Human Factor Difference of Japanese and Indonesian pipeline workers
–Psychological characteristics and “Setsugu”–

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This paper analyzes psychological attributes of Japanese lifeline construction workers and Indonesian lifeline construction workers. A questionnaire was administered to residents who have claimed complaint in the past. Most of Japanese workers pertained to answering “we thought it was safe” or “we did not think deeply”. On the other hand, Indonesian workers pertained to answering “we did not realize” or “we had forgotten”. Analysis of how Setsugu and communication would affect incidents and accidents, showed high relativity between reinforcing manners of Setsugu and reducing accidents applied in both countries. Therefore, substantial education to foster “Setsugu” manners would be significant for both countries.

Key words: *Human factor, Self-responsibility, Psychosomatic function characteristic*

1. INTRODUCTION

The author was involved in Indonesian Gas Council (PT.Perusahaan Gas Negara (PGN))'s pipeline construction work to supply the natural gas to Jakarta as the owners consultant from April, 2006 to March, 2007. Research on human factors of Indonesian workers was conducted followingly. Though there are many theses written on human factors, this is the only previous work comparing Indonesian people with the Japanese. Number of occupational injuries is increasing according to the recent statistics report[1), 2)] on serious injuries in Japan. Accidents caused by ignoring legal regulations or caused by human error in the violation of engineering plans or engineering guidelines, seem to be eminent among various causes of industrial injuries. On another hand, study was done on difference between the two nationalities, and how Indonesian workers maintain safety at construction sites to derive how Japanese workers could improve their perception on safety. Japanese workers' awareness on safety could be increased by studying the difference of safety perception between the two countries, and by studying security management at construction sites in Indonesia.

2. DEFINITION

(1) Setsugu

“Setsugu” in this paper, means 1) motivation, 2) courtesy manners, 3) morality, and 4) generosity or mercy. It is not equal to the English word “Hospitality”, which presumes that there is a host and a guest who receives this hospitality. However, according to Japanese mentality, every task or work should be carried out with a sense of hospitality. In practical work experience, hospitality should be expressed in order to satisfy the customers and members of different departments and other working process who are working together. Survey on Japanese mentality regarding how Japanese think of “motivation”, ”manner”, “morality”, “mercy”, showed that the order of importance is Motivation ‹ Manner ‹ Moral ‹ Mercy（National Web survey sample number =2,187）[3)]. Setsugu can be categorized into 9 types of requirements, and classified according to level of ability, and awareness level.（4M is defined as “Sestugu”.）（Table-1）

Table-1 Setsugu requirements and Awareness level[3), 4)]

Conditions	Level of ability	Awareness level
Necessary requirements	1. Bright and honest personality 2. Capable of making appropriate judgment and representation. 3. Properly dressed	Motivation Manner
Worker requirements	1. Possesses common sense and acts honestly. 2.Capable of taking appropriate actions and work in cooperation with others. 3. Understands cleanness. 4. Capable of enduring and paying efforts.	Motivation Manner Morality Mercy
Service knowledge	1.Understand the importance of servicing others 2.Understands the effect of servicing others 3.Capable of utilizing servicing techniques.	Motivation
Worker knowledge	1.Understands the term of the Chamber of Commerce and Industry.	Motivation
Social knowledge	1.Possesses social common sense and capable of understanding current topics.	Motivation Manner
Human relationships	1.Capable of corresponding in human relationships.	Manner Morality Mercy
Knowledge on customer service	1.Understands customer psychology and express Intelligence. 2.Understands and show ordinary manners 3.Capable of expressing appropriate manners in front of customers.	Manner Morality Mercy
Conversation	1. Speaks polite and welcoming words. 2. Speaks intelligently in front of customers. 3. Able to present, explain and convince customers.	Manner Morality Mercy
Attire	1. Dresses appropriately in front of customers.	Motivation Manner

(2) Mercy

The word “Mercy” used in this paper does not mean “tolerance” in English. Tolerance in technical terms means “allowance” or “general variance”, but in primary meaning it signifies “to tolerate”. Secondary meaning is “generosity”. In this paper, “Mercy” means “mercy or generosity” as primary meaning. Thus, “Mercy” in this sense refers to individual sense of morality subordinate to social ethics.

3. CONSIDERATION ON ANALYSIS MODEL

3.1 Physical and Psychological Analysis

Physical and Psychological attributes of Japanese workers and Indonesian workers should be revealed by conducting a questionnaire by 4 categories, 1) Understanding the situation, 2) Decision making, 3) Emotional State, 4) Motional activities.

3.2 Heinrich's law

Heinrich's law drawn by Herbert William Heinrich of the United States, is frequently used in on site safety education to analyze occurrence probability of labor accidents. According to Heinrich's law, there are about 300 small incidents which may give a little chill and a gasp but did not lead to injury, and 29 small injuries behind one big serious disaster. The same law can be applied to probability in business failures, for example there are 29 customer complaints behind one serious trouble and at the same time, a problem can come under light because of one complaint. Furthermore, there may be 300 employees who might have thought "oh! Boy!" but since no complaint aroused the small mistake might have been ignored or neglected behind the scene.

3.3 Relationship between Setsugu and Communication

Communication is often referred to exchange of dialogs and words between two people but there are non-verbal communications as well. Especially with incidents which gives little "chill and gasp" , there will be no affirmative action taken. On the other hand, Setsugu is considered as manners and etiquette for to lubricate communication. On site activities may include 5 S (Seiri meaning organizing, Seiton meaning neatness, Seisou meaning cleaness , Seiketsu meaning sanitary and Shitsuke discipline) , compliments and salutations, confirmation procedures by pointing out verifying objects. Since lifeline sites are often near public roads and recognized by stakeholders that construction works should be carried out without being seen as a risk. Consequently, it is important to recognize that communication and Setsugu are closely interrelated, and to be aware that stakeholders would perceive construction work as "danger" or as "trouble", if either one of communication or Setsugu is lacking.

3.4 Communication and Setsugu Model

Relationships between incidents and accidents are described in Heinrich's law and density of communication at work site is important in performance (execution of the task). Therefore, how much effect of communication and Setsugu which account for larger part of verbal communication will have on incidents and accidents, is studied, then the number of incidents and accidents should be reduced. In order to grasp the relationship between communication and Setsugu, a new model is designed to generalize the object of research using the covariance structure analysis model[3),4),5),6)]. (Figure-1)

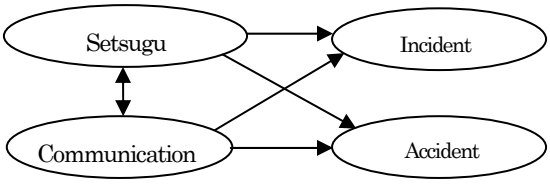

Figure-1 Influence model of communication and Setsugu

note) This model was based on the findings[3)] that enforcing Setsugu would reduce of accidents.

4. RESEARCH METHOD

4.1 QUESTIONNARE SURVEY

(1) Investigation object

Psychosomatic function Characteristic Questionnaire survey (conducted to workers)

①Psychosomatic function of workers at pipeline construction is analyzed.

Term: Conducted in both countries from April 2009 to December 2009. Result of psychosomatic function characteristic analysis was drawn from the answers "yes" or "no", to 3 questions for each characteristic category including, 1) Understanding of the situation, 2)Decision making, 3)Emotional state, and 4)Motional activity[7)] . (Table-2)

②All workers were male in both countries.

③219 were Japanese respondents and 242 were Indonesian respondents.

④Table-2 was used for correspondence analysis.

Table-2 Psychosomatic function Characteristic [7)]

Characteristic- category	No	Questions
Understanding of the situation	1	Did not perceive well
	2	Did not recognize
	3	Forgot about it
Decision making	4	Did not know
	5	Did not think enough
	6	Thought there is no problem
Emotional state	7	Felt hastened
	8	Felt impatience , irritated
	9	Felt tired
Motional activity	10	Moved hands unconsciously
	11	Had some difficulty moving
	12	Lost balance physically

(2) Examination of relationship between communication and Setsugu can affect incident and accident (Administered to complaint claimers)

① Japan

a. Selection of research area and decisions

a-1 Process of Selection

Preliminary research was conducted on internet to a national level during period of March 21st to 23rd in 2009, regarding reliability of gas supplying companies. Gas supplying industry was selected as object of research since it was presumed that there would be differences in service between the publicly owned and privately owned gas companies. Total of 2,104 results were obtained from 1,123 males and 981 females of ages from 20 up to 69. The result of analysis based on Chubu district revealed that reliability of gas supply companies (Natural gas supplier) is higher in Kanto (eastern) area and Kansai (western) area than reliability of gas supply companies in local cities.

This proved that as much as stakeholders remembered about disasters of gas accidents in the past, they were concerned that security, Setsugu and technology are necessary conditions to guarantee reliability[8)] Therefore, areas which are further north of Chubu district are selected as subject of research, considering that both large cities and local cities are included. Companies selling to stakeholders who are appropriate for research were selected out of approximately 240 gas supply companies (natural gas supplier) which exist nationally. (Table-3)

Table-3 Reliability of gas supply companies [8)]

Areas applied	t Statistical value	p value
Hokkaido	0.196	0.845
Tohoku	0.132	0.895
Kanto	4.206	<0.0001
Chubu	standard	————
Kinki	3.551	0.000392
Chugoku	0.743	0.457
Shikoku	0.559	0.576
Kyusyu	-0.211	0.833
Security	7.661	<0.0001
Setsugu	7.329	<0.0001
Technology	6.770	<0.0001
Public relations	1.318	0.187

Note) 1) Sample average of sample distribution of X_{mean} when distribution is unknown, is defined as t statistics with the following equation;
$t = (X_{mean} - \mu) / \sqrt{(s^2/n)}$
2) Possibility of observing a more extreme statistics than statistics data from actual calculated value under Null hypothesis is called the p value.

a-2 Selecting measures of research area of complaints

Considering among stakeholders of private and public enterprises in cosmopolitan cities and rural cities, Tokyo 23 districts and Nagoya city which was examined in preliminary research, were selected as necessary subject for studies. In cosmopolitan cities, lifelines except upper and lower water pipeline and highways are already under private owned. Especially 96% of gas enterprises are privately owned and only 4% remains public owned. In rural cities, there are still public owned companies among lifeline companies other than upper and lower water pipelines and highways. In rural cities, larger percentage of areas use LP gas (propane gas) compared to cosmopolitan cities and center cities in rural areas. Therefore lifeline conduits (duct, vessels) must be maintained and areas with actual demand of more than 50,000 households must be selected. This is because, when there is less household demand, number of complaints from stakeholders are presumably less and effective response rate of conducting the research in large scale would be low. Considering above conditions, research on 4 areas in Kanagawa city which is operated by Kanazawa corporate bureau (household demand of 77,000) as one of the local cities in Chubu area managed by gas bureau in Sendai city in Tohoku (household demand of 362,000) should provide appropriate results for further analysis.(Table-4)

Table-4 Research area of lifeline administrator and operator

Category	Name of city	lifeline operation category			
		Electric power	Gas	Upper & lower water pipeline	Road
Cosmopolitan cities	Tokyo 23district	A Electric Power	E Gas	Tokyo metropolitan	Federal and municipal organizations in rural areas
	Nagoya	B Electric Power	F gas	Nagoya city	
Rural cities	Sendai	C Electric Power	G city Gas bureau	Sendai city	
	Kanazawa	D Electric Power	H city corporate bureau	Kanazawa city	

a-3 Research Measures

Questionnaire research on internet was conducted in 4 areas selected by as in Table-3. Response was obtained from registered respondents at "Corporation I". Therefore, respondents were limited to those who are capable of using PCs and e-mails to respond to the questions. Further, in order to avoid concentration of response from one area, response from each area was limited to 500 samples and research was terminated soon after 500 samples were obtained. Therefore number of samples from 4 areas totaled number =2,000. Number=382 samples were collected as stakeholders who claimed complaint in the past. Since parameter to gain reliable results for using covariance structure analysis in the hypothetical model is generally said to be bigger than sample number =200, n=382 samples collected for this study should provide some legitimacy in research. Subsequently, covariance structure analysis was conducted to complaint claimers (Sample number =382) Questions were asked on complaints and reasons for discontent toward lifeline construction. Based on the hypothesis, questions were categorized into following 4 types, "questions on Setsugu", "questions on communication", "questions on incidents" and "questions on accidents" asking 18 issues. Number of questions were allocated equally, 6 questions were asked on Setsugu, 4 questions asked on communication, 4 questions asked on incidents and 4 questions asked on accident, which amounts to 18 questions in total. Response to the questions were answered in 5 levels; "applies" when the answer apply, "in a way applies" when the answer apply partly, "cannot say" when the answer is unclear, "in a way it does not apply" when the answer is partly inapplicable and "does not apply" when answer does not apply at all. Web research was conducted for 5 days from December 17th to 21st in 2009. (Table-5)

Table-5 Reasons for complaint and discontent

Category	No	Questions
Setsugu	1	Workers were impolite and treated you rudely.
	2	Workers did not act promptly.
	3	Workers used bad languages and rude words.
	4	Worker's expressions and tone of voice were dark and unpleasant.
	5	Workers clothes, nails and hair were not kept clean and properly.
	6	Workers were smoking cigarette and joking during work.
Communication	7	Did not listen to you before deciding on construction matters.
	8	Workers decided on construction matters one-sidedly
	9	Workers way of handling construction works lacked enough explanation
	10	Precautions were not made before starting construction.
Incident	11	There were much noise and vibration.
	12	There was water leak and fowl smell.
	13	Construction tools were lost and found.
	14	Road was left un-cleaned.
Accident	15	There were inconvenience and damage by construction
	16	Were hit by stone and concrete
	17	Electric・gas・telephone was out of order.
	18	Existing objects were damaged and broken.

② Indonesia

Lifelines are managed by nationally owned companies in Indonesia, that cases true to Japanese lifelines do not necessarily apply. Research areas included Indonesian cities where lifeline infrastructures have already been developed so that same level survey can be conducted as Japanese lifelines. Number of samples is limited to 500 per area, same as with research on Japanese lifelines and investigation was terminated as soon as 500 samples were gathered. Therefore, hearing research was conducted on complaint claimers according to questions in Table-5, large cities such as Jakarta city (Cosmopolitan), Surabaya city (Second big) and local cities such as Bekasi city (city ware lifeline is developed and many workers commute to Jakarta to work) and Bandung city (city located in the highlands where National University of Technical Engineering and Institute of Technology is situated as well as wealthy villas) .It was sample number=106 in Jakarta, n=67 in Surabaya, n=29 in Bekasi, n=92 in Bandung, obtaining total of n=316 as effective data. At once, It researched recognition of Self-help of Indonesian. (n=864) Research followed previous research.

Research was conducted between December 27th 2009 to January 4th and April 30th to May 5th in 2010. All of the Republic of Indonesia lifeline are State-owned companies. Therefore, 4 regions were selected as samples from areas where local lifeline are well organized.[9] Tap water cannot be drunk as drinking water. In addition, although highways and main road of the city and suburbs and rural roads have been paved, some roads in the suburbs and rural roads are left unpaved. Like when selecting regions of Japan, reliability of gas supply companies is studied in order to select a region. All regions are noted under Java, since the local collaborator excluded areas where security issues and lifeline is not maintained. (Table-6)

Table-6 Reliability of gas supply companies [9]

Areas applied	t Statistical value	p value
Bandung	standard	———
Bekasi	2.623	0.00037
Jakarta	4.557	<0.0001
Yogyakarta	0.145	0.936
Surabaya	3.279	0.00023
Security	4.536	0.00024
Setsugu	5.331	0.00017
Technology	2.517	0.048
Public relations	0.101	0.361

Note) 1) Sample average of sample distribution of X_{mean} when distribution is unknown, is defined as t statistics with the following equation;
$t = (X_{mean} - \mu) / \sqrt{(s^2/n)}$
2) Possibility of observing a more extreme statistics than statistics data from actual calculated value under Null hypothesis is called the p value.

4.2 RESEARCH METHOD

(1) Mental and physical analysis

Correspondence analysis approach is applied in the mental and physical analysis. Correspondence analysis shows strong influence of Japanese workers and Indonesian workers and factors contributing to mental and physical problem.

(2) Complaint and dissatisfaction analysis

Covariance structure analysis approach is used in the complaint and dissatisfaction analysis. Covariance structure analysis enables to measure the impact of complaint and dissatisfaction. Model explanation is proven to be liable if the values of GFI (Goodness of Fit Index), AGGI (Adjusted Goodness of Fit Index), CFI (Comparative of Fit Index)) should exceed 0.9. Covariance structure analysis according to AMOS[10] was conducted on data obtained from questionnaire administered to those who were given the role as stakeholders (Sample number =382 and 316) .

5. RESULTS

5.1 Characteristics of Japanese and Indonesian workers' psychosomatic function

Careful examination of an incident will lead to understanding of underlying claims, which will eventually lead to prevention of accidents. When an incident report is analyzed, there are much more factors that must be learned from OJT (On the Job Training) at workplace. These factors obtained through OJT education are "knowledge", "technical skills" and "attitude". Relationship between incident report and OJT is modeled in Table-2 which divides in to the following categories; 1) Understanding of the situation, 2) decision making, 3) emotional state, and 4)motional activity. (Table-2) From Table-2, difference in what needs to be strengthened in OJT education, according to their inter-relationship and individual characteristics, is shown. Correspondence analysis reveal that "First dimension is Decision making and Emotional state" and "Second dimension is Understanding of the situation and Motional activity". When Correspondence Analysis is conducted for both Japanese and Indonesian workers, Japanese incident cases applied to "Thought there was no problem" of "did not think thoroughly" and Indonesians incident cases applied to "Did not notice" of "had forgotten about it". On one hand, Japanese cases rarely apply to "Unconsciously moved the hands", "Lost physical balance" and "Could not see". Indonesians rarely apply to "Felt irritated", "Felt hastened" "Felt tired". Therefore Japanese workers tend to lack decision making capability. On the other hand Indonesian workers tend to lack understanding of the situation. Each axial contribution was, 0.786 for first dimension, 0.212 for second dimension and cumulative contribution of 0.998. (Figure-2)

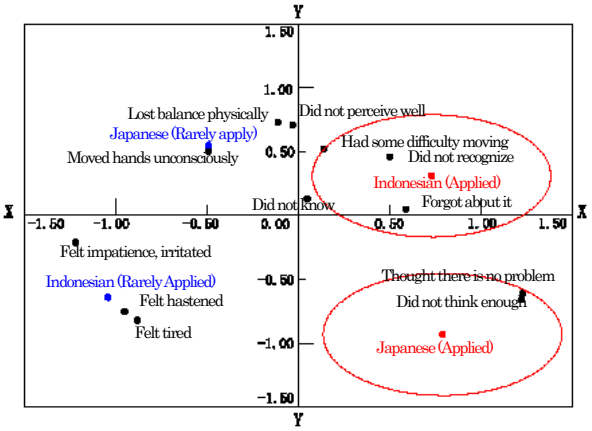

Figure-2 Characteristics of Japanese and Indonesian workers' psychosomatic function

5.2 Condition at construction

Construction works are often conducted throughout the night in Japan. Traffic control is conducted under police surveillance especially when there is heavy traffic. Contrary, there are not so many construction works carried out during the night in Indonesia. Even when there is heavy traffic, the road is excavated under individual responsibility. Then excavated dirt (mud) which would have been carried away by Japanese workers would be left stacked on the road side by Indonesian workers. This kind of construction work procedure is prohibited in Japan. (Photo-1)

1) Construction condition of Japan (Night time)

2) Construction condition of Indonesia (Day time)

Photo-1 Construction condition

5.3 Relationship with incidents and accidents regarding communication and Setsugu

Covariance structure analysis was conducted based on questions shown in Table-5 to study Japanese complaint claimers in actual experiences by stakeholders. Results showed, GFI (Goodness of Fit Index)=0.933 , AGFI (Adjusted Goodness of Fit Index)=0.881 , CFI (Comparative of Fit Index)=0.943 and RMSEA (Root Mean Square Error of Approximation)=0.092. Values obtained here, exemplify the reality of stakeholders' complaints although they may not be perfectly precise. Nevertheless, judging from the fact that there is a similarity between the reality of complaints by telephone calls in 2007 and actual figures shown as GFI and CFI, reliability of the model marked above 0.9. χ^2=540.8, and Significant probability marked below 0.0001. Results of analysis showed strong relativity between communication and Setsugu of 0.78. Setsugu has 0.5relativity towards accidents and 0.46relativity towards incidents. On the other hand, communication had 0.4relativity towards accidents and 0.49relativity towards incidents. In general, if GFI, AGFI and CFI values are more than 0.9, then it is safe to say that the influencing coefficient is liable. If RMSEA is below 0.05, then it can be said that the model is suitable and if it is more than 0.1 then it is unsuitable. (Figure-3)

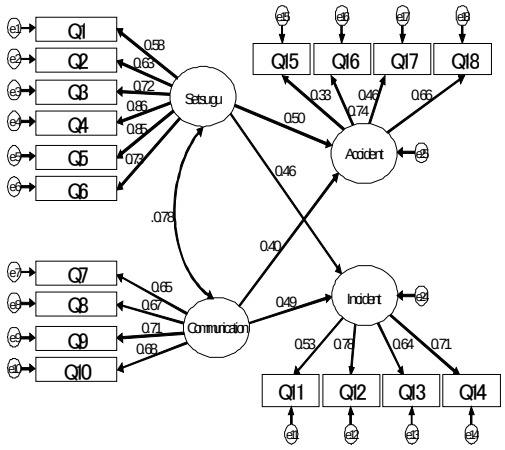

Figure-3 Communication, Setsugu relativity regarding incidents and accidents in Japan (n=382)

note) It is same that Q18 fromQ1 for Table-5.

Similarly, results showed that Indonesians' RMSEA exceeded 0.1 and thus model was inappropriate. Thus questions which were almost irrelevant as 0.2 to 0.3 regarding Setsugu and communication were omitted to reexamine the model, a new model was established to prove relativity of incident, accident regarding communication and Setsugu. New results showed GFI=0.911, AGFI=0.881, CFI=0.923 and RMSEA=0.084. Setsugu, Communication, incident and accident are interested in both Indonesia and Japan relevance ration was around 0.8 between Setsugu and communication in both countries. (Figure-4)

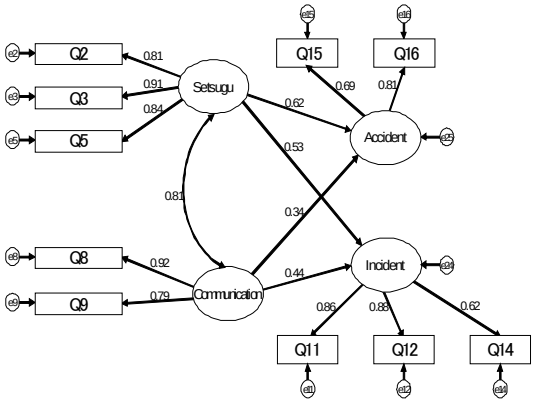

Figure-4 Communication, Setsugu relativity regarding incidents and accidents in Indonesia (n=316)

note) It is same that Q16 from Q2 for Table-5.

The fact that lack of Setsugu lead to incidents and accidents is also shown in Indonesia's incident and accident statistics (n=243,774/3years).[2] Under insecure (unsafe) conditions, 67.9% of work accidents are due to lack of security. 64.4% of work accidents are due to lack of FIVE S in the insecure (unsafe) actions. Lack of basic (fundamental) confirmation lead to incidents and accidents .[9), 11)] (Table-7)

Table-7 Work accidents Statistics in Indonesia

a) Work accidents by unsafe conditions ranking dangerous conditions ration

Ranking	Dangerous conditions	Ration (%)
1	Lack of safety protection by uniform and facility	23.7
2	Lack of safety protection by equipment	17.0
3	Inappropriate conditions	13.9
4	Usage of inappropriate tools and materials	13.3
Total		67.9

b) Work accidents by unsafe actions

Ranking	Dangerous conditions	Ration (%)
1	Loss due to selfish actions and neglect of giving appropriate instructions and warnings	24.1
2	Loss due to using useless safety equipment	20.9
3	Loss due to using dangerous facility without equipments.	19.4
Total		64.4

Sense of self-reliance of Indonesian is stronger than Japanese. 44.22% of Japanese answered "always apply" or "apply". 67.24% of Indonesians answered (Table-8) "always apply "and "apply".

Table-8 Self -reliance Ratio

Nationality	Ratio of always apply or apply (%)
Japan(n=1,108)[12)]	44.22
American(n=1,007)[12)]	71.61
Indonesian(n=864)	67.24

note) The workers were asked the question whether or not if "he thinks everything should be done himself".

P value etc, of Japanese and American was $p<0.001$ and χ^2=494.1.

6. DISCUSSION AND CONCLUSIONS

6.1 Characteristics of workers' psychosomatic function

Thinking that "there would not be any problem" or "not thinking carefully" may have lead to an accident in the case of Japanese workers. In the Indonesian worker's case, "forgetting" and "did not recognize" may have led to the accident. (Figure-2) Moreover, motion activities which are typical to Indonesians, show similar results as in Table-7. From OJT, "Work habits due to assumption offer lead to accidents" is evident that self-recognition and should be strictly enforced as" FIVE S (Seiri, Seiton, Seisou, Seiketsu, Sitsuke)" has been enforced. In Indonesians case, it is likely that they "continue to work without understanding the situation" that KYT (Kiken Yochi Training) should be employed to related workers including supervisors. Furthermore according to incident report, both countries should implement risk management to increases worker's self-recognition that "One should think of one's self-responsibility" under the man-to-man training to encourage "One to prevent one's own risk by one's self" and "Work attitude education" is important as is the case with technical education programs. Five S has already been a formal standard in Bekasi 's a factory. (Photo-2)

Photo-2 Factory of Bekasi (Indonesia)

6.2 Significance of education on Setsugu at lifeline construction

According to Strauss's (2002) factor analysis of customer satisfaction level research regarding satisfactory response in complaints[13] Primary factors include "appropriateness and fairness", "responsiveness" and "reliability". Secondary factors include "effectiveness and politeness" and "Sympathy and understanding". Looking further into this discussion, complaint claimer would categorize corporations' response into "cold reality" and "cordial behavior". If this is true, "responsiveness" which is classified as primary factor as well as "politeness and sympathy" as secondary factor would be considered as Setsugu. Therefore, it is appropriate that the Japanese respect Setsugu and maintain pleasant communication when dealing with incidents and accidents. On the other hand, when comparing the influence of Setsugu and communication on incidents , it is difficult to say either Setsugu or communication has significant advantage over another . However, it is safe to say that education to encourage both Setsugu and communication in lifeline construction would be essential to avoiding incidents and accidents. Workmen's apprenticeship owes much of its credit in Japanese culture, being transcended over the years to cultivate sense of self-control and self motivation. Training to "do what is decided" is not a systemized training to develop know how and technology.

Since incidents are prone to personal habits and faults, although attaining Setsugu and communication skill may be useful there should be other type of learning that must be implemented. In Indonesia, it is especially important to administer task as determined, and education Setsugu would contribute to reducing number of incidents and accidents. However above should be addressed to workers and as for the supervisors it is necessary to report daily progress and update on working schedule and measures in the weekly meetings. These discussions and conclusions agree with construction risk evasion[5] and Domain-specific theory[14] .

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