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BASIC STUDY ON THE ESTIMATING THE VALUE OF SAND BEACH USING AMENITIESREPLACE

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ABSTRACT: The sand beach along the east coast of Korea offers beautiful scenery with high-quality sand for leisure, and is also famous for white-sand and pine-trees both of which are important scenic resources. Furthermore, the sand beach helps to maintain natural environment of the coastal area and has the function of a disaster prevention system against high waves. There are two major value evaluation methods, Travel Cost Method and Contingent Valuation Method, to assess the value of sand beach. Contingent Valuation Method is considered to be more appropriate for simultaneous evaluation on the usefulness and the uselessness of the beach. But in order to apply Contingent Valuation Method to coastal sand beach evaluation, close examination and investigation on the potential bias, such as on questionnaires, surveys and replies are required. In this study, the characteristic of amenities which sand beach visitors prefer the most is investigated, in prior to evaluating the usability of the beach measured by contingent valuation method. The characteristic of amenity of major sand beaches on the east coast of Korea is studied and compared by diverse value evaluation methods.

Keywords: Sandy beach, amenity, contingent valuation method, bias

INTRODUCTION

The importance of sand beach has been recognized for long time in advanced countries so much that its effect on their local economy and community is big enough to be called Economy Machine. Furthermore, it has been thought of to be an invaluable asset for environment and against disaster prevention.

But now, 20 years later, the ecology of that Alaskan coast has been completely recovered. The bacteria on the surface of granular sand on the beach have removed the oil through self-purification, which shows us that sand beach plays a significant role in maintaining the ecological environment of coasts. The relatively wide sand beaches with beautiful landscapes among Korean beaches have been utilized as beach resorts. Those beaches are relatively flat, have homogeneous kind of sand for leisure activities and command a beautiful view. In Korea, those beach resorts are critical resources of tourism and economy as well as an invaluable asset having the function of protecting the natural environment against high tide. There are 349 beach resorts as of 2011, and the number of visitors is continuously increasing with the 40% of increase from 63 million visitors in 2001 to 90 million in 2004(Korea Maritime Institute, 2006). It was confirmed that the five-day work system enacted since 2006 contributed to the increase. But there is a serious problem of sand beach erosion which has resulted from the increasing trend. The coast erosion in Korea was realized first late in the 1990's, and it has extended to many beaches for various reasons, which ultimately has led to a burden of enormous cost for restoration. With this, the importance of beaches is again acknowledged. So far, the value of sand beaches has been estimated mostly by Travel Cost Method and Contingent Valuation Method.

Their environmental value can be categorized into two: use value of recreation and no-use value of existence. Such methods as TCM cannot estimate both the values, but CVM is more appropriate for the estimation. Still, CVM for sand beaches needs survey with questionnaire and answers to that, and accordingly it needs a statistical interpretation, in which case the effect of Bias, that is, the respondents' prejudice, requires a close re-verification. It means that the arrangement of questionnaire and answers minimizing the bias is needed prior to any statistical interpretation of the answers. Therefore, it is desirable to make the respondents recognize the basic character of amenity to sand beaches in order to minimize this kind of effect. But unfortunately it is not easy to find any study case on definite establishment of amenity and its factors to be previously suggested to respondents. This study adopted CVM to introduce to the respondents the method of reviewing the features of primary amenity so as to reduce the effect of bias for the comparison and review

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of them with a variety of estimation factors by selecting representative sand beaches on the east coast.

STUDY METHOD

Study Area

As seen in Fig. 1, the areas for this study are Namhangjin Beach Resort in Gangneung, Namae Beach Resort in Yangyang and Hujung Beach Resort in Gyoungbuk Province including Haewoondea Beach Resort in Pusan which was for comparison.

The coast of Namhangjin is 600 meter long with reducing foreshore width owing to coast erosion around the estuary and steep slope of the foreshore, against which a reinforcement method is being established. Namae Coast of Yangyang has a wide sand beach of about 2 km, where a reinforcement method was applied against coast erosion resulting from the construction of coast road in the past. Hujung Coast, 2 – 3 km away from Jukbyun Harbor, is 300 meter long and 1 – 2 meter deep, which has a gentle slope typical on the beaches of the east coast. Its sand beach has a lot of clams, which makes it a good summer resort for any family with children. But with the comparison survey research in 1971 and 2010, it was found that its coastline receded about 1.6 m. Though any map shows that Haeundae Beach Resort is located on the east coast, as a matter of fact, it is influenced by tide level, which is a characteristic of the south coast. Haeundae Beach Resort is the most famous sand beach in Korea with short back-shore and relatively gentle slope.

Hujung Beach Resort, 2 – 3 km away to the north from Jukbyun Harbor, is a 300-meter-long beach resort. Among the study objects, it has the widest back-shore compared with foreshore but its back-shore has a kind of steep slope(1/5).

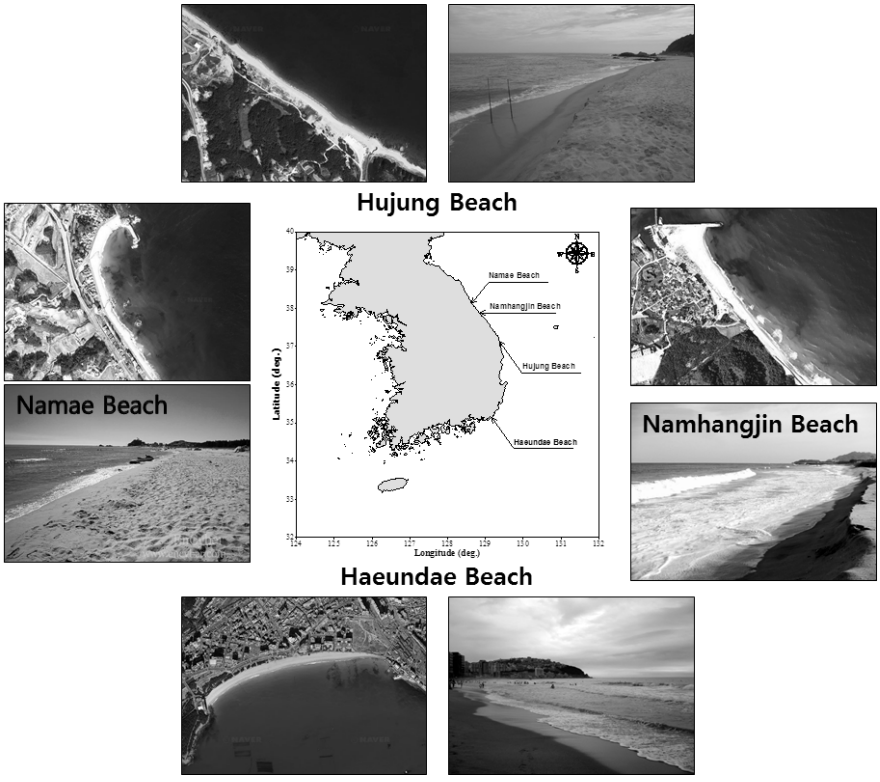

Fig 1. Study Area

Selection of Study Items

It was already mentioned above that the method for estimation of economic value of sand beach (value of non-market goods) is CVM or TCM which measures the value of use, that is, the convenience felt by the beach visitors.

These methods can be applied with the classification for reviewing the function of beach resort by the appreciation of the condition forming the sand shore on the coast. Also both are often used for review of economic validity after completion of any planned protective project needing enormous amount of expense.

This study has selected basic research items such as change of beach width, slope change of shore, also the depth change as the conditions of forming shore for comparison estimation.

The features of Amenity on sand beach can be evaluated on the basis of natural environmental factors such as water quality and scenery, access factors, utility by environmental change including development and

convenience of shore use. For this, it is typical to utilize the data on physical features of shores and the capability of parking lots as basic data for any study(Kojima et al., 1997). Accordingly, this study has adopted the existing method of selecting research items for reviewing the environment of amenity. The primary factor among research items is the level of satisfaction with such natural environments as naturalness, scenery and cleanness of sea water including the traffic access to the relevant beach resort. The secondary factors are the area of sand beach and the appropriate use of sand beach for recreations such as sports and games.

As seen in Fig. 2, shore means the area distributed with sand and pebbles outward to the ocean from the shoreline. It can be divided into two sections by tide and wave, which are foreshore with relatively steep slope to the ocean and back-shore almost flat to the land. The foreshore is the area between the high water line and low water line on the ocean, and the back-shore the area higher than the high water line where there is usually a wide dune. The specific data of physical beach on the coast for this study are the width and slope between foreshore and back-shore and the median diameter (D50). The naturalness means the ratio of the length of natural beach for the extension of beach resort. The capability of parking lots at beach resorts is also utilized as an index for access.

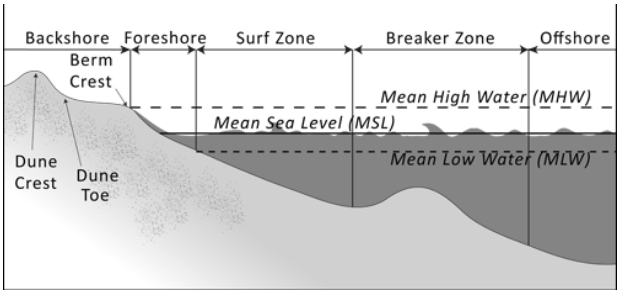

Fig 2. Classification of beach profile

STUDY RESULT

Status of Beach by Area

The areas for study are Namhangjin Beach Resort in Gangneung, Namae Beach Resort in Yangyang and Haeundae Beach Resort in Pusan in Table 1 including Hujung Beach Resort. Table 1 shows the results of analyzing width between foreshore and back-shore (m), slopes of both and median diameter (D_{50}), and Fig 3 – 6 shows the comparison by factor. The naturalness of research areas is the ratio of natural beach length for the extension of beach resort, and since most of the research shores are being used as beach resorts and accordingly there are not any artificial structures in the research areas, the naturalness was decided as 100%.

Table 1. Assessment-items & results

	Hujung Beach	Namhangjin Beach	Namae Beach	Haeundae Beach
Width of foreshore(m)	30	15	20	30
Width of backshore(m)	55	35	30	20
Slope of foreshore	1/5	1/5	1/6	1/20
Slope of backshore	1/5	1/8	1/7	1/15
Median Diameter(D_{50})	0.249mm	0.253mm	0.320mm	0.280mm
Number of Parking Lots	400	120	50	4,800

Development of Assessment Criterion

The study results were analyzed on the basis of multi-variety analysis(Cluster Analysis, Principal Component Analysis). For the examination of similarity of researched shores, the tree diagram of Cluster Analysis was made and the similarity of the shore features was divided for the classification of the researched shores. The features and similarities of each group can be explained by the following analysis results of principal components. The primary principal components are the luxury of natural environment such as [surrounding naturalness], [scenery beauty] and [clean sea water] and traffic access of [easy reach to beach resort], and the secondary ones their unstableness such as [area of shore] and [appropriate shore for sports and games].

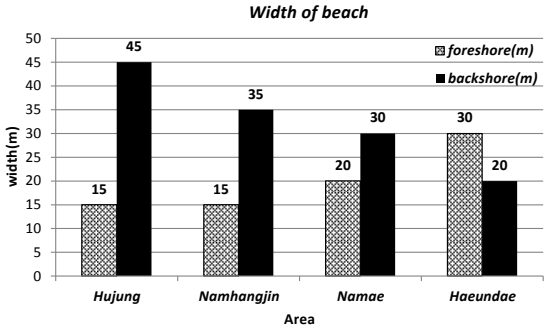

Fig.3 Comparison on the width of beach

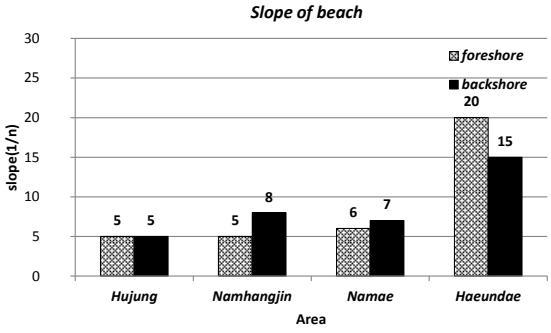

Fig.4 Comparison on the slope of beach

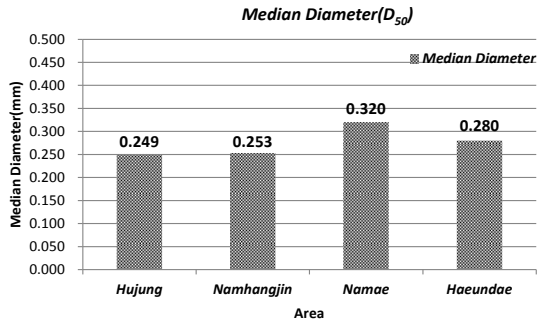

Fig.5 Comparison on the median diameter

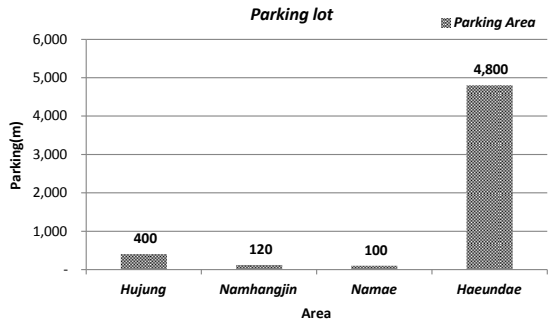

Fig.6 Comparison on the number of parking lots

Table 3 shows the evaluation items and weighted values specified at Table 2 used to establish environmental conditions of three shores at research and comparison areas for the comparison the research results with weighted conditions. The primary principal components were applied for the comparison of the luxury of natural environment such as [surrounding naturalness], [scenery beauty] and [clean sea water], and for the analysis of traffic access of [easy reach to beach resort], and the secondary ones were for the analysis of their usableness such as [area of shore] and [appropriate shore for sports and games].

The research items were classified into primary and secondary principal components for assessment. The former is those of naturalness and the latter is the width between foreshore and back-shore, their slopes and low-quality grain-diameter. The most important factors for better amenity at shores are natural environmental ones such as water quality and scenery, access and usableness of share.

Fig 7 shows the results of comparing the values of shores at the 4 selected areas for comparison, where Haeundae is found to have the biggest width between foreshore and back-shore and the most desirable foreshore slope followed by Hujung Beach Resort.

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Table 2. Assessment-items & results

Impact Factor / Assessment-Items	-3	-2	-1	0	1	2	3
Width of foreshore(m)	~5	5~10	10~15	15~20	20~25	25~30	30m~
Slope of foreshore(1/x)	~3	3~6	6~9	9~12	12~15	15~20	20~
Width of backshore(m)	~5	5~10	10~20	20~30	30~40	40~50	50m~
Slope of backshore(1/x)	~20	20~30	30~50	50~100	100~120	120~150	150~
Mean Diagram(D_{50})	above 0.6	0.6~0.5	0.5~0.4	0.4~0.3	0.3~0.2	0.1~0.2	below 0.1
Naturalness	0~20	20~40	40~60	60~70	70~90	90~100	~100%
Number of Parking Lots	0~50	50~100	100~150	150~200	200~250	250~300	300~

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Table 3 Results of assessment-items

		-3	-2	-1	0	1	2	3
Hujung Beach	Width of foreshore(m)	~5	5~10	10~15	15~20	20~25	25~30	30m~
	Slope of foreshore(1/x)	~3	3~6	6~9	9~12	12~15	15~20	20~
	Width of backshore(m)	~5	5~10	10~20	20~30	30~40	40~50	50m~
	Slope of backshore(1/x)	~20	20~30	30~50	50~100	100~120	120~150	150~
	Mean Diagram(D_{50})	over 0.6	0.6~0.5	0.5~0.4	0.4~0.3	0.3~0.2	0.1~0.2	below 0.1
	Naturalness	0~20	20~40	40~60	60~70	70~90	90~100	~100%
	Number of Parking Lots	0~50	50~100	100~150	150~200	200~250	250~300	300~
Namhangjin Beach	Width of foreshore(m)	~5	5~10	10~15	15~20	20~25	25~30	30m~
	Slope of foreshore(1/x)	~3	3~6	6~9	9~12	12~15	15~20	20~
	Width of backshore(m)	~5	5~10	10~20	20~30	30~40	40~50	50m~
	Slope of backshore(1/x)	~20	20~30	30~50	50~100	100~120	120~150	150~
	Mean Diagram(D_{50})	over 0.6	0.6~0.5	0.5~0.4	0.4~0.3	0.3~0.2	0.1~0.2	below 0.1
	Naturalness	0~20	20~40	40~60	60~70	70~90	90~100	~100%
	Number of Parking Lots	0~50	50~100	100~150	150~200	200~250	250~300	300~
Namae Beach	Width of foreshore(m)	~5	5~10	10~15	15~20	20~25	25~30	30m~
	Slope of foreshore(1/x)	~3	3~6	6~9	9~12	12~15	15~20	20~
	Width of backshore(m)	~5	5~10	10~20	20~30	30~40	40~50	50m~
	Slope of backshore(1/x)	~20	20~30	30~50	50~100	100~120	120~150	150~
	Mean Diagram(D_{50})	over 0.6	0.6~0.5	0.5~0.4	0.4~0.3	0.3~0.2	0.1~0.2	below 0.1
	Naturalness	0~20	20~40	40~60	60~70	70~90	90~100	~100%
	Number of Parking Lots	0~50	50~100	100~150	150~200	200~250	250~300	300~
Haeundae Beach	Width of foreshore(m)	~5	5~10	10~15	15~20	20~25	25~30	30m~
	Slope of foreshore(1/x)	~3	3~6	6~9	9~12	12~15	15~20	20~
	Width of backshore(m)	~5	5~10	10~20	20~30	30~40	40~50	50m~
	Slope of backshore(1/x)	~20	20~30	30~50	50~100	100~120	120~150	150~
	Mean Diagram(D_{50})	over 0.6	0.6~0.5	0.5~0.4	0.4~0.3	0.3~0.2	0.1~0.2	below 0.1
	Naturalness	0~20	20~40	40~60	60~70	70~90	90~100	~100%
	Number of Parking Lots	0~50	50~100	100~150	150~200	200~250	250~300	300~

As described the above, the analysis of function and value of beach resorts can be reviewed by shore features (width of sand beach, shore slope, water depth and median diameter), naturalness and status of parking lot.

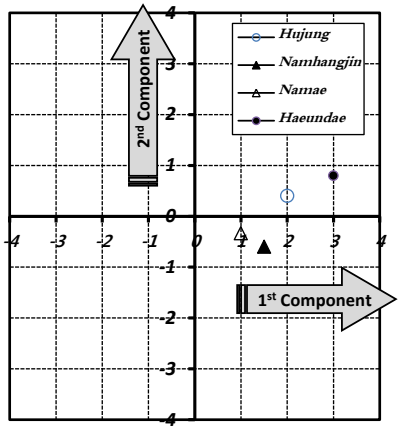

Fig.7 Value of sandy beach

Analysis of Change to Environmental Components of Shore Value

However, since the review of existing data on the research areas revealed insufficient for the examination of periodical water-depth measurement, low-quality median diameter and naturalness, the change to the shore width and the water-depth estimation drawn from the investigation of coast erosion history by aerial photos (analysis of aerial photos) were utilized for analysis of the change to value of Hujung Beach Resort (East Coast Conservation Associate 2010).

(1) Change to Shore Width

Table 4 shows the amount of change to the shore width at the positions of U-B0 ~ U-13 from the standard points of the years 1971, 1980, 1988, 1997, 2005 and 2010.

(2) Water-depth Analysis by Aerial photos

The water-depth can be estimated from a dispersion relation formula by the analysis of wavelength values shown on aerial photos. For this analysis, the aerial photos should be clear enough to be able to see the waves. As described above, since only the photos in 1980 among those of 7 years can be analyzed for this study, they were applied for the estimation of water-depth at the entire Hujung Beach Resort. And the slope of ocean bed was estimated with the application of the water-depth measured in 1980 and 2010 and the distance to the rock-island of the beach resort in Fig 9.

CONCLUSION

While TCM and CVM are chiefly used for the methods of value assessment on the natural environment like sand beach, there may be the probability of big fluctuation of value assessment according to the errors of Bias which can be seen at survey. Accordingly, in order to reduce any effect of Bias shown at survey, this study adopted a review method applying the factors related to the natural environmental factors representing naturalness, access factor and shore utilization including the primary amenity of water quality and scenery. all of which can be presented to respondents so that it can suggest a method in which the value of shore can be assessed prior to performing any concrete survey.

Table 4 Bottom topography analysis using water depth estimation & present conditions

from Shoreline(m)	Water Depth(m)		Slope of Beach Profile	
	1980.10	2010.06	1980.10	2010.06
0	0	0	-	-
83	1.2	4.8	1/70	1/17
117.5	1.7	4.8	1/70	1/25
190	4.1	6.4	1/46	1/30

The result of analysis of function and value of Hujung Beach Resort with the application of features of amenity revealed that there has not been a big change to the primary principal components (surrounding naturalness and parking capability) of its value except for some construction of artificial structures but some change to the secondary ones such as the slope and width enabling to understand the appropriateness for sports or games.

Consequently, the method is thought to be necessary which can reduce the steepness of shore slope while maintaining the current shore width and minimizing the artificial factors for the improvement of the amenity at research areas, the conservation of natural environment factors and the reactivation of shore utilization.

ACKNOWLEDGEMENTS

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