Urban Landscape Planning and Design Determination of Urban Landscape Identities in Sakai

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Urban Landscape Planning and Design
Determination of Urban Landscape Identities in Sakai

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Abstract

This article presents what types of urban landscape identities are recognisable in Sakai city. There are many possible approaches. The Principal Component Analysis Method was used in this study. As a first step, 25 variables were converted from 34 basic data. Then, correlation between components and variables and the proportion and cumulative proportion of total varience were calculated by the Principal Component Analysis Method. Finally, component No. 1, No. 2 and No. 3 were selected for discussion. The result of the analysis for each component was overlayed and Sakai was categorized into 8 urban landscape identity types.

Introduction

This article intends to show that the identities of district landscape and townscape are very important aspects for urban redevelopment or rehabilitation. If the landscape structure in each district and city is identified clearly, it can be used to formulate criterion and standards for urban planning and design projects, and also proposal plans.

Sakai city was selected as a case study for this study for the purpose of setting up priority areas for revitalization of the urban landscape leading to the development of conceptual guidelines for urban landscape planning and design based upon the urban landscape identities.

Outline of Sakai City

The city of Sakai is located almost in the center of Osaka Prefecture. It opens out on the Osaka Bay to the west, faces the Yamato river to the north, to the east borders on Matsubara city, Mihara-cho and Sayama-cho and to the south borders on Takaishi city, Izumi city and Kawachinagano city. The city area is 134.14 km^2 and the population is approximatetly 810 thousand.

Sakai is rich in history and historical monuments, for example, emperor's tombs and many other cultural assets stretching back from recent centuries to the period of ancient burial mounds. At the present time, these historical monuments are preserved very well, however, they are poorly related to each other.

Existing Land use of Sakai can be characterized roughly into 5 areas; industrial area along the Bay; the urbanized area along the rail lines; the new development area of Senboku New Town; the agricultural area in middle part of the city; and the forest area in

the south-east mountain area (Fig. 1). However, in each land use has problems with respect to the urban landscape past 30 years, Sakai has extremely mixed and poorly related land use districts.

Today, there are 6 rail lines and many major roads connecting to Osaka City. Thus, as can be seen in Fig. 1, Sakai City's transportation network is lacking sufficient connection between the east and west sides.

As can be understood from the existing situation of Sakai City, it is important to determine urban landscape identities for setting up any guidelines for urban landscape planning and design on both the district and Sakai City scale.

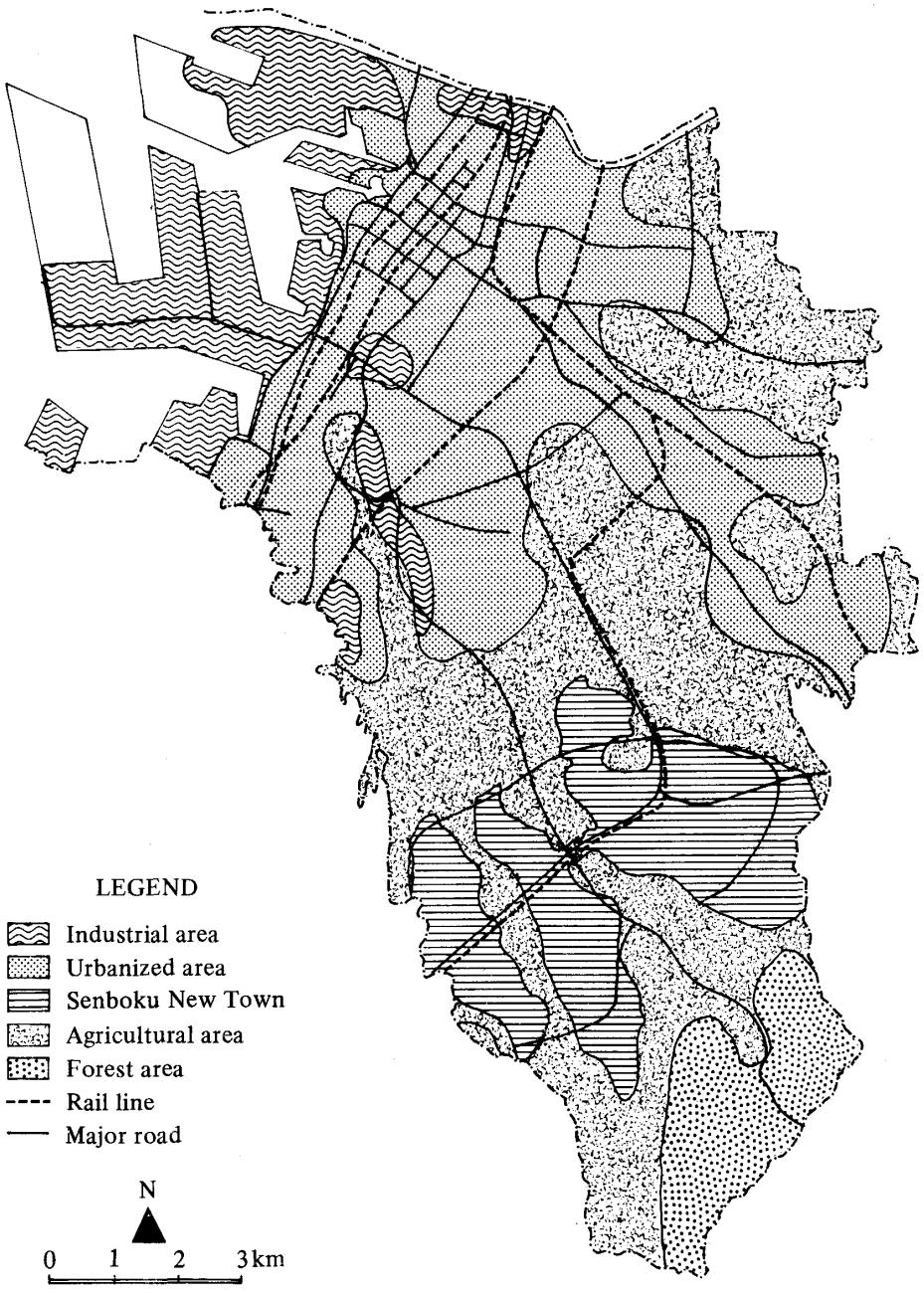

Fig. 1. Existing situation of Sakai

Methods and Procedure

For the basic planning unit of this study, it was necessary to choose analysis and planning units, of equivalent scale keeping in mind the aim of the project. The elementary school district was chosen as the basic unit for this case study.

This unit was chosen for the following reasons:

1) The population of each elementary school district is quite similar.
2) The elementary school district is recognized as a community unit.
3) The elementary school district unit is a very effective one for the collection of information and materials and for the analysis and evaluation of characteristics, structures, and activities in the city.

The 77 elementary school districts shown in Fig. 2 were used as the units and urban landscape identities were derived for each unit.

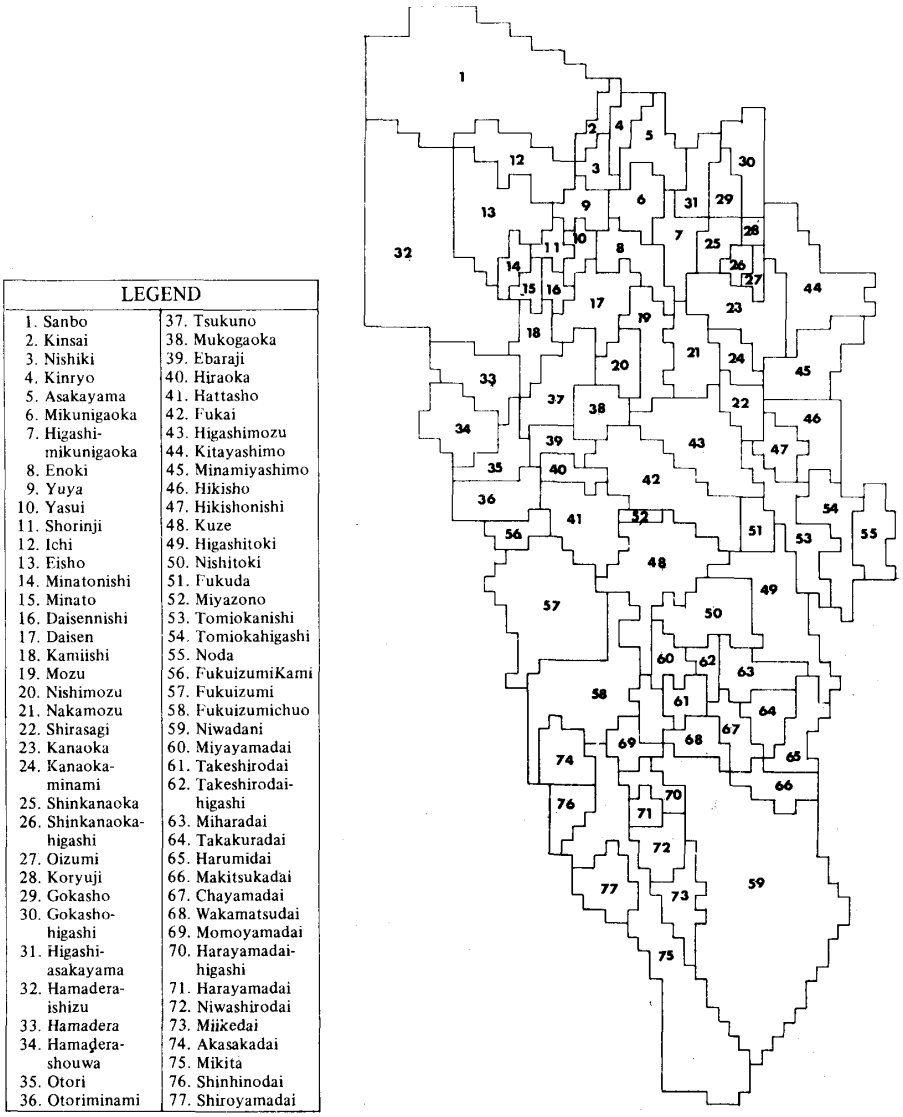

Fig. 2. Elementary school districts

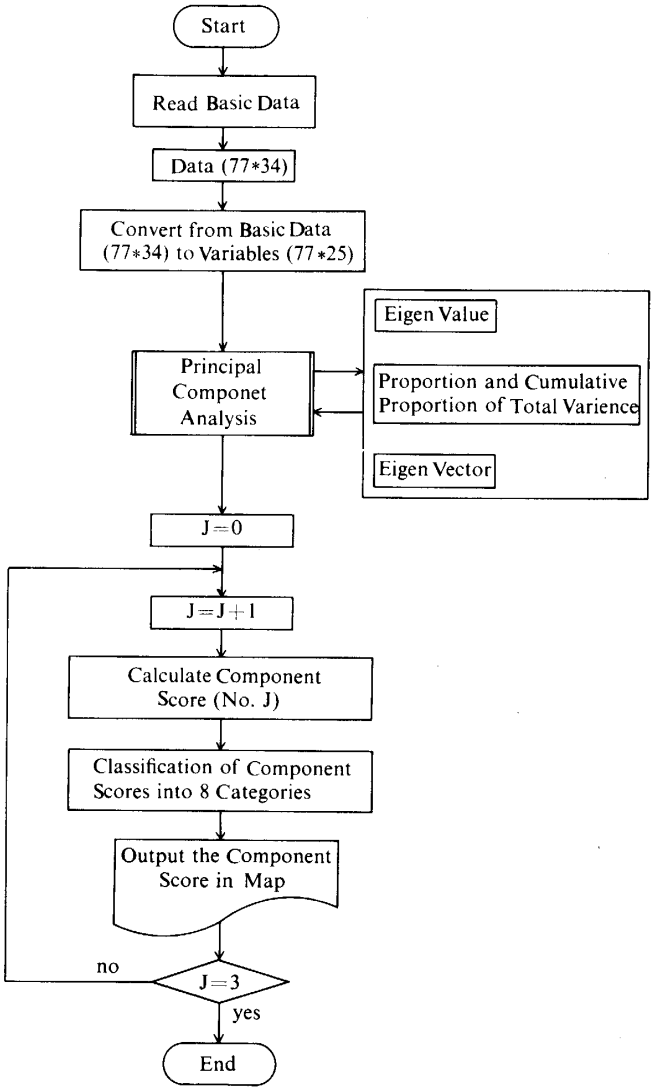

Fig. 3. Flow Diagram

Table 1. Basic Data and Variables

Basic Data

Data(1)	Number of elementary school district
Data(2)	Area of Elementary school district
Data(3)	Population of elementary school district(1975)
Data(4)	Population of elementary school district(1979)
Data(5)	Total floor area of business, amusument, commercial and hotel facilities
Data(6)	Total floor area of warehouse, factory, transportation and conveyance facilities
Data(7)	Total floor area of hospital and clinic, school and culture facilities
Data(8)	Total floor area of housing
Data(9)	Total floor area of flats
Data(10)	Total floor area of building uses
Data(11)	Area of residential
Data(12)	Area of commercial and business
Data(13)	Area of industry
Data(14)	Area of parks and open space
Data(15)	Area of agricultural field
Data(16)	Area of another land uses
Data(17)	Residential area in urbanization control area
Data(18)	Area of buildings
Data(19)	Converted agricultural field(1975)
Data(20)	Converted agricultural field(1976)
Data(21)	Converted agricultural field(1977)
Data(22)	Converted agricultural field(1978)
Data(23)	Area of proposal parks
Data(24)	Area of existing parks
Data(25)	Building coverage
Data(26)	Floor area ratio
Data(27)	Road ratio of habitable area
Data(28)	Wooden building ratio
Data(29)	Area of urbanization promotion area
Data(30)	Area of urbanization control area
Data(31)	Ratio for potential area for people lives
Data(32)	Green coverage in parks
Data(33)	Potential area for people lives
Data(34)	Area of road(over 4m width)

Variables

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Var.( 1)=Data(32)*10000/Data(4)
Var.( 2)=Data(24)*10000/Data(4)
Var.( 3)=Data(4)/(Data(29)*Data(30))
Var.( 4)=Data(4)/Data(3)
Var.( 5)=Data(10)/Data(18)
Var.( 6)=Data(5)/(Data(5)*Data(6)*Data(7)*Data(8)*Data(9))
Var.( 7)=Data(6)/(Data(5)*Data(6)*Data(7)*Data(8)*Data(9))
Var.( 8)=Data(7)/(Data(5)*Data(6)*Data(7)*Data(8)*Data(9))
Var.( 9)=Data(8)/(Data(5)*Data(6)*Data(7)*Data(8)*Data(9))
Var.(10)=Data(9)/(Data(5)*Data(6)*Data(7)*Data(8)*Data(9))
Var.(11)=Data(11)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(12)=Data(12)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(13)=Data(13)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(14)=Data(14)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(15)=Data(15)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(16)=Data(16)/(Data(11)*Data(12)*Data(13)*Data(14)*Data(15)*Data(16))
Var.(17)=(Data(19)*Data(20)*Data(21)*Data(22))/(Data(29)*Data(30))
Var.(18)=Data(32)/(Data(29)*Data(30))
Var.(19)=Data(26)/(Data(29)*Data(30))
Var.(20)=(Data(29)*Data(30)-Data(33))/(Data(29)*Data(30))
Var.(21)=Data(18)/((Data(29)*Data(30))*10000)
Var.(22)=Data(10)/((Data(29)*Data(30))*10000)
Var.(23)=Data(34)/(Data(29)*Data(30))
Var.(24)=Data(28)
Var.(25)=Data(29)/(Data(29)*Data(30))
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Table 2. Correlation between Variables and Components

Components / Variables	1	2	3	4	5
1	−0.58160	0.11112	0.28219	0.37396	0.00821
2	−0.58704	0.45410	0.26821	0.10497	−0.21655
3	0.59589	0.23519	−0.55861	0.02721	0.14887
4	−0.38712	0.40874	0.23889	0.20055	0.50054
5	0.25129	0.38587	0.14765	0.45199	0.11087
6	0.57589	0.08860	0.49083	0.39188	−0.21790
7	0.44637	−0.24451	0.65308	−0.41039	0.10455
8	0.44259	−0.01923	−0.05435	0.33240	0.06900
9	0.64770	−0.44529	0.05397	0.31971	−0.01991
10	0.33479	0.50291	−0.31304	−0.11308	0.07178
11	0.58407	−0.03950	−0.70125	0.12456	0.12977
12	0.57015	0.19467	0.49197	0.36970	−0.23752
13	0.17289	−0.13795	0.60203	0.64607	0.16537
14	0.21904	0.66822	−0.02250	−0.05127	−0.56141
15	−0.53662	−0.66344	−0.07754	0.13370	−0.30171
16	−0.69319	0.32883	0.21171	0.24933	0.39850
17	−0.07518	−0.65486	−0.32205	0.07253	0.02164
18	−0.62311	0.28560	0.19463	0.39153	0.02647
19	−0.16700	0.67767	−0.11836	−0.23157	−0.53907
20	−0.40171	−0.21884	0.23033	0.15266	0.08319
21	0.84206	−0.24267	0.32382	0.02290	0.01999
22	0.87909	−0.12407	0.30558	0.18206	−0.01642
23	0.57167	0.47117	0.13603	0.18795	0.08022
24	−0.03190	−0.78441	−0.03068	0.35971	−0.15736
25	0.52982	0.51599	−0.03285	−0.09623	0.32457

Note; Variables
1. Green coverage in parks per person 2. Area of existing parks per person 3. Density of population 4. Increase ratio in population 5. Average building hight 6. Floor ratio of business, amusement, commercial and hotel facilities 7. Floor ratio of warehouse, factory, transportation and conveyance facilities 8. Floor ratio of hospital and clinic, school and culture facilities 9. Floor ratio of housing 10. Floor ratio of flats 11. Ratio of residential area 12. Ratio of commercial and business area 13. Ratio of industrial area 14. Ratio of parks and open space 15. Ratio of agricultural area 16. Ratio of other land uses 17. Ratio of converted agricultural fiealds 18. Ratio of green coverage in parks 19. Ratio of existing parks 20. Ratio of inhabitable area 21. Ratio of building coverage 22. Ratio of building volume 23. Ratio of road 24. Ratio of wooden buildings 25. Ratio of urbanization promotion area

There are various approaches for determining urban landscape identities, however, the Principal Component Analysis Method was chosen as the method of this study. The methods and procedures are shown in Fig. 3. As a first step, it was necessary to choose the factors which organize the urban landscape structures. 34 data were chosen as basic factors and were converted into 25 variables for the Principal Component Analysis (Table 1). Correlation between variables and components (shown in Table 2) was culculated by

Table 3. Proportion and Cumulative Proportion of Total Varience

Components	Proportion	Cumulative Proportion
1	0.27	0.27
2	0.12	0.44
3	0.12	0.56
4	0.08	0.64
5	0.06	0.70
6	0.05	0.75
7	0.05	0.80
8	0.04	0.84
9	0.03	0.88
10	0.02	0.90
11	0.02	0.92
12	0.02	0.94
13	0.02	0.95
14	0.01	0.96
15	0.01	0.97
16	0.01	0.98
17	0.01	0.98
18	0.00	0.99
19	0.00	0.99
20	0.00	0.99
21	0.00	1.00
22	0.00	1.00
23	0.00	1.00
24	0.00	1.00
25	0.00	1.00

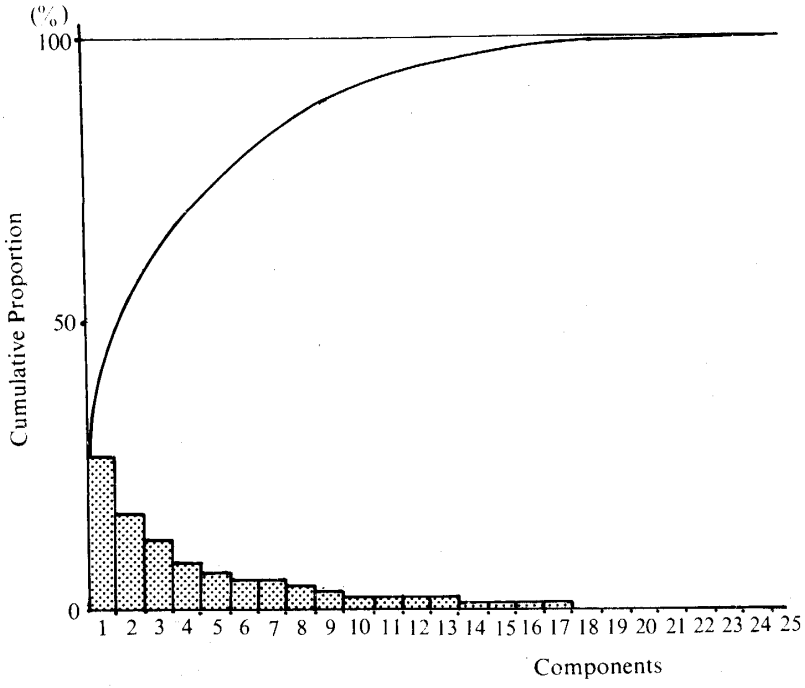

Fig. 4. Proportion and cumulative proportion of total varience

the Principal Component Analysis Method based upon the correlation coefficients among the 25 variables. And also the proportion and cumulative proportion of total varience (shown in Table 3 and Fig. 4) were used as a base for the discussion of the meaning of each component.

Results

The results of this analysis showed that approximately 90 percent of the cumulative proportion of total varience was explained by components No. 1 to No. 10. However, components under No. 4 show less than 0.1 in proportion of total varience and therefore its difficult to distinguish their meaning. Thus, component No. 1 – 3 were used in this discussion (Table 3).

The results are decribed as follows:

1. Correlation among components and variables

1) The proportion of varience of component No. 1 is 0.27 (Table 3) and its shows a

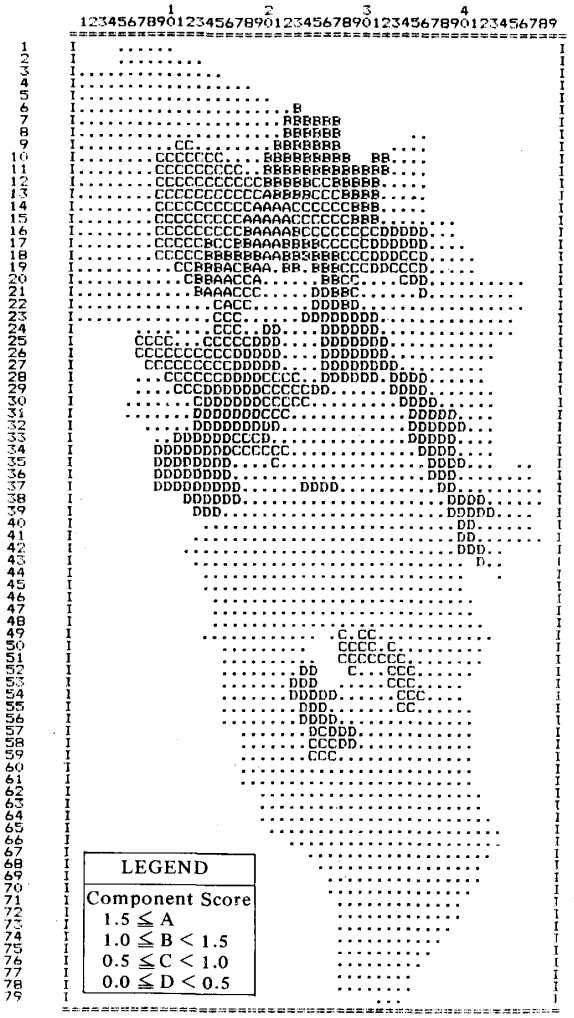

Fig. 5. High component score areas for component No. 1

positive correlation with variables (6), floor ratio of business, amusement, commercial and hotel facilities; (9), floor ratio of housing; (11), ratio of residential area; (12), ratio of commercial and business area; (21), ratio of building coverage; (22), ratio of building volume; (23), ratio of road; and (25), ratio of urbanization promotion area. The other hand, variables (1), green coverage in parks per person; (2), area of existing parks per person; (15), ratio of agricultural field; (16), ratio of other land uses; and (18), ratio of green coverage in parks, show a negative correlation.

Component No. 1 shows a positive correlation with variables which promote urbanity and shows a negative correlation with variables which relate to green space and agricultural areas. As a result, it is suggested that component No. 1 be identified as "Urban Identity". Fig. 5 shows the distribution of high score areas (above average) which are described by component No. 1. The highest component score areas "A" (shown in Fig. 5) are located mostly in existing downtown area of the city, along the rail lines area and in parts of Senboku New town.

2) For component No. 2, the proportion of total varience was 0.17 and cumulative proportion of total valience of components No. 1 + No. 2 was 0.44 and this explains approximately 50 percent of the total varience. Principal component No. 2 cor-

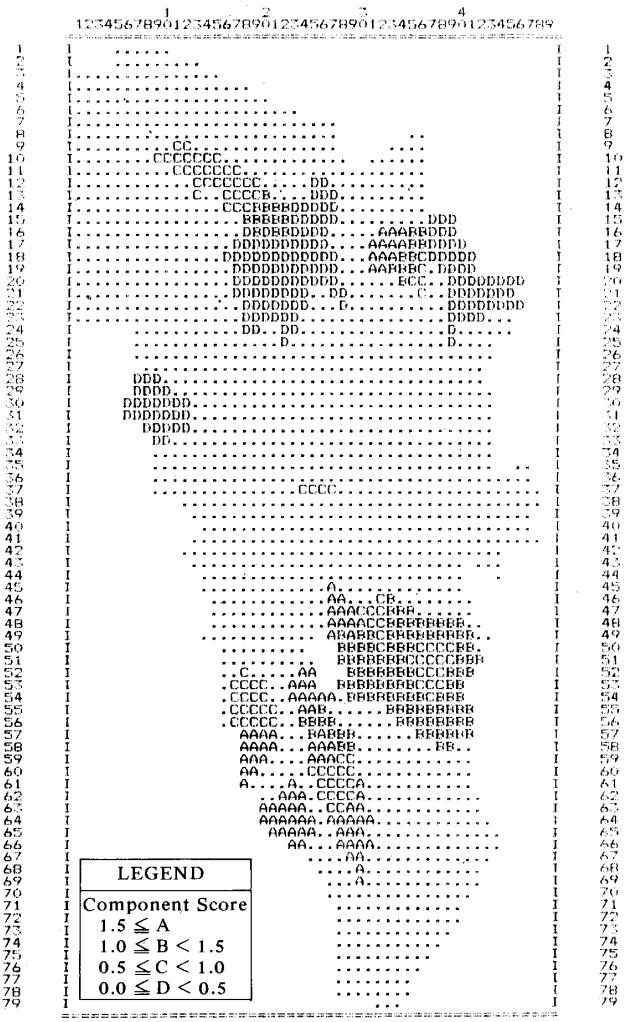

Fig. 6. High component Score areas for component No. 2

relates positively with variables (10), floor ratio of flats; (14), ratio of parks and open space; (19), ratio of existing parks; and (25), ratio of urbanization promotion area. Variables (15), ratio of agricultural field; (17), ratio of converted agricultural field; and (24), ratio of wooden buildings had negative correlation with component No. 2. From these results, the component No. 2 be understood as "Planned Urban Development Identity". Fig. 6 shows the distribution of high score areas for component No. 2 and these areas correspond with new housing districts like Senboku New Town.

3) The proportion of total varience of component No. 3 was 0.12. Component No. 3 had a positive correlation with variables (7), floor ratio of warehouse, factory, transportation and conveyance facilities; and (13), ratio of industrial area and a negative correlation with variables (3), density of population; and (11), ratio of residential area. From these results, component No. 3 can be identified as the "Low Population Identity". Fig. 7 shows the distribution of high score for component No. 3 and these areas correspond with industrial and forest areas.

2. Urban landscape identities of Sakai

The results derived from the Principal Component Analysis Method will provide some directions for the development conceptual guideline for future urban landscape

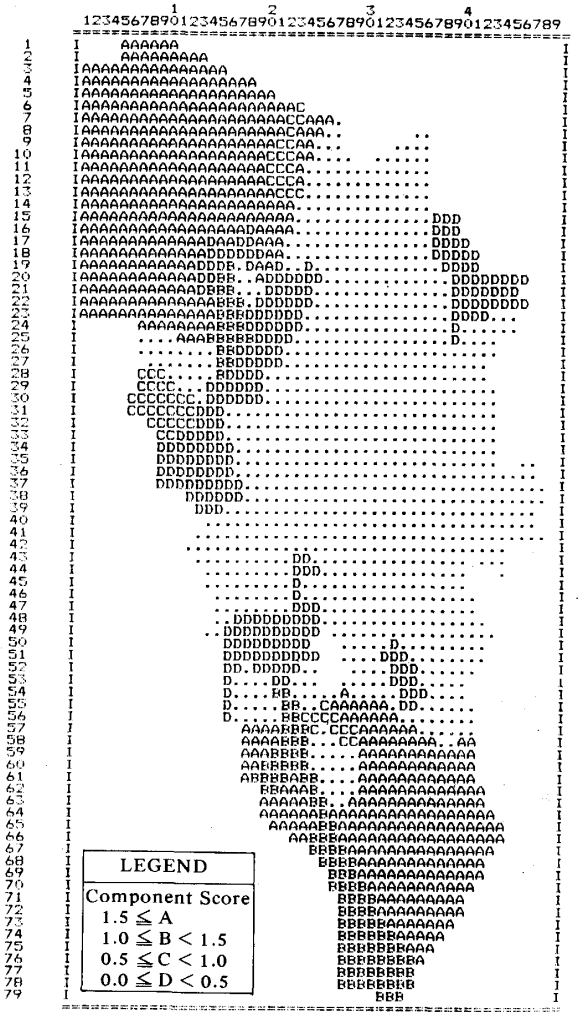

Fig. 7. High component score areas for component No. 3

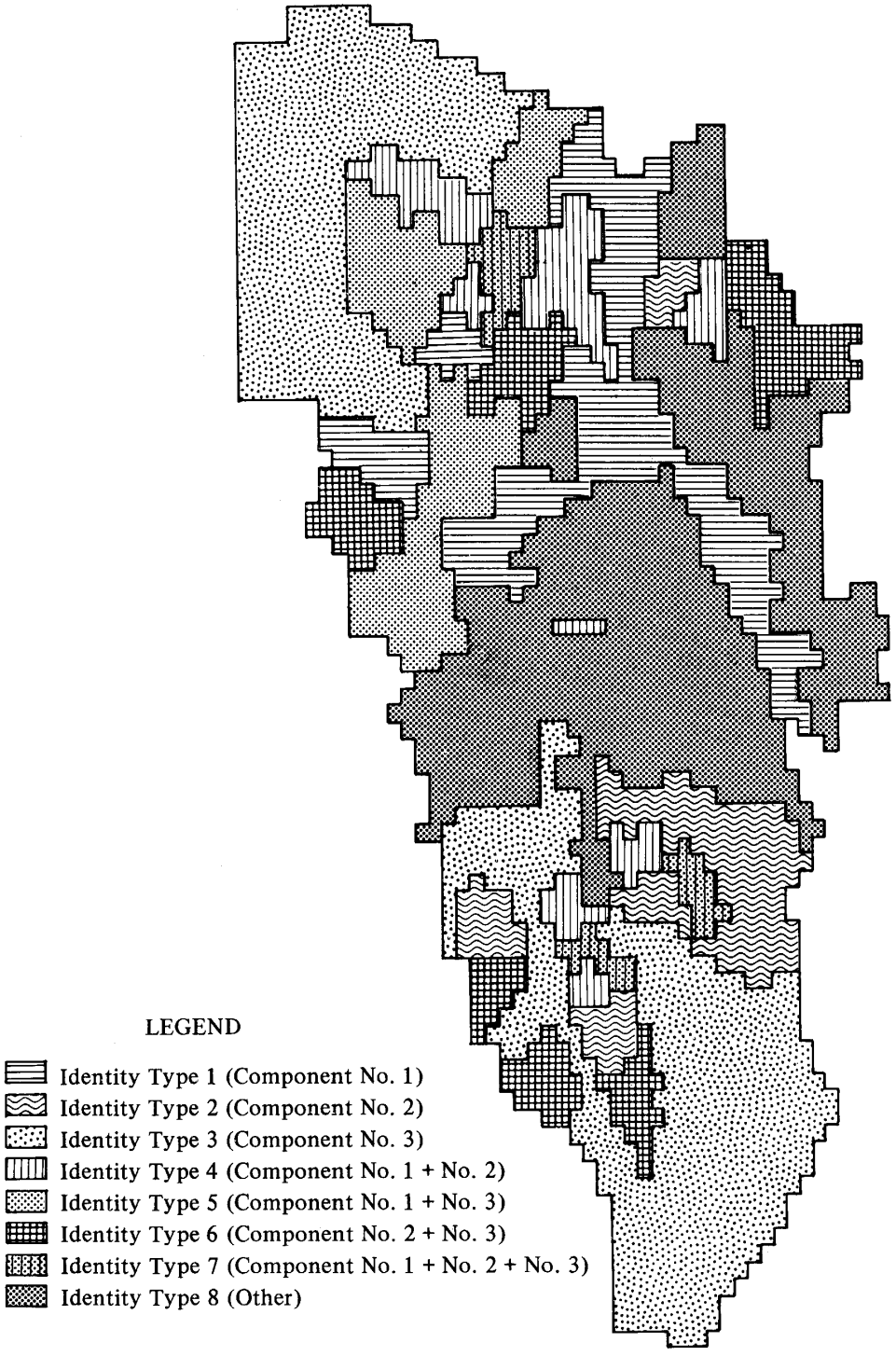

Fig. 8. Urban landscape identities in Sakai

planning and design. For use in this kind of study, Fig. 8 was made by the overlaying Fig. 5 – 7. The urban landscape identity of each district in Sakai was categorized into eight Identity Types as shown in Fig. 8.

Identity Type 1 to Type 7 were derived from components No. 1, No. 2 and No. 3 individually or compounded. The component score of each of these Identity Types was over average. The districts which were include in Identity Type 8 could not be identified

clearly by the Principal Component Analysis Method. It mean that the component score was less than average. In these districts, existing land use is mostly agricultural and made up of small villages. It is easy to see that some districts are identified by only one Type but other districts are identified by a number of Identity Types.

From the results (shown in Fig. 7) urban landscape identities can be described as follows:

- Sakai can be seen to be divided into 4 basic urban landscapes.
- The north-west area is clearly characterized by strong urban qualities especially along the rail lines (Identity Type 1). The areas to the north-west of the rail lines also show strong concentration of urban characteristics (Identity Type 4 and 5).
- The southern area is characterized by strong Identity Type (Planned Urban Development Identity) characteristics. Senboku New Town is located in this area.
- Both the "Urban Identity", north-west area and the "Planned Urban development Identity", south area, enclose pockets of Identity Type 4 areas. It is important, however, to recall for planning and design purposes, that these areas are sorounded by quite different urban landscapes.
- It is important to note that, although both are classified Identity Type 3, "Low Population Identity", nothernmost district is predominantly industrial, and the southernmost district is predominantly forest.
- In the north-east district, classified as predominantly Identity Type 8, "Other" a large area of Identity Type 4 can be seen. A large park is located in this area.

Discussion

In this study, the urban landscape identities of districts in Sakai were determined by the Principal Component Analysis Method. From the results of this study it can be seen that the Principal Component Analysis Method is a useful and efficient approach; however, in order to determine more detailed identities for further discussion, it is necessary to correct and fill out the fundamental data and information concerning the study area.

References

1) KAWAGUCHI, M. (1976). The Introduction of Multivalriate Analysis. Morikita Shupan Co.
2) SAKAI CITY (1980). Fundamental Land Use Data of Elementary School District for Master Plan.
3) SAKAI CITY (1981). City Planning of Sakai.