The influence in selection of pile type and foundation piling method

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Abstract. One of the jobs that have a high complexity in civil works is foundation pile work. Practitioners are often faced with many choices and various conditions in the field in making decisions about the types of piles and methods of piling. The selection of the type of piles and the method of piling will have environmental, economic and social impacts. Many conditions need to be considered when making this selection. This paper presents a literature review in the study of influence in the selection of pile type and foundation piling method in problem identification and approaches. The results of this study support the influence factor used by case studies of decision-making taking into triple constraint in project management.

1. Introduction

In general, the structure of the building is divided into two basic parts, namely the substructure and the upper structure. The foundation is the most stable structure and functions as a load support as a whole on the part of the structure that is above the ground [1].

In choosing the type of foundation, there are aspects that need to be considering because it will affect the method that should be used, such as soil bearing capacity, hard soil depth, the load of the upper structure, cost, and length work available [2]. In order to get the best cost and processing time, it is very important to pay attention to several existing criteria because they are influential in choosing the type of foundation and the type of foundation that is also very much [3]. In general, the process of implementing piles usually has an impact on the environment that is detrimental to human comfort or physical damage to buildings. So that a distance of 200 m from the construction site is considered an ideal distance that needs to be done to pay attention to the limitations of the given environment [1].

It can be concluded that foundation work is a job that has many criteria that need to be considered and has many alternative types of foundation piles and pile methods that can be used. Therefore, in selecting the type of foundation piles and the method of piles, unique knowledge is required with strict regulations and must be followed so that the required costs and execution time are in accordance with the economic conditions and can avoid environmental and social damage [4].

A lot of research on influence in decision-making types of foundation poles and piling methods. This research presents literature review in the study of the influence of decision making in determining the type of foundation pole and piling method. The main problem in researching the influence of the selection of foundation pole types and piling methods is to review what influence affects in the retrieval of the foundation. This research was conducted by grouping research on the influence of the selection of the type of foundation pole and the method of piling along with its approaches. Each study group was
analyzed by combining and comparing emerging issues. This was developed using a methodology map, in which the results of the analysis are prepared to find the direction of future research.

The foundation consists of two types, namely shallow foundation and deep foundation. Shallow foundations do not require deep soil digging, as hard soil is at a fairly shallow depth and is commonly used in simple house buildings. While deep foundations are used on hard soil layers that have a deep enough depth, it is commonly used in multi-story buildings, bridges, coastal or offshore buildings, and so on. The foundation of the stake is a type of foundation [5].

In the selection of the type of stake to be used, there are three main factors that must be reviewed, namely the location and type of the building, the durability of the pole, and the characteristics of the soil obtained from soil testing at the point of the piling site [6]. The limitations of the construction site or construction site are an obstacle that must be overcome by regulating the type of pole to be used, piling equipment, materials, and labor. The characteristic factor of the soil in the selection of the foundation design is determined by the testing of soil samples at the site. Depth of hard soil layer by getting qc conus value and fs value. In selecting the type of foundation pile practitioners use parameters related to information on soil characteristics to determine decision making [7].

In the selection of foundation piling methods, it is worth noting several factors such as environmental impact, cost, location. The need to pay attention is the demand for tranquility from the environment due to the implementation of development such as noise and vibration disturbances. The vibration sparked by the piling activity is quite difficult because it is very disruptive and can damage existing buildings in the vicinity of the construction is carried out in a densely populated location.

2. Method

This paper presents a literature review in case studies on the selection of foundation pole types and piling methods from previous studies. It is necessary to clarify the issues raised in this study in order to be useful as a basis for thinking for the development of further research [8]. The method of literature review used is to collect related literature, analysis, synthesis and results.

The first stage of the literature review is to collect and read some previous research related to the issues raised [9]. In collecting related research, it is done by determining relevant keywords and then searching for literature using relevant keywords. The research that has been obtained is filtered by reading the title and abstract of the research, then followed by the analysis process by mapping the previous research grouped based on the research method used. The results of the mapping were synthesized by linking the differences and similarities of each previous study. From each of these studies, it can be analyzed the similarities and differences between each study aimed at finding supporters of influence in the selection of foundation pole types and piling methods.

3. Result and discussion

3.1. Research map

The results of the study influence the selection of the type of foundation pole and the method of piling presented in Figure 1. Based on the results of the analysis, it was obtained that there are two research groups used in literature review this time, namely primary quantitative and qualitative primary. Almost all of the studies reviewed came from the primary quantitative group. It has been explained that the research used determines the criteria for the selection of foundation types with survey questionnaires and continued with AHP study [10][11][12]. Another research analyzes the effect of foundation piling vibrations and demolishing buildings on the residential environment [1] [13]. And several research projects comparing foundation shape and design against the cost, soil structure, and soil characteristics [3][4] [6] [7]. For more detail, the research methods in literature review are shown in the Table 1.
3.2. Research position
Based on the results of previous literature studies, previous research on decision-making models of foundation pole types and piling methods, then obtained research positions grouped based on variables discussed in research and research models. The four group variables used as a comparison include the criteria of piling, the type of foundation pole, the method and the impact of the piling, as indicated in Table 2. Slices of the variables of each literature reviewed that are illustrated using venn diagrams can be seen in Figure 2.

Figure 1. Map of the research methodology.

Table 1. Research methods.

| Authors                                      | Year | Method                                           |
|----------------------------------------------|------|--------------------------------------------------|
| R. Sutjipto Tantyonimpuro dan Agustina Dwi Retnaningtias [10] | 2006 | Qualitative quantitative research, AHP           |
| Mohamad Ridwan [2]                           | 2008 | Data analysis, quantitative                      |
| Mahendra Cipta A.N., Guntur Panji Wijaya, Hermawan, M. Agung Wibowo [11] | 2010 | Qualitative quantitative research, interviews, AHP |
| Juniada Pagehgiri [3]                        | 2015 | Comparative research, survey and interview       |
| Joko Yulianto [12]                           | 2017 | Observation and interviews, AHP                  |
| Oryza Lhara Sari [13]                        | 2019 | Qualitative and quantitative research            |
| Kukuh Prayogo and Hasriyasti Saptowati [7]   | 2016 | Data Analysis, quantitative                      |
| Lilies Widojoko [6]                          | 2015 | Data Analysis, quantitative                      |
| Taufan H. Saputra, Habir and Achmad Munajir [4] | 2016 | Comparative, quantitative                        |
Table 2. Research position.

| Authors | Piling Pile Criteria | Pile Type | Piling Method | Impact | Research Model |
|---------|----------------------|-----------|---------------|--------|----------------|
| R. Sutjipto Tantyonimpuro dan Agustina Dwi Retnaningtias [10] | ✓ | ✓ | ✓ | AHP |
| Mohamad Ridwan [2] | | ✓ | ✓ | Experimental Research |
| Mahendra Cipta A.N., Guntur Panji Wijaya, Hermawan, M. Agung Wibowo [11] | ✓ | ✓ | | AHP |
| Juniada Pagehgiri [3] | ✓ | | ✓ | Comparative Research |
| Joko Yulianto [12] | ✓ | ✓ | ✓ | AHP |
| Oryza Lhara Sari [13] | | ✓ | | Modeling |
| Kukuh Prayogo and Hasriyasti Saptowati [7] | ✓ | ✓ | | Experimental Research |
| Lilies Widojoko [6] | ✓ | ✓ | | Experimental Research |
| Taufan H. Saputra, Habir and Achmad Munajir [4] | ✓ | ✓ | ✓ | Experimental Research |

Figure 2. Venn diagram of variables.
4. Conclusion
Based on the literature review in the selection of the type of foundation pole and piling method, it can be concluded that the influence of soil characteristics, cost, characteristics of buildings and impact on the environment greatly affects the type of poles and piling methods used. Such influence should be considered as a basis in research on the selection of foundation pole types and future piling methods. The results of this study support the influence factor used by case studies of decision-making taking into triple constraint in project management.

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