Journal of the Eastern Asia Society for Transportation Studies, Vol. 6, pp. 225 - 240, 2005

WALKING AND CYCLING BEHAVIOR WITHIN THE SERVICE AREA OF PUBLIC PARKS

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Abstract: Public parks provide a variety of benefits and opportunities for community. This paper reports the investigation on the behavior of park users in Saga city, Japan using a new recreational valuation method and Voronoi diagram to redefine service area of park. The valuation was performed through comparison of walking, cycling and car mode. Different threshold distances based on rational choice approach was derived to understand behavior of walking and cycling users that their characteristics and socioeconomic cou3ld affect different patterns of park utilization. This information reflects the need to improve accessibility and facility for walkers and cyclists according to the community need since approximately 70 percent of parks users are the frequent users. This valuable approach could be utilized to guide local planning agency to locate suitable plan for current and future policy for accessibility of public park service improvement for livable city.

Key Words: public parks, walking and cycling, behavior

1. INTRODUCTION

Public parks have been recently given much attention as one of the key indicator for quality of life due to the reason that it provides a variety of benefits and opportunities for community (e.g., environment, economic, educational). Furthermore, parks have long been an image of recreation area that confers a range of physical and mental health benefits to the visitors. For the visitors who live near or within the service area of a park, walking or cycling for travel to park need to be promoted for pursuing the goal of livable city that also reflects positive relationship between physical activity and health. However, lack of understanding of associations between physical activity (walking and cycling) and pattern of park utilization has made difficulties to encourage the park visitors to use these physical modes while reflecting the social needs of the park users. This study has been developed to investigate the behavior of park users focusing only within parks' service area to utilize the inexpensive modes of transportation which are walking and cycling. To reflect the actual pattern of park usage and park users' behavior, Saga city in Japan was selected as a case study. This selection is due to a wide variety classification of parks in the study area as well as there are more than 30 public parks served for the community of less than 200 thousands population. An unconventional method was employed to capture the actual target group of public park service by using the recreational valuation method compared to Voronoi service area (Iamtrakul et al., 2003).

The service area of park was redefined to correlate public preferences on public park utilization. By using traditional method, service area of park is defined based on number of population and size of park (Herzele and Wiedemann, 2003) while users' point of view has not been considered in this process. The traditional method, therefore, ignore the actual behavior of main stakeholders that is the target group to provide this kind of public service. In order to redefine the service area of public parks, the gathering of public opinion through the valuation of recreational trip was utilized in this study to determine the indifferent point of benefit to users compared to different transportation means. Based on this method, we were able to put forward a number of basic principles and to guide the development of public park service to improve accessibility and facility for walkers and cyclists according to community need.

The uniqueness of this method is that it focuses on the linkages between the availability of public parks and social needs. On the basis of findings, this study provides useful information for enhancing public parks service by incorporate transportation point of view to public parks planning. The interesting of this study reflect very useful results between leisure time, physical activity and non-motorized transportation that provide substantial health benefits to users who walk and ride bicycle to park. We investigate the potential of substantial increase of these physically active (i.e walking and cycling) visits to park in comparison with uneconomic and polluted mode (i.e car). The results of this study are very useful to guide the local planning agency to allocate suitable plan for current and future policy for public park service improvement.

The structure of this paper is organized as follows. First, the employed method for investigate the pattern of public park utilization and park users' behavior is presented and the relevant literature is reviewed in the next section. Subsequently, a method that is utilized in order to capture the behavior and preference of park users are given. Before concluding remarks, the analysis is performed by using the collected data from questionnaire interview survey and the result of investigation is presented in this section. Finally, the conclusion of this study is summarized and discussed for future research.

2. BACKGROUND OF STUDY

2.1 The Role of Public Parks in the Community

As an increasing in the development of technology, many cities have become industrialized and increasingly urbanized societies and their quality of life. As the results, many impacts also have been arising from such development in many aspects such as economic, society, and environmental. Among all aspects, healthy air, a quiet neighborhood, an attractive street scene and green spaces have been given much attention in the development of indicators for urban livability. Public Park is one kind of green space that provides numerous amenities for nearby residents including recreation opportunities and attractive views. The presence of park creates social benefits to the community that offer to everyone, from kids and teens to the elderly and it can also be a cohesive force in a neighborhood. In the view point of economic benefits, parks also generate positive impacts on local businesses, real estate and etc. In addition, for the environmental benefits, park also provide a community gardens, greenways and other types of urban open space that are significantly improve air, water and environmental quality of the community. For the recreational purpose, people who live near to the proximity area of park location can enjoy their leisure time by various kinds of leisure activities.

However, while there is an increasing demand of this kind of leisure activity, the available land use for leisure activities has become dramatically diminish. The evidence from the survey in 1999 indicated that compare to other type of urban land use (residential, industrial, public land use, etc.), only 2% of land was for leisure use. Not only limited number of this type of land use that was only approximately 500 ha, but it also has recently been declining. Figure 1 is graphically demonstrated the characteristic of land use in Japan as well as the distribution of land use for leisure purpose in each year.

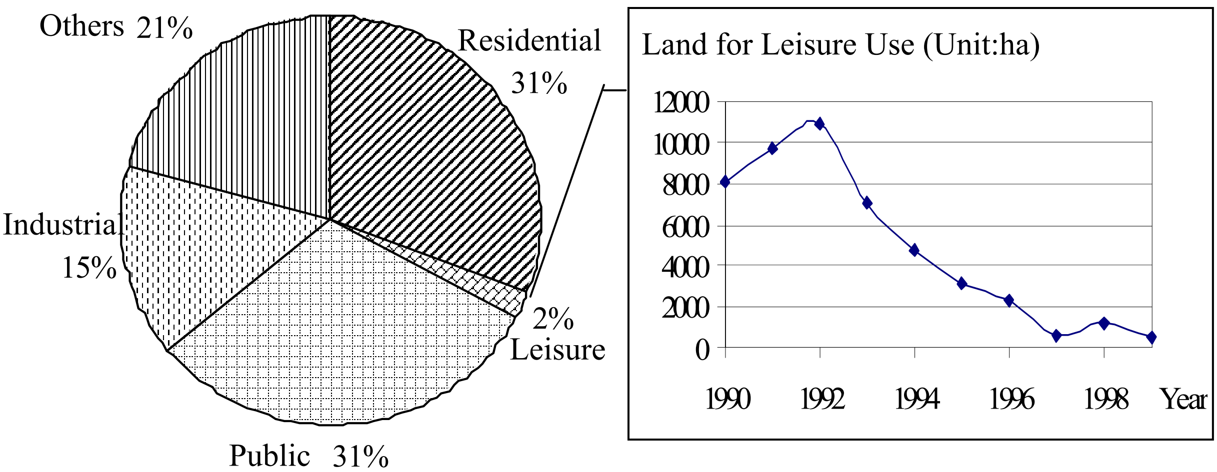


Figure 1 Distribution of Land Use in Japan 1999
Source: Land Information Division / Land and Water Bureau,
Ministry of Land, Infrastructure and Transport, Japan

These statistics can be used to support the existing situation of public park service in this country. Since it is not only the higher number of visitors has lead to overcrowding and degradation of the natural environment on site, but also the decline of supply side may accelerate the deterioration of park service in term of ineffectively and insufficiency service. Therefore, the investigation on the interconnection between environmental and users' behavior on park utilization plays a vital role in order to reflect the community point of view to guide local planning agency to locate suitable plan for current and future policy to maintain the quality of public parks service in the community.

2.2 Interaction of Users and Public Park Service

Different parks provide different opportunities on activities along with the different groups of people form different behavior and preference on park utilization. Locations of public parks within and outside users' residential area are perceived in different way by park users. Different characteristics and past experience of using public park service produce different patterns of public park utilization. The concerns of advantages and opportunities that public parks provide to resident through accessibility to get pleasure from services, facilities and amenities are necessary to be considered. The park users as consumers may obtain benefit that dependent on the distance to the existing park. It directs to the allocation problem to locate the facility that should be corresponded to guarantee an equal level of service to the residents in the neighborhood area. This idea is consistent to Voronoi method that has been applied to define service area of park by Iamtrakul et al. (2003).

Therefore, this study proposes new approach to measure the service area of public parks by using the actual value of the distribution of park service to users based on rational choice approach. This follows from the fact that the location of facility limits service to users in some optimal distance with respect to all users' location. The rational choice approach represents the choice of the perception on the location selection decision process where it requires the use of a particular social point of view according to location accessibility and destination attractiveness information. Together with the valuation method to place a value on nonmarket resources such public parks by estimating user benefits from visits to recreational sites, the role of public parks in the community could be highlightened. On the other hand, recently non motorized transport has become a popular issue for physically active lifestyles that are one of the major public health challenges (Sallis et al., 2004). Walking and cycling are the common forms of daily physical activity that can be done for transportation, health, or leisure purpose. Therefore, this study aims to incorporate the non-motorized transport towards sustainable green supply to the community that may offer a new approach to strengthen the weak position of green spaces in the context of current planning efforts to improve the quality of life for residents.

3. METHODOLOGY

The transportation-related data collection efforts have not much focused on non work trip travel, especially, for the recreational trips that do not play the major role on demand on transportation network. The vast majority of recreational travel data collected to date overlooks and undercounts non-motorized modes, and as a result, only a few studies take account for non-motorized modes (Sallis et al., 2004). It is necessary for transportation research to concern with built-environmental determinants of "active transport" modes of travel, driven largely by the need to reduce auto-generated pollution. Therefore, the considerate on the variable affects on this kind of travel behavior can no longer be ignored. We apply two fundamental concepts of urban form that affect recreational travel choice in general, and transport choice in particular, which are the proximity and connectivity between complementary activities. This study relates the recreational travel behavior by organizing the data collection at destination site to draw the relationship on the existing condition of proximity and connectivity of route to park effect to users. The service area of parks are redefined by untraditional method, threshold distances. These threshold distances are derived from indifferent benefit points by comparing between different modal usages. Based on this approach, the major concerns of park utilization that are park users' behavior and recreational travel characteristics, can be integrated for analysis and provide useful results for the policy suggestion. This valuable approach can capture the real behavior of park users in the community and the classification by rational service area of park may also reflect the actual pattern of park utilization from the target group of parks users. The more accessible transportation means to park, the more frequent in park visit become walking and cycling users. Subsequently, the conceptual framework to identify public park service area is illustrated in Figure 2.

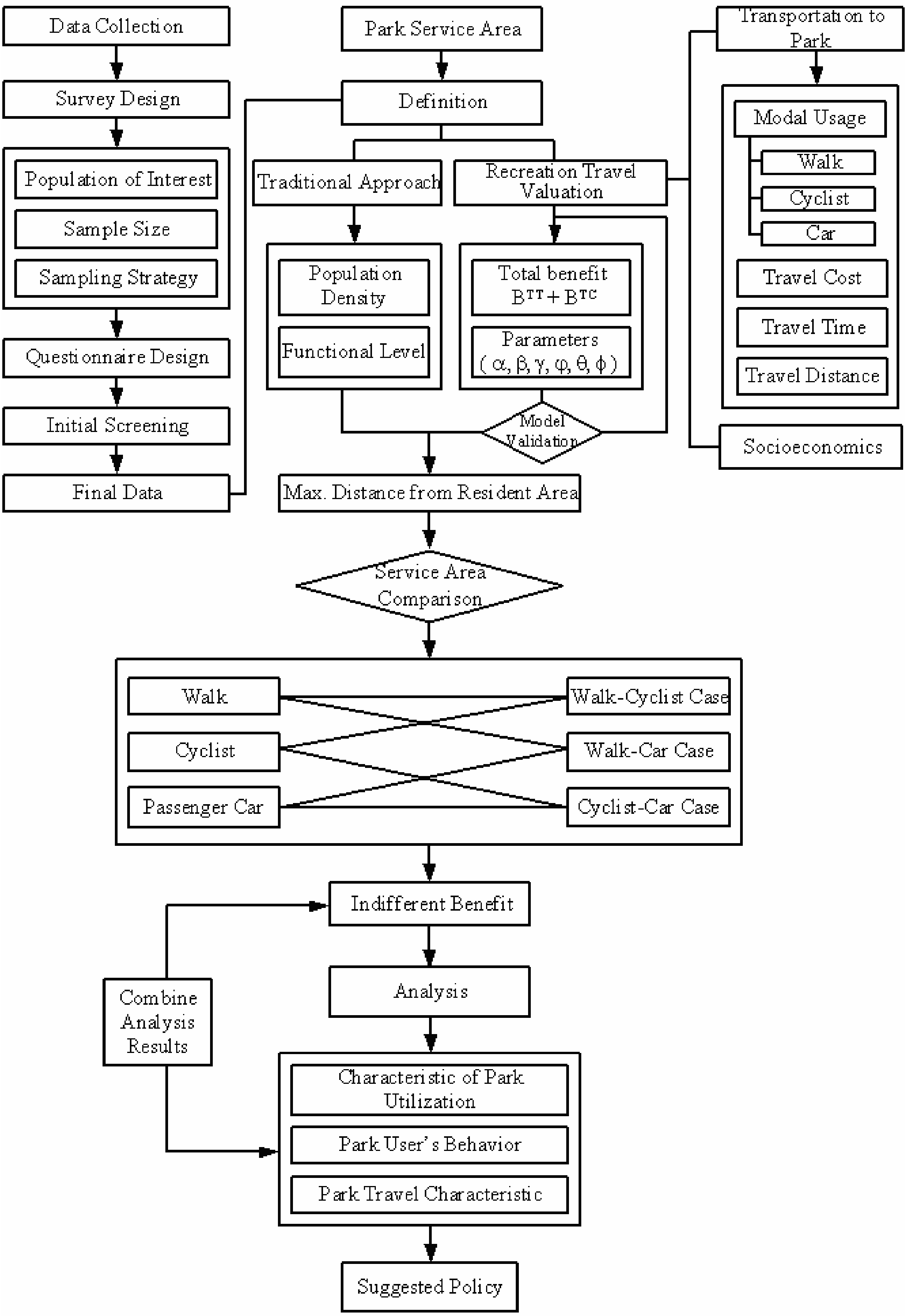


Figure 2. Conceptual Framework of Study

3.1 Concepts of park service area

A fundamental concept of analysis method applied in this paper is the valuation of public parks that users perceive when they perform their leisure activity. This benefit reflects the real value of park service to users that can be utilized to define the park service area. A number of studies employed the traditional service area of park that is designed to cover area of population and distance (Herzele and Wiedemann, 2003). The concept of a hierarchic system of park standards already provide a framework for the estimation of green spaces' supply for walking or cycling trips that start at the doorstep of one's home. The type of green spaces differs according to the scope of green spaces of the catchments area. However, due to the fact that behavior and preference of park users play important role on park utilization, the assessment on the effect of should be investigated. This study employ unconventional method to examine benefit of public park service to users by using the travel cost method. This method is a revealed behavior approach to measuring the economic benefits of outdoor recreation (Whitehead et al., 2000).

The valuation of park to users can be identified by assuming travel time and cost of a recreation trip implicit price of the trip. However, this study identified benefits from recreational travel to users by consider only benefit from recreation travel cost and do not take the recreation quality and environmental quality into account. The total benefit of recreation trip transfer to users based on travel time and travel cost can be expressed as follows:

$$TB = (\alpha+\beta B^{TT}+\gamma B^{TC}) \tag{1}$$

Where:

TB = Total benefit from recreational travel estimation (yen)
B^{TT}= Benefit from travel value (yen)
B^{TC}= Benefit from travel cost value (yen)

The parameters α, β and γ are given to cover up the possible inconsistency values between travel cost and travel time. However, travel time value can be calculated by the following equation:

$$B^{TT} = \lambda TT \tag{2}$$

Where:

λ = Value of time (yen/hour)
TT= Travel time to public park location (hr)

By substituting equation (2) to equation (1) and substitute travel cost value (TC) to B^{TC}, the monetary term of benefit from travel to public parks in general modal usage can be obtained.

$$TB= (\alpha+\beta\lambda TT +\gamma TC) \tag{3}$$

The functional form used to estimate the boundary of park service can be determined from the threshold distance by focusing on indifferent benefit of different mode usage travel to parks. This threshold distance is important to be determined to cover up the service area of park for walker, cyclist and beyond that would be car. At indifferent benefit point, the total benefit should equate to zero. From the agreement of the differentiation in travel speed of each mode, car speed (v_c) is greater than cycle speed (v_b) and walking speed (v_w), respectively.

Subsequently, the following assumption is denoted.

$$v_c > v_b > v_w \tag{4}$$

When the distance is fixed for all modes, the travel time can be replaced by the distance (d) and speed (v). The indifferent benefit between three modes can be modeled from the positive sign from travel time saving and negative sign from expense on travel cost. The model of indifferent benefit between walking and car users is presented as equation (5).

$$\alpha + \beta \cdot \lambda \left(\frac{d}{v_c} - \frac{d}{v_w} \right) + \gamma \cdot TC_c = 0 \tag{5}$$

Where v_c represents car speed (kph) and v_w represents walking speed (kph) of park users. By apply this concept of calculation; the different benefit point of each mode comparison can be identified. The cyclist speed (kph) is denoted by v_b and substitute to determine different indifferent benefit point between cyclist and car as well as walking and cyclist, the model of both indifferent benefits can be shown as in equation (6) and equation (7), respectively.

$$\alpha + \beta \cdot \lambda \left(\frac{d}{v_c} - \frac{d}{v_b} \right) + \gamma \cdot TC_c = 0 \tag{6}$$

$$\alpha + \beta \cdot \lambda \left(\frac{d}{v_b} - \frac{d}{v_w} \right) = 0 \tag{7}$$

The travel cost function for car users can be plotted in the relationship with travel speed. It is assumed that longer distance should give higher travel cost as well as for the very low and very high travel speed also induced on the higher expense of travel cost. Therefore, the graph between travel cost and speed must contain the minimum speed. The graphically representation of relationship between travel cost and speed can be simplified into parabola with a minimum travel cost as shown as example in Figure 3.

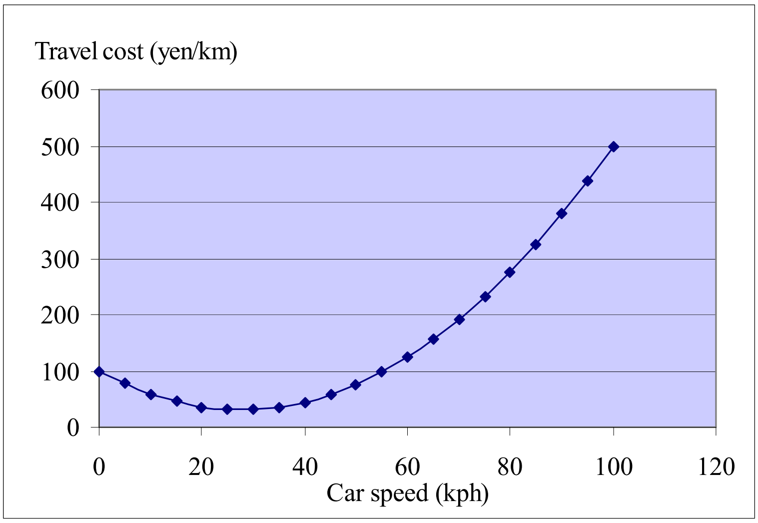


Figure 3. The Relationship between Travel Cost and Car Speed

The figure above is a hypothetical graph between travel cost and car speed which the result of this unit cost multiply with distance can represent the travel cost at such distance in monetary term (yen). Thus, the formulation of travel cost can be generalized into;

$$TC_c = d(\phi \cdot v_c^2 + \varphi \cdot v_c + \theta) \tag{8}$$

Input equation (8) into equation (5) to for indifferent benefit of car users' case;

$$\alpha + \beta \cdot \lambda \left(\frac{d}{v_c} - \frac{d}{v_w} \right) + \gamma \cdot d(\phi \cdot v_c^2 + \varphi \cdot v_c + \theta) = 0 \tag{9}$$

To reduce the number of parameters, the equation is divided by β so that the other parameters in the equation after separation the term of distance is still remain the same terms as follows;

$$\alpha + \lambda \cdot d \left(\frac{v_w - v_c}{v_w \cdot v_c} \right) + \gamma \cdot d(\phi \cdot v_c^2 + \varphi \cdot v_c + \theta) = 0 \tag{10}$$

Which is equivalent to

$$d^{wc} = \frac{-\alpha}{\left(\lambda \cdot \left(\frac{v_w - v_c}{v_w \cdot v_c} \right) + \gamma \cdot (\phi \cdot v_c^2 + \varphi \cdot v_c + \theta) \right)} \tag{11}$$

Equation (11) represents for indifferent benefit point for car users and walker case. For the indifferent benefit point between cyclist and car as well as walking and cyclist, the threshold distances are demonstrated by equation (12) and equation (13), respectively.

$$d^{bc} = \frac{-\alpha}{\left(\lambda \cdot \left(\frac{v_b - v_c}{v_b \cdot v_c} \right) + \gamma \cdot (\phi \cdot v_c^2 + \varphi \cdot v_c + \theta) \right)} \tag{12}$$

$$d^{wb} = \frac{-\alpha}{\left(\lambda \cdot \left(\frac{v_w - v_b}{v_w \cdot v_b} \right) \right)} \tag{13}$$

The calculation method that mentioned in previous section is new approach that is used to redefine the boundary of public park service area. However, the real data is required to prove with the numerical example from real data collection from public park utilization.

3.2 Data

The purpose of this study is to address the new issue on identification of public park service area by using the new approach from rational choice survey. Therefore, the case study needs to be selected to perform data collection. Therefore, Saga city in Japan is selected to gather the opinion from park users due to a wide variety classification of parks in this study area.

This city is located in Saga Prefecture in the northwestern part of Kyushu surrounded by Fukuoka Prefecture to the east, Nagasaki Prefecture to the west, the Genkai Sea to the north, and the Ariake Sea to the south. Superhighways pass within the borders of this prefecture, making it an important part of Kyushu's transportation network.

The different accessibility and different attractiveness of destination may affect on different travel behavior of park users. To calibrate this approach, a field survey was conducted on three parks in the study area. One location was located at the out skirt of city limit that is Shinrin park and another two parks were within the central city that were Saga castle park and Kono park. An on-site interview survey at three locations of parks that are Saga castle park, Kono park and Shinrin park is carried out with a multiple-choice response format of questionnaire sheets. Each interviewer was trained about the interview procedures, the meaning of each question in the questionnaire sheets, and the description of each question. A total of 289 useful questionnaires were obtained from interview on site in three parks in both weekend and weekday. As carried out, the sample was distributed in the following ways: location (32.2% Saga castle park, 32.6% Kono park, 32.2% Shinrin park) and day of week (20% weekday, 80% weekend)

4. ANALYSIS

The data that was utilized in this analysis was a subset of all survey data and it was screened for only valid cases out of all answers from respondents who travel to park as their recreational sites. The survey consisted of three sections. The first section was a screening survey which included questions about participation in recreational activity at park and demographic information. The second section is trip-specific surveys provide an information about recreational trips to public parks. And third section is about the attitude on park utilization and participation on park management and maintenance. The useful data on second part play a vital role in order to determine the service area of park by follow the methodology of this study. Several aspects about recreational trip that respondents were asked to answer about the cost of trip and time for travel to park are input to calibrate the model as well as the other related variable to recreational trip such as distance from respondents' origin to park, modal usage, etc.

The parameters in equation (1) were estimated using data on travel time and travel cost. However, value of time (yen/hour), λ can be calculated directly from the socioeconomic variable on income of users by assumed that working hour is 160 hour per month. The value of λ for this study is equal to 918.04 yen per hour and the other parameters were calibrated by using linear regression model. The model represents the high coefficient of determination of R^2 on 0.889. All of explanatory variables are positive statistically significant at 5% level of confidence. The value of estimated coefficients of travel cost and travel time value can be described as in Table 1 and the final generalized of total benefit can be shown in equation (14) since α means the other benefits while γ represent the conversion of travel time to travel cost parameter.

$$TB = (\alpha + B^{TT} + \gamma B^{TC}) \tag{14}$$

The positive value of both α and γ parameters reflect the effort that users attempt to reach the destination, consequently it could be used to express recreational benefit value that users perceived indirectly in term of total benefit.

Table 1. Estimation Results for Travel Time and Travel Cost Parameters

Explanatory Variable	Unstandardized Coefficients		t-Statistic	Sig.
	Parameter	Std. Error		
Constant, α	271.644	26.901	10.098	.000
Travel cost /Travel time value, γ	1.755	.076	22.944	.000

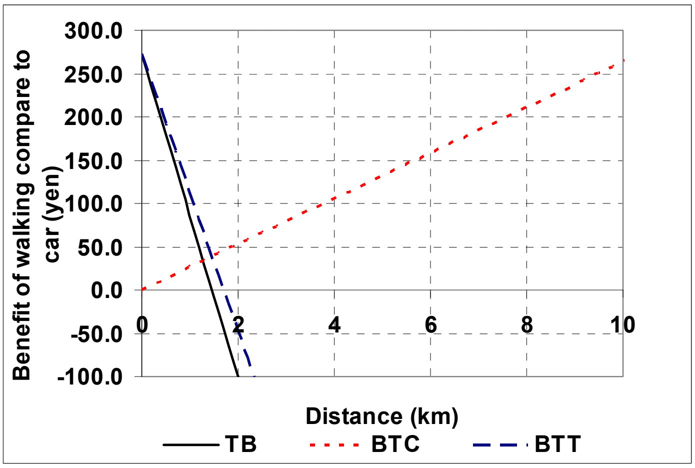
Non linear regression model is used to determine the relationship between car speed (kph) and unit travel cost (yen/km). The results of car travel speed and travel cost model is presented in Table 2. Based on this model, it is considered to be acceptable because of the high degree of an overall fit shown by R^2 of 0.424 with 6 iterations before optimum solution found.

Table 2. Estimation Results for Car Travel Speed and Travel Cost Parameters

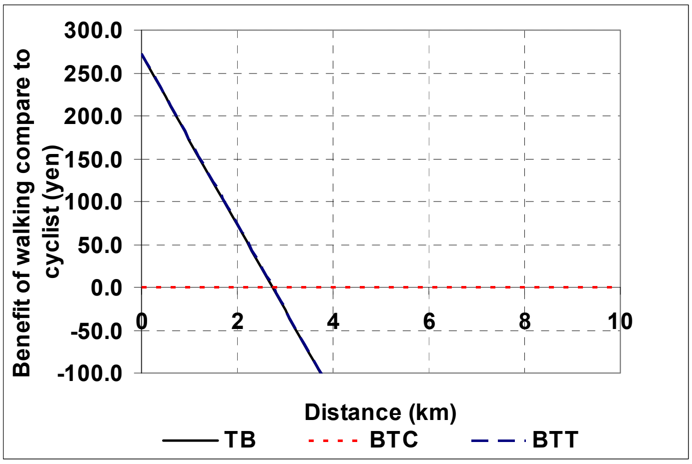
Explanatory Variable	Parameter Estimate	Asymptotic Std. Error	Asymptotic 95% Confidence Interval	
			Lower	Upper
Constant, θ	35.921904	6.253904	23.556037	48.287771
Car Speed (kph), φ	-0.877537	0.271943	-1.415250	-0.339824
Car Speed^2 (kph)^2, ϕ	0.007153	0.002554	0.002103	0.012203

With all parameters estimation, the threshold distance between different modes can be identified from the relationship of total benefit (*TB*) generated from travel cost (*BTC*) and time (*BTT*). The result on different slope of benefit generated from travel time by comparing between inexpensive modes and car was influenced by different speed between walking and cycling. It consequences to the different intercept on distance axis from different mode comparison. At indifferent benefit point, it means the benefit that users gain from economical mode (walk and cycling) has no different benefit from car users. It means that at this point users would receive the same utility or satisfaction from travel to park by nonmotorized mode as if they use motorized. It can be clearly seen that the benefit that user perceived in different mode transportation to park was resulted to different threshold distances at indifferent benefit points. The results of calculation are graphically demonstrated in Figure 4.

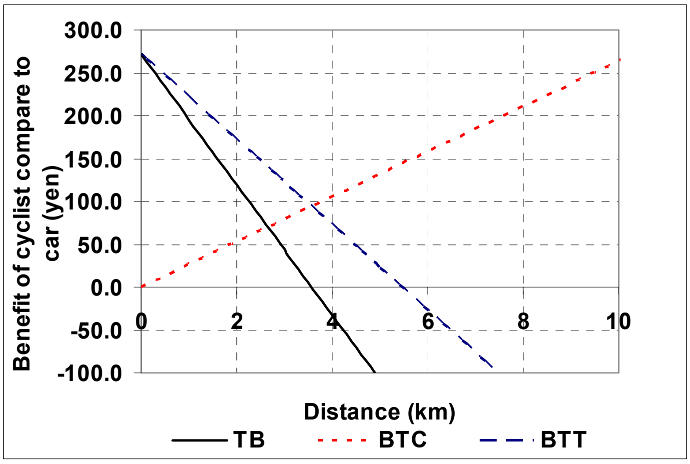
From the interpretation of indifferent benefit point, the threshold distance can be systematically obtained. When there is no different benefit between two different mode users, the maximum distance that users can reach the same benefit are consumed from public parks. By this useful investigation, the service area of park can be identified from actual pattern of park visits. This analysis reflects the attractiveness and accessibility of park by comparing it to the traditional method that the service area of park is designed to cover the minimum distance by considering the population and area of each region. The traditional methods leads to lack of information on the effectiveness of public investment and social concerns. Since there is no relationship with the need from target users and in order to reach the goal of public service to community, the maximized of social benefits is necessary to be considered. Therefore, the derivation of threshold distances can be scientifically utilized as a representative of maximum distance or the service distance of parks to users.



(a) Walking and Car Case



(b) Walking and Cyclist Case



(c) Cyclist and Car Case

Figure 4. Benefit on Different Modal Usage Compare to Distance

Comparing between different modes with the same parameters, threshold distances are applied to define the service distance of parks in different case of modal usage comparison that can be expressed as Figure 5.

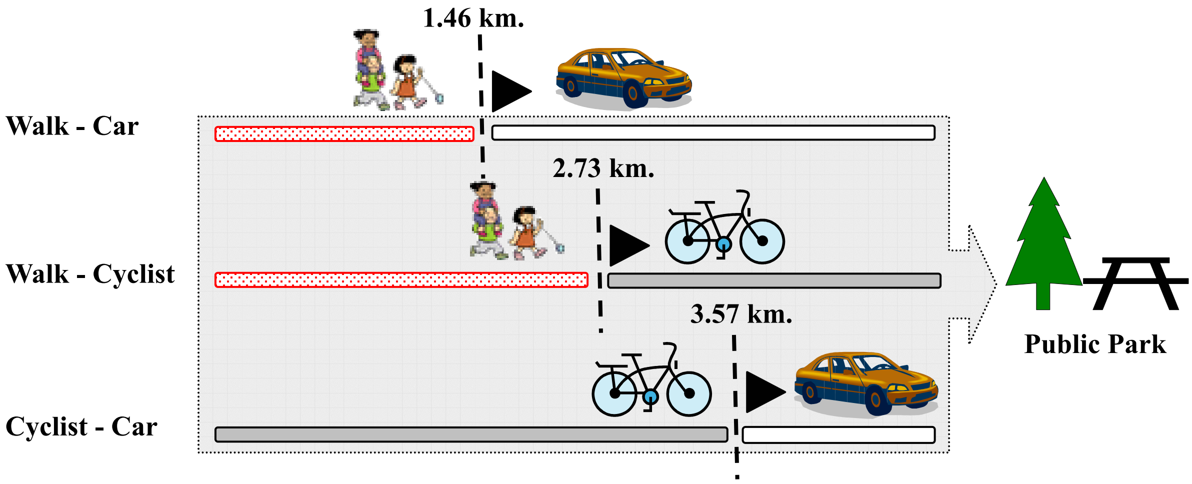
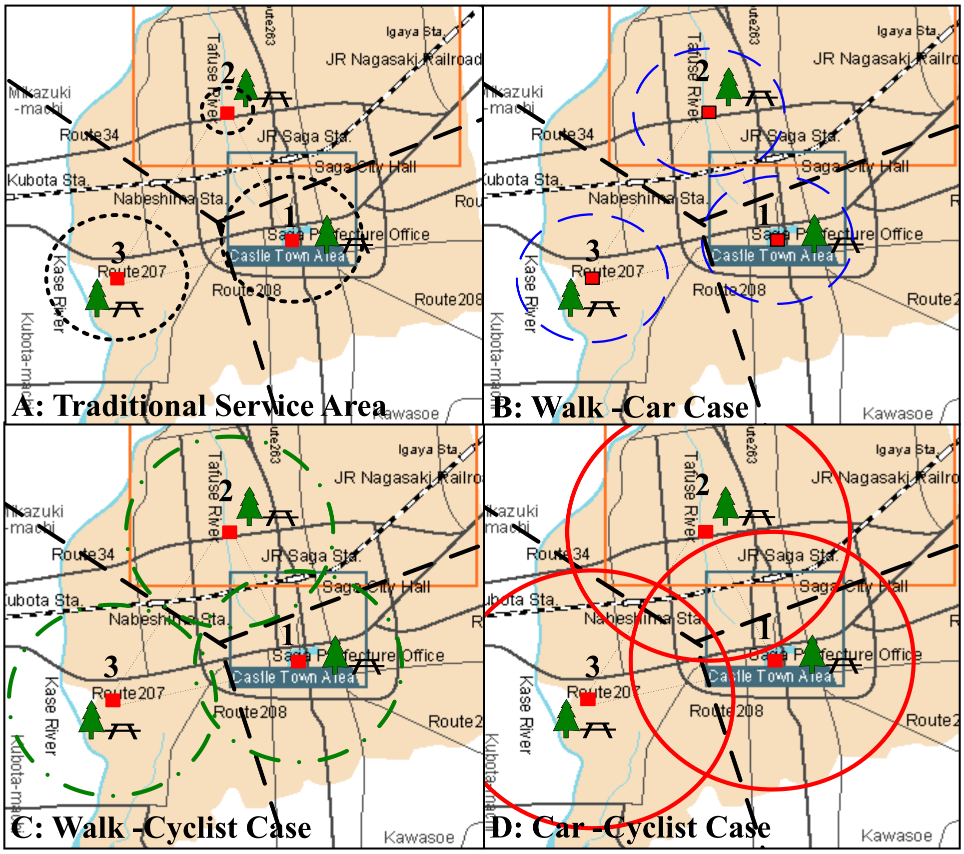


Figure 5. Threshold Distances of Different Mode Usage

It can be seen that at distance equates to 2.73 km., park users prefer to walk to park rather than other modes. However, between 2.73 and 3.57 km., cyclist is more desirable for the range of longer distance. If they need to travel in much longer distance (>3.57 km.), car would be rational selected to travel to parks in this city. This result can be compared with previous study that Iamtrakul et al. (2003) applied Voronoi diagram to measure the equality of public park service. Subsequently the calculation of Voronoi service area of public parks can be performed to make a comparison of existing park service areas in different approaches that can be demonstrated as in Figure. 6.



Three Public Parks in Saga City: 1. Saga Castle Park 2. Kono Park 3. Shinrin Park

Figure 6. The Comparison Between Threshold Distances and Voronoi Service Area of Park

From Figure 6, it is clear that the service area of different approaches of actual behavior on recreational travel produce different distances on traveling to park. To present the real design value of service area that was utilized in Figure 7, the traditional approach was applied to classify service area of park is applied to public parks in this city (Herzele and Wiedemann, 2003). Subsequently, the classification of three parks from survey is categorized as follows:

Table 3. Classification of Public Parks in Saga City, Japan

Park Name	Area of Park (hectare)	Functional Level	Max. distance from home (m.)	Min. surface (hectare)
Saga Castle Park	24.40	District	1600	30 (park:10 ha)
Kono Park	5.40	Neighbourhood	400	1
Shinrin Park	37.30	District	1600	30 (park:10 ha)

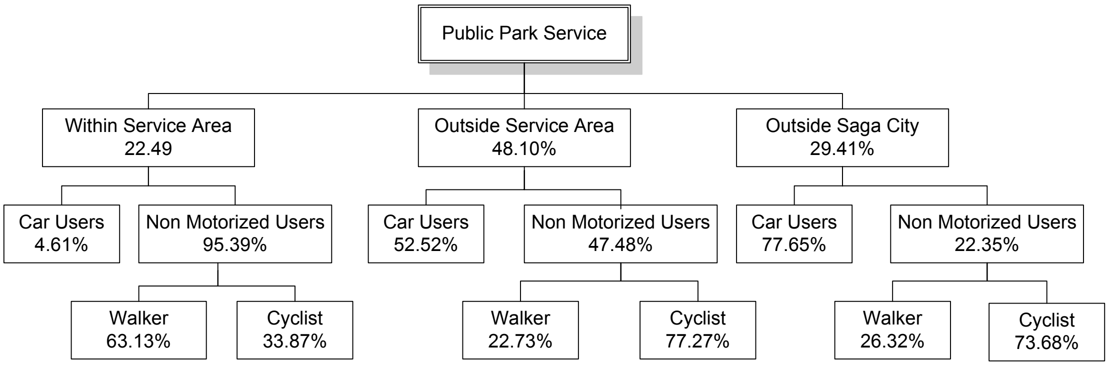
The different service area of parks in Saga city in Figure 6 reveals that there are some gaps between different park service areas. However, when using the threshold distance to define the actual service area from rational choice, the uncover area of service became overlapped. This useful information can be confirmed that the different attractiveness and accessibility of parks play a vital role in recreational choice behavior of users in community (Iamtrakul et al., 2004).

5. RESULTS

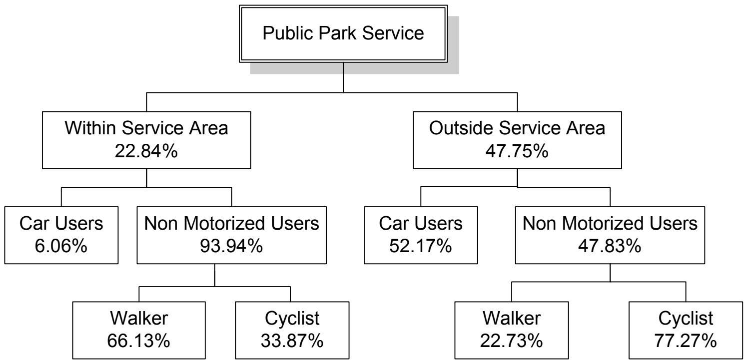
To apply the definition of threshold distance to redefine new service area of this study, the proportion of walking and cycling to park are shown by Figure 7. It can be seen that the number of park users are willing to consume the public service is greater than the design standard in all threshold distances. This was verified from the result that percentage of users in service area are 22.84%, 36.68% and 45.33% from walk-car case, walk-cyclist case and cyclist-car case, respectively, compared to 22.49% from the standard design. Furthermore, the statistically also indicated that all cases of different group of users are independent at significance level 0.05. This result can be used to sustain that within park service area, users should be promoted to travel to park by walking or cycling instead of driving car.

To support the findings on the behavior of walker and cyclist on park utilization in Saga city, the result of different characteristics that influence the park users' behavior was analyzed by using SPSS software (Iamtrakul et al., 2004). Table 4 shows the summary of different variable of park users' characteristic and this kind of recreational behavior. The empirical results of park visitor's characteristics and behavior on park visitation were summarized based on modal usage since park is a kind of public facility that all group of users should be able to consume service without expense.

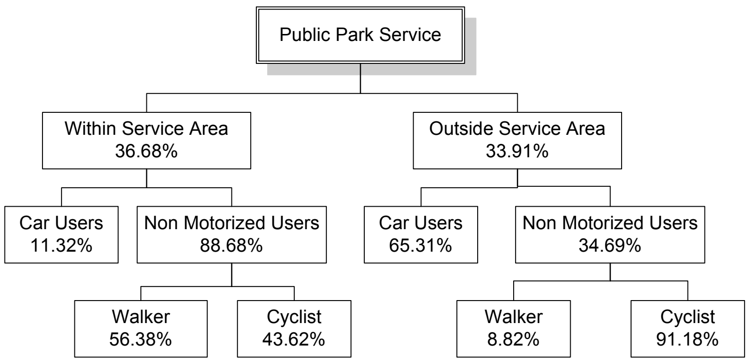
The assessment on the characteristics and behavior of park users is subdivided into walker, cyclist and car users. This result was performed to confirm the essential of this methodology on classification of park service area since it was clearly denoted that most of users with in service area are non-motorized users. It can be seen that not only the location of public parks within and outside residential district are perceived in different way but the respondents' personal characteristics also result to the different patterns of park utilization.



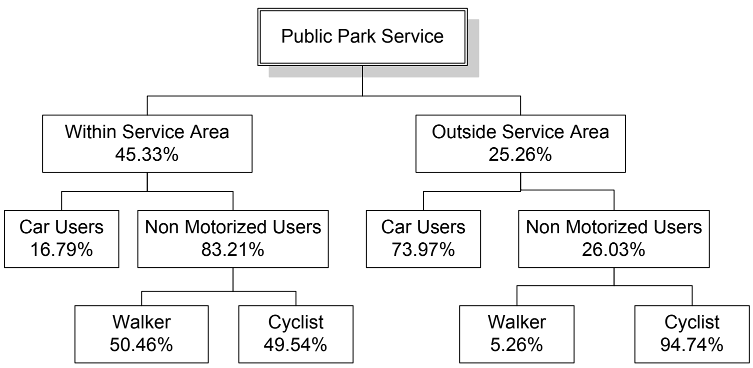
(a) Traditional Approach Case



(b) Walk and Car Case



(c) Walk and Cyclist Case



(d) Cyclist and Car Case

Figure 7. Comparison of Different Service Area Classified by Different Threshold Distances

Table 4. Summary Characteristics of Park Visitors and Characteristics of Park Visits

Variables	Park Visitors (n=289)		Modal Usage					
			Walk (n=61)		Cyclist (n=86)		Car (n=142)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Demographic								
Age (year)	33.74	14.96	41.39	15.60	30.00	15.89	32.71	12.89
Household size	2.89	1.54	2.66	1.40	2.80	1.56	3.04	1.58
Income (yen)	146,885.81	146,394.13	162,295.08	148,788.37	102,325.58	144,894.89	167,253.52	141,301.67
Activity Characteristic								
Activity time (min)	102.88	81.52	89.67	64.81	103.33	93.57	108.27	80.02
Activity expense (yen)	287.72	620.07	125.25	262.68	183.60	331.66	420.56	808.62
No. accompany person	3.29	3.82	2.72	1.88	3.58	4.03	3.37	4.27
No. visit in year	23.86	20.02	33.25	19.91	24.40	18.39	19.51	19.72
Trip Characteristic								
Travel time (min)	21.41	18.52	11.18	9.00	16.62	13.76	28.71	20.96
Travel distance (km.)	7.59	12.14	1.12	1.43	3.24	3.19	13.00	15.32
Travel cost (yen)	109.07	220.78	0.00	0.00	0.00	0.00	221.97	272.62

6. DISCUSSION

This study concentrates on majority group of non-motorized park users because the verification result concluded that most of frequent park users would walk and ride to park. However, park users who stay outside park service area also should be taken into account. We also attempt to explain the characteristics of parks users and their behavior on park visitation by perform statistically analysis. The investigation on different factors effect on different behavior on park visit was extracted from Table 4. The three categories of mode usage that is concluded in main category of variables effect on different group of park users are explained as follows:

■ Park users' characteristics and socioeconomic

From the result of sample analysis, the several characteristics and socioeconomic of park users were considered in this study such are age, gender, income, occupation, etc. It is surprisingly that among the similar trend of popular group of park users on middle age in other modes, we found out high proportion of elder (> 60 years) users by walk to park. This might be from the fact that the high percentage of walker are housewife that most of them have no income and have more free time to enjoy social activity park. As expected, most of walker and cyclist are the lower income group compare to expensive mode.

■ Characteristics of Activity

The average number of activity time and expense clearly designated that most of park users who travel to park by economic mode would spend less time and money while enjoy different activity at park. Car users spend money about 3 times and 2 times higher than walker and cyclist for activity expenditure, respectively. On the other hand, the mean value on number on frequency of park visit per year of non-motorized and car mode is reversely from the previous variable effect. The more accessibility mode would result to the high number of visit. It is clearly seen that walkers would visit park almost twice more frequently than car users. This result may due to reason that walking and cycling are not only economical and physical active mode but also it may give direct benefit on physical health of users and they can enjoy their leisure time with amenity of environment and surrounding while travel to park.

■ Characteristic of Recreational Trip

Three significant variables on characteristics of recreational trip that are considered in this study consist of travel time, travel distance and travel cost. When users have no expense to travel to park, they would travel in shorter distance with shorter time of travel compared to car users. The travel time of car mode compare to walk and cyclist are 2.57 times and 1.7 times, respectively. In addition, the same tendency for travel distance that average car distance to park were about 12 times higher than walking distance and about 4 times greater than cycle distance.

7. CONCLUSION

This study employed the recreation valuation method to determine the actual service area of public parks based on rational choice. The derived threshold distances to maximize benefit among different group of users were compared to other untraditional approach, Voronoi service area, to reflect the useful results of considerate real behavior of park users in Saga city, Japan. It was noticeably verified by this methodology that more than 70 percent of park users within park service are walkers and cyclists. The findings of inexpensive modes on commuting to park warrant the conclusion pertinent primarily to guide for promote non-motorized mode for recreational activity. There is potential for a substantial increase of these physically active travels to park instead of uneconomical and polluted mode. The usage of walking and cyclist are not only to promote health-enhancing physical activity by these recommended modes, but also public park utilization encourage daily life of residents due to the reason that the frequency of park visit depends on accessibility of transportation modes. Thus, a uniqueness of this study on the linkages between supply of green spaces and the social needs can provide fruitful insights concerning non-motorized park users to launch more effectively plan complemented with the target group of park users and for provide better service according to specific requirement.

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