Awareness of the Installation the Lightning Protection System (LPS) by Using Structural Bonding Method in Malaysia

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Abstract. Structural Bonding Method (SBM) is one type of Lightning Protection System (LPS), design to protect human, structures, contents inside structures, electrical equipment, transmission lines and other from the lightning flash. Besides, SBM is a standard LPS that comply with technical standards or codes of practice or called as conventional Lightning Protection System. In order to know the level of the Awareness of the Installation LPS by using SBM in the building among Civil Engineering Consultants, conducting survey need to be done. This paper presents the Research Design and Research Strategy in conducting the survey. It is explaining about the way before conducting the survey which are determine the population of sample (Consultant Company at Northern Region Area), samples of respondents (Civil Engineer at Consultant Office with the number of sample is 40), data collecting process, structure of the questionnaire form and the way in analysis the data. After the analysis the data, the result of the level of awareness in the Installation of LPS by using SBM are consider as moderate level.

1 Introduction

Lightning is one of the natural phenomena, being a flow of electrical current between the earth and storm clouds, occurs as moving charges of positive and negative polarity build up in the atmosphere during a storm [1]. The protection against lightning had been increasingly used in the building to protect the building from the direct lightning impact. One of the methods is to embed the lightning protection cable in the concrete structure [2]. When Benjamin Franklin first experimented with electric charges in the 1700s using a kite, a key, and some string, he originally proposed that lightning rods could reduce or eliminate lightning by relieving the imbalance between clouds and the ground. However, he later realized that if the conductive metal rod was struck by lightning, then it worked to safely conduct lightning to the ground. In other words, the initial confusion was an issue of

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prevention versus attraction. It turns out that Benjamin Franklin was correct, and prevention is indeed an option for lightning protection but the technology would not be available for another 200 years [3].

The lightning protection system (LPS) can be defined as a complete system used to reduce physical damage due to lightning flashes to the structure and lightning caused surges on surges and data lines. Before the installation of Lightning Protection System (LPS), the user or consumer must make sure the LPS is comply with the standard due to the legal and safe installation. The lightning protection system divided into two types which are conventional and unconventional LPS. Conventional LPS is a standard LPS that is comply with standard while unconventional LPS are a non-standard LPS which are not comply with standard. Example, the air terminals associated with the unconventional LPS is the early streamer emission (ESE) and the charge transfer system (CTS).

In 2005, the International Conference on Lightning Protection (ICLP) issued a warning that the use of the unconventional LPS presents a danger to the end users [4]. Structural Bonding Method (SBM) is a type of Lightning Protection System that complies with the standard. SBM consist of three components which are Air Termination System, Down-Conductor System and lastly is Earth Termination System [5]. For the structural bonding system is the method where the LPS cable concealed within the reinforced concrete structure. In this method, the air termination system will be connected with the lightning protection system embedded in the reinforcement steel bars in the concrete column, ground beam and pad footing before discharge to the earth [6]. The objective of this research is to determine the level of awareness of the installation of LPS by using Structural Bonding Method (SBM) among Civil Engineer Consultant in Northern Malaysia.

2 Materials and methods

2.1 Population of sample and respondents

This survey was conducted at the Consultant Company in Perlis, Kedah and Pulau Pinang. The Survey was focus on the Civil Engineer at Consultant Company around the Northern Region Area. The targeted respondents are the Civil Engineer from Consultant Company. There will be around Forty-five (40) Civil Engineer selected from Northern Region Area.

Table 1. Population sample

State	District	No. of Respondent
Perlis	Kangar	5
	Arau	5
Kedah	Alor Setar	15
	Sungai Petani	10
Pulau Pinang	Perai	5
Total		**40**

In deciding the number of sample size, there are two ways proposed which are by using the calculation (used formula) and using the table provided by Krejcie and Morgan. The formula demonstrates the ways in determining number of sample size.

$$S = \frac{P(1-P)}{\frac{A^2}{Z^2} + \frac{P(1-P)}{N}} \quad (1)$$

where S = Sample size that determine, N = Number of population, A = Accuracy that needed (sampling error), P = Percentage of population that interested. Commonly, expected is 50 %, Z = Exact in distribution of sampling. Value of exact commonly used, (1.96 = 95 %, 1.64 = 90 %)

2.2 Data collection and analysis

In this research, Questionnaires will be used as the method in collecting the Primary data. Then, for the Secondary data in the other hand is the data already have been collected by someone else and have been passed through the statistical process. The data were obtained from the journal, related articles, thesis, books, organizational records or statistics and information from the internet.

2.3 Structure of questionnaire

Questionnaires design can be categories into three components which are to decide the questions to be asked, select the type of each question and finally, design of the overall layout of the questionnaire. The questionnaire was printed documents containing summarization about the Structural Bonding Method (SBM), instructions answering the questions, and lastly is to get answers from the respondents. In this research, the questionnaire form consist of two (2) sections which are sections I (Demographic of Respondents) and II (Awareness).

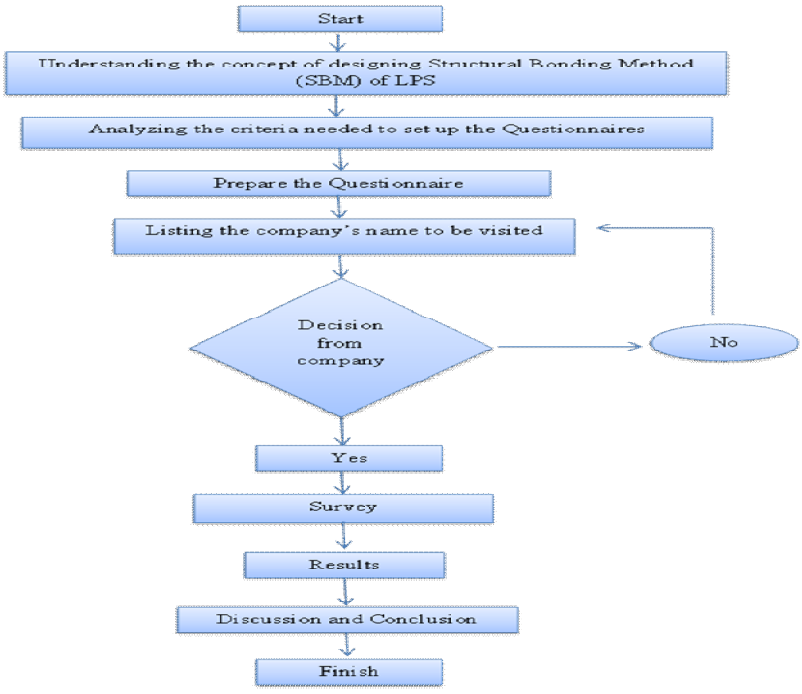

Fig. 1. Research framework

3 Results and discussions

3.1 Demographic of respondents

Table 2 shows the summary of the analysis of respondent's demographic information represents the major attributes of the selected Civil Engineering Consultants that used in this research.

Table 2. Demographic of respondents

Demographic of Respondents	Result
1. Gender of Respondents	Female (63.33 %)
2. Age of respondents	26 to 40 years old (50 %)
3. Respondents working in the Company	More than 5 years (43.3 %)
4. Respondents Experience	Less than 5 years (40 %)
5. Highest Education Level of Respondents	Degree Level (86.7 %)
6. Total Project Company involved	More than 40 Projects (53.3 %)
7. Values of Project	More than RM 10,000,000 (60 %)
8. Types of Project	Government building (33.3 %)
9. Sources of Information toward SBM	Internet and IEM (30 %)

3.2 Awareness of the installation of LPS by using SBM on company

Comprises of four (4) questions with the name of SWLS1 until SWLS4. Three (3) choices of answers are given which are Yes, No and Partially. Table 3 demonstrate the explanation of questions.

Table 3. Explanation of questions (part 1)

Number of Question	Question
SWLS1	Your company used Structural Bonding Method (SBM)?
SWLS2	Your company frequently uses Structural Bonding Method (SBM)?
SWLS3	You can differentiate between Structural Bonding Method (SBM) and other methods of Lightning Protection System (LPS)?
SWLS4	You participate during the designing of Structural Bonding Method (SBM) with Electrical Engineers?

Based on the Fig. 2, the percentage of the respondents are saying no with the question SWLS1 are 90 % and saying yes with the percentage of 10 %. In the question SWLS2, 83.3 % and 10 % of the respondent are saying no and partially. Only 6.7 % saying yes with the SWLS2 question. Besides that, for the question SWLS3, 46.7 % of the respondents are saying partially and 33.3 % saying no with the question. The respondents saying yes are 20 %. Lastly in the question SWLS4, the respondents saying no are 80 % and saying partially are 13.3 %. Then, the respondents saying yes in the question SWLS4 are 6.7 %.

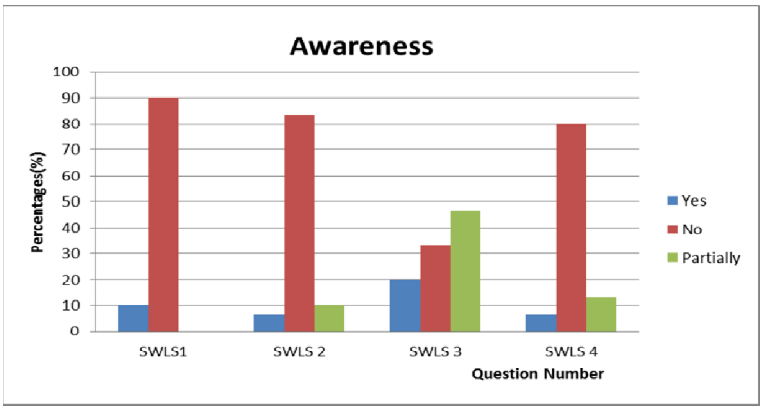

Fig. 2. Percentage of the awareness of installation of LPS by using SBM on company

3.3 Self-awareness of the installation of LPS by using SBM

This part consists of six (6) questions with the name of SWLS5 until SWLS10. Five (5) options of answers are given which is Absolutely Aware, Very Aware, Moderately aware, Slightly Aware and lastly is Not Aware. Table 4 shows the explanation of questions for Part 2.

Table 4. Explanation of questions (part 2)

Number of Question	Question
SWLS5	Installation of the Lightning Protection System (LPS)
SWLS6	Installation of the Structural Bonding Method (SBM)
SWLS7	Air Termination System of Structural Bonding Method (SBM)
SWLS8	Down Conductor System of Structural Bonding Method (SBM)
SWLS9	Earth Termination System of Structural Bonding Method (SBM)
SWLS10	The installation of down conductor embedded in the reinforcement

Based on the Fig. 3, the percentage of the respondents moderately aware with the question SWLS5 are 43.3 % and 26.7 % are slightly aware with that question. Besides that, 13.3 % of the respondents are absolutely aware and not aware with the question SWLS5. Then, 3.3 % of respondents are very aware of that question. For the question SWLS6, 53.3 % of the respondents are slightly aware and 23.3 % of the respondents are moderately aware with the question. Only 16.7 % of the respondents are not aware and 6.7 % are absolutely aware with the question SWLS6. In the question SWLS7, 40 % and 26.7 % of the respondents are moderately aware and slightly aware. The percentages of the respondents that are very aware with that question are 23.3 % and 10 % are not aware. In addition, for the question SWLS8, 43.3 % and 33.3 % of the respondents are slightly aware and not aware with the question. The 16.7 % of the respondents were moderately aware and 6.7 % were very aware with the question. For the question SWLS9, 60 % and 26.7 % of the respondents are slightly aware and not aware with the question. Then, 10 % of the respondents are moderately aware and 3.3 % of the respondents absolutely aware with the question SWLS9. Finally in the question SWLS10, 36.7 % and 33.3 % of the respondents are slightly aware and moderately aware. Besides that, 26.7 % and 3.3 % of the respondents are not aware and absolutely aware with the question SWLS10.

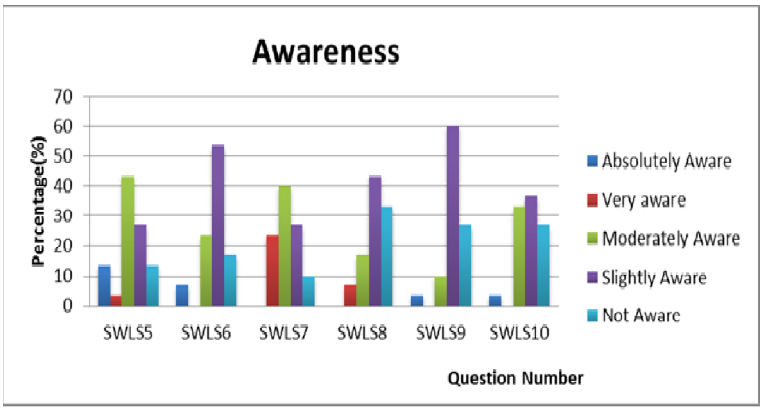

Fig. 3. Percentage of the self awareness of installation of LPS by using SBM

4 Conclusions

Based on the result achieved, the levels of Awareness of the Installation of Lightning Protection System (LPS) by using Structural Bonding Method (SBM) among Civil Engineers are moderate in the Northern Region of Malaysia. According to the feedback, the respondents are slightly aware with the Installation of Lightning Protection System (LPS) by using Structural Bonding Method (SBM) because of some factor such as company. Most of the respondents are agree that, the companies are not using Structural Bonding Method (SBM) in the Lightning Protection System (LPS). Thus it affects the level of awareness.

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