differs.

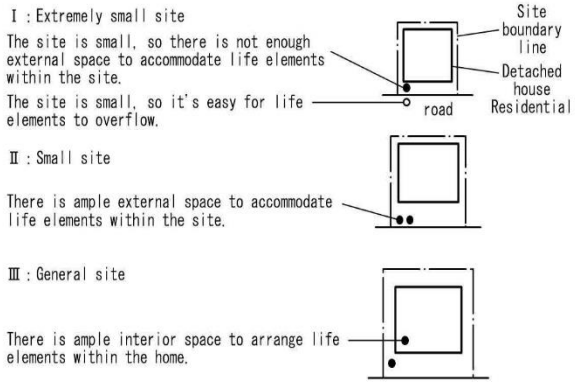

Fig. 27 Arrangement of life elements for three types of sites.

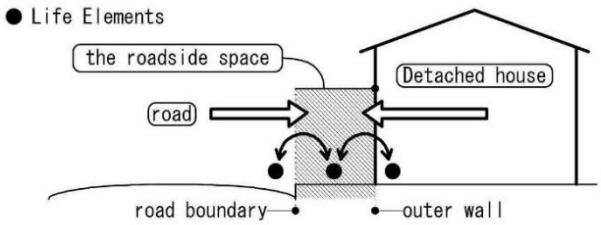

Fig. 28 Characteristics of life elements in the roadside space.

6.6 Future Outlook

In this study, we evaluated the amount of life elements in detached residential areas in urban areas where many sites are small. It was revealed that the amount of life elements is affected by the road access shape and the size of the site. In addition, a resident questionnaire was conducted to investigate residents' awareness of and usage of the roadside space. From these findings, it was found that life elements have diverse characteristics and roles. The results of this survey showed that in some cases more than 100 specimens could be observed, while in others only a few could be observed. They are not able to consider each life elements. In particular, bicycles and cars were observed in large numbers. In the field survey, these factors appeared to have a significant impact on the spatial structure in the roadside space. By exploring the relationship between the area around parking spaces and other life elements, we believe it will be possible to consider the spatial composition in the roadside space on small urban sites.

The target area for this study was a residential area in the city center. If a survey similar to this one were conducted in suburban residential areas, rural residential areas, rural areas, or fishing villages, it would be possible to compare it with this study. We believe that the relationship between life elements and residents can be further examined.

Acknowledgments

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