A STUDY ON REGIONAL DIFFERENCE OF RECREATIONAL DESTINATION CHOICE BEHAVIOR

Naohisa OKAMOTO
Research Associate
Department of Built Environment
Tokyo Institute of Technology
4259, Nagatsuta-cho, Midori-ku
Yokohama #226 JAPAN
Fax:+81-45-924-5651

Tetsuo YAI
Associate Professor
Department of Civil Engineering
Tokyo Institute of Technology
2-12-1, O-okayama, Meguro-ku
Tokyo #152 JAPAN
Fax:+81-3-3726-2201

Shigeru MORICHI
Professor
Department of Civil Engineering
Tokyo Institute of Technology
2-12-1, O-okayama, Meguro-ku
Tokyo #152 JAPAN
Fax:+81-3-3726-2201

Toru NISHIMURA
Graduate Student
Department of Civil Engineering
Tokyo Institute of Technology
2-12-1, O-okayama, Meguro-ku
Tokyo #152 JAPAN
Fax:+81-3-3726-2201

abstract: In Japan, several roads in suburban areas are heavily congested on weekends, spatially in recreation area and in access routes to recreational areas due to increasing recreation demand.
In 1992, the Ministry of Construction of Japan conducted the Nationwide Recreation Travel Survey (NRTS), which is the largest survey of recreation trips ever conducted in the country. NRTS is expected to provide fundamental and useful information for the road planning in recreational area.
The purposes of this study are: 1) development of models pertaining to recreation behavior and 2) comparison of the regional recreational travel characteristics using NRTS.

1.INTRODUCTION

In Japan, road investment plans are outlined based on the future weekday traffic volumes. Therefore, several roads in suburban areas are heavily congested on weekends, spatially in recreation area and in access routes to recreational areas.Furthermore, recreation demand has increased with characteristics becoming more and more varied which create transportation problems in these areas.

Recreation trips have the following characteristics different from urban weekday trips: 1) spatial and temporal concentration, 2) attractiveness of recreation spot and road including travel time and cost, and 3) touring activity and number of destinations. From above, it is clear that the characteristics of recreational travel by car should be analyzed in order to gain valuable insight into road planning in recreational areas and their surrounding areas.

Several surveys were conducted in this twenty years by each organization or researchers. From viewpoint of nationwide road planning, these survey data did not have enough sample size to analyze recreation behavior in general. For example, the Japan Tourist Association has conducted recreation travel survey every two years. It has about three thousand samples

for each years, but it was conducted in a few urban cities. So it is good data for time-series analysis but not good for nationwide study of recreation behavior. There might be some regional difference of recreation behavior which depends on road network development or accessibility to recreation area or etc.

In this paper, recreational destination choice behavior is investigated. Using NRTS data and destination choice model, regional difference of destination choice behavior is analyzed. It provides the fruitful result for recreational demand forecasting method.

2.PROFILE OF NRTS SURVEY

The Nationwide Recreation Travel Survey (NRTS) was conducted by Ministry of Construction in Japan in 1992. NRTS covered all the 9 regions of Japan and collected more than 30 thousand samples through home-based surveys and nearly 13 thousand samples from recreation site surveys. Before NRTS, recreational activities had been investigated by smaller scale surveys (one-tenth the size of NRTS) every two years. The purpose of NRTS is providing fundamental and useful information for the suburban highway planning.
Recreation trips have the following characteristics different from urban weekday trips: 1) spatial and temporal concentration which means two kinds of concentration such as seasonable concentration and temporal concentration in a day, 2) attractiveness of recreation spot and road including travel time and cost.

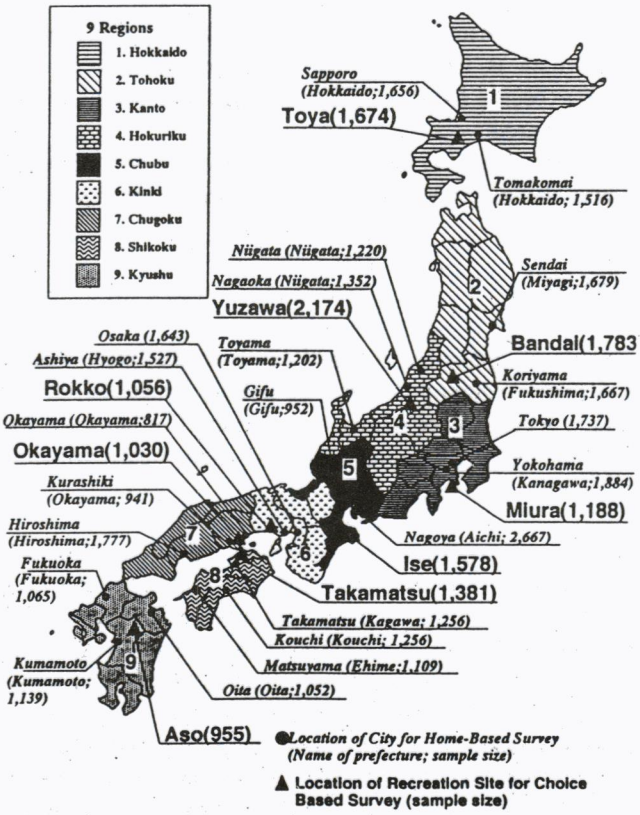

FIGURE 1 Locations of Home-Based and Recreational Site Surveys

Origin-destination trip survey of a specified data of a specific season, such as the Road Traffic Census(RTC) in Japan which is conducted by MOC, is not efficient. Considering the above characteristics, the survey by which the data of personal record of travel can be collected should be conducted. Therefore combined home-based and recreation site surveys were conducted as the NRTS. Using both of them, home-based surveys and recreation site survey, the data of personal record of travel by car can collect, which depends on memory, to examine characteristics of recreation travel and to demonstrate the modeling applicability of trip generation, trip distribution and route choice behavior and chaining behavior for trip assignment.

The other hand, there was not enough recreation traffic data, from the viewpoint of sample size and sampling area, to establish the demand forecasting models. For establishment of the demand forecasting system, the spatial transferability of model is one of the most important factor. Collecting the nationwide data of recreation trips is one of the way for this purpose.

Because of these reasons, NRTS survey was composed Home-based survey and recreation site survey and was conducted by every 8 Regional Construction Bureau (RCB) of MOC and Hokkaido Development Agencies in 1992 and 1993. The areas cover 19 prefectures 22 cities which belong to 9 regions in Japan, as shown in Figure 1. Surveyed areas are concentrated in rather large cities, including cities in every metropolitan region and several central cities in local areas such as Sapporo in Hokkaido region, Sendai in Tohoku region, Hiroshima in Chugoku region and Fukuoka in Kyushu region. Total individual samples exceed 30 thousand, encompassing 13.6 thousand households. Table 1 shows the outline of Questionnaires of Home-based survey.

Choice-based surveys were conducted in nine specific popular recreation sites corresponding to the nine regions in Japan. Most of the surveys were conducted on weekends in August during summer vacation, with the exception of Bandai in Tohoku region in October and Yuzawa in Hokuriku region in February in 1993. These schedules were determined by the peak season of each recreation area: sightseeing of autumn foliage in Tohoku and skiing in

Table 1 Outline of Questionnaires of Home Based Survey

Household Information	provided by Householder	
Content : address, residence, household size, type of dwelling, living arrangement, car ownership		
Personal Information	provided by each household member ≥ 18 years of age	
Question A	Personal information	sex, age, marital status, occupation, income, frequency of holidays, frequency of driving, passport possession
Question B	Record of domestic over night trip one year before survey	number of trips every month and purpose, destination, number of staying days, activity, composition of travel group, travel mode, accommodation, travel cost, reason of destination choice, etc.
Question C	Record of domestic day trip using car one year before survey	number of trips every month and purpose, destination, activity, composition of travel group, owner of the car, travel mode, travel cost, reason of destination choice, etc.
Question D	Record of overseas travel five years before survey	number of trips and purpose, destination, number of days, travel arrangement, composition of travel group, travel cost
Question E	Record of holiday activity survey (specific date)	destination, activity, travel mode

Hokuriku. The sample size for all sites is nearly 13 thousand and the response ratio is about 10%. The survey was distributed by hand and returned by mail.

Figure 2 presents a brief structure of surveyed items and primary goals in both surveys. The primary objective of home-based surveys is to collect data for the development of nationwide trip generation model and regional destination choice models. On the other hand, the main purpose of recreation site surveys is to collect data for modeling of trip and activity chaining behaviors within a recreational region. However, both surveys' questionnaires supplement each other. Travel activity on the designated day of recreational site survey was obtained from home-based survey to examine the total travel volume from the city and portion of the total volume headed into the recreational region on that day. Annual car travel record was surveyed for recreational site survey respondents to combine them with home-based survey data in order to develop car travel destination choice models.

In this study, the recreation destination choice behavior is analyzed for trip distribution model as a part of demand forecasting system.

3.CHARACTERISTICS OF DESTINATION CHOICE BEHAVIOR

Using NRTS survey's results, various profiles of recreational travel have been examined. Particularly, trip generation, trip distribution, route choice and trip chaining behaviors in recreation areas, and the correlation between domestic and overseas travel, were briefly investigated. In this section,the profile of travel destination choice behavior for trips distribution modeling is introduced.

Figure 3 indicates an example of the distribution of travel destinations for overnight and daytrips using home-based survey data in Tokyo and Yokohama. Figure 4 also shows the

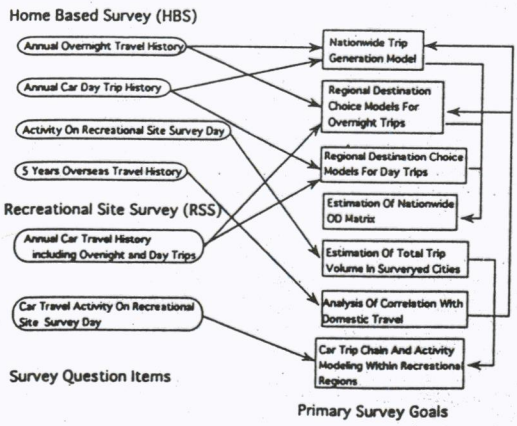

FIGURE 2 Surveyed Items and Primary Goals in Home Based and Recreational Site Surveys

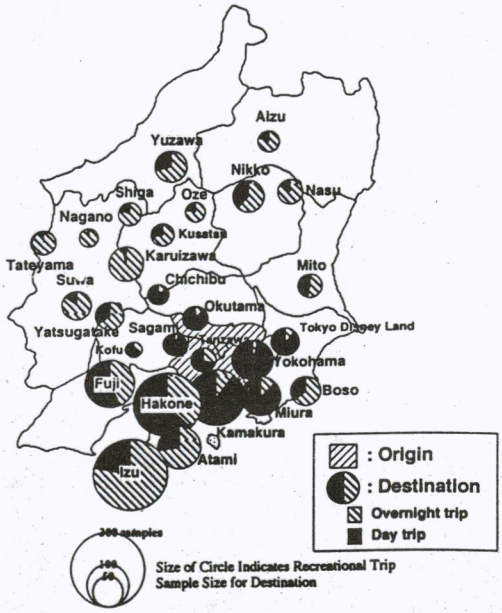

FIGURE 3 Sample Size for Recreational Destinations from Tokyo and Yokohama Home-Based Survey

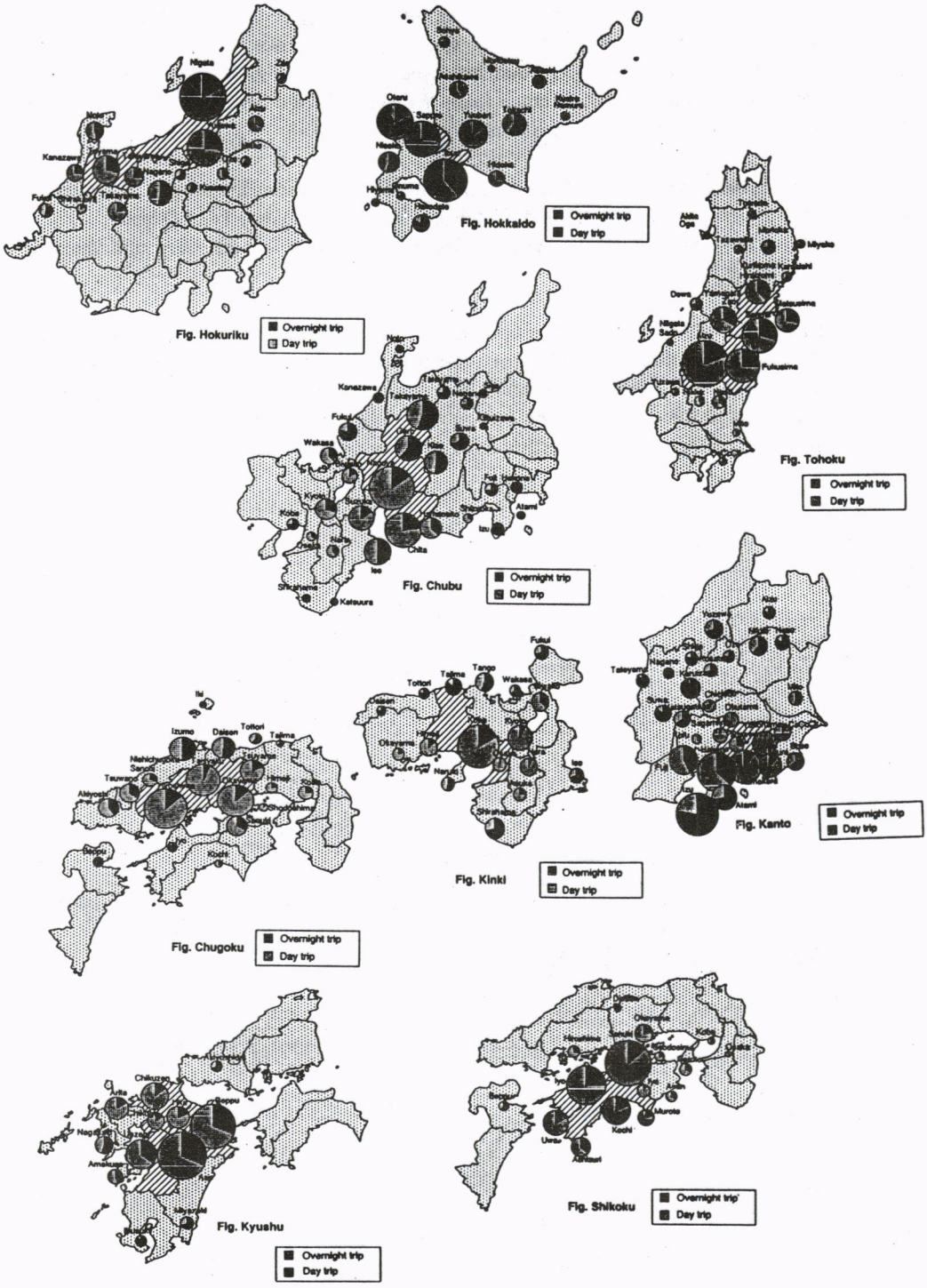

FIGURE 4 Sample Size for Recreational Destinations from 9 Regions' Home-Based Surveys

distribution of each 9 regions. The circle indicates the sample size for destination. Overnight and day trips percentages are indicated within the circle. Trip destinations beyond the described area are not illustrated here, in spite of the existence of a few long-distance trips. Almost 90% of samples from each surveyed area are shown in these figures. Day trips distribute in accordance with distance from the origin, while distributions of overnight trips for nearby destinations represent a small portion of the total.

Figure 5 shows the composition of the travel time in each region and total. The average travel times of overnight trip in total is 3.35 hours and that of day trip is 1.80 hours. These three figures show that the alternatives of destination choice for day trip and that for overnight trip are different.

Figure 6 shows the cumulative composition of sample volume by access cost to recreation area. Distributions of Hokkaido and Shikoku are different from others distribution, peaks of these distribution are shorter than another. The reasons of this result is as follows. These 2 regions are island and there are only one bridge way to go to Honshu-island. Therefore the almost alternatives of these regions are limited depending on the road network.

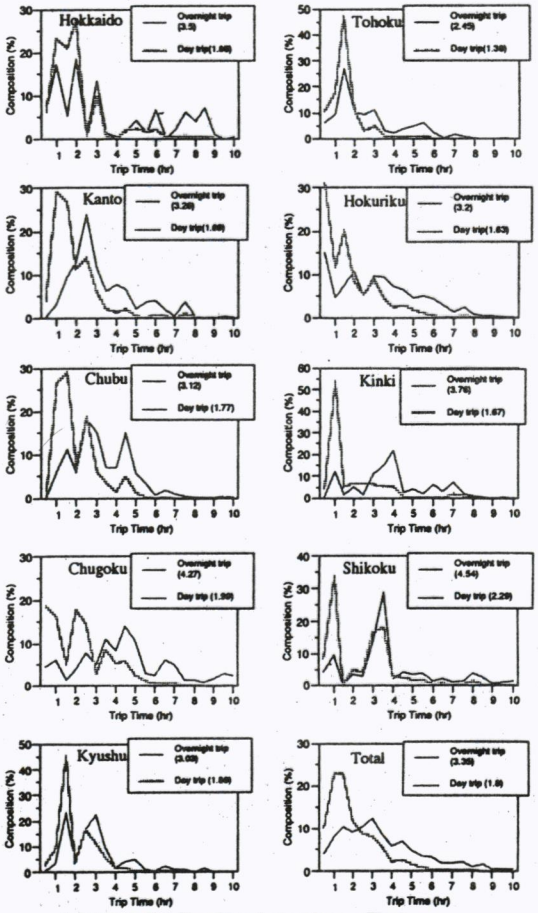

FIGURE 5. Trip Time Distoribution (Average Time)

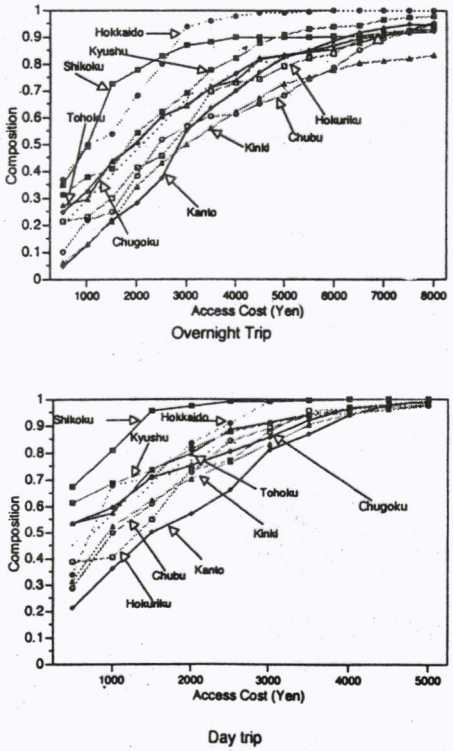

FIGURE 6 Cumulative Composition of Trip Volume by Access Time

4.DESTINATION CHOICE MODEL

Road investment and development of recreational area naturally changes the distribution of trips. Consequently, the relation between choice behavior and following factors should be investigated: i) accessibility to recreation area, ii) attractiveness of recreation area, iii) difference of behavior among several trip purposes, and iv) regional difference of choice behavior with respect to the preceding factors. For this investigation, the sample data are divided to 9 groups depending on the region. Considering the above mentioned factors, the destination choice model, which used for trip distribution, is developed using a disaggregate model. The disaggregate approach has an advantage of estimating individual behaviors. Regional differences of destination choice behavior are investigated using this model parameters.

4.1 Alternatives for Modeling

Recreation destination choice behavior depends on activity of recreation, season, attractiveness of destination, accessibility to recreation area, etc. Considering these factors, the choice sets for modeling should be selected. A multinominal logit model employed for making destination choice model.

Firstly, the maximum size of choice sets size must be provided. In this study, chosen destinations within the cumulative 90% was selected for maximum size of choice sets for each regions. The largest regional choice set size is 30 in Chubu and Kinki for overnight travel destinations and the smallest size is 11 in Shikoku for day trip.

Secondly, we make the choice sets for each samples. Mentioned above, the destination choice behavior depends on activity of recreation. It is obvious that no one go to the seaside to climb a mountain. Destination alternatives that have no recreational resource corresponding to an individual's activity should be excluded from maximum choice set. So each samples have the each alternatives for destination choice depending on the recreational resources.

4.2 Estimation of Destination Choice Model

Regional utility functions are composed of three kinds of variables: travel time, travel cost and attraction variables.

(1)Travel Time

Using road network data, the shortest route was selected and also the time and cost of its route was calculated.

(2)Travel Cost

Several variables was tried to apply to this model, such as the the variables which is transformed by the dividing total cost or toll of express way by the logarithm of personal income.

(3)Attraction

Attraction variables are combined with attractiveness of destination and a personal activity dummy. The attraction variable is expressed as

Activity Attraction of k = (k Activity Dummy) * (ln(k Attraction Resources))(1)

k Activity Dummy = 1, if traveler's activity is k,

= 0, if his activity is not k

where, k Attraction Resources is the number of attraction resources corresponding to activity k in a destination. For example, only travelers who participate in seaside or marine activity have an attraction variable of "seaside and marine activities". There are many recreational activities, so we condensed them into four kinds of activities. Four activities are 1)Seaside & Marine activity, 2)Field activity, 3)Spa visitation activity and 4)Sightseeing activity. The number of attraction resources of each destination were obtained by summing up the number of recreational spots recognized by the Japan Travel Bureau (JTB).

Comparisons of model parameters among regions are discussed here, with consideration given to future integration to a nationwide common model. The available survey have never conducted in order to examine such a comparison for recreational trip distributions, in spite of unique recreation sites in each region.

Using samples from NRTS survey data, it is possible to estimated regional destination choice models for each regions. Table 2 shows estimation results for overnight and one day trips. Also, figure 7 shows the parameters.

Evaluation of estimation results is as follows;

1) Parameters of travel time in Chubu and travel cost in Shikoku are insignificant in overnight trips.
2) On the model for overnight trip, the attraction variable for sightseeing in Tohoku, Hokuriku and Kinki has an unexpected sign for overnight trip models.
3) For day trip models, the travel cost variable in Kanto and an attraction variable for spa visitation in Kinki had unacceptable parameters.

Table 2 Estimation Results of Destination Choice Models for Overnight and Day Recreational Trips

(a) Overnight Trip Destination Choice Models

				Surveyed Area					
Variables	Hokkaido	Tohoku	Kanto	Hokuriku	Chubu	Kinki	Chugoku	Shikoku	Kyushu
Travel time	-0.00178	-0.00454	-0.003	-0.0038	-0.000024	-0.00203	-0.00108	-0.00458	-0.00266
t-statistics	-8.58	-8.0	-5.8	-8.46	-0.05	-4.6	-1.87	-8.48	-2.8
Travel cost / ln(Personal Income)	-0.000287	-0.000455	-0.000246	-0.000406	-0.00105	-0.000689	-0.00106	-0.000055	-0.00086
t-statistics	-2.12	-4.11	-2.48	-4.21	-11.5	-7.25	-9.4	-0.28	-4.37
Seaside & Marine Activity Attraction	0.326	-0.107	0.319	-0.123	0.144	-0.235	0.736	0.0336	0.123
t-statistics	6.04	-1.8	4.78	-1.96	2.75	-3.54	8.14	0.31	0.8
Field Activity Attraction	0.0682	0.552	0.596	0.682	0.828	1.12	0.595	0.305	0.762
t-statistics	0.73	5.75	8.39	3.65	10.0	12.23	4.32	2.83	3.61
Spa Visitation Attraction	0.392	0.545	0.435	0.73	1.3	0.0303	0.0611	0.612	1.32
t-statistics	5.99	4.48	4.48	5.11	12.6	0.26	0.35	3.24	5.78
Sightseeing Attraction	0.706	0.303	0.923	0.510	0.722	0.422	1.35	1.45	1.39
t-statistics	11.5	3.26	14.7	4.46	11.6	4.84	10.1	8.60	13.9
Log-Likelihood at zero	-2594.7	-2271.9	-3071.8	-1898.9	-3192.1	-2471.8	-1372.0	-1025.5	-1303.2
Log-Likelihood at convergence	-2400.1	-2040.5	-2786.0	-1737.0	-2897.1	-2277.6	-1183.6	-906.5	-1051.2
Sample Size	1000	802	1000	614	1000	765	442	353	469
Choice Set Size	15	21	27	27	30	30	26	21	19

(b) Day Trip Destination Choice Models

				Surveyed Area					
Variables	Hokkaido	Tohoku	Kanto	Hokuriku	Chubu	Kinki	Chugoku	Shikoku	Kyushu
Travel time	-0.00815	-0.0156	-0.0164	-0.0125	-0.00602	-0.00464	-0.00876	-0.00899	-0.00971
t-statistics	-22.9	-11.1	-17.7	-23.7	-7.64	-5.26	-13.4	-16.2	-11.9
Travel cost / ln(Personal Income)	-0.000237	-0.00143	0.000276	-0.00128	-0.00275	-0.00148	-0.000856	-0.00215	-0.00273
t-statistics	-1.57	-6.04	1.48	-9.07	-15.4	-6.78	-4.65	-4.92	-11.3
Seaside & Marine Activity Attraction	0.134	0.494	0.543	0.128	0.316	0.0936	0.296	0.434	0.494
t-statistics	2.6	8.14	8.54	1.36	5.81	1.63	2.79	4.67	4.1
Field Activity Attraction	0.196	0.898	1.01	0.572	0.485	0.779	1.62	0.495	1.12
t-statistics	1.83	7.1	12.5	4.49	5.36	6.48	6.05	5.19	5.39
Spa Visitation Attraction	0.815	0.83	0.617	0.517	0.844	0.917	0.276	1.27	2.67
t-statistics	4.47	5.52	6.84	3.55	6.52	3.48	1.4	4.81	8.57
Sightseeing Attraction	0.674	0.0918	0.788	0.28	1.06	-0.585	0.845	1.63	1.23
t-statistics	5.68	0.38	6.4	1.64	5.1	-1.05	3.77	7.21	6.98
Log-Likelihood at zero	-2558.8	-2624.5	-2598.1	-2445.0	-2598.7	-1553.3	-1494.5	-1667.8	-1754.0
Log Likelihood at convergence	-1988.2	-1629.8	-2252.9	-1451.9	-2163.8	-1387.4	-1129.4	-1225.5	-1154.1
Sample Size	1000	1000	922	939	933	577	626	744	660
Choice Set Size	15	16	23	17	18	18	13	11	17

4) Most parameters had reasonable results, which is useful for the future integration of models.

The sample size and log-likelihoods are listed in Table 2. Sample sizes in most regions exceeded one thousand and log-likelihood ratios stand between nearly 0.1 and 0.4. These permit us to compare the models with one another.

Figure 8 shows regional differences of two important parameters of overnight trips. The intersection of two lines on the figure indicates expected values of parameters and the line length indicates the standard deviation of the parameter. The parameters for East and West Japan seem to be separated, except for the positions of Shikoku and Chubu. The parameters for West Japan has larger cost and smaller time parameters than that for East Japan. Relatively speaking, this implies that West is cost conscious and East is time conscious.

As a result, different regions may have different parameters of time and cost and the regional combination to make a few model segmentations is possible to represent trip distributions in Japan. Furthermore, the fact that parameter trade-off ratios between time and cost variables, in regions where both parameters' t-statistics exceed 2.0 (Tohoku, Hokuriku, Kinki and Kyusyu) were nearly identical among overnight and day trip models, suggests the possibility to integrate overnight and day trip models.

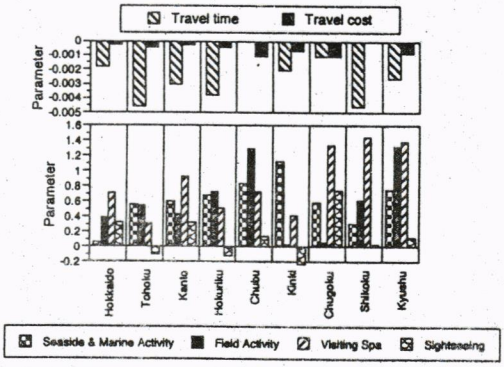

FIGURE 7(1). Estimated Parameters of 9 Regions - Overnight Trip

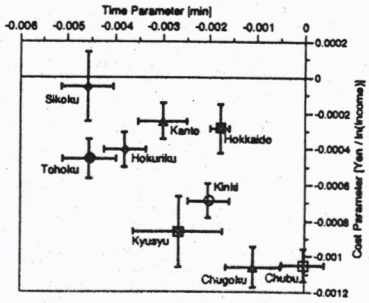

FIGURE 8(1). Comparison of Estimated Parameters - Overnight Trip

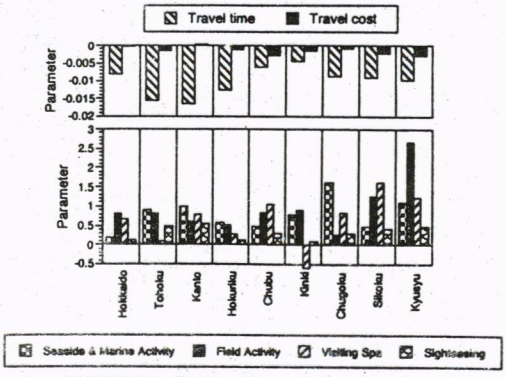

FIGURE 7(2). Estimated Parameters of 9 Regions - Day Trip

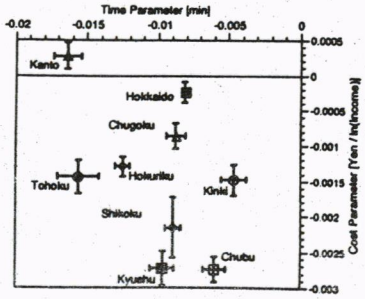

FIGURE 8(2). Comparison of Estimated Parameters - Day Trip

5.CONCLUSION

Understanding recreational travel behavior is essential to revise the road planning in suburban areas. In this paper, the outline of the first large scale survey of recreation travel in Japan and the applicability of survey data to distribution models were shown. The modeling abilities from NRTS data were also conformed by successful results of destination choice models.

From the results of regional comparison of recreation destination choice behaviors, fundamental characteristics of recreational destination choice behavior was provided. Those are different in demographic attributes and regional factors. Considering these characteristics, destination choice models were estimated for each regions.

Destination choice models in most regions provided significant and reasonable parameters and siginificant difference between the parameters of travel time and cost. That shows the regional difference of recreational destination choice behavior and the possibility to make model system by pooling the regional data.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the valuable discussions with Harutoshi Yamada, Hideki Nakamura, Hiroshi Wakui in the calibration of the models and their contributions to the paper.

REFERENCES

a) Journal papers

H. Yamada, T. Yai, H. Nakamura, and T. Hyodo.(1994) A Trip Generation Model Using Nationwide Survey for Recreation Trips.(in Japanese) **Traffic Engineering, Vol. 29, No. 2**, 19-28

T. Yai and N. Okamoto (1994) Fundamentals of Transport Planning Based on the Characteristics of Infrequent Trips in Recreational Regions. (in Japanese) **City Planning, Vol. 25, No.6**, 28-34

S. Morichi and T. Yai. (1984)"Application of Disaggregate Travel Demand Model and Choice Based Sampling for Infrequent Trips."(in Japanese) **Proc. of JSCE, No. 343**, 161-170

T.Yai. (1989) Disaggregate Behavioral Models and Their Applications in Japan. **Transportation Research A, Vol. 23A, No. 1**, 45-51

b) Papers presented to conferences

N. Okamoto, S. Morichi, and T. Yai.(1992) A Study on Road Network from the Environmental Viewpoint. **Presented at 7th World Conference on Transport Research, in Lyon**

T.Yai, H.Yamada,N.Okamoto (1995) Nationwide recreation Travel Survey in Japan: The Outline and Modeling Applicabilty. **Present at TRB in Washington (in printing)**