

# The Role of Railway Services in Sustainable Urban Development

Kazufumi Ueno

**Abstract**—Kobe City is a metropolis including large suburbs, where housing communities have been developed for many years. People have been recently moving to the urban areas and the suburbs are losing their power to attract population. At the same time, many blocks of high-rise flats have been built near railway stations adjoining town centers, and are drawing people of all generations. Residents with different lifestyle preferences are making good use of town centers and city centers based on effective railway services to live together happily in a household as well as the same flats. Thus railway services can play an essential role in sustainable urban development.

**Keywords**—Compact town, railway services, suburbs, sustainable development.

## I. INTRODUCTION

JAPAN has actually entered a depopulation process since 2007. Moreover people are moving to urban areas and notably concentrated in city centers<sup>1</sup>. Then suburbs, especially distant from city centers, are suffering depopulation [3]. Suburbs in Japan are now standing at the beginning of a new phase of urban development. Japan is asked to create sustainable urban forms including city centers and suburbs in a depopulated society.

Kobe City was focused for this study. This is because Kobe is a metropolis including large suburbs, where housing communities have been developed for many years. A “back-to-the-city movement” is observed in the old urbanized areas<sup>2</sup> (referred to as the “old areas” hereafter), whereas the suburbs are recently, as a whole, losing their former power to attract population. Some areas are suffering rapid aging and depopulation. On the other hand, as from around 2000, many blocks of high-rise flats have been built near railway stations<sup>3</sup> adjoining town centers, and are attracting people of all generations [4]. Suburbs have been intentionally developed in order to meet the demand for cozy and affordable detached houses with a private garden. The recent situations in Kobe show that people seek conveniences for their places of residence even in the suburbs, while they are enjoying

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<sup>1</sup>The recovery of population in some larger cities has been reported in Europe and the United States, too [1]. However, it is questionable whether this trend of re-urbanization can initiate a new cycle of urban growth [2].

<sup>2</sup>Urbanization in Japan has generally proceeded centering on railway stations and service facilities are concentrated around railway stations to form city centers. Then the old urbanized areas in Kobe have a various size of city centers.

<sup>3</sup>This is one of the municipal subway lines, but described as railway in this paper.

amenities which are unavailable in the old areas. This suggests the birth of a new suburban lifestyle which can contribute to sustainable development in the suburbs.

This paper paid attention to the migration to a block of high-rise flats near a railway station, and aimed to show why people moved to the flats, how they are living and evaluating their living environment by means of a questionnaire survey.

## II. POPULATION MOVEMENT IN KOBE CITY

Kobe City covers an area of 551 sq. km and has a population surpassing one and a half million. The old areas had been already urbanized before the 1960s, and the suburbs have been developed mostly after the 1970s. The old areas occupy roughly 30% of the city area, but are home to 60% of the population. It suffered massive damage by the earthquake in 1995. This resulted in wide changes in the city planning and hence a number of new redevelopment projects were carried out in the old areas. They have induced population inflow to the old areas not only from the outside of the city but from the suburbs [5].

Fig. 1 shows the population flow between the old areas and the suburbs. Before the earthquake, there had been a constant and large surplus of population inflow to the suburbs. Inflow to the suburbs suddenly rose up to a peak in 1995 and then quickly reversed, due to the swift comings and goings of refugees. The both flows reversed since 1999, and the surplus of inflow to the old areas has been gradually getting smaller. It is fair to say that the pressure of sprawling already ceased in Kobe City.

Table I exhibits population movement among four wards comprising the suburbs. All wards show negative inflows to the old areas. North Suma is suffering an excess of migration to all

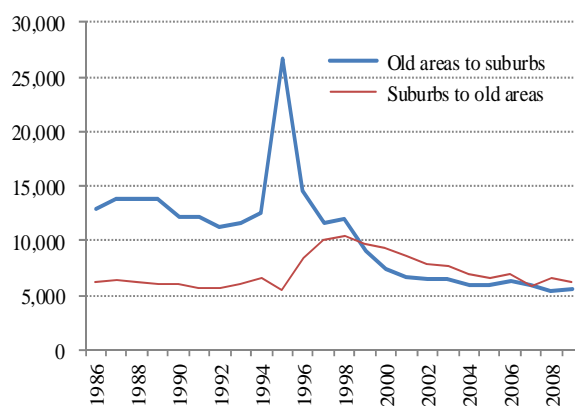


Fig. 1 Population flow between the old areas and the suburbs

TABLE I  
ANNUAL AVERAGE NET POPULATION INFLOW  
TO WARDS IN THE SUBURBS (2007-2011)

	North Suma	Kita	Tarumi	Nishi
Total	-851	78	-20	175
From inside of the city	-493	-94	-190	246
Old areas	-182	-90	-112	-148
Suburbs	-311	-4	-78	394
North Suma	-	15	132	164
Kita	-15	-	-12	31
Tarumi	-132	12	-	199
Nishi	-164	-31	-198	-
From outside of the city	-358	172	170	-71

Note: The Basic Resident Registers of Kobe City

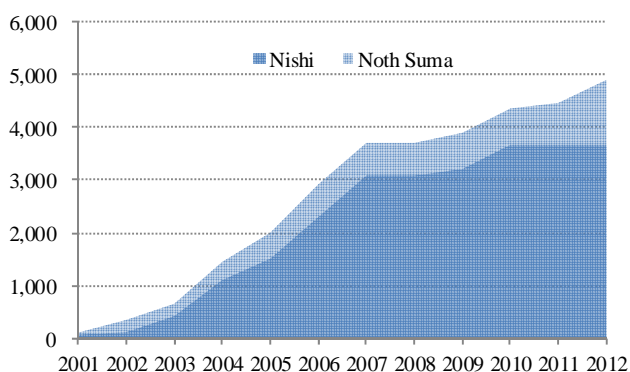


Fig. 2 Accumulated number of houses provided by the flats near railway stations

other areas. Tarumi is losing population, but not as much as North Suma. Kita shows a positive inflow in total, but is feeble in attracting population. Nishi shows large positive inflows from other three wards. Thus, there is such a difference in a power to attract population between the wards. In this, Nishi is as a whole relatively prosperous and many blocks of flats have been recently built near railway stations.

There are two railway stations in North Suma and five ones in Nishi along the same line to the CBD<sup>4</sup>. Fig. 2 exhibits the change in the accumulated number of houses provided by the flats built near railway stations. The number is constantly increasing since 2001. It is noted that one fourth of the houses in 2012 are in North Suma. This proves people prefer locations convenient to the CBD even in the area which is losing population.

### III. CHANGE OF A TOWN CENTER

A town center<sup>5</sup> of Seishin Newtown (referred to as Seishin NT) was picked up. The new town has an area of 634 ha and has 50,462 inhabitants in 2012. It takes 30 minutes by railway to the CBD. The town center used to be an ordinary complex of facilities. However it has changed to a kind of compact town since a block of fifteen-story flats was built in 2003. It has 305 houses and annexes a nursery. Afterward two blocks of flats

<sup>4</sup>This is the busiest city center in Kobe City.

<sup>5</sup>This is identical to "town center" in the typologies described in PPS6 [6].

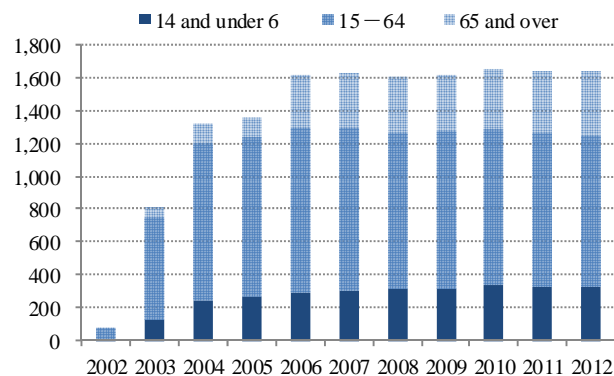


Fig. 3 Population of the town center

were built on other locations in the town center. One was built in 2004. It is a block of fourteen story flats and has 192 houses designed to ease aged people's physical handicaps. The other was built in 2006. It is a block of sixteen-story flats and provides 209 houses with life care services. The change in land use was out of the original town planning. It was induced by restructuring in business and financial difficulties in Kobe City.

As shown in Fig. 3, residents have been increasing in number and then 1,636 residents are living in 724 households in 2012. The three blocks of flats are different from each other in facilities for living and hence are creating diversity of inhabitants. The composition of age is well balanced and relatively stable since 2006. This is one of the ambitions of the Urban Village Campaign [7]. The town has an area of 22.8 ha and a high population density of 72 dwellings per ha. It has a railway terminal station, a bus terminal of many lines, a high-rise hotel, a medical center, a shopping mall, a department store, a supermarket, a municipal library, a municipal branch office and so on. The town is connected with surrounding housing communities, large public parks and foot passes via vehicle-free promenades over busy roads. Residents can utilize on foot all the facilities for amenities as well as conveniences. Moreover the new town itself is surrounded by rural areas, and so residents can easily enjoy pastoral environment.

There are some common features of a compact town; compactness, mix of land uses and interconnected street layouts, support by strong public transport networks, environmental controls, and high standards of urban management [8]. The town center is indeed controversial about effective town planning, considering unintended change in land use. Nevertheless, it is fair to say that it substantially works as a compact town and also follows the advocacy of PPS 6 [6].

### IV. PREPARATION FOR ANALYSIS

#### A. Two Types of Lifestyle

Ge et al [9] define residential lifestyle as the way of life related to residence features such as consumption of time, space and money. The degree of satisfaction with a place of residence depends on how it eases the practice of one's own lifestyle [10]. Each household member usually has a different assessment of the living environment due to their different lifestyle

preferences. However residential locations are generally determined by household lifestyles and consequently family member more or less compromise on their lifestyle preferences. This paper focused on personal assessment of the living environment and then looked at a personal lifestyle.

Amenities and conveniences were taken up as fundamental factors to characterize residential locations. The practice of preferred lifestyle is closely related to which factor people seek more for residential places. Then, two types of lifestyles were set. One is a suburban lifestyle which seeks more amenities. The other is an urban lifestyle which seeks more conveniences. Amenities here correspond to the quality of environments such as public parks, landscape, natural environment, and so on. Conveniences here correspond to accessibility to urban services, such as job opportunities, shopping, medical treatment, public transport, and so on. Those who prefer a suburban lifestyle are described to be "S-LS", and those who prefer an urban lifestyle "U-LS".

### B. Two Kinds of Conveniences

S-LS generally prefer to live in suburbs and so do U-LS in city centers. However popularity of the flats near railway stations in the suburbs of Kobe suggests that the both are living in the same location and even in the same households. In other words, such flats possibly provide living conditions which satisfy both S-LS and U-LS. Thus it is the main theme of this study how the two lifestyle preferences are distributed among dwellers and how they are different in activities and attitudes toward living environment. Then two kinds of conveniences were set. One is whether they can easily utilize service facilities in the town center. The other is whether they can easily go to city centers. They are hereafter referred to as "convenience 1" and "convenience 2", respectively.

### C. Questionnaire Surveys

Two questionnaire surveys were carried out at two sites in February 2004. One site is a block of eighteen-story flats in the town center and is hereinafter called "site 1". The other site is a detached housing community, which is hereinafter called "site 2". Site 2 is located 8 km northeast of Seishin NT. It takes approximately 60 minutes by bus and railway from site 2 to the CBD. This study regarded site 1 as a new type of residential place in the suburbs, and site 2 as a traditional one in the suburbs. Site 2 was used as an object of comparison to define the characteristics of site 1.

Site 1 has 305 households and site 2 443 households. The survey at site 1 resulted in the collection of 119 effective cases for households with a response rate of 39.0%, which included 202 effective cases of family members. The survey at site 2 resulted in the collection of 176 effective cases for households with a response rate of 39.7%, which included 303 effective cases of family members.

## V. ANALYSIS OF SURVEY DATA

### A. Profile of Respondents

Family composition, sex and age are shown in Tables II-III.

TABLE II  
FAMILY COMPOSITION

	Site 1	Site 2
No. of cases	119	176
Single	7.6	8.0
Couple	39.5	35.2
Couple and their children	43.7	38.6
Couple and their parents	3.4	3.4
Couple, their children and parents	1.7	5.1
Others	1.7	1.7
N.A.	2.5	8.0
Total (%)	100.0	100.0

TABLE III  
SEX AND AGE

	Site 1	Site 2
No. of cases	202	302
Sex		
Male	43.1	46.0
Female	54.5	52.3
N.A.	2.5	1.7
Total (%)	100.0	100.0
Age		
20-39	37.6	6.3
40-49	<u>20.8</u>	7.6
50-59	15.3	<u>28.8</u>
60 and over	23.8	<u>56.0</u>
N.A.	2.5	1.3
Total (%)	100.0	100.0

Note: Underlined values are larger than the corresponding ones at a significance level of 5%. This holds true through the paper.

TABLE IV  
LIFESTYLE PREFERENCES

	Site 1	Site 2
No. of cases	202	302
S-LS	37.1	<u>73.8</u>
U-LS	<u>53.0</u>	13.6
Neither	8.9	10.6
N.A.	1.0	2.0
Total (%)	100.0	100.0

TABLE V  
REALIZATION OF PREFER

	Site 1		Site 2	
	S-LS	U-LS	S-LS	U-LS
No. of cases	75	107	223	41
Enough	21.3	26.2	<u>40.4</u>	7.3
Somewhat	52.0	43.9	<u>44.4</u>	24.4
Not at all	4.0	6.5	6.7	<u>61.0</u>
Neither	5.3	5.6	2.2	4.9
N.A.	17.3	17.8	6.3	2.4
Total (%)	100.0	100.0	100.0	100.0

Older people are more dominant at site 2 than at site 1.

Table IV shows the percentage of respondents with different lifestyle preferences at each site. The share of S-LS at site 2 is larger than at site 1. The share is reversed for U-LS. Realization of preferred lifestyles is shown in Table V. There is no significant difference in the percentage between the two life

TABLE VI  
COMBINATIONS OF LIFESTYLES  
IN THE SAME HOUSEHOLDS

	Site1	Site2
No. of cases	86	124
S-LS and S-LS	23.3	<u>65.3</u>
U-LS and U-LS	<u>38.4</u>	4.8
S-LS and U-LS	<u>23.3</u>	12.1
Others	15.1	17.7
Total (%)	100.0	100.0

Note1) Cases are households with two respondents.

Note2) Others are a combination including "neither"

TABLE VII  
FORMER PLACES OF RESIDENCE OF HOUSEHOLDS

	Site 1	Site 2
No. of cases	119	176
Suburbs	<u>69.7</u>	40.3
(Seishin NT)	(26.9)	-
Old areas	9.2	<u>22.2</u>
Outside of the city	18.5	<u>29.5</u>
N.A.	2.5	8.0
Total (%)	100.0	100.0

TABLE VIII  
RANKINGS OF THE REASONS FOR HOUSEHOLDS AT SITE 1  
TO HAVE LEFT THEIR FORMER HOUSES

	Detached houses	Others	t-value	
No. of cases	42	75		
Inconvenience for shopping	<u>4.29</u>	2.79	2.036	*
Inconvenience for a station or a bus stop	3.81	2.56	1.786	
Inconvenience for medical treatments	<u>3.82</u>	2.19	2.210	*
Inconvenience for going to work or school	2.97	2.43	0.756	
Uneasiness in security	2.83	2.07	1.269	
Difficulty in maintenance	<u>4.02</u>	0.88	5.272	**
Slopes here and there in the vicinity	2.02	1.89	0.197	
Difficulty in going up and downstairs	<u>2.95</u>	0.89	3.435	**
Decrease in family members	<u>2.42</u>	0.69	2.738	**
Increase in family members	0.63	<u>1.65</u>	-2.036	*
Inconvenience for associating with relatives	1.59	1.10	1.000	
Poor educational environment for children	0.47	<u>1.59</u>	-2.613	*
Troublesome relationships with neighbors	1.25	0.60	1.437	
Inconvenience for associating with friends	<u>1.33</u>	0.27	2.216	*

Note1: Figures are mean scores. 10, 5, 3 and 0 were respectively allocated to the five responses; very important, important, somewhat important, and unrelated.

Note2: \*\*, \* and + denote a significance level of 1%, 5% and 10%. This holds true through the paper.

styles at site 1. "Enough" and "somewhat" make up about 70% of the total. On the other hand, S-LS give far more affirmative

TABLE IX  
RANKINGS OF THE IMPORTANCE OF REASONS WHY HOUSEHOLDS  
MIGRATED TO SITE 1

	No. of cases	119
Very near to a subway station and a bus terminal		9.11
Convenience for medical treatments		7.55
Convenience for shopping		7.54
Convenience for going to work and school #		5.88
Well maintained neighborhood and quietness ##		5.50
Convenience for visiting the CBD		5.38
Adequate security services		4.88
Living on the same floor		3.47
Good educational environment for children		2.95
Relatives are living nearby		2.50
A nursery school is annexed		1.23

Note1: Figures are mean scores. 10, 5, 3 and 0 were respectively allocated to the five responses; very important, important, somewhat important, and unrelated.

Note2: # shows that the reason has a larger score for households of U-LS&U-LS than for those of S-LS&S-LS, and ## shows the reverse at a significance level of 5%.

responses than U-LS at site 2. Table VI exhibits combinations of respondents' lifestyle preferences within the same household, which gave two responses in the questionnaire survey. Site 1 shows a better balanced composition of different lifestyle preferences than site 2. The shares for U-LS & U-LS and S-LS & U-LS at site 1 are much larger than that at site 2. Site 1 likely has conditions for both lifestyles to live as they please and hence demonstrates a new way of living in suburbs, whereas site 2 shows a traditional way of living for S-LS as expected by town planning.

Table VII shows the former place of residence of households. The share for the suburbs is 69.7% at site 1, much larger than the 40.3% at site 2, but is the reverse for the old areas and outside of the city. In other words, short distant migration is dominant at site 1 and Seishin NT remarkably occupies 26.9% of the total. Thus site 1 symbolizes the latest change in the population movement in the suburbs. Reasons for residents at site 1 to have left their former houses are shown in Table VIII. As a whole, highly ranked reasons concern inconveniences for urban services. Focusing on detached houses, they are higher than the others as to the scores about inconveniences for shopping, medical treatment and association with friends, and further physical difficulties in daily life, such as "in maintenance of houses" and "in going up and down stairs". The same holds true for "decrease of family members". The reverse is observed for "increase of family members" and "poor educational environment for children". This mainly reflects the aging of residents in detached houses.

Table IX shows the reasons why households migrated to site 1. "Very near to a railway station and a bus terminal" is ranked highest. Conveniences for several urban services follow it. "Well maintained neighborhood and quietness", and "convenience for visiting the CBD" are ranked relatively high. This also indicates site 1 provides not only conveniences but also amenities. "Convenience for going to work and school" has a larger score for the households with U-LS&U-LS than for

TABLE X  
EVALUATION OF THE LIVING ENVIRONMENT AT TWO SITES

No. of cases	Site1	Site2	t-value	
	202	302		
Livability	<u>1.57</u>	1.18	6.507	**
Houses	1.12	1.08	0.569	
Convenience 1				
Convenience for shopping	<u>1.65</u>	0.64	12.784	**
Convenience for leisure activities	<u>0.85</u>	0.10	8.125	**
Convenience for medical treatments	<u>1.07</u>	0.15	9.900	**
Convenience 2				
Access to working places and schools	<u>1.16</u>	-0.49	18.607	**
Use of public transport	<u>1.35</u>	-0.54	19.788	**
Access to the CBD	<u>1.13</u>	-0.62	19.240	**
Amenities				
Maintenance of neighborhood and quietness	0.89	<u>1.06</u>	-2.290	*
Neighboring parks	0.99	1.01	-0.228	
Natural environment in the vicinity	1.06	1.03	0.542	
Community environment				
Community activities	0.15	<u>0.42</u>	-4.097	**
Neighborhood human relationships	0.25	<u>0.66</u>	-5.995	**
Locality	0.85	0.84	0.239	

Note: Figures were measured by a five-point scale: "satisfied", "fairly satisfied", "neither", "a little unsatisfied" and "unsatisfied". Scores of 2, 1, 0, -1 and -2 respectively were allocated. Missing values were replaced by a mean in calculation.

TABLE XI  
EVALUATION OF THE LIVING ENVIRONMENT  
BY LIFESTYLES AT SITE 1

No. of cases	S-LS	U-LS	t-value	
	75	107		
Livability	-0.24	<u>0.20</u>	-2.936	**
Houses	-0.10	0.05	-1.030	
Convenience 1	-0.06	0.02	-0.511	
Convenience 2	-0.11	0.08	-1.261	
Amenities	0.05	-0.05	0.665	
Community environment	-0.17	<u>0.15</u>	-2.090	**

Note: Figures of conveniences 1 and 2 are a factor score produced by a principal component analysis. Other figures are a standardized score.

those with S-LS&S-LS. "Well maintained neighborhood and quietness" shows the reverse. The other reasons show no differences between the both. In summary, households as a whole migrated to site 1 seeking mainly conveniences. However the U-LS&U-LS relatively make much of convenience for travel and so do the S-LS&S-LS amenities in the neighborhood. It is thus noted that the households with opposite lifestyle preferences moved to the same site. These confirm that site 1 is a new type of residential location in the suburbs.

TABLE XII  
COMPARISON OF THE EVALUATION OF LIVING ENVIRONMENT  
BETWEEN THE LEVELS OF REALIZATION OF REFERRED LIFESTYLES

No. of cases	S-LS		t-value	U-LS		t-value		
	Enough	Some-what		Enough	Some-what			
	16	39		28	47			
Livability	<u>0.32</u>	-0.39	2.771	**	<u>0.71</u>	0.08	4.054	**
Houses	0.24	-0.25	1.424		<u>0.51</u>	-0.13	3.071	**
Convenience1	<u>0.17</u>	-0.27	1.760	+	0.39	0.04	1.344	
Convenience2	<u>0.20</u>	-0.43	1.878	+	<u>0.57</u>	-0.10	3.650	**
Amenities	<u>0.36</u>	-0.12	2.242	*	<u>0.67</u>	-0.24	3.851	**
Community environment	-0.01	-0.34	1.163		<u>0.91</u>	-0.07	4.042	**

Note) The Pearson's Chi-square test showed no significant differences in the compositions of sex and age between compared groups.

TABLE XIII  
COMPARISON OF REGRESSION STRUCTURES BETWEEN  
THE TWOLIFESTYLES

No. of cases	S-LS		U-LS			
	Standard coefficient	t-value	Standard coefficient	t-value		
Sex dummy	-0.10	-1.177	-0.04	0.602		
Age dummy (40-59)	0.03	0.259	-0.08	0.336		
Age dummy (60 and over)	-0.22	-2.101	*	0.04	0.604	
Houses	-0.16	-1.445	0.41	0.000	**	
Convenience 1	0.29	2.479	*	0.09	0.310	
Convenience 2	0.39	3.468	**	0.48	0.000	**
Amenities	0.25	2.409	*	-0.05	0.694	
Community environment	0.13	1.277	0.02	0.866		
Adjusted coefficient of determination	0.52		0.51			
F-value	10.024		13.262		**	

### B. Living Environment of the Flats

Table X shows respondents' evaluation<sup>6</sup> of livability and of thirteen conditions comprising livability at the two sites<sup>7</sup>. Livability of site 1 is rated higher than at site 2. Differences are observed in most conditions, except for "houses", "neighboring parks" and "natural environment in the vicinity", "locality". Site 2 is rated more highly than site 1 for "maintenance of neighborhood and quietness", "community activities" and "neighborhood human relationships". It is notable that the scores are strongly negative at site 2 for "access to working places and schools", "use of public transport" and "access to the CBD. Thus inconveniences for public transport characterize site 2. On the other hand, high satisfaction with community suggests that residents have fostered good human relationships over many years of living together<sup>8</sup>.

<sup>6</sup>They were measured using a five-point scale; "satisfied", "somewhat satisfied", "neither", "a little unsatisfied" and "unsatisfied". Scores of 2, 1, 0, -1 and -2 respectively were allocated.

<sup>7</sup>Twelve conditions, exclusive of houses, were in advance grouped into four factors by a cluster analysis.

<sup>8</sup>About 70% of respondents had lived longer than fifteen years at the time of the survey.

Next, Table XI shows respondents' evaluation of living environment at site 1. In order to make synthesized scores, a principal component analysis was applied to the total respondents' evaluation of conditions comprising conveniences 1, 2, amenities and community environment. And for corresponding to this operation, respondents' valuation scores of livability and houses were normalized. It is noted that there is no significant difference in the compositions of sex and age between the two lifestyles. Site 1 is more livable for U-LS than S-LS, although each level of livability is very high as shown in Table X. This suggests the flats are fairly blessed with conveniences and amenities and hence livable for the both lifestyles. There is a difference in the level of satisfaction with community environment. Community environment needs time to mature<sup>9</sup>. Hence such a difference may be due to the fact that S-LS prefer close human relations, while the reverse for U-LS.

### C. Characterization of the Two Lifestyles

Table XII shows the difference in the evaluation of living environment between the levels of realization of preferred lifestyles. If "enough" has a higher score in a condition than "somewhat" at a lifestyle, the condition can be regarded as a necessary condition for realization of the lifestyle. Otherwise, it is independent of realization. As to S-LS, conveniences 1 and 2, and amenities have larger scores for "enough" than for "somewhat". These are to be regarded necessary conditions to realize S-LS at site 1. As to U-LS, houses, convenience 2, amenities and community environment are to be regarded necessary conditions as well. Convenience 2 and amenities are shared by two lifestyles. Therefore high levels of the two conditions are indispensable for attracting both lifestyles.

In order to find the influential factors in livability at site 1,

TABLE XIV  
 INFLUENTIAL CONDITIONS

	Realization of preferred Lifestyles		Improvement of livability	
	S-LS	U-LS	S-LS	U-LS
Houses		✓		✓
Convenience 1	✓		✓	
Convenience 2	✓	✓	✓	✓
Amenities	✓	✓	✓	
Community environment		✓		

regression analyses were carried out with explanatory variables as houses, convenience 1, convenience 2, amenities, community environment, and constant dummies of sex and age. Age dummies were made based on three age groups: 20-39, 40-59, and 60 and over. Results in Table XIII roughly show the contrastive characteristics of each lifestyle. Conveniences 1 and 2, and amenities have a significant and positive coefficient for S-LS. On the other hand, so do houses and convenience 2 for S-LS. In other words, S-LS make much of living conditions in the neighborhood for livability, whereas U-LS do private space and visiting other areas. As for S-LS, the conditions influencing livability agree with the necessary conditions to realize the lifestyle as shown in Table XII. As for U-LS, so are houses and convenience 2, while amenities and community environment are necessary conditions but they have no influence on livability.

Results are summarized in Table XIV. Conveniences 1 and 2, and amenities are necessary conditions to live enough S-LS, and simultaneously to improve livability. Meanwhile, houses, convenience 2, amenities and community environment are necessary conditions to live enough U-LS and so are the first

TABLE XV  
 HOUSEHOLDS' SHOPPING DESTINATIONS AND FREQUENCIES

	No. of cases	Nearly daily	A few times a week	Once a week	A few times a month	Once a month and under	Total (%)
The town center in Seishin NT	100	63.0	30.0	5.0	2.0	0.0	100.0
Other areas in Seishin NT	95	5.3	3.2	12.6	17.9	61.1	100.0
Town centers in other new towns along the railway line	97	0.0	6.2	12.4	7.2	74.2	100.0
Shops in city centers along the railway line	95	0.0	2.1	3.2	7.4	87.4	100.0
The CBD	97	0.0	5.2	7.2	25.8	61.9	100.0
Others	96	0.0	1.0	7.3	6.3	85.4	100.0

TABLE XVI  
 TRAFFIC MODES TO SHOPPING DESTINATIONS

	No. of cases	On foot	Railway	Cars	Buses	Others	Total (%)
The town center in Seishin NT	114	100.0	0.0	0.0	0.0	0.9	100.9
Other areas in Seishin NT	77	19.5	0.0	72.7	6.5	13.0	113.0
Town centers in other new towns along the railway line	58	0.0	37.9	69.0	0.0	3.4	110.3
Shops in city centers along the railway line	35	2.9	85.7	14.3	0.0	2.9	105.7
The CBD	94	5.3	83.0	26.6	1.1	0.0	116.0
Others	64	0.0	6.3	84.4	12.5	4.7	107.8

Note: The total exceeds 100% because of multiple answers

<sup>9</sup>The period of residence for all was eight months at the time of the survey.

TABLE XVII  
FREQUENCIES OF VISITING THE CBD AND EVALUATION OF THE TWO CONVENIENCES

No. of cases	S-LS		t-value
	More than once a month	Once a month or less	
Livability	-0.51	<u>0.05</u>	-2.328 *
Convenience 1	-0.42	<u>0.10</u>	-2.301 *
Convenience 2	-0.61	<u>0.07</u>	-2.214 *

No. of cases	U-LS		t-value
	More than once a month	Once a month or less	
Livability	<u>0.59</u>	0.13	2.647 **
Convenience 1	0.40	0.01	1.472
Convenience 2	0.35	0.02	1.644

Note1: The visit excludes commuting.

Note2: Cases consists of those who are enough or somewhat practicing their preferred lifestyles.

TABLE XVIII  
EVALUATION OF THE TWO CONVENIENCES BY HIGH FREQUENCY VISITORS TO THE CBD

No. of cases	More than once a month		t-value
	S-LS	U-LS	
Livability	-0.51	<u>0.59</u>	-5.534 **
Convenience 1	-0.42	<u>0.40</u>	-3.433 **
Convenience 2	-0.61	<u>0.35</u>	-3.413 **

two items to improve livability. In addition, convenience 2 has the largest influence on livability as to both lifestyles. Thus convenience 2 notably plays an important role for both S-LS and U-LS to live happily in a household as well as the same location. That is, high level of convenience 2 can make residents to utilize the town center and the CBD properly based on their preferred lifestyles. Beyond that, amenities, convenience 1 and houses are important conditions for one or two lifestyles. They are also contributing much for the compact town to be attractive.

#### D. Actual Conditions of the Two Conveniences

Shopping was picked up as an important activity common to the residents. Table XV exhibits households' shopping destinations and frequencies. Traffic modes for them are shown in Table XVI. As for all destinations, there are no significant differences in frequencies and traffic modes between the households with S-LS&S-LS and those with U-LS&U-LS. Over 90% of respondents go to the town center more than a few times a week. They almost go on foot. In comparison with other destinations, daily demand for shopping is adequately supplied in the town center. Thus residents can easily and enough enjoy convenience 1. In addition 38.2% of respondents go to the CBD over a few times a month. 83.0% of them use railway. They inclined to use more cars than train in going to areas without railway services or to nearby areas in the suburbs.

Nevertheless, considering the frequencies, residents much

depend on walking and railway services for shopping<sup>10</sup>. Further commuters occupy 53.9% of the effective respondents and 40.0% of them commutes by train. Residents also can easily and enough utilize convenience 2, mainly railway services. This supports that residents moved to the flats seeking conveniences and are in fact making good use of them.

Table XVII shows the frequency of visiting the CBD and the evaluation of conveniences. High frequency visitors of S-LS assess livability and two conveniences lower than low frequency visitors<sup>11</sup>. This suggests that S-LS who evaluate convenience 1 low have a higher necessity to visit the CBD. That makes them have a severe evaluation of convenience 2 and then lowers livability. This seems that their visits are a means to compensate for the lack of urban services at the town center. The high frequency visitors of U-LS, conversely, evaluate livability highly, but evaluate equally two conveniences. As shown in Table XVIII, they are more satisfied with the three factors than the high frequency visitors of S-LS. That is, their visits increase their use of the urban services they enjoy, and then enhance their evaluation of livability. This stems from a difference in the motives of visits to the CBD between two lifestyles. This supports that the town center functions in different ways as two lifestyles like.

## VI. CONSIDERATION

Is it possible to apply the findings to other areas? The answer is yes for properly planned areas blessed with facilities and an effective railway service, but not necessarily. Town centers are usually designed for car travelers to easily approach to their facilities. Then there is little space for flats to be newly built inside, and to be worse they are bordered by busy roads and hence town centers are hindered from unification with their neighboring housing communities. In making a compact town around an existing railway station, busy roads need to be moved outwards to spread the area of a town center or to bridge a town center with neighboring areas by promenades over busy roads. This seems the most feasible way to create a compact town in highly developed areas around railway stations. It is supported by a view that shopping centers adjacent to stations of railways will survive in the face of stiff competition from other shopping centers in suburbs in Japan, which are relatively densely populated [11].

Then, does this study give any suggestions to other nations? With the study of the acceptability to relocating households of more sustainable residential alternatives in the Cardiff region, the dominant preferences remain for semi-detached and detached properties with their own private gardens in suburban areas [12]. As Talen [13] points, there is little evidence to determine whether suburban dwellers would be willing to shift their current residential preferences towards a more compact urban living pattern. Car dependency basically stems from a

<sup>10</sup>81.0% of the effective households' cases have their own cars. This car ownership rate is not low and then suggests a low rate of operation.

<sup>11</sup>Many of users of the railway complain of thirty minutes' ride to the CBD, although satisfied with its frequent scheduled services.

typical suburban lifestyle that people live in a detached house at a place blessed with many amenities and then move often by car to city centers for seeking convenience 1<sup>12</sup>. This study suggests that adequate amenities and convenience 1 can change such a lifestyle, if convenience 2 much decreases car dependence. The question is whether people need a detached house with their own private garden or not. It is reported in the UK that highly cherished suburban qualities can be achieved in higher-density schemes through careful planning, good design and effective management [14]. This study can be effective in other nations as well in achieving higher- density by the best use of railways.

Convenience 2 is crucial for residents to live their preferred lifestyles beyond the restriction of convenience 1. It also enables compact towns to establish good relations with city centers. Hence it is desirable that effective public transport is provided by planning mainly based on public investment. Compact towns and railway business are interdependent in prosperity<sup>13</sup>. Construction of new railway in suburbs is not easy due to the prospect of small demand in low density areas. Then it is important to invest in making effective use of existing railways<sup>14</sup>. Besides economic assessment, a larger viewpoint considering environmental and welfare policies is required to achieve sustainable suburbs [15]. The third high-rise flats with life care services are under construction near another railway station in Nishi ward. It is very important to create such a virtuous circle in making suburbs attractive to all generations by an effective use of railways.

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<sup>12</sup>In order to cope with the situations, PPS6 [6] advocated the creation of vital and viable town centers on the government initiative. This aims to make market towns more attractive by providing a wide range of services and ensuring effective access to facilities for all. It makes much of a choice of transport modes to reduce car dependency.

<sup>13</sup>The close of a private railway in the suburbs is now controversial in Kobe City. This is because the passengers are decreasing due to a decay of housing communities along the line. It is now a critical question whether or how public sectors along the line including Kobe City give a financial support.

<sup>14</sup>Railway companies in Japan have been recently invested in making new stations in high-densely populated areas. That improves accessibility to stations and then increases passengers as well as profits. This will lead, in a broad sense, to a compact town centering on a railway station, if facilities are adequate.