Survey on Tourist's Participation to Waste Separation for Implementation of Waste Separation Bins in Guam

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ABSTRACT

Okayama City, Japan, is going to gift waste separation bins to Guam, US, as a sign of good friendship. Idea of this gift is based on the expectation that Japanese tourists which occupy more 80 than percent of total tourists will separately dispose solid waste into the waste separation bins and then other people whoever have no custom to sort the waste in household will learn and copy the waste separation behavior of Japanese tourists. However, only gifting separation bins is not enough to carry out separation collection of recyclable waste in Guam. In order to launch and operate new separate collection system smoothly and effectively, tourist's willingness to participate in waste separation, setting location of waste separation bins, and information of waste components to be collected and recycled should be investigated before implementation of the system. In this study, a set of surveys on checking candidate location of setting, waste characterization of tourist's solid waste, questionnaire survey on tourist's willingness to waste separation were conducted under the collaboration of Okayama University (OU) and University of Guam (UOG).

KEYWORDS

Waste separation, Checking of Setting Locations of Waste Separation Bins,

Waste characterization, Questionnaire survey, Tourism, Guam

INTRODUCTION

Okayama City, Japan, is going to gift waste separation bins to Guam, US, as a sign of good friendship (Picture 1). Idea of this gift is based on the expectation that Japanese tourists which occupy more 80 percent of total tourists will separately dispose solid waste into the waste separation bins and then other people whoever have no custom to sort the waste in household will learn and copy the waste separation behavior of Japanese tourists. However, only gifting separation bins is not enough to carry out separation collection of recyclable waste in Guam. In order to launch and operate new separate collection system smoothly and effectively, tourist's willingness to participate in waste separation, setting location of waste separation bins, and information of waste components to be collected and recycled should be investigated before implementation of the system. In this study, a set of surveys on checking candidate locations of setting, waste characterization of tourist's solid waste, questionnaire survey on tourist's willingness to waste separation were conducted under the collaboration of Okayama University (OU) and University of Guam (UOG).

Picture.1 Image photo of waste separation bin gifting from Okayama city to Guam

The actual objective of this project was to find appropriate positions of waste separation bins from view point of high accessing opportunity of the bins by tourists, balancing the quantity of waste accumulation among the bins, as well as convenience in waste disposal by tourists and waste collection by waste collector. Moreover, to decide appropriate separation categories of recyclable waste, identification of quantity and quality of tourist's waste was necessary.

To carry out these objectives, this project consisted of three surveys:

I. Checking of Candidate Positions for Waste Separation Bins,

II. Questionnaire Survey on Tourist's Waste Separation Behavior,

III. Waste Characterization Survey.

MATERIALS AND METHODS

1. Checking of Candidate Positions for Waste Separation Bins

The purpose is to determine suitable places for the bins. Not only bus stops but also tourist's sightseeing spots, shopping areas, public areas as well as residential areas are being analyzed.

The procedure is the following:

1) Preparing a list of position candidates,

2) Visiting sites and evaluate the suitability for placing separation bins,

3) Inquire private place owner about permission for placing separation bin,

4) Inquire public waste collector about possibility to pick up the separated waste,

5) Consideration of optimal placement of waste separation bins.

2. Waste Characterization Survey

The purpose is to receive information about waste that is discarded by tourists in the Tumon Street.

The procedure is the following:

1) Selecting five sample bins among the existing waste bins placed along Tumon Street,

2) Installing a big plastic bag in each waste bin before survey,

3) Picking up plastic bags four times a day; sorting contents into selected waste categories.

3. Questionnaire Survey on Tourist's Waste Separation Behavior

The purpose is to guess the separation behavior of tourists and inhabitants by questioning on consciousness about and participation in waste separation in the most visited tourist location. For this purpose an imitation of the future gifted waste bin – made from cardboard – is being placed.

The procedure is the following:

1) Selecting the position of the imitated waste separation bin,

2) Placing and watching waste separation behavior of tourists and inhabitants,

3) Interviewing people about their consciousness on waste separation for recycling.

RESULTS AND DISCUSSION

1. Target area for surveys

The assessment took place in the north western area of Guam Island. Here, the investigation area is divided into three main areas of different surrounding characteristics. The first area is parallel to the beach of the Tumon Bay along the Pate San Vitores Road. Due to its location near to the beach, the hotel district and many shopping facilities, this area represents the most crowded area of Guam marked by a high influence from tourism. The locations of 27 existing waste bins (ST01~27) were

selected as candidate locations of separation bins in Tumon Bay Street which are shown in Fig.1. Each location is close to the bus stop of sightseeing trolley.

A combination of tourism and inhabitant influences is represented by the second area. It relates to the Chamorro Village including the Statue of Liberty the Paseo Baseball Stadium directly at the Agana Bay. The last observation spots are several places around the tourism center. Here, the main focus was on the areas around the supermarket respectively shopping malls K-Mart, Guam Premier Outlet, CostULess and Micronesia Mall as well as the tourism spot Two Lovers Point. These places except of Two Lovers Point are particularly influenced by daily purchases. Two Lovers Point is a bit further north than the other examined spots. 11 sightseeing spots (SS01~11) and 7 mall or su-permarkets (MK01~07) were selected as candidate locations of separation bins which are shown in Fig.2.
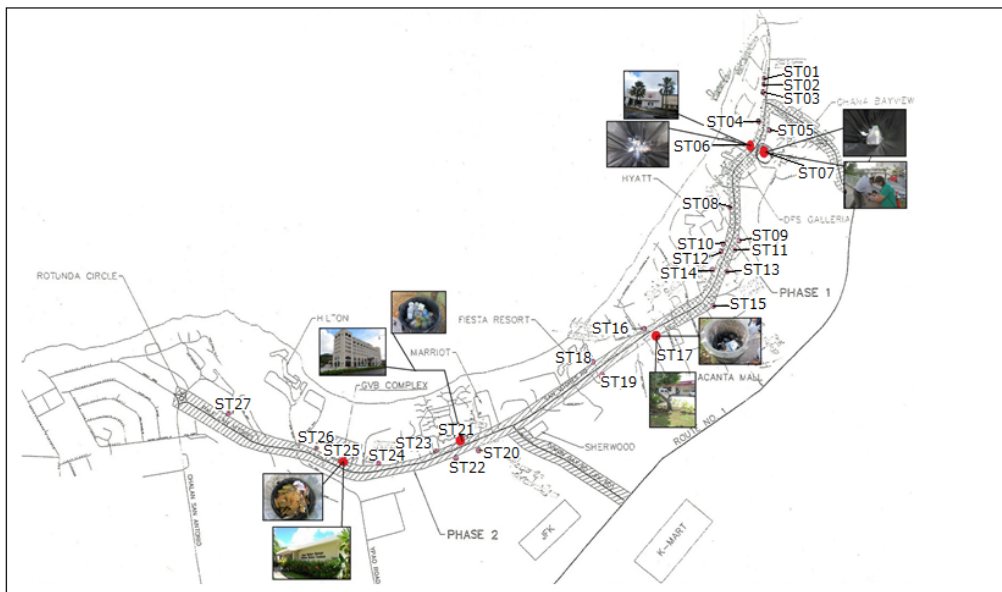

Figure 1. Candidate locations of separation bins in Tumon Bay Street (ST01~27: station)

Figure.2 Candidate locations of separation bins in Tumon and Agana Bays Area
**(SS01~11: sightseeing spots, MK01~07: markets)**

Picture 2. Survey of checking existing waste bins

By ignoring 14 spots due to difficulty in checking, 31 spots were finally selected. Through the survey, it was found each of MK03, SS01, SS05, SS04, SS07, SS16 has 2 bins in a spot, also each of ST06 and ST08 has 5 bins in a spot. Therefore, total 45 bins were checked.

Two different aspects influencing the waste accumulation potential were regarded to make a recommendation for appropriate pitches for waste bins in Guam. On the one hand side there is the surrounding conditions of each station because it is thought that the existence of several stores affects the waste accumulation significantly. On the other hand side there is the basic condition of pedestrian density. With this consideration the principle of the more pedestrians passing the more waste will be generated can be followed. Therefore, for each waste bin, after taking pictures of inside the waste bin, surrounding tourism building (hotels, restaurant, food shop, convenience and chain store, variety shop, office of travel agency, bank, etc.) were counted, the existence of beach access was checked, and pedestrians within 10 meters from the waste bin for 10 minutes were investigated were counted.

This survey shown in Picture 2 was conducted on January 17, 2013. A result of tourist building near the station is shown in Fig.3. ST06 at the center of shopping street, and ST15 at hotel and restaurant area, and SS06 at a festival square, Chamorro village are the best three.
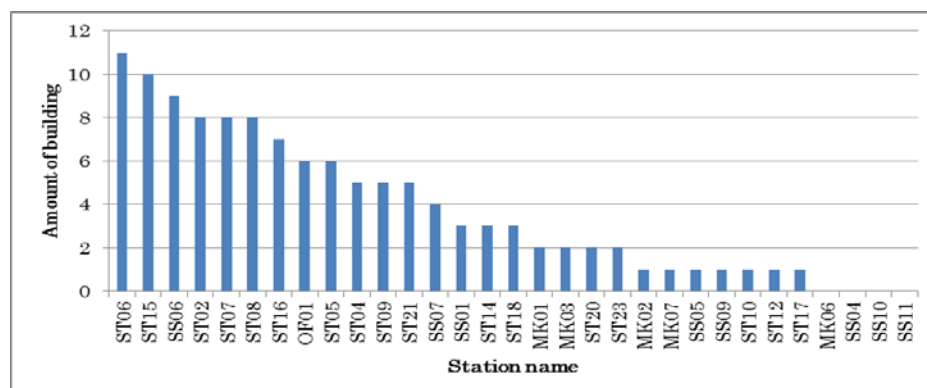

Figure 3: Amount of tourism buildings

The counted number of pedestrians near the spot for 10 min and the number per waste bin are shown in Fig.4 and 5, respectively. Because ST06 is located at the cross of roads in the center of

shopping street, many pedestrians was observed. Also many shopping customs were observed at ST08 in front of shopping plaza building.   Pedestrians at 3 spots in market or shopping places are followed by.   5 waste bins at each of ST06 and ST08 are put by the building company, and the plastic bag used in the waste bin is replaced twice a day.
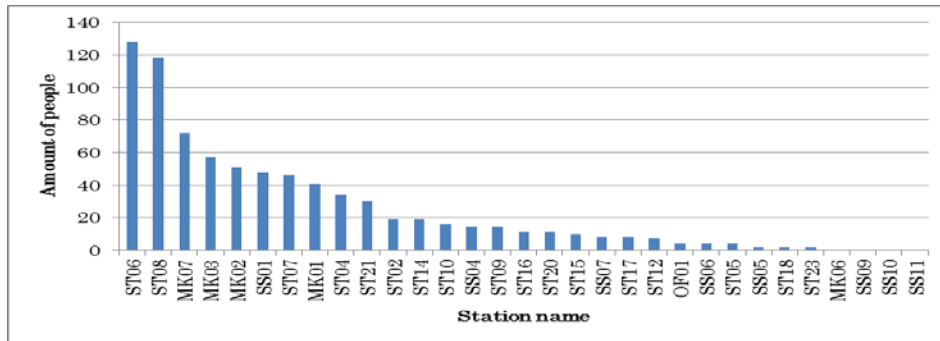
Figure 4: The amount of pedestrians per station (the count for 10 min)
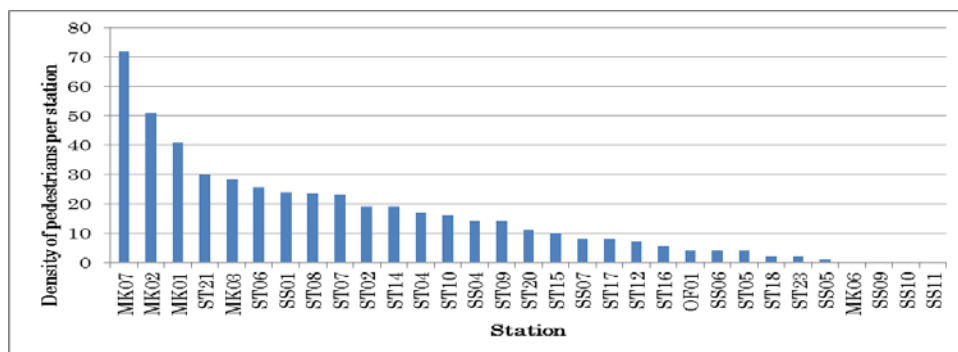
Figure 5: Amount of pedestrians per bin (the count for 10 min)

Caused by the number of thirty donated waste bins just around thirty appropriate waste bin places have been chosen. The selected places reached high values regarding either the amount of buildings or the pedestrian density. At first there are the stations which have shown higher values in both categories. These stations are: SS01. ST02, ST04, ST06, ST07, ST08, ST09, ST14, ST15, ST20 and ST21. Furthermore considering the pedestrian density the stations MK01, MK02, MK03, MK07, SS04, ST10 and ST12.

## 2.   Result of Waste Characterization Survey

After collecting waste bags from the specified waste bins, waste components for each waste bag were separated and measured in weight at 10:00 am (before lunch time), 2:00 pm(after lunch time), 4:30 pm(before dinner time), and 9:00 pm(after dinner time), on January 18, 2013. Picture 3 shows a scene of conducting waste characterization test.
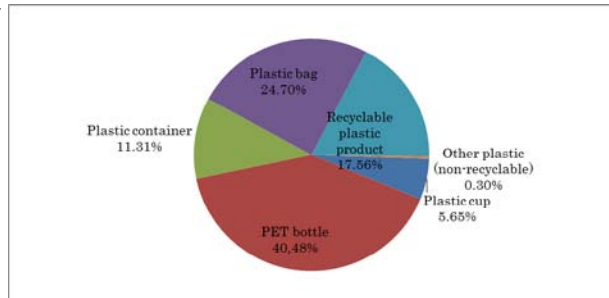
In this report, the result of ST06 is denoted due to high representativeness of tourist's waste. ST06 is located in the shopping area, having a high pedestrian density as well as a high number of touristic buildings (hotels, restaurants, stores). The total quantity of waste at this station amounted 2,372 g.

Picture 3 Waste Characterization Survey
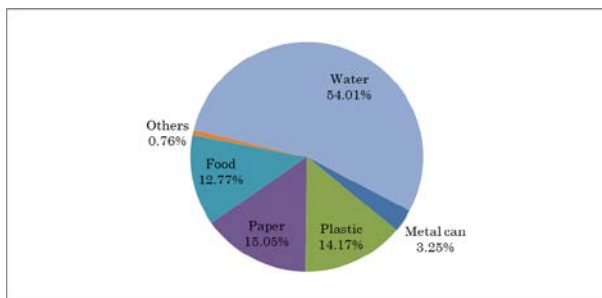

Figure 6: General Components (ST06)   **Figure 7: Plastic Components (ST06)**
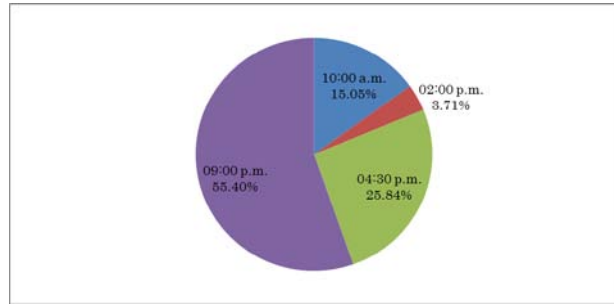
General components in Fig. 6 show that the biggest fraction belonged to "Water" with 54.01%. The fractions of "Paper" (15.05%), "Plastic" (14.17%) and "Food" (12.77%) occurred in almost the same frequency. "Metal can" (3.25%) and "Others" (0.76%) were collected only in a small number.

The total quantity of plastic waste of ST06 during the four time intervals amounted 336 g. Plastic components in Fig. 7 show that "PET bottle" with 40.48% occurred in the first place. "Plastic bag" (24.70%), "Recyclable plastic product" (17.56%), "Plastic container" (11.31%) and "Plastic cup" (5.65%) were subsequently detected. The quantity of "Other plastic (non-recyclable)" occurred only with 0.30%.

The total quantity of paper amounted 357 g. The paper components in Fig.8 show that the biggest fraction belongs to "Other paper (non-recyclable)" with 75.91%. The second biggest fraction amounted is "Paper cup" with 12.04%. "Recyclable paper product" (7.84%) and "Paper bag" (4.20%) are slightly smaller than "Paper cup". The fraction of "Paper container" is not occurred.
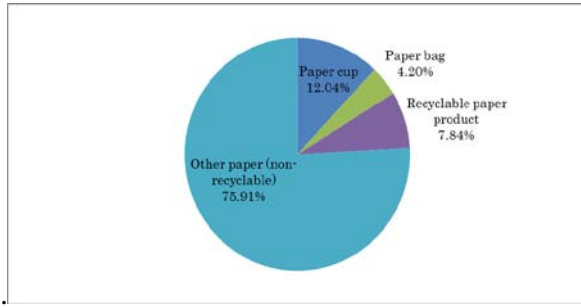
Figure 8: Paper Components (ST06)　　　**Figure 9: Temporal Change of Waste Analysis (ST06)**

As for the temporal change of the waste analysis, Fig.9 shows that the biggest quantity of waste was detected at 9:00 p.m. with 55.40%, More than a quarter of the waste at ST06 was collected at 04:30 p.m. with a quantity of 25.84%. At 10:00 a.m. (15.05%) and at 02:00 p.m. (3.71%) wastes were subsequently detected.　Time averaged waste discharge (%/hr) are 1.2, 0.9, 10.3, 12.3 during 21:00-10:00, 10:00-14:00, 14:00-16:30, 16:30-21:00, respectively.　This result suggests waste discharge is much higher after noon than before noon because tourists tend to go shopping and eating after noon to evening.

3.　Surveying of Tourist Waste Separation behavior

The Survey took place at JP square near ST06 over a period of January 19, 2013. A total number of 193 people were surveyed about their waste separation behavior. The questionnaire consisted of 16 questions about age, origin, waste separation behavior etc. In the following sub-paragraphs the 16 questions are being analyzed and evaluated.


Picture 4　Prototype waste separation bin and questionnaire survey at JP squre.

1)　Attributes of respondents

Among the 193 questionnaire respondents, the majority of the respondents (66.32 %) are female. More than half of all the respondents (56.48%) are between 20 and 30 years old, and 19.17% of the respondents are between 30 and 40 years old. Most of the surveyed people are single (66.84%). As for nationality, most of the surveyed people are Japanese (86.01%), the other 13.99% are distributed among 7 countries in Fig.14. Country of residence is almost similar to nationality. As for occupation, most of the respondents are business persons (44.04%), the second is students (24.87%). The remaining 31.09% are distributed among housewives (9.84%), others (8.29%), and professionals

(5.70%). As for staying, in Fig. 11, most of the surveyed people are tourists (89.64%), inhabitant (4.15%) and others.
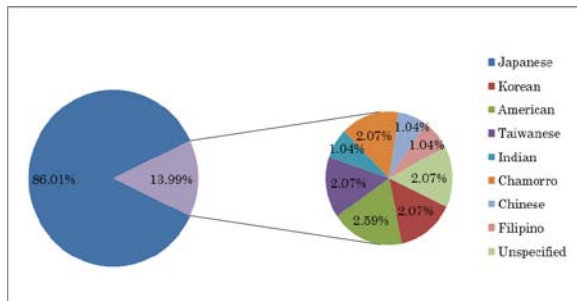
Figure10: Nationality
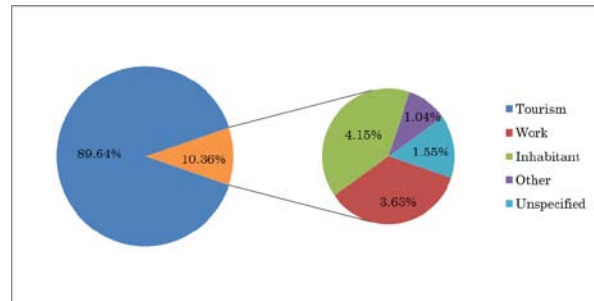
Figure11: Purpose of Staying in Guam

2) General interest in environmental activities

As for the general interest in environmental activities, most of respondent has the interest, but the strength has wide variation. As for recognition level of waste separation bin, that means whether the prototype separation bin, which was prepared for the purpose of this questionnaire survey, can be identified when at first glance. Most of the respondents noticed the waste separation bin easily (59.07%) or at least in general (31.09%). Also recognition level of waste separation categories of the bin, as the result, most of the surveyed people (92.75%) could recognize the different kinds of waste chambers through labeling.

3) Willingness to waste separation

As for the willingness to dispose their generated waste separately, most of the people (66.32%) are willed to separate their generated waste. 27.46% of the respondents have no waste to separate. As for the tourist's waste generating in other countries, more than half of the respondents (58.03%) have been aware of tourist' s waste generating in other countries. 37.31% did not notice waste generating much; 3.63% did not notice it at all. As for waste separation on a routine basis in the respondent' s household in their hometown. 91.71% of the surveyed people separate their waste regularly.

4) Behavior of Waste Separation in Travel Destinations

As for the respondents in waste separation in travel destinations, 59.59% of the respondents separate their waste regardless of travel destination. 36.79% of the respondents separate their waste in travel destinations. As for the participation willingness of the respondents when seeing others separating, 63.73% of the surveyed people would follow waste separation when seeing someone doing it. 31.61% of the respondents are already participating regardless of seeing someone doing it. As for respondent's opinion about the necessity of waste separation in Guam, 81.96% think that waste separation is absolutely necessary, 13.40% think that it is necessary if Guam has trouble. As the result of question about whether tourist's participation to waste separation relies on governmental decision is inquired, 70.47% of the respondents would separate their waste regardless of Guam

government's decision, and 28.50% of the surveyed people would participate if Guam government thinks that it is necessary.

5) Comparison between foreigner and inhabitant

Most inhabitants have strong interest in environmental activities (62.50%), and more than foreigners' interest (12.40%). Most inhabitants have willingness to separate their waste (87.50%), and more than foreigners' willingness (65.41%). Almost all of the inhabitants and tourists would participate in waste separation either regardless (Foreigners: 70.81%; Inhabitants: 62.50%) or if Guam government thinks that it is necessary to separate waste (Foreigners: 28.11%; Inhabitants: 37.50%). It is found that inhabitants in Guam have high acceptance for waste separation.

CONCLUSION

1) Summary of checking candidate positions for Waste Separation Bins

The following Table.1 shows recommended locations which were chosen for placing the separation bins according to the analysis of pedestrian density, building count and specific locations. Due to the data, 25 waste separation bins can be placed appropriately. The remaining five waste bins are going to be placed in regular intervals in the most crowded area due to pedestrian density.

Table 1: Recommended locations for separation bins

Station	Amount of donated waste bins	Reasons
ST02	1	Building Count
ST04	1	HPD/Building Count
ST05	1	Building Count
ST06	1	HPD/Building Count
ST07	1	HPD/Building Count
ST08	2	HPD/Building Count
ST09	1	HPD/Building Count
ST13	1	Many Bus Stops in Short Distances
ST10	1	HPD/Many Bus Stops in Short Distances
ST14	1	HPD/Many Bus Stops in Short Distances
ST16	1	Bus Stop With Access to the Beach/Bldg. Count
ST17	1	Bus Stop With Access to the Beach/Bldg. Count
ST18	1	Building Count
ST21	1	HPD/Building Count
ST22	1	HPD/Building Count
ST25	1	Guam Visitors Bureau for Representation
SS01	1	HPD/Famous Sight Seeing Spot
SS06	1	Building Count

SS07	1	HPD/Building Count
Total	*20*	

Additional Places		
UOG	2	Gift to Guam University
Near Burger King	1	Potential Waste Accumulation Spot
Fujita Road	1	Direct Access to the Beach
San Vitores Ln.	1	Access to the Beach
Total	*5*	

2) Summary of Waste Component Analysis

According to the analysis the two biggest fractions had been "Others" and "Water". The waste, which belonged to "Others", was for example green waste, cigarette stubs, stones or diapers. All this kind of waste is not recyclable. The analysis showed too that there is a big potential to recycle, because more than half of the separated waste is recyclable, like "Paper", "Plastic", "Metal can" and "Glass bin". The analysis of the plastic components showed that most of the disposed plastic waste belonged to "PET bottles". But also the amount of "Plastic cup" and "Plastic Bag" occurred in almost a third of the plastic waste. Most of these plastic products came from food shops or convenience stores which are located in the Tumon area very often. After the analysis of the paper waste, almost the half of the paper waste belonged to "Other papers (not recyclable)" as used tissues. The amount of recyclable paper waste as "Recycled paper products" and "Paper Cup" occurred on to a third of the collected paper waste. The analysis of the temporal change of the waste analysis shows that almost waste was disposed afternoon to evening. By the analysis of the collected waste during Thursday 17th of January 2013 the suggestion for the three chambers of the waste container are PET bottles, metal can and paper.

3) Summary of questionnaire survey

The respondents are foreigners especially Japanese, female, between 20 and 40 years of age. Since Japan already enacted waste separation policies, Japanese tourists are already used to obey separation laws and have the ability of separating waste. Additionally almost all of the respondents pointed out that if Guam government would decide waste separation as a policy, they would follow the adopted laws. The waste separation bin can be identified easily by its design and size. The different waste categories of the bin are also recognized easily. The overall willingness for waste separation is high. Since a lot of the respondents already separate on a daily routine household basis, separation in tourist areas would not be highly challenging for them. This means that almost all of the respondents already know how to do waste segregation. The remaining people who are not introduced in waste separation so far declared that they would separate their waste after watching other people doing it. Furthermore even as being tourists most of the respondents are willing to separate in travel destinations like Guam. Since local population are also highly interested in environ-

mental activities respectively waste separation they would use and appreciate waste separation bins. They also might adopt separation on daily routine household basis.

Finally it has become evident that establishing separation container in the Guam tourist area, based on the answers of the 193 respondents, will positively be adopted.