A QUALITATIVE REVIEW ON ACCEPTANCE OF SILENT PILING TECHNOLOGY AMONG DESIGNERS IN MALAYSIA

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Abstract: Normally, the conventional method of piling that uses percussion, vibration or bored piles is less environmental friendly and may contributes to environmental problems. The study was conducted in order to identify the potential of silent piling technology for sustainable implementation. In addition, it is also useful to evaluate the acceptance of this technology and the level of technical knowledge among the engineers who are involved in construction industry, especially in Malaysia. Qualitative research using questionnaires was considered for this study in order to gain relevant information. The questionnaire was distributed to 43 companies that are registered under ACEM (Association of Consulting Engineers Malaysia). The result shows that there is a great potential for silent piling technology in Malaysia. The technology is accepted among designers at the highest level. Meanwhile, the technical knowledge regarding silent piling technology is also at the highest level. In addition, the result also shows that Press-in technology is highly recommended for the construction industry for sustainable implementation. In conclusion, it is hope that suggestions and strategies can be synergized so that sustainable technology, such as Press-in technology, is applied in Malaysia. The technology is not only useful for the designer, but also the industry, local authorities and universities.

Introduction

The Japanese Ministry of Environment has established seven types of environmental pollution in the construction industry, which are air pollution, water and earth contaminants, bad odour, noise, vibration and ground subsidence [1]. Conventional dynamic piling methods are ill suited to urban development because of their adverse impact of deafening noise complemented by their earth shattering vibrations that has a rippling effect on the environment [2, 4]. Fig. 1.1 shows the public complaints during construction. The 'Press-In' method, with its silent and vibration-free driving process, may be the solution to the widespread problem of noise and vibration on construction sites [2].

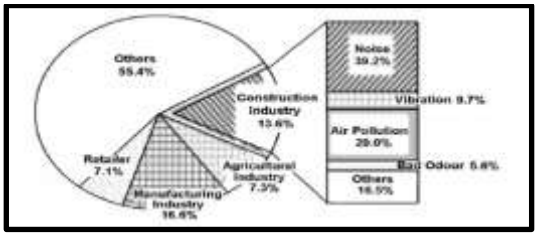

Fig. 1.1: Public Complaints during Construction [1]

Literature Review

Current Practice of Pile Installation Method in the Construction Industry in Malaysia

The conventional method for piling installation such as diesel hammer, drop hammer and vibratory hammer are ill suited in urban areas and has potentially produce the greatest source of noise and ground vibration. Nevertheless, conventional pile driving methods are still widely used in many construction sites though it is cause excessive noise, ground vibration and poses a risk in damaging critical structures [2]. Modern methods such as jacked-in pile, G-pile and silent piling technology are not familiar, because it seems to be costly compared to the conventional method.

Nowdays, the silent piling installation method has been implemented in the construction industry. Fig. 2.1 shows one of the construction site in which using this technology.

Fig. 2.1: The sheet pile installation at Bukit Serdang, Malaysia (2014)

Qualitative Research

Qualitative Data Analysis Technique

Qualitative technique was used to convert quantitative analysis by using Likert scale from questionnaire to qualitative analysis by interpreting simple explanations from the result.There are a number of other sources for data analysis and interpretation procedure that includes the use of computer software. SPSS is relatively simple and requires less than 2 seconds each for the personal computer to complete computing [4].

Quantitative Data Analysis Technique

A quantitative data refers to measurable and countable demographic and economic characteristics which cannot be accounted in numerical terms [5]. According to the previous research, this research method is typically considered to be the more “scientific” approach in conducting social science study [6]. In general, the procedure to perform the quantitative research is consists of instrumenting basedquestions, interpreting performance data, assessing attitude data, considering observational data and conducting statistical analysis [7].

Methodology

Questionnaire Design and Data Collection

Reliability analysis is an important analysis to determine whether our data in questionnaire is reliable or not before distribute to the respondents. For this study, pilot study was carried out with 20 respondents who are lecturers at the Sultan Mizan Zainal Abidin Polytechnic and engineers in the government sector such as JKR and JPS. Then, the pilot test analysis is made using the Statistical Package for the Social Science (SPSS) software in order to determine the reliability of the research tools. The Cronbach alpha coefficient obtained was more than 0.7, suggesting that the items have relatively high internal consistency.

For actual study, a set of questionnaires were distributed by post to 43 civil engineering consultant companies are registered with ACEM (Association Consultancy Engineering Malaysia). These respondents had to return the questionnaires to the researcher within 4 weeks. Theoretically,

response rate from respondents vary considerably to as much as 30%, generally. 20% response can be considered adequate and 80% response is considered to be high [8]. For this study, the sample size for data analysis was 52%, which are 22 companies registered with ACEM. Therefore, statistically it is acceptable and presentable to answer the research question.

Data Analysis

Reliability Analysis for Questionnaire

Table 3.1 shows the Cronbach alpha value from the reliability analysis. From the figure, the value of Cronbach's alpha is more than 0.6, so the data obtained by analysing the questions to achieve the objectives are verified. High level of reliability means the items or questions contained in the questionnaire can be used to measure the variables that are studied.Reliability means the items or questions contained in the questionnaire can be used to measure the variables to be studied and a good level of reliability is between '0.6 to 1.0' [9].

Table 3.1: Cronbach's Alpha Value

Objective	Cronbach's Alpha	Total Question	Description
The technical knowledge in silent piling technology	0.856	5	Acceptable
Potential of silent piling technology in Malaysia	0.946	7	Acceptable
Acceptance of silent piling technology	0.771	10	Acceptable
Implementation of sustainability in the construction industry by using the Press-in method	0.956	8	Acceptable
The demographic of the respondent	0.308	5	Not Acceptable

Result and Discussion

Frequency Analysis Section A (Demography)

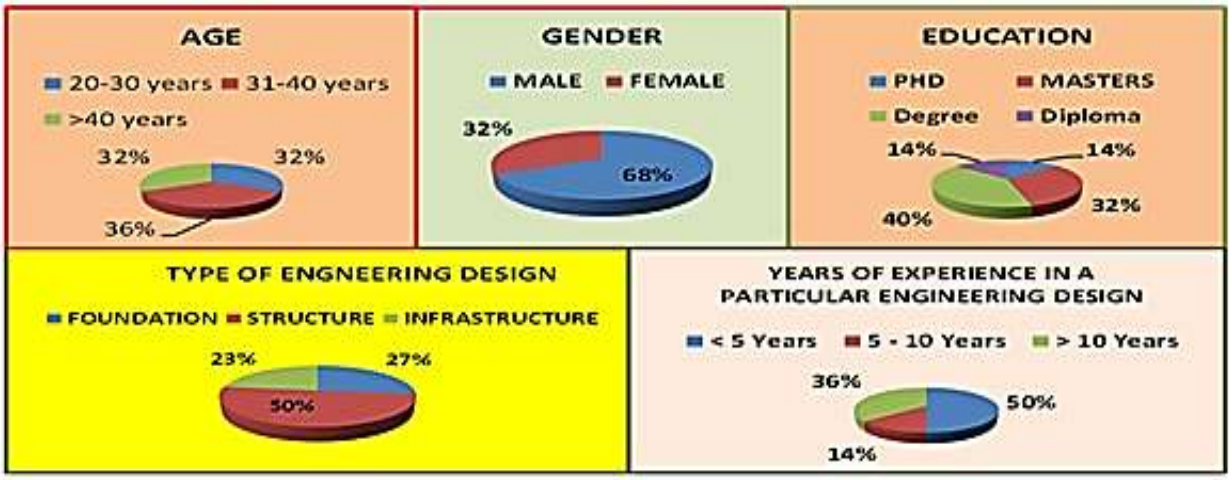

Fig. 4.1: Frequency Analysis for Section A

Fig. 4.1 shows frequency analysis for demography. Based on the graph, most of the respondent age was between 31 to 40 years old. Then, most of them are male engineers. On the other hand, the educations of respondents that involve in design are mainly bachelor's degree. Apart from that, structural engineers represent the highest percentage for the type of engineering design field based on their position. In conclusion, those who are active in responding to this questionnaire are young engineers that have experience in design of less than 5 years.

Frequency AnalysisSection B (Survey on Acceptance of Silent Piling Technologies and Sustainability)

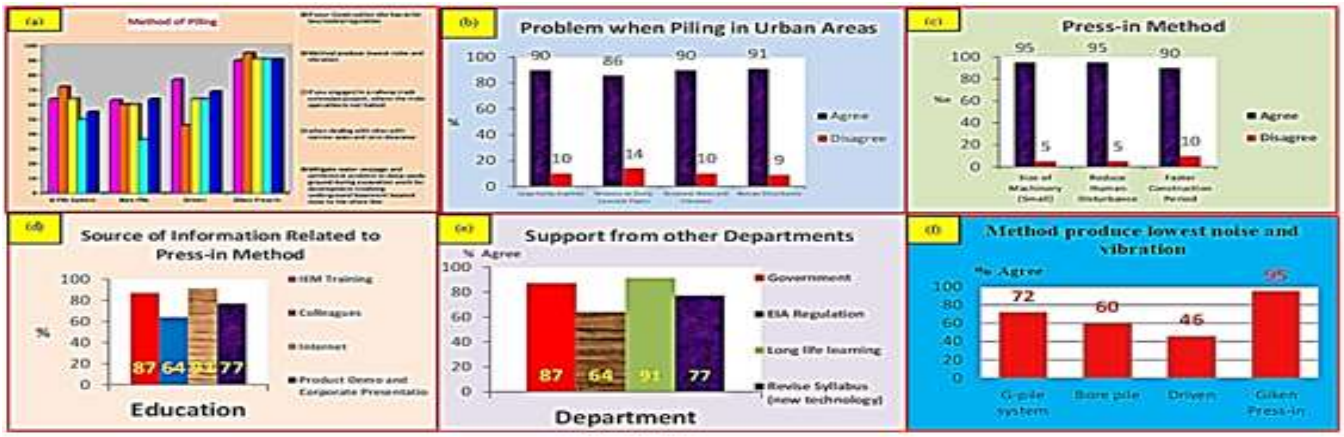

Fig. 4.2: Frequency Analysis for section B

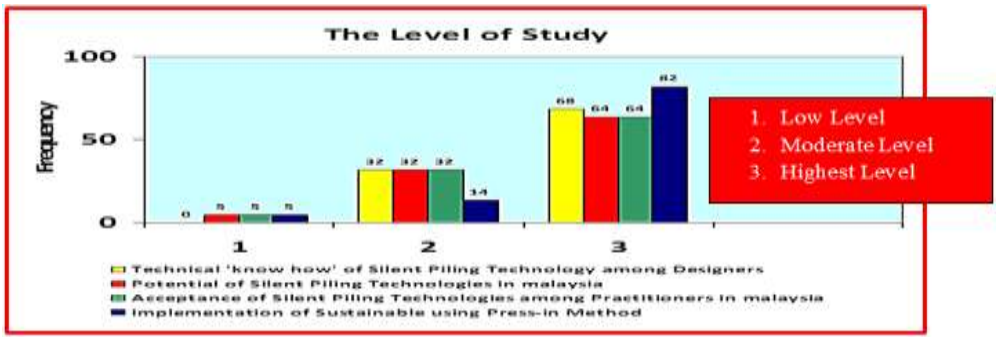

Fig. 4.3: Frequency Analysis (The Level of Study)

Based on the Fig. 4.2 (a), the Press-in method was the first choice or the method employed with the highest percentage to solve the problems faced by designers at the construction site.Graph Fig. 4.2(b) show the problem when piling in urban area and Fig. 4.2(c) shows that the potential of silent piling technology in the construction industry at the highest level with 64% (Level 3). In Addition, Fig. 4.2 (d) and Fig. 4.2(e) found that most designers agree to improve their knowledge and encourage other departments to support new technology in the construction industry. Therefore, it was found that the acceptance of silent piling technology among designers is at the highest level (Level 3). Based on Fig. 4.2(f), most of respondents agree that Press-in method was the method that produces lowest noise and vibration compared to driven method that produces highest percentage of noise and vibration. Finally, Press-in technology is highly recommended by designers that contribute 82% (Level 3). Fig. 4.3 shows the level of study from the frequency analysis that shows as ingraph above.

Correlation Analysis

Table 4.1: Correlation between two variables
(Dependent variable: Potential of Silent Piling Technology in Malaysia)

Independent variable	Pearson Correlation - r	Description
Technical knowledge	0.590	Positively strong
Implementation of sustainability in the construction industry	0.725	Positively strong
Acceptance of silent piling technology	0.734	Positively strong

Age of designers	-0.156	Negatively weak
Years of Experience in a particular engineering design	-0.344	Negatively weak
Highest designer's education	0.042	Positively weak

Table 4.2: P-level between two variables
(Dependent variable: Potential of Silent Piling Technology in Malaysia)

Independent variable	p (Significan
Technical knowledge among designers	0.004
Implementation of sustainability in the construction industry	0.000
Acceptance of silent piling technology among designers	0.000
Age of designers	0.48
Years of Experience in a particular engineering design	0.11
Highest designer's education	0.85

Conclusion

In conclusion, Press-in technology is highly recommended for the construction industry in Malaysia and especially employed by designers working in civil engineering consultant companies. In addition, the potential of this technology and its acceptance by practitioners in the industry is also at the highest level. In a nut shell, most of the respondents agree to consider silent piling technology as sustainable technology in the construction industry.This result may be useful not only for the designer, but also the industry, local authorities and for universities in order to shape and inculcate a more sustainable construction practice in Malaysia. In addition, this research can also introduce new knowledge to designers in Malaysia regarding to the new technologies that are practiced in many other countries such as Singapore, Japan and United Kingdom.

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