

# A STUDY ON USER'S CHARACTERISTICS AND SELECTION FACTORS OF THE HIGHWAY SERVICE AREAS

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## ABSTRACT

In recent years, the concept of highway service areas is developing from simple resting areas to areas of prospective economic growth by providing various services related to neighboring tourist destinations. The concept of a multi-purpose highway service area was introduced in Japan in 1990. Currently, there are 26 Highway Oases which have been institutionalized as the central business in regional areas and have a significant contribution to help revive regional economies. This study analyzes the surveys of 417 users of 4 highway service areas in Korea. The results from the surveys are used to determine the characteristics which have the most influence in users' selection of highway service areas. According to the results of the survey of, it was determined that 65.3% of the total variables categorized into 3 main factors. The most considered Factor-1 is the appropriate condition of the location (easy access, service area scale, scenery). Factor-2 is appropriate facilities, (diversity of the menu, restaurant atmosphere), and finally Factor-3 is the quality of sales (local products, sale of goods).

■ Keywords: Highway Service Area, Highway Oasis, Multidimensional Scaling Method, Factor Analysis

## 1. INTRODUCTION

In recent years, the concept of highway service areas is developing from simple resting areas to areas in which the benefits of users can be maximized. In other

words, service areas have become places which can accommodate users with various services and facilities, such as providing foods and products which cannot be found in the city, selling local specialized products and agricultural goods so consumers can purchase these goods without having to travel to the production sites. Also, working in conjunction with nearby tourist attractions or facilities can attract tourists and thus develop simple service areas into a space where the features of the local areas can be expressed, and as a result, regional economic growth can be promoted. Consequently, service areas are developing into areas similar to shopping centers where characteristics of neighboring tourist destinations can be expressed and thus promote economic growth.

For a long time, Japan has been developing various facilities for activities such as sale, culture and leisure. Such progress has assisted the development of enhanced services for users of highway service areas and therefore acted as a stimulus for regional society. By installing Smart IC facilities, they are currently operating highway oases which both neighboring area road users and highway users can use. This development of highway oases includes the selling of local products which are produced at their original locations at highway oases. This movement has had a significant contribution in reducing Logistic traffic and Logistic costs.

There is a need to increase the distribution function approach of highway service areas instead of these areas being regarded as simple passing points. Hence, these highway service areas, in conjunction to the neighboring area development projects, are being developed into complex service area towns that can contribute to the improvements of the convenience of service area users and local economic stimulation.

This study reviews the current situation of highway oasis in Japan for the formalization of highway service town and the study uses a user specialized survey for national highway service areas, to find out the importance and performance of service area facilities. By the analysis of such surveys, the study aims to find the key factors and their weight for expressway users to choose certain service areas.

## 2. THE THEORETICAL BACKGROUND OF MULTI-PURPOSE HIGHWAY SERVICE AREAS

### 2.1 The Concept and Structure of Highway Oases Facilities.

The meaning of Highway Oasis, in Japan, refers to a section of a highway service area and a parking area connected to city parks and areas of regional development. This name was established in 1997 with the constitution on the highway oasis system, and originated from the project name intended to connect highway service areas and nearby city parks and thus activate service improvement.

Following this development, there has been an increase of highway oases users and thus causing a ripple effect in using these areas as the promotion of local areas rather than simple resting areas. These possible connection facilities cannot be

limited by city parks and have been maximized as areas for regional development and institutionalized as “local development areas using service areas.”

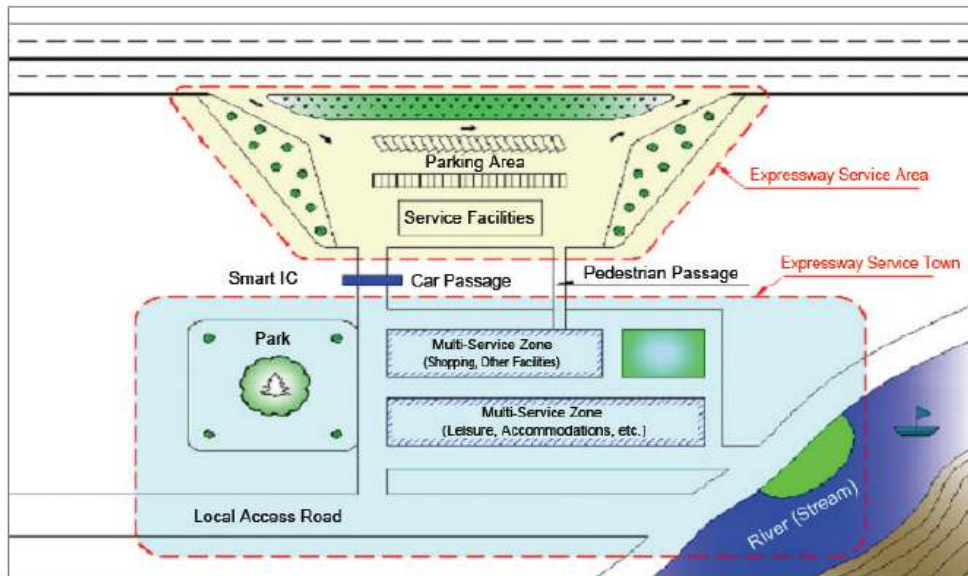


Figure - 1 Conceptual Layout of Expressway Service Town

Japan has constructed service towns called Highway Oases at 26 locations next to expressway service and parking areas since the 1990s. Multi-facility complexes have been built near expressways so that they can be used by both service area users and drivers using nearby roads. The facilities include parks, hot springs and campsites. Out of these, there are even ones which have managed to have some maintenance with Michinoeki of national highway. The Highway Oasis in Japan is designed in such a way as to allow transfers from expressway buses to buses running on local routes and taxis. It is equipped with Smart IC facilities, thus allowing entrances and exits for cars installed with an ETC (Electric Toll Collection) transponder.

On the other hand, the structure of the Highway Oasis is

- 1) An open system where the flow of cars from highways and regular roads is possible with installation of smart IC,
- 2) A closed system where the flow of cars from highways and regular roads isn't possible. A system where a 2<sup>nd</sup> car park is used.
- 3) A closed system, however without a 2<sup>nd</sup> car park and a system where the facilities are attached and identified as SA and PA.

A table of the installation status in facilities of currently operating 20 highway oases is shown below in Table - 1.

Table – 1 Installation status and number of HWO

Facility Item	Facility Detail	Number (%)
Food. Selling Facilities	restaurants, souvenir stalls	16(80%)

Entertainment Facilities	aquariums, zoos, Ferris wheels	3(15%)
Leisure Facilities	camping sites, ski resorts, golf courses	12(60%)
Nature Park (Rides Included)	walk paths, flower gardens, water features	14(70%)
Information Facilities	information facilities	12(60%)
Memorial Centers. Museums	Memorial centers. museums	6(30%)
Hot Spa Facilities	hot spas, foot baths	6(30%)
View Facilities	observatories, observatory lounges	8(40%)
Accommodation Facilities	hotel, resting areas	6(30%)
Multi-Purpose Plaza	multi-purpose plaza	12(60%)

Reference: Yoshihide Nakagawa, Yuya Sato (2005)

From this table, we can see that there is a higher ratio of food, Selling facilities, natural parks, multi-purpose area compared to leisure facilities which have a lower ratio. This is due to the fact that most highway oases facilities are facilities which connect city parks and SA's and PA's and are therefore installed to fit such features.

## 2.2 Concept of Highway Service Areas and Service Review

The current installation status of national highway service areas is 32 on Gyungbook Highway, 18 on Joongang Highway, 17 on Tongyoung Daejun, Joongboo Highway, 13 on Youngdong Highway. Thus, a result of 165 highways service areas nationally. Although the user population is 3.2 million a day, there are many service areas which offer only simple resting facilities. However recently, by applying various changes to service areas, highways are becoming specialized by focusing on particular characteristics of the area in which the highway is allocated to. Examples of this situation is the fact that service areas can be allocated into certain categories; Usefulness (Donghae, Okgae, Haengdamdo, Daechun, Geumgang, Sanchung Service areas), facility specialization (Dukpeong nature, Insam Land service area), food specialization (Unyang, Andong, Gangreung Service area), souvenir specialization (Insam Land, Chunahn, Moongyung saejae).

Dukpeong service area, by establishing a service area focusing on nature and eco-friendly facilities established Dukpeong natural service area in June 2003. In 2007, they opened an upward road and in 2009 a downward road was opened. Also, for the first time, it became a service area which had been established with the concept of a multi-purpose highway service area. Sports equipment outlets and fast food stores were introduced and through the establishment of a themed area constructed

from recycling nature, it became a key example of a successful service area using the areas natural resources to promote tourism.

Previous researches on highway service area have mainly focused on the satisfaction and promotion of users. The main evaluation factors have been service area facilities (parking, toilet, etc), services of the employee, food, merchandise, and so on. However, this analysis focuses on the comparison of factors which influence users' choices of service area and finding the significance and performances of users regarding the marketing side.

Among previous researches, Lee (2001) did a survey on the satisfaction of users for the facility, service, and merchandise. Kim (2001) did a survey on the choice factors of service area and Jung & Lee (2009) surveyed the significance and performance of selection factors of satisfaction by IPA (Importance Performance Analysis).

Although most research on highway service area focuses on the users' satisfaction and efficiency rate. The characteristic of this study which sets it apart from other studies can be seen as the use of MDS to analyze the factors influencing the service area choices of highway service area users.

### 3. ANALYSIS OF QUESTIONNAIRE SURVEY

#### 3.1 Research Overview.

For this research, 4 SA's (service area), with relatively high usage were selected and that is Andong SA, Gungang SA, Haengdamdo SA and Deukpyung SA. The surveyors interviewed each SA user directly for the questions and 417 questionnaires were collected as seen in Table - 2.

The content of the survey includes service area selection factors, purpose and user behavior and reasons for inconvenience and problems. The results of the survey are as shown below.

Table – 2 Outline of Questionnaire Survey

Items	Contents				
Survey Location	<ul style="list-style-type: none"> <li>- Andong SA, Jung-ang expressway</li> <li>- Gungang SA, Gyeong-bu expressway</li> <li>- Haengdamdo SA, Seuhaeon expressway</li> <li>- Deukpyung SA, Youngdong expressway</li> </ul>				
Survey Topics	<ul style="list-style-type: none"> <li>- Service Area Selection Factors</li> <li>- Purpose and User's Behavior</li> <li>- Inconveniency Reasons and Problems</li> </ul>				
Number of surveys	Andong	Gungang	Haengdamdo	Deukpyung	Total
	118	108	89	102	417
Survey	November 28th, 2009				

Date	
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**Reference:** Basic Outline Research of Development of Youngjoo Multi purpose expressway development, 2009

### 3.2 Analysis of Service area user purposes and types

#### 3.2.1 *Personal Attributes of Interviewees*

Out of the 417 people interviewed, there were 283 males (67.9%) and 134 females (32.1%). 38.8% of the interviewees were in their 20's, 27.8% of them in their 30's, 19.2% of them in their 40's, and 13.4% of the interviewees were in their 50's. The occupations of the interviewees consisted of company employees (37.9%), students (22.8%), business owners (18.7%), and workers in transport businesses (3.1%). Looking at the purpose of such users' travel, it was seen that irregular transport (work, travel, visiting family, attending weddings) was usually the case with 98.6% of the users. Compared to this percentage, there were a very low percentage of users with a regular transport purpose (going to and from work or school) had at the time when the survey was conducted.

#### 3.2.2 *User Purpose*

The main purposes of service area use were seen to be rest (38.9%), toilet use (35.0%), meals (13.2%), snacks (10.3%), petrol and car inspection (1.3%), sleep (0.7%), and other (0.7%). These figures are shown respectively in Figure - 2.

The average frequency of users' visits to SA is one (47.2%) and two to four (39.6%). The stopover times at SA were recorded to be 10 minutes (11.3%), 10 to 20 minutes (42.9%), 20 to 30 minutes (32.1%) and 30 to 60 minutes (10.1%). There is a need to notify the fact that the majority of SA users (96.4%) had a stopover time of less than 60 minutes.

Criteria of SA choice were analyzed with the highest factor being driving time (41.2%), general service (27.8%), bus stops (15.3%), natural view (9.4%), food selection (3.4%), and other (2.9%), the specialization for food and special products as a user choice factors when selecting SA was merely 3.4%. These figures are shown below in Figure - 3 and Table - 3.

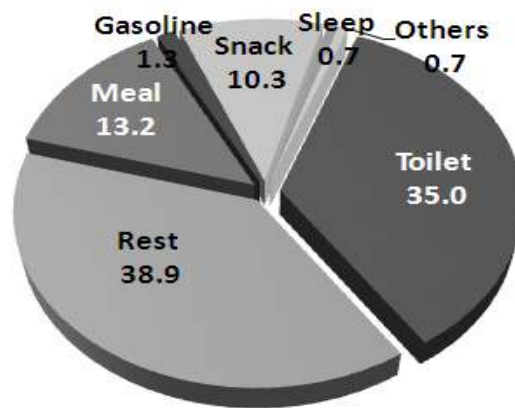


Figure - 2 Purpose of Use of Service Area

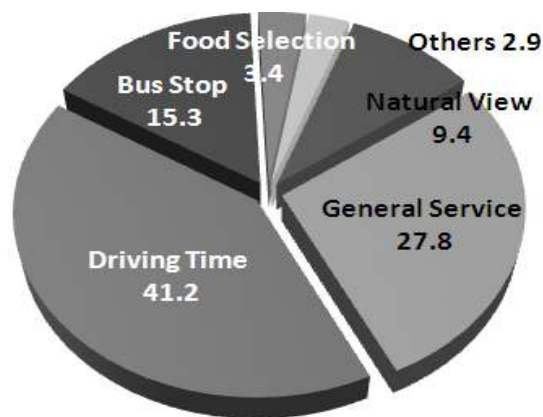


Figure 3 - Selection Criteria of Service Area Selection

Table 3 - Selection Criteria of Service Area Selection

Distinguishing Factors	Andong	Geumgang	Haengdam Do	Dukpeong
Surrounding scenery of SA	12(10.2%)	10(9.3%)	5(5.6%)	12(11.8%)
Service of SA	39(33.1%)	11(10.2%)	44(49.4%)	22(21.6%)
Travel Time	43(36.4%)	41(38.0%)	30(33.7%)	58(56.9%)
Highway bus stops	9(7.6%)	44(40.7%)	3(3.4%)	8(7.8%)
Preferred food and local specialized products	8(6.8%)	2(1.9%)	2(2.2%)	2(2.0%)
Other	7(5.9%)	0(0.0%)	5(5.6%)	0(0.0%)
Total	118(100%)	108(100%)	89(100%)	102(100%)

### 3.3 Desired Features of Highway Oases

The most desired feature of multi purpose highway service area is a resting function (40.0%). From a resting function, walk paths have the overall largest ratio with 16.2%. Next is shopping features (19.2%), specialized local products and famous brand discount stores had a similar percentage of 9.6% and 9.4% respectively. Accommodation facilities (15.5%) and entertainment facilities (13.8%) had specific facilities such as natural recreational facilities and hot springs had the highest desire with 8.0% and 8.3% respectively./ compared to this, the last and comparatively high percentage was found in the desire for cultural recreational facilities.

As seen above, it can be seen that the call for facilities such as entertainment, shopping and accommodation which can facilitate service areas and thus maximize the benefit of users are increasing.

Table 4 - Specific desired features of SA

Distinguishing Factor	Facility	Frequency	Percentage	Effective Percentage
Resting Facility	<b>walking path</b>	103	16.2	40.4
	waterside park	35	5.5	13.7
	arboretum	45	7.1	17.6
	lookout	48	7.5	18.8
	forest bath	24	3.8	9.4
	subtotal	255	40.0	100.0
Shopping Facility	<b>local specialized product</b>	61	9.6	50.4
	luxury brand discount store	60	9.4	49.6
	subtotal	121	19.0	100.0
Entertainment Facility	theme parks	17	2.7	19.3
	ski resorts	9	1.4	10.2
	swimming pools	9	1.4	10.2
	hot spas	53	8.3	60.2
	subtotal	88	13.8	100.0
Accommodation Facility	<b>natural recreational areas</b>	51	8.0	51.5
	camp site	17	2.7	17.2
	log cabin	31	4.9	31.3
	subtotal	99	15.5	100.0
Other	youth centre	2	0.3	2.7
	silver town	12	1.9	16.2



	<b>culture space</b>	60	9.4	81.1
	subtotal	74	11.6	100.0
Total		634	100.0	

Note: the most desired facilities in each area are highlighted in bold.

#### 4. ANALYSIS OF SELECTION FACTORS OF SA

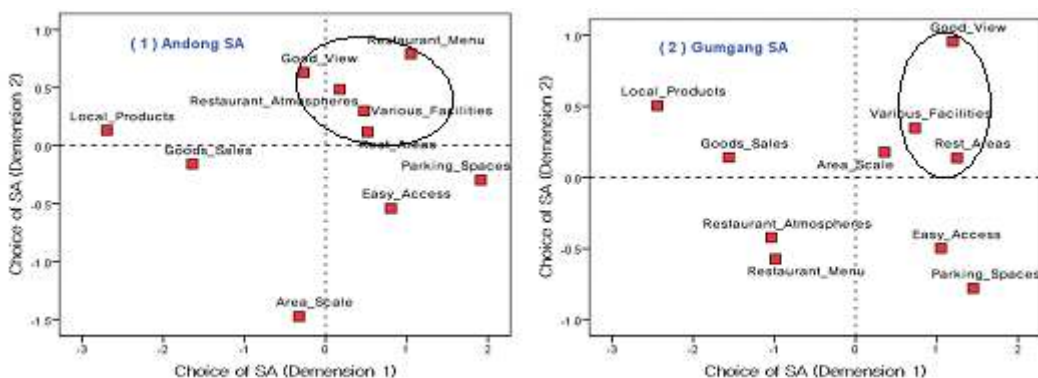
##### 4.1 Analysis of the Importance of SA Selection Using Multidimensional Scaling Method.

In order to find the proximity of each evaluation criteria which influenced the SA choice of users, multidimensional scaling method (MDS) was used to assist in the analysis.

Multidimensional scaling (MDS) is a set of related statistical techniques often used in information visualization for exploring similarities or dissimilarities in data. MDS is a special case of ordination. An MDS algorithm starts with a matrix of item-item similarities, and then assigns a location to each item in N-dimensional space, where N is specified a priori. For sufficiently small N, the resulting locations may be displayed in a graph or 3D visualization.

By the positioning of multidimensional scaling method, it showed 1) Andong SA "Restaurant Menu", 2) Gungang SA "Good View", 3) Haengdamdo SA "Good View + Area Scale" and 4) Dukpyung SA "Good View + Various Facilities". This means that each SA has different characteristics based on different clear user's consciousness by selection importance.

As shown the result of MDS, at Figure - 4, location map of 2 dimension space about SA selection importance show 3 groups. First dimension indicate that factors of "easy access + rest area + parking spaces" are more important than others. On the other hands, 2nd dimension indicate that factors of "restaurant menu + restaurant atmospheres + various facilities" and "good view + area scale" doesn't have similarity, but it effect for the SA choice.



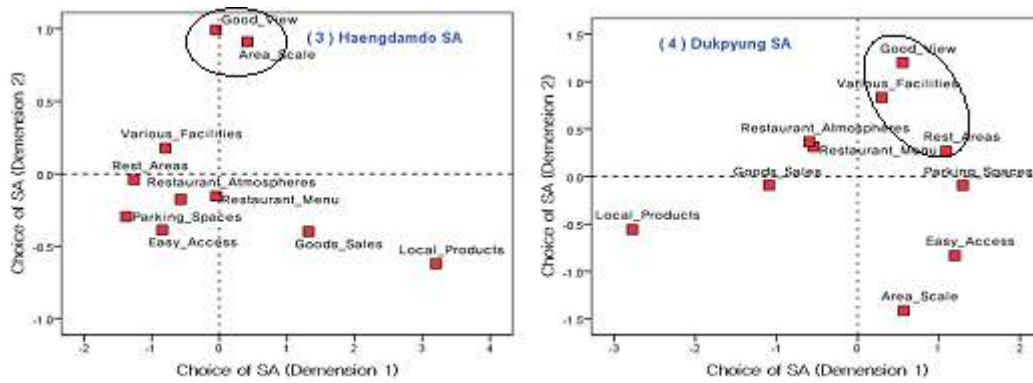


Figure 4 - Importance and Satisfaction of Service Area

#### 4.2 Factor Selection of SA Choice

This study analyzed mutual relationship by factors to find out characteristics of each factors with its statistical analysis. The analysis show that variance rate of factor 1 is 41.24% and factor 2 is 14.75 % (accumulation rate 55.99%), factor 3 is 9.28% (accumulation rate 65.27%). This means that 65.27% of total variance explains importance of 3 factors (location condition + facilities + goods sales).

By the rotation of factors, Table - 5 show factor loading of factor matrix are became clearer. In this regards, factor 1 is better location (easy access + service area scale + good view), factor 2 is better facilities (restaurant menu + restaurant atmospheres), and factor 3 is better goods sales (local products + goods sales).

Table 5 - Important Factors Analysis for SA Choice

Variances	Components		
	1	2	3
Service Area Scale	.730	-.075	.314
Easy Access	.776	.172	-.033
Parking Spaces	.710	.288	-.108
Rest Areas	.682	.379	.095
Good View	.535	.218	.347
Various Facilities	.418	.628	.130
Restaurant Menu	.162	.843	.187
Restaurant Atmospheres	.144	.793	.290
Goods Sales	.160	.330	.762
Local Products	.002	.151	.871

- \* Remarks 1. Factor selection method is principal component analysis
- 2. Rotation method is Kaiser Normalization's varimax rotation and converged 5 repeating calculation factor rotations

## CONCLUSION

As road users desire highway service are to provide multiple functions, the idea of "Expressway Service Town" concept emerged to provide commercial, tourism and leisure, and accommodation services instead of functioning jus as rest areas. In this context, expressway service towns could help revitalize the neglected provincial economy through promoting exchanges between the national and regional economies.

Based on this background, this paper conducted surveys to find out importance and satisfaction factors of service area, importance of SA selection, and factor selection of SA choice. First of all, the analysis showed that users are satisfied on most of factors except on local products, goods sales and restaurant atmospheres. Secondly, multidimensional scaling (MDS) of 2 dimensional spaces showed that 10 factors display 3 groups having similar characteristics. Thirdly, factor selection of SA choice showed that 65.27% of total variance explains import of 3 factors of location condition + facilities + goods sales.

Finally, based on the assumption of different importance by user groups, further studies with the surveys by professionals of decision making groups will be carried out. As a result, it can be expected that more detailed classification of SA functions for the structural evaluation will display more accurate analysis.

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