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## Empirical Analysis Of Leisure Driver Decision Structures Underlying Sa/Pa Choice Behaviors On Expressways In Japan

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**EMPIRICAL ANALYSIS OF LEISURE DRIVER  
DECISION STRUCTURES UNDERLYING  
SA/PA CHOICE BEHAVIORS ON EXPRESSWAYS IN JAPAN**

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**ABSTRACT**

Recently, it has been recognized that leisure drivers have a variety of needs when using expressways and that service and parking areas (SA/PAs) are required to offer not only traditional rest stop services but also additional services, such as refreshments, dining, and souvenir shopping. As previous research on driver decisions related to SA/PA choice behaviors is limited, it is necessary to identify the factors determining SA/PA choice behaviors to develop marketing strategies for promoting SA/PA use. Therefore, one of the objectives of this research is to analyze leisure driver SA/PA choice behaviors and their level of customer satisfaction with SA/PA services. A paper-based questionnaire was administered to the drivers who stopped at the studied SA/PAs on the survey day; a web-based survey is planned as a complementary survey. Structural equation modeling was applied to represent the decision structure underlying SA/PA choice behavior. We also discuss marketing strategies to promote SA/PA use for leisure drivers. In addition, a SA/PA choice model was developed to identify whether a given driver would stop at any of the studied SA/PAs or not and to identify which SA/PA would be chosen.

## INTRODUCTION

### Background and Objectives

Recently, it has been recognized that leisure drivers have a variety of needs when using expressways in Japan. This implies that the service areas (SAs) and the parking areas (PAs) are required to offer not only rest services, but also other services, such as refreshments, dining, and souvenir shopping. Some SA/PAs along expressways in Japan are markedly different from those in European countries and even those in US. They have innovated in their function as a service facility, providing amenities such as shops and restaurants in addition to restrooms. Notably, a SA with a luxurious, marble toilet has become an attraction, like a tourist spot.

In Japan, interurban expressways have either SAs or PAs every 20 km. Drivers thus have a choice of several SA/PAs when they utilize SA/PAs as part of leisure tours taken on vacation. Previous research on such drivers' SA/PA choice behavior has not been conducted. Iida (1998) has explored the basic characteristics of rest service areas on expressways in Japan focusing on their parking spaces and amenity services. Recently, Shino, Hibino and Morichi (2005) has analyzed performances of usage of rest areas such as dropping rate, staying time, and effect of the congestion level on driver's choice behavior of rest areas. When we consider the variety of needs and wants for SA/PAs, it is clearly important to identify which of many possible factors determine SA/PA choice behavior. It is also required to analyze the current status of leisure drivers SA/PA choice behavior and the level of customer satisfaction with SA/PA services in terms of marketing research.

When focusing on the demand side of the services market on expressways in Japan, we can note trends indicating a decrease in leisure trips on non-workdays. A comparison of non-workday PT data from 2000 and 2010 in Kyoto, Osaka, and Kobe shows the out-going rate on non-workdays has decreased from 67.0% in 2000 to 59% in 2010. Notably, it decreased by up to ten percentage points in case of younger segments of the population. Further, total discretionary trip generation on non-workdays decreased nearly three percentage points, from 18.5 million trips/day (51.5%) in 2000 to 16.2 million trips/day (48.8%) in 2010.

While the total trip generation by car on non-workdays has declined (from 18.1 million trips/day in 2000, to 16.8 million trips/day in 2010) as a whole, it is noteworthy that the ratio of discretionary trips by car to the total has declined since last decade for the younger generations. The largest decrease is over ten percentage points and is part of the trend illustrated below:

20~24 yrs old;	47.1%→43.4%	3.7 points down
25~29 yrs old;	62.3%→52.1%	10.2 points down
30~34 yrs old;	66.2%→59.3%	6.9 points down
35~39 yrs old;	64.7%→62.3%	2.4 points down

The supply side of services market in expressways has recently made efforts to react to the changes the demand side, as described above. The main efforts made by the supply side of expressway services market are to progress to a better understanding of SA/PA users needs and wants and to identify effective measures to improve the level of services in SA/PAs to increase customer satisfaction.

This research has two main objectives. The first is to analyze basic properties of drivers' behaviors and their satisfaction with SA/PAs. The second is to develop a structural equation model,

denoted as SEM, in SA/PA choice behaviors for identifying the decision structure related to revisiting the SA/PA. To achieve the first objective, a questionnaire on driver behaviors at SA/PAs is conducted to collect the data that will be applied to our SEM calibration.

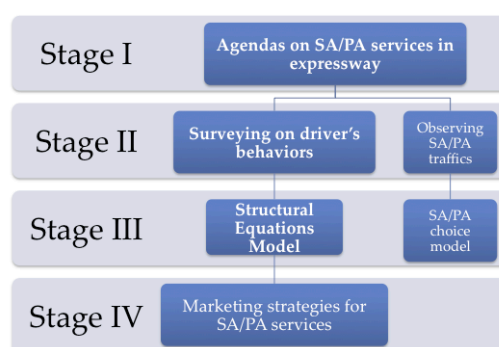
### Analytical Framework

The analytical framework consists of four stages, as shown in **Figure 1**. The first stage identifies goals for service performance at expressway SA/PAs. It is clear that this stage is linked to the final stage (Stage IV) because our framework is regarded as a kind of marketing process in which the proposed goal itself will be reframed through the P-D-C-A cycle. At present, our first goal is discovering ways to identify effective strategies for increasing the number of expressway drivers through improving their satisfaction with services at SA/PAs.

In the second stage, a questionnaire on driver behaviors is conducted at select SA/PAs. An internet-based survey is conducted about one month later to complement the initial questionnaire. Additionally, the number of stop-over vehicles per day and the total traffic per day around the surveyed SA/PAs is observed.

The third stage is the main part of this study. A structural equation model is developed to identify the decision structure of driver decisions about whether to revisit to the SA/PA. The SEM is a model capable of identifying factors that determine whether drivers choose the same SA/PA when driving to the same destination. This paper here focuses on a better understanding of the driver decision structures that underlie SA/PA choice behavior.

Finally, in the fourth stage, we will discuss how marketing strategies can effectively improve expressway drivers' satisfaction with services at SA/PAs, based on the results obtained from the proposed SEM in the third stage. It is noted that the fourth stage is not included in this paper.



**FIGURE 1 The Analytical Framework.**

## A SURVEY OF DRIVERS' SA/PA CHOICE BEHAVIORS AND THEIR BASIC PROPERTIES

### The Surveyed SA/PA s and Their Profiles

Figure 2 shows a map of the surveyed SA/PA s on the Chugoku-Expressway bound for Hiroshima. This survey focuses on the following four SA/PAs: Nishinomiya-Nashio SA, Akamatsu PA, Yashiro PA, and Kasai SA. The figure shows the total number of vehicles that pass through each of the surveyed SA/PAs and the number of the vehicles that stop at each SA/PA. The ratio of stop-over to pass-through at these SA/PAs is as low as 9.4% in the Yashiro PA and as high as 26.8% in the Kasai SA.

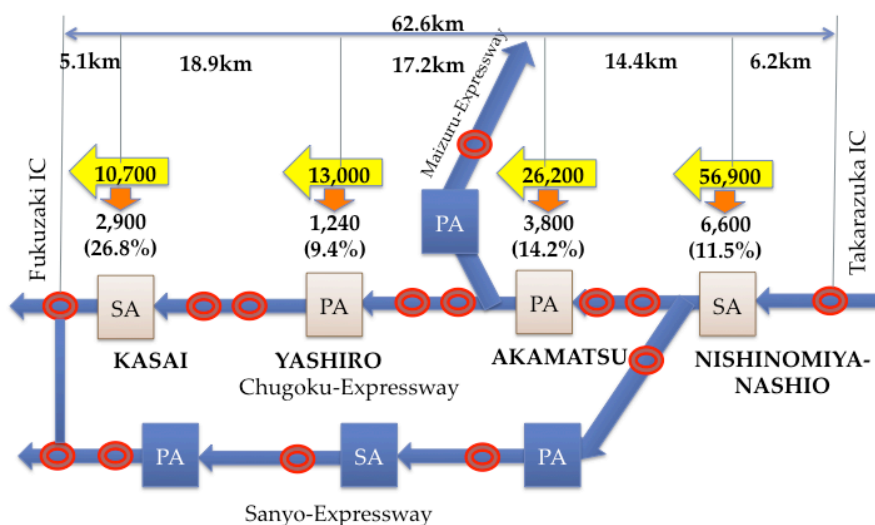


FIGURE 2 Map of the surveyed SA/PA s

TABLE 1 Profile of the surveyed SA/PA s

SAs / PAs	Nishunomiya-nashio SA	Akamatsu PA	Yashiro PA	Kasai SA
Parking spaces	Passenger cars: 202 lots Trucks / Buses: 22 lots	Passenger cars: 126 lots Trucks / Buses: 63 lots	Passenger cars: 32 lots Trucks / Buses: 21 lots	Passenger cars: 121 lots Trucks / Buses: 45 lots
Service Facilities	Souvenir-shop Food court (24hrs) Restaurant (7am-10pm) Gas stand (24hrs) Café (7am-9pm)	Convenience store (Daily Yamazaki) (24hrs) Food court (6am-10pm) Shopping corner (6am-10pm)	Souvenir-shop Food court (7am-8pm)	Souvenir-shop Food court (24hrs) Restaurant (7am-10pm) Gas stand (24hrs)
Other service Facilities	Baby care Facsimile Information desk Wheelchair Hot-spot/i-desk	ATM Facsimile Massage chair	Facsimile Doggy run	Baby care Facsimile Information desk Wheelchair Hot-spot/i-desk

Table 1 shows the variety of services at each surveyed SA/PAs on the Chugoku-Expressway as well as the number of parking spaces for each.

Our questionnaire was conducted on March 11, 2012 (Sunday) from 9:30am to 6:00pm. In this survey, 4,250 questionnaires were distributed at the four SA/PAs, and 1,154 sheets were returned by mail. The response rate was 27.2%, as shown in Table 2.

**Table 2 Distributed questionnaire sheets and response rate by SA/PA**

Surveyed SAs / PAs	No. of distributed sheets	No. of returned sheets	The ratio of return(%)
Nishunomia-Nashio SA	2,000	460	23.0
Akamatsu PA	700	200	28.6
Yashiro PA	250	89	35.6
Kasai SA	1,300	392	30.2
unknown	-	13	-
Total	4,250	1,154	27.2

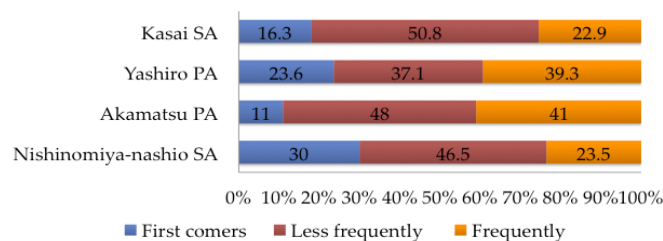
The profiles of the respondents to our questionnaire are described below. The age-distribution is as follows: 1<sup>st</sup>; 60's (31.0%) 2<sup>nd</sup>; 50's (25.3%), 3<sup>rd</sup>; 70's (13.5%), 4<sup>th</sup>, 40's (13.4%). It is noteworthy that the drivers aged 20-39 account for only 13% of the total. This indicates that age demographic of expressway drivers is increasing.

The purposes of their trips on the surveyed day are as follows: 1<sup>st</sup>; sightseeing and leisure activities (46.9%), 2<sup>nd</sup>; other activities (17.2%), 3<sup>rd</sup>; returning home after leisure activities (13.3%), and 4<sup>th</sup>; homecoming (10.6%).

When focusing on the major OD patterns of respondents, it was found that the top ten OD patterns account for 80% of total behaviors; the driving distances of these patterns covered up to 150 km. The top five OD patterns are as follows: 1<sup>ST</sup>; Osaka-Hyogo (23%), 2<sup>nd</sup>; Osaka-Okayama (10%), 3<sup>rd</sup>; Hyogo-Hyogo (9.5%), 4<sup>th</sup>; Kyoto-Hyogo (6.8%), and 5<sup>th</sup>; Osaka-Tottori (5.9%).

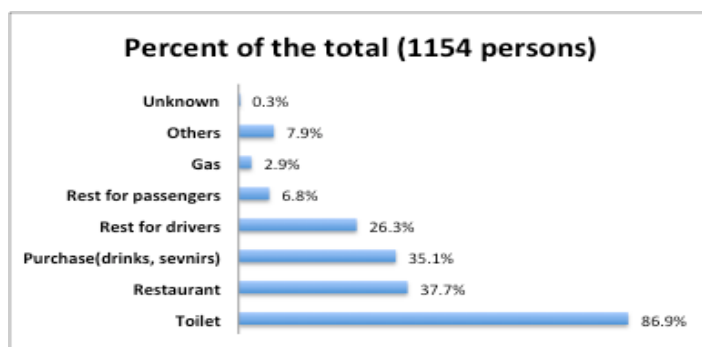
### The Basic Properties of Driver Behaviors and Satisfaction with Use of SA/PAs

The results obtained from our questionnaire are as follows. First, the data only characterize the SA/PA where drivers stopped on the surveyed day. The percent of respondents who did not know the SA/PA at which they were stopped was 13.4%. It is noteworthy that the level of SA/PA recognition at the Nishinomiya-Nashio SA (20.2%) is much higher than at the other three SA/PAs: Kasai SA (9.9%), Yashiro PA (6.7%), and Akamatsu PA (5.5%).

**FIGURE 3 The frequency of visits to SA/PAs**

This may be because at the Nishinomiya-Nashio SA, approximately 90% of the visitors who failed to recognize the SA were first-time visitors to the SA; these included the passengers who stopped there by bus. As shown in **Figure 3**, the percent of first-time visitors to the Nishinomiya-Nashio SA is higher than at the Akamatsu PA and the Kasai SA.

**Figure 4** shows a distribution of the reasons drivers and passengers stopped over at the SA/PAs. The figure indicates that almost 90% stopped at the SA/PA for toilet-use and that approximately one third of the total stopped for restaurants (38%), purchases (35%), or rest to alleviate drivers’ fatigue (26%).

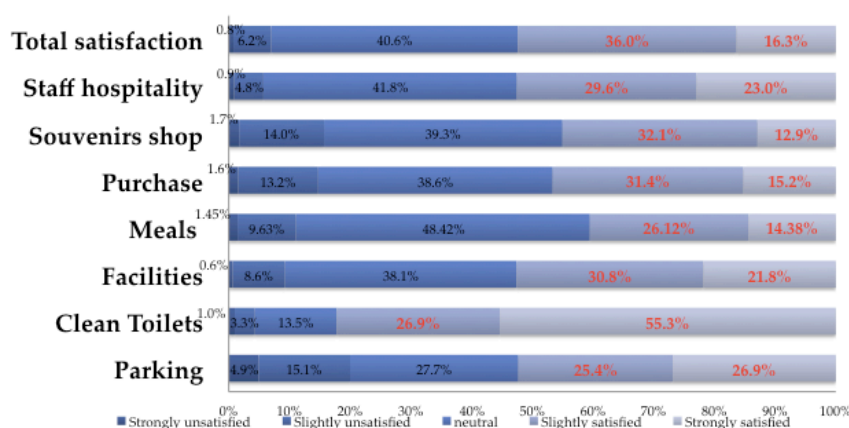


**FIGURE 4** The distribution of reasons why people stopped at the SA/PA

The data also indicate that visitors undertake multiple activities at the SA/PA. For example, 26% of drivers performed two activities in addition to using the toilet; other significant combination patterns are toilet and purchase (14.6%) and toilet and dining (13.2%).

The questionnaire also collected results on driver satisfaction for the SA/PA. **Figure 5** shows the distributions of satisfaction ratings for activities at the SA/PA. A five-category rating scale was used: “strongly unsatisfied”, “slightly unsatisfied”, “neutral”, “slightly satisfied”, and “strongly satisfied”. Total satisfaction is here defined as the sum of satisfaction scores for all evaluated items. The data indicate relatively high overall satisfaction: the sum of “strongly satisfied” and “slightly satisfied” responses accounts for 52.3% of the total. “Cleanness of toilets” is a high-satisfaction category, with over 80% of drivers either “strongly satisfied” or “slightly satisfied” with this attribute.

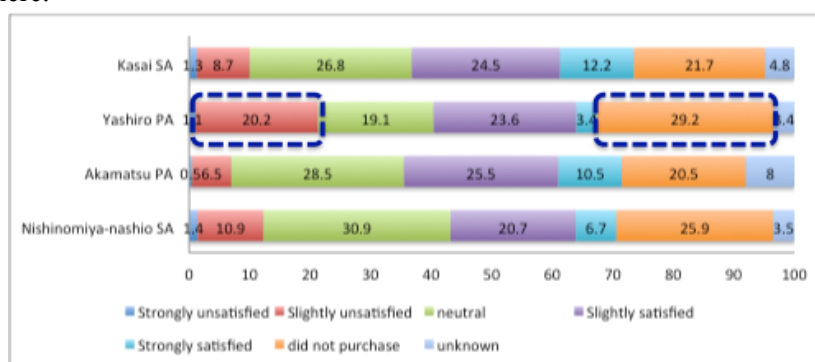
**FIGURE 5** The distribution of satisfaction ratings for activities at SA/PA s



In contrast, satisfaction with the availability of parking, denoted as “parking”, was evaluated as relatively low; the percent of “strongly unsatisfied” together with the percent of “slightly unsatisfied” accounts for 52.3% of respondents. The reasons why parking satisfaction was low are

mainly parking congestion (63.4%), insufficient parking lots (45.5%), and small parking lots (30.8%). Visitors were generally not satisfied with parking, especially, in case of the Nishinomiya-nashio SA, where approximately 40% of the drivers provided an “unsatisfied” rating due to congestion and lack of space.

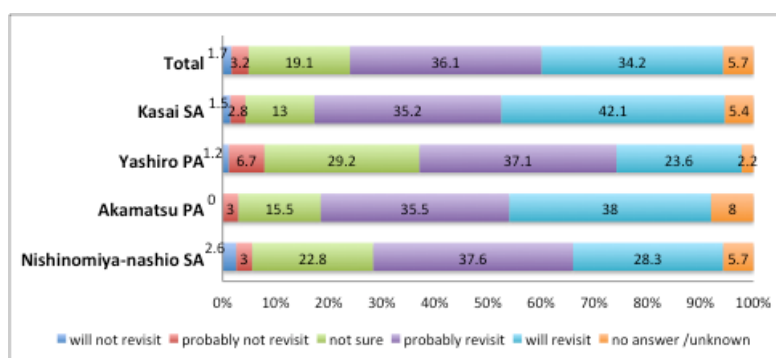
**Figure 6** shows that approximately 15% of drivers are either “strongly unsatisfied” or “slightly unsatisfied” with local souvenirs. When comparing the local souvenir satisfaction by SA/PA, the Yashiro PA shows the lowest satisfaction, with approximately 21% of respondents providing an “unsatisfied” evaluation. However, the Akamatsu PA and the Kasai SA represent higher satisfaction ratings. It was also found that when visitors are unsatisfied with the souvenir offerings at an SA/PA, they tend also to report that they “did not purchase”. In other words, at the SA/PAs with low satisfaction with local souvenirs, drivers tend not to purchase anything even if they stop there.



**FIGURE 6** The distribution of satisfaction ratings for local souvenirs by SA/PA

In our survey, one stated preference question was included: “Will you revisit the SA/PA if you make a trip to the same destination?” **Figure 7** results indicate that the percent of total responses for “will probably revisit” is 36.1% and for “will revisit” is 34.2% . When these two responses are summed for each SA/PA, the Kasai SA shows the highest percent (78.3%), followed by the Akamatsu PA (73.5%), the Nishinomiya-Nashio SA (65.9%), and the Yashiro PA (60.7%).

**FIGURE 7** The distribution of stated preference on revisit to the SA/PA





## A DEVELOPMENT OF SEM IN SA/PA CHOICE BEHAVIORS

### The proposed SEM and Results

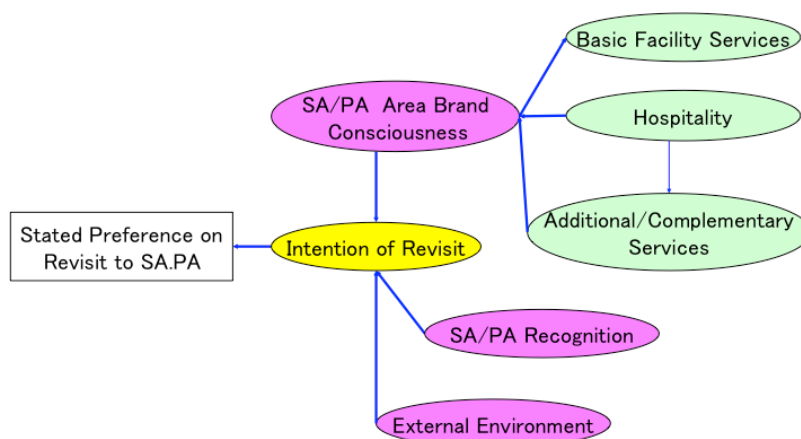
Here, we introduce the results of an early attempt to develop a structural equation model using the data set obtained from our questionnaire. Through our several experiences of SEM applications, this method is expected to be useful for us to identify causal relationship among factors determining driver’s decision structure on SA/PA choice behaviors (See Nishii et. al (1996), Nishii et. al (1998), Kim, Nishii et. al (2007)).

The data used for the proposed SEM were extracted as follows. From the total of returned sheets with no missing information, 650 samples were used to calibrate our model. We excluded the respondents who used either buses or expressway buses and those whose modes were unknown.

Our SEM here focuses on the driver’s decision regarding whether he/she would choose the same SA/PA if he/she made a trip to the same destination again. The model has seven latent variables with causal relationships with each other, following the hypotheses:

- H<sub>1</sub>: The stated preference for the “revisit SA/PA” observed variable is a function of the “intention to revisit SA/PA” latent variable.
- H<sub>2</sub>: The “intention to revisit SA/PA” is causally influenced by three latent variables: “SA/PA area brand consciousness”, “SA/PA recognition”, and “external environment”. These latent variables are assumed to have a positive effect on the intention of revisiting the same SA/PA.
- H<sub>3</sub>: “SA/PA area brand consciousness” is causally influenced by three latent variables: “basic services”, “hospitality of workers” and “additional/complementary services”. “Area brand consciousness” is here assumed to be a function of these three variables.

**Figure 8** shows the causal relationships between the “intention to revisit SA/PA” latent variable and the other six other latent variables. **Table 3** shows a list of the observed variables used in our SEM.



**FIGURE 8 Hypothesized causalities among latent variables in SEM**

**Table 3 A list of observed variables in SEM**

Observed variables	Definition
Stated Preference on Revisit to PA/SA	1:will NO, 2: probably NO, 3: neutral, 4: probably YES, 5: will YES
Revealed Recognition of SA/PA	1: never know, 2: only know the name, 3: roughly know, 4: well know
Frequency of visits to SA/PA	1:first comer, 2:less than once a year, 3: twice a year, 4: once every a few months, 5: once a month, 6: more than twice a month
Readily Available Parking	Five ratings: From unsatisfied (1) to satisfied (5)
Amenity Inside Facilities	Five ratings: From unsatisfied (1) to satisfied (5)
Toilet Amenity	Five ratings: From unsatisfied (1) to satisfied (5)
Substantial Meals	Five ratings: From unsatisfied (1) to satisfied (5)
Pleasant Souvenirs	Five ratings: From unsatisfied (1) to satisfied (5)
Local Specialities	Five ratings: From unsatisfied (1) to satisfied (5)
Driver's Fatigue	1: YES, 2:NO
Distance from IC to SA/PA	The distance (km) of the shortest route in NEXCO-West expressway
Distance from SA/PA to IC	The distance (km) of the shortest route in NEXCO-West expressway
Worker's Service Attitude	Five ratings: From unsatisfied (1) to satisfied (5)

**Table 4 Parameter estimated for a primitive SEM**

Causal Relation	Adj. estimates	S.E	t-statistic	p-value
Complementary Services ← Hospitality	0.85	0.062	13.856	***
SA/PA Brand-consciousness ← Basic Facility Services	1.724	0.691	2.494	0.013
SA/PA Brand-consciousness ← Complementary Services	0.115	0.116	0.995	0.32
SA/PA Brand-consciousness ← Hospitality	-0.809	0.392	-2.062	0.039
Intention of Revisit ← SA/PA Brand-consciousness	1			
Intention of Revisit ← SA/PA Recognition	0.526	0.139	3.784	***
Intention of Revisit ← External Environment	0.002	0.001	1.741	0.082
Stated Preference on Revisit to PA/SA ← Intention of Revisit	1			
Revealed Recognition of SA/PA ← SA/PA Recognition	1			
Frequency of visits to SA/PA ← SA/PA Recognition	1.998	0.181	11.058	***
Readily Available Parking ← Basic Facility Services	1			
Amenity Inside Facilities ← Basic Facility Services	1.748	0.191	9.172	***
Toilet Amenity ← Basic Facility Services	0.767	0.108	7.07	***
Worker's Service Attitude ← Hospitality	1			
Substantial Meals ← Complementary Services	1			
Pleasant Souvenirs ← Complementary Services	1.25	0.065	19.327	***
Local Specialities ← Complementary Services	1.256	0.065	19.306	***
Driver's Fatigue ← External Environment	0.001	0	1.812	0.07
Distance from IC to SA/PA ← External Environment	1			
Distance from SA/PA to IC ← External Environment	0.608	0.204	2.972	0.003
Frequency of visits to SA/PA ← External Environment	0.003	0.001	2.297	0.022

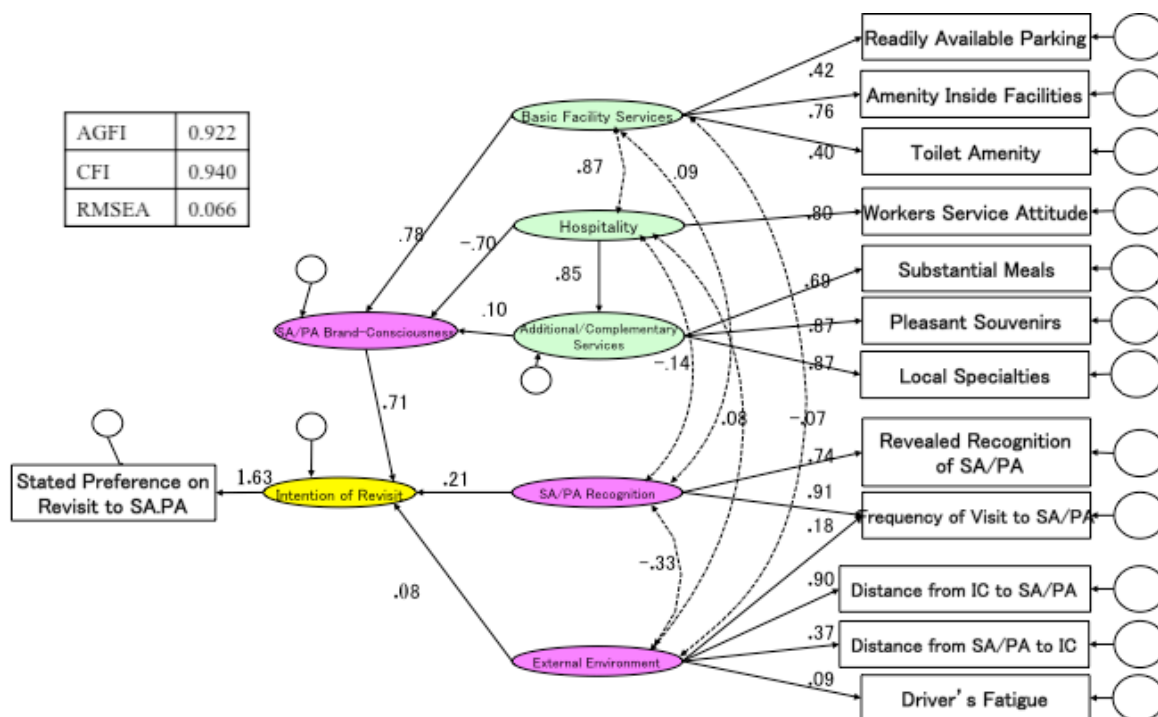


FIGURE 9 Estimated parameters of a primitive SEM

Table 4 and Figure 9 show the results of parameters estimated for our primitive SEM. It can be found that the proposed model shows significant goodness of fit judging from the following indices: AGFI=0.922, CFI=0.940, and RMSEA=0.066. The table shows that most of the estimated coefficients of paths are statistically significant, with only two that are insignificant. These are the path from “complementary services” (latent variable) to “SA/PA-area brand consciousness” (latent variable) and the path from “external environment” to “intention to revisit SA/PA”. The estimated coefficient of path from the “hospitality” latent variable to the “SA/PA-area brand consciousness” latent variable is a minus sign. This means that “hospitality” exerts a negative influence on “brand consciousness” even if it is improved. It is also noted that this “hospitality” may have a positive effect through the “complementary services” latent variable.

The proposed SEM as a whole represents the results so that these hypotheses can be supported. It is clear that there remain a few problems to be resolved. Hence, we term our current model “primitive”. In the next section, the future direction of our work to improve our SEM will be discussed after summarizing the whole content of this study.

## CONCLUSIONS

The current phase of this study is at the beginning of Stage III in our analytical framework. At the first stage, the objectives were identified based on the agendas underlying the improvement of services at SA/PA on expressways. Moving to Stage II, a questionnaire on drivers' behaviors at the SA/PA and his/her stated preferences as far as revisiting the SA/PA was administered. It is noted that the traffic stopping over at SA/PAs are counted together with the total traffic passing through on the survey day. Therefore, it remains for us to analyze characteristics of the ratio of stop-over vehicles and to calibrate a SA/PA choice model in the following stage.

It is also necessary for us to analyze much more detailed characteristics of driver behavior, needs, and wants regarding SA/PAs. At that time, we will make use of the data set obtained from the web-based survey. These data are expected to be effective for comparison with SA/PA choice behaviors. It is furthermore necessary to identify which market segment should be taken into consideration in developing our SEM. It is clear that there remain a few problems to be resolved in our primitive model. In Stage IV, we expect to identify effective marketing strategies for increasing the attractiveness of services and recognizability of SA/PAs on expressways by applying a market segmentation method to the improved SEM.

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