

# The Difference between Stated and Measured Travel Data and Their Impact on Environmental Valuation by Travel Cost Method

by

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The main purpose of this study is to assess the reliability of the respondent's own estimation of the travel distance as a base for calculating travel costs. In order to attain this objective, we have compared the respondent's stated distances with that of the measured ones, by using environmental valuation survey data conducted on Huis Ten Bosch (HTB). As evaluation tools, scattered diagram plotting, correlation analysis and t-tests of the differences between two means have been used. The findings of the study suggests that, measured distance data might be used for travel costs calculation, as the stated distances are prone to be distorted as the distance from respondent's residence to the recreational site increases. On the other hand, the significance of the stated distance data should not be disregarded in TCM studies, as it reflects the length of distance felt by the respondents and would provide an important base for estimating recreational benefits.

*Key words:* travel cost method, travel distance, environmental valuation, recreational benefits

## 1. INTRODUCTION

Since its inception about 50 years ago the travel cost method (TCM) has undergone substantial developments<sup>1)</sup>. TCM is one of the monetary-based eco-system valuation methods and calculates use values associated with ecosystems or sites which are used for recreation purposes<sup>2)</sup>. The basic assumption of the travel cost method is that the peoples' willingness to pay for visiting a particular site can be estimated based on the number of trips they make at different travel costs, because the time and travel cost expenses that people incur to visit a site represent the price of access to the site.

Hence, for calculating travel costs, TCM relies heavily on estimates of travel time and distance covered by the respondents. But interestingly, these data are rarely obtained straightly from the respondents. Rather, most of

the studies measure distances between the city from where the trip started and the location of recreation site and multiply it by a uniform conversion ratio to obtain matching journey times assuming constant speed. According to Bateman *et al.* (1996), ...concerns about the ability of individuals to infer distances traveled accurately have encouraged the alternative use of airline distances (straight lines)- with or without the application of "road circuitry factors"- calculated from the center of the city (or county) where the trip began<sup>3)</sup>. Distances measured in such way are of course convenient, but it fails to take into account the geographical characteristics such as the congestion factors, structure of the road networks etc. and thus are doubtful in providing accurate travel distances and time<sup>1)</sup>.

From the ongoing discussion it is clear that, both travel distance measurement obtained

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directly from the traveler himself or herself (hereafter referred to as *stated distance*) and distances measured by assuming constant speed (hereafter referred to as *measured distance*) have their relative advantages and disadvantages. But, actually a very few studies done to assess the reliability of respondents' own assessment of travel distances, and as far as the authors know, none in the context of Japan. On this background, this study is a modest attempt to compare the *stated distances* (based on empirical data) and *measured distances* to suggest which one to use in final calculation of travel costs. In doing so we took Huis Ten Bosch (HTB) - a recreational theme park located in Sasebo, Nagasaki Prefecture as a case<sup>1</sup>.

## 2. ABOUT HUIS TEN BOSCH (HTB)

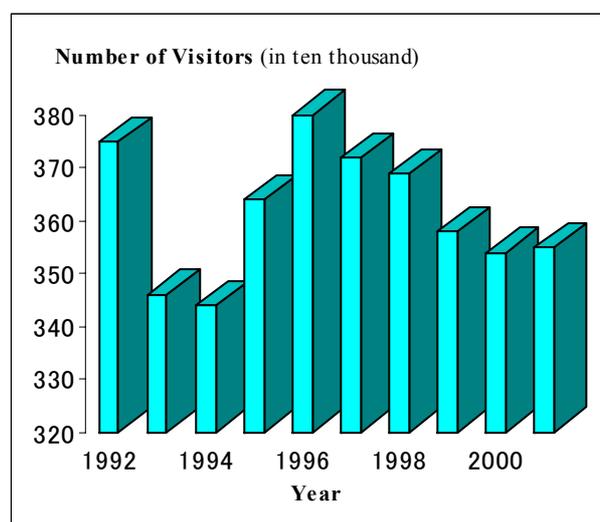
Huis Ten Bosch is one of the biggest theme parks in Kyushu, Japan. It is a famous private recreational theme park opened on March 1992 at an approximate cost of \$ 2.5 billion, created by transforming 152 hectares of industrial wasteland through various environmentally affable mechanisms. The concept of Huis Ten Bosch is "coexistence between ecology and economy". With the year 2002 HTB completed 10th year of operation (see **Photo 1** for a recent view).

Although it initially attracted tourists, both domestic as well as from Asian countries, but later this trend did not continue. **Figure 1** shows the gradual declining trend in the number of visitors coming to visit HTB. This problem of visitor shrinkage coupled with other financial deficiencies eventually forced HTB to bankruptcy, at the end of February 2003. Currently efforts are continuing for its revival under Corporate Rehabilitation Law.

<sup>1</sup> This study is a part of the environmental valuation study of recreational theme park Huis Ten Bosch, by applying both actual (TCM) and potential (CVM) behavioral methods. The final results of the study are forthcoming.



**Photo 1** Recent view of HTB  
Source: Reproduced from HTB published materials



**Fig.1** Yearly number of visitors visiting HTB  
Source: Derived from Huis Ten Bosch Environmental Accounting Report: 1992-2001<sup>4)</sup>

## 3. OBJECTIVES OF THE STUDY

The main purpose of this study is to assess the dependability of the respondent's own assessment of the travel distance as a base for calculating travel cost. In doing so the authors also tried to find answer to the following questions too:

- a) In calculating travel costs, which assessment of travel distance and length should be used: respondent's stated distance or the one calculated otherwise?
- b) Does distance from the location of the recreational site reduces respondent's

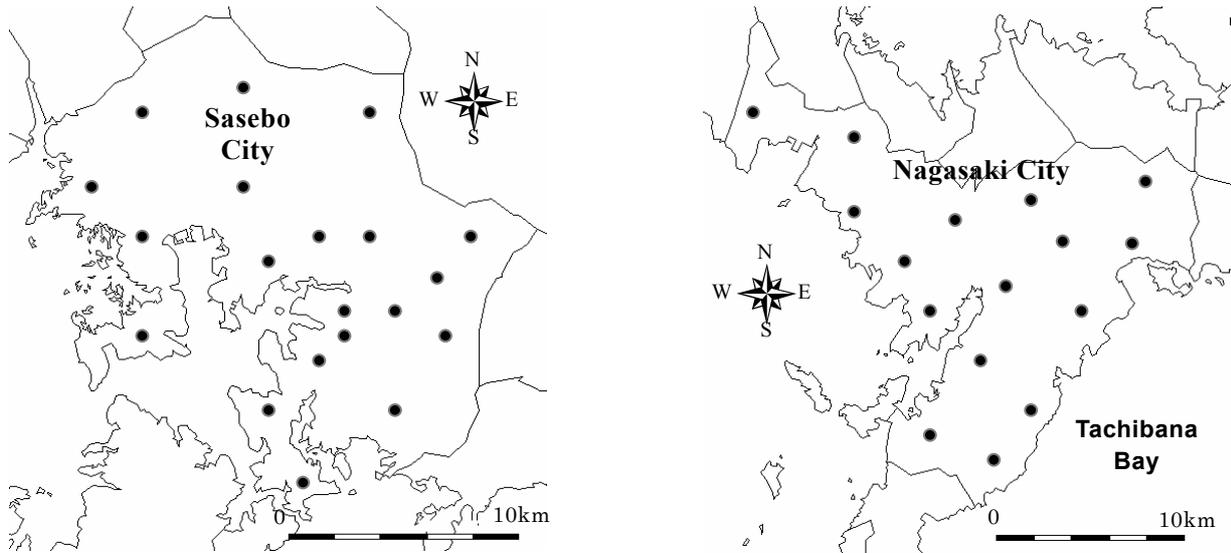


Fig. 2 Sampled area in Nagasaki and Sasebo City (shown by black dots)

ability to quote distance accurately?

#### 4. METHODS

##### (1) Outline

The entire structure of the research methods followed in this study can be summarized as shown in Fig. 3 and are outlined below briefly.

##### a) Stated distances

For *stated distances* data we are going to use the environmental valuation survey conducted on Huis Ten Bosch starting from January 2003. The details of the survey description are provided in sub-heading 2.

##### b) Measured distances

Next for *measured distances*, there are various ways for measurement such as: GIS measurement approach, free hand distance measurement on maps, mapping software etc. Among these, the first two approaches are time consuming and costly if the respondents are geographically spread. Accordingly in this study, we have measured the distances from the house of the residents to HTB with aid of a software package<sup>2</sup>. We have selected the “shortest route” option in calculating the distance with a constant speed of 60 km. per hour.

##### c) Analytical methods

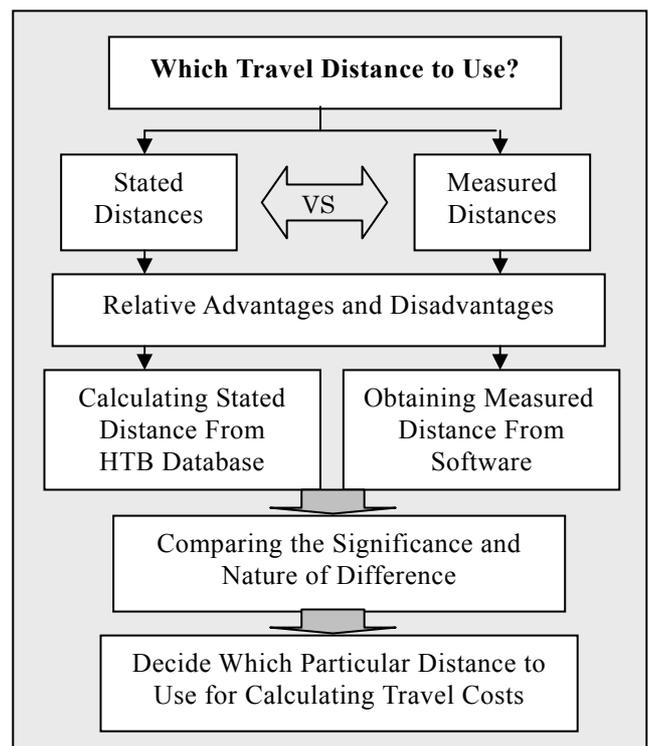


Fig. 3 Summary of research methodology

We have used t-tests of the differences between two means to find the significance of difference between stated and measured distances. Correlation analysis and scattered diagram plotting are also done to have an insight into the relationship.

<sup>2</sup> Zenrin Digital Mapping 5, Zenrin Co. Ltd. 2002

## (2) Survey Description

### a) Study region and selection of respondents

The questionnaires were sent to a random sample of 950 households of Sasebo and Nagasaki City. Mail survey technique was used for data collection and households were selected randomly from the registered telephone directory<sup>5)</sup>. The sample cities and areas are as shown in **Fig. 2**.

### b) Response rate

As shown in **Table 1** the response rate is approximately 27 percent and 24 percent for Sasebo and Nagasaki City, respectively. Getting higher response rate above 25 percent is difficult under mail survey technique of data collection. But based on the experience of the mail survey response rate of studies conducted in Japan, the response rate in our study can be considered to be satisfactory for conducting environmental valuation study<sup>6) & 7)</sup>.

### c) Contents of the questionnaire

The original questionnaire contained different environmental valuation questions on Huis Ten Bosch and among them one part contained travel data related questions, which are summarized in **Table 2** for reference.

**Table 1** Response rate of the final study

	Sasebo City	Nagasaki City
Questionnaire Distributed	950	950
Filled Questionnaire Returned	252	232
Response Rate	27%	24%

**Table 2** Partial contents of the questionnaire used in the survey to draw out travel data

Contents of the questions asked
1. Have you visited HTB? If yes, then how many times?
2. If your answer is yes for the above question, then by what means you went to HTB.
3. How far is your house from HTB in Km.?
4. On an average how long does it take to reach HTB?
5. What was the average time that you spent inside HTB?
5. What other places similar to HTB do you want to visit?
Followed by standard demographic questions

**Table 3** Summary statistics of Sasebo City

	Stated Distances	Measured Distances
Sample Size (n)	213	213
Mean	13.43	13.53
S.D.	9.22	5.62
Median	12	13.9
Correlation ( <i>r</i> )	0.68	
<i>t</i> -test of paired samples:		
Difference in sample means	-0.10	
<i>t</i> -Test Statistic	-0.14	
<i>P</i> -Value	0.89	

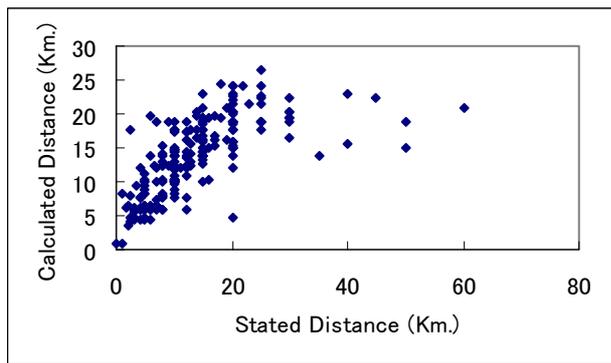
**Table 4** Summary statistics of Nagasaki City

	Stated Distances	Measured Distances
Sample Size (n)	205	205
Mean	57.69	52.72
S.D.	16.43	3.82
Median	60	52.6
Correlation ( <i>r</i> )	0.33	
<i>t</i> -test of paired samples:		
Difference in sample means	4.97	
<i>t</i> -Test Statistic	2.80*	
<i>P</i> -Value	0.00	
*Significant at 5% level of significance		

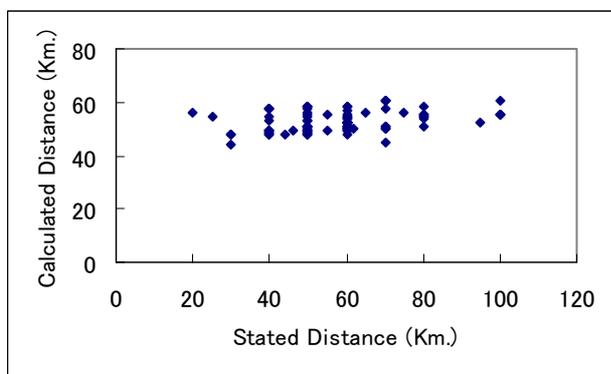
## 5. STATISTICAL ANALYSIS

The results of the statistical analysis, including the outcomes of the *t*-tests of the difference of means of stated and measured distances, are summarized through **Table 3** and **4**, and also by **Figs. 4** and **5**. **Table 3** presents the results for the Sasebo City and **Table 4**, is that of the Nagasaki City, respectively.

Descriptive statistics for the Sasebo City shows that both mean and the median are slightly lower in stated distances than the measured ones. This might indicate the propensity of respondents to underestimate the distance to some extent. On the other hand, both the *t*-statistic and *p*-value indicates that the difference between stated and



**Fig.4** Scatter Diagram showing correlation between stated and measured distance in Sasebo City ( $r=0.68$ )



**Fig.5** Scatter Diagram showing correlation between stated and measured distance in Nagasaki City ( $r=0.33$ )

measured distances is not statistically significant ( $p=0.89$ ), and leads us to accept the null hypothesis that there is no difference between them. The correlation coefficient calculated between them (stated vs. measured) has also shown moderate positive relationship ( $r=0.68$ ). Scattered diagram plotting of the same also confirmed this pattern of relationship (see **Fig. 4**). This is probably due to the reason that the respondents are residing close to the HTB.

On the contrary, the results of the statistical analysis for the Nagasaki City presented a contrasting picture (see **Table 4**). Both mean and median stated distances are higher than the measured ones. Thus the respondents of the Nagasaki City are in a way overestimate their travel distances. Also interestingly,  $t$  and  $p$  values reject the null hypothesis, indicating there is difference between the stated and measured distances for Nagasaki City. The correlation coefficient is also very low ( $r=0.33$ ). Scatter

diagram plotting as shown in **Fig. 5** also fails to show any particular pattern. The increase in distance from the HTB might be one of the main reasons for respondent's failure to estimate the distance accurately. Hence, it can be said that travel costs calculated by taking respondent's stated distances in Nagasaki City, would overestimate the recreational benefits of Huis Ten Bosch under travel cost method.

## 6. DISCUSSION AND CONCLUSIONS

- (1) Firstly, the finding that, the stated distance by the respondents of the Sasebo City does not differ statistically from that of the measured one implies that, closeness from HTB site might have aided respondents to quote the distance more accurately. On the other hand, the variance between stated and measured distance for Nagasaki City indicates that, comparatively higher distance from the respondent's house to HTB site possibly had made them more confusing about the exactness of the distance.
- (2) Secondly, it is a very difficult task to generalize which distance measurement (stated vs. measured) is the best for calculating travel costs. Because both have their relative merits and demerits. As we have found from our study, if we follow stated distance, then there is the possibility of overestimation of travel costs, as the distance from the recreation site increases respondents showed the tendency to overstate the distance. On the other hand, while measuring distance by other methods, we need to make some assumptions like: constant speed, road congestion etc., which again questions their reliability or accuracy. If travel details are readily available from the respondents, there is no reason to think that the results of the analysis will improve if these are substituted by estimates made in other ways, particularly if these are obtained by making crude assumptions about the network of roads available to travelers<sup>3</sup>).

But our conclusion is that, if this tendency of overstatement by respondents shows the same trend with increase in the distance from the recreational site, then it would be better to calculate travel costs by taking measured distances, which at least would give better approximation than stated distance data provided by the respondents. Otherwise it would lead towards overestimation of recreational benefits estimated by travel cost method.

- (3) Finally, by suggesting to calculate travel costs by using measured distances does not imply that stated distances are valueless. Rather if possible all individual travel cost survey should incorporate questions to know the respondent's assessment of travel distance and time. Because such data would contain the respondent's *feeling of distance* (the distance that the respondent felt) regarding the length and time covered to reach the recreational site, no matter whether the assessment is correct or wrong. And travel costs calculated based on this data might not reflect actual distance, but it would surely provide useful estimation regarding recreational benefits to visitors of a particular site. This area leaves the ample scope for further empirical analysis and study.

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