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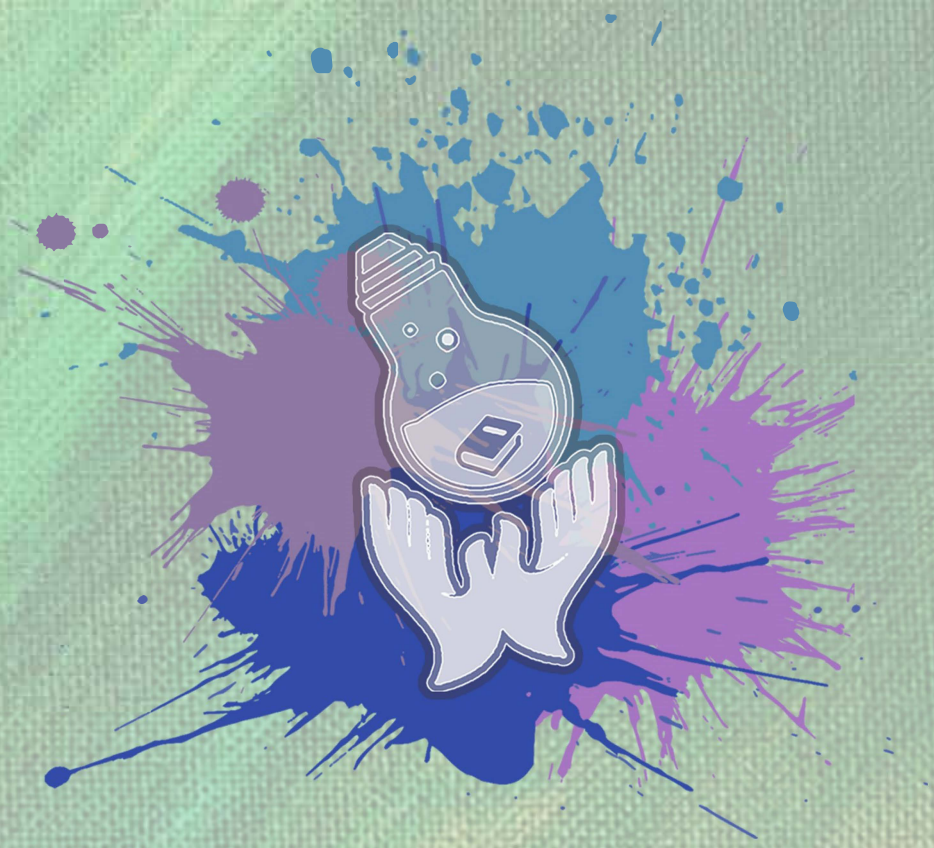

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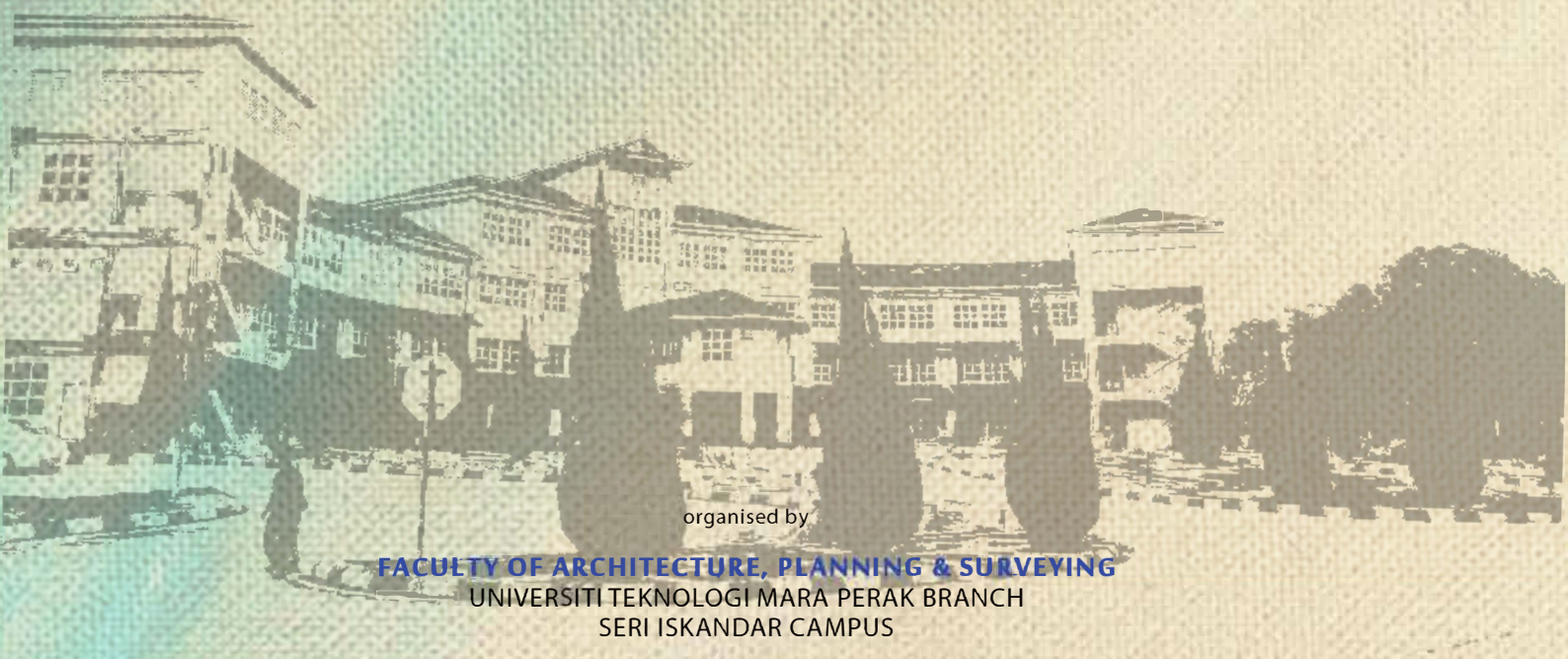

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THE INNOVATION OF PILE DRIVER: A REVIEW

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Abstract:
Almost all construction required pile as foundation. Pile has evolved from time to time to suit the purpose. No matter how good the pile is design, without a good installation, the design will not work. this report is aim to lower the accuracy and technical issues. Quality control (QC) is crucial to cut and/or probably avoid the issues. There not much report but still substantiated incidents of using pile. A method of desk study will be use to find out information about pile driver, accuracy and technical problem. Plus, the solution is mostly always adding new pile but this option can now be minimized, as expected. By using a simple device called tilt sensor, the possibility to cut these issues. Tilt sensor cannot fully stop these issues but the improvement is simply adapted to all pile rig. Significant of the study hoping that in the future, t sensor become a common thing in piling work. At least to cut casualty numbers in construction.

Keywords:
Keywords: Pile Driver; Tilt Sensors.

1.0 INTRODUCTION

Pile is a common term in the construction industry, in fact has been well use in Malaysia in early 90's. piles is getting more widely used and has higher demand in the piling, mainly for new developments in middle of city (Liew, 2016).

Construction is always haunted by the dirty, difficult and dangerous issues also known as 3D which equal to death. The issues go the same with pile installation. Pile system is expected to have issues prior, during and after installation. Pre-boring is sometime used to overcome the obstruction and to ensure the effectiveness of pile. Innovation to improve installation process using specific device and guide is proven for a better quality and productivity (Liew, 2016).

During installation, verticality issues is occurring and this will interrupt the impose load which will later pass on to the pile then to the ground. This is cause by overburden to one side of pile. Pile will be drive with a slight angle and cause the pile to be unsuitable to load bearing. Also, will cause geotechnical issues toward other pile as it may interrupt to drive the pile if the is block by other pile due to the pile is drive inaccurately (Liew, 2016). Overall, the purpose of this report is to minimize the problem faced in piling work such as accuracy, injuries and casualty.

2.0 LITERATURE REVIEW

The tolerance deformations are narrow by the structure type and function, design service life, and anticipated performance at particular displacement levels. Vertical, horizontal, and rotational displacements should be considered during design, where tolerance shall be recognized by empirical procedures, structural analysis, or both. Rationally, there is 1-inch tolerance. Anyhow, a weak soil and faulty installation of pile to the machine vertically can cause tilt during driving. large horizontal movements may cause damage to the structure (Hannigan, 2016). The consequence of poor foundation cause by poor workmanship is the failure and collapse of superstructure. Solution for this problem would be by adding new piles (Camp, 2013).

During the driving process pile tend to misalign from the original angle due to and obstruction in the ground and tilting of frame leaders. This issue cause by the displacement of soil adjacently. The positive

effect is that the possibility to compact the soil and the negative effect is the compacted soil pushes anything adjacent to the pile, including the other pile. Plus, driving in a cluster may cause ground movement and deflect the piles. This is the unwanted scene in construction industry because all the pile meant to transfer load vertically and directly to the ground. The controlling the position is crucial since misalignment can affect the design of pile caps and ground beam. The changing of design can be costly and waste of time to evaluate the situation. The deviations can cause interference the adjacent pile in the cluster and unsafe focus of load at the toe. As mention before, the imposed load must be transfer vertically to the hard strata. Meanwhile, if pile already driven, a countermeasure needs to be taken either to redesign pile caps or give an additional pile to cover the working load within the accepted values (Tomlinson, 2008).

Inaccurate of piling can cause building's structure to crack and tilt the building. Structures' failure occurs due to uneven load distribution. Even though, the building is stiff and there are no crack on the walls, such situation will be subjected to additional internal forces due to eccentricity. when situation get critical and the inclination is considerable, the structural statics of the object may be weakened and is known as "leaning instability". if the pile had been protected and executed in a proper way, the tilting could have been possibly avoided or limited (Kijanka, 2017).

There are also technical issues involve with pile installation. Piling work risk assessment should be outlined and reinforced with a better design standard and workmanship to understand the technical issues. With the Malaysia's construction activities is a low level, look attractive although low cost but acceptable by the client. Anyhow, this could cause to failures in the structural and performance of the pile. Requirement of a high standard of workmanship in the construction process because a lack of support due to poor working practices can cause incidents. There not much report but still substantiated incidents of using pile.

With the data taken from DOSH reports and include all sectors: manufacturing; mining and quarrying; construction; agriculture, forestry, logging, and fishery; utility; transport, storage, and communication; wholesale and retail trade; hotel and restaurant; financial, insurance, real estate and business services; public services and statutory bodies in Malaysia from 2013 to 2016 (Ayob, 2017). Based on data from DOSH, there are 17.36% total fatalities over three years by being crush by objects and materials (Ayob, 2017). There are cases such as a worker dies when pile driver collapsed due to unstable soil and the victim in the cabin but could not get out at Johor on 22nd April 2018, piling driver fall on people nearby the site at Bandar Baru Bukit Raja and killing husband and wife on 4th November 2016, a worker dies when pile driver fall due to unstable soil and kill the worker at Klang on 7th November 2016, a victim crushed by concrete pile at Klang port on 11th December 2016, a victim dies when pile hammer fall at Mukah on 4th April 2018 and a victim dies when a pile slip from cable and hit his head at bridge construction site at Meru Raya river on 5th April 2018.

3.0 METHODOLOGY

3.1 Desk study

There are some academic books and journal articles related to piling work. all the information about piling work is compiled into one report. The installation method is not well explained however there are some issues and problems which are highlighted such as accuracy and technical issues. With all the information, a suggestion is given on how to reduce the issues and problems are given. The desk study is written as part of an introduction to, or preparation for, a longer work, usually a thesis or research report.

4.0 ANALYSIS AND FINDINGS

Pile have been used for a quite some time. Still there are some issues with pile such as accuracy and technical issues. These lead to unwanted injuries and casualties and additional cost toward contractor. The report is aimed to minimized the injuries and casualties of piling work. Plus, can also cause to structure failure on the building. Some margin is given with a specific tolerance. Pile driving has an acceptable 1-inch tolerance for installation. A slight error can cause tilt either acceptable or not is depend on specialist to solve the issues, however during driving, tilt can occur due to impact. The issue causes

the installed pile to go down with a little gradient and may not be suitable to impose load. Another is obstruction in the ground cause tilt and the ground is always moving, underground issues are considered as geotechnical problem which required civil specialist to analyse and solve the problem. Still, the problem can be detected. Then, is the leaning instability cause by tilted pile which cannot imposed load vertically. Another one is technical issues, this cannot be avoided because humans are prone to make mistake no matter how good the QC is. Technical issues are due to worker incompetency or contractor purposely use unskilled worker than skilled worker.

The issues are due to accuracy and technical problem, since humans hardly to perform this delicate problem, a device is needed to help and detect the problem in early stage. Plus, a device might become a solution to the highlighted problem earlier. An example of the device is called tilt sensor. A tilt sensor is a device used for calculating the tilt in multiple angles of a reference plane. Airplane use an almost similar device call attitude indicator which use two angle of reference plane. Tilt sensors can calculate the tilting position with gravity reference and are used in many uses. Enable the ease of detection of orientation or inclination. Same as mercury switches, tilt sensors may also be known as tilt switches or rolling ball sensors (Ellison, 2018).

There is an innovation in the lifting equipment from JLG Industries' scissor lifts called tilt sensors. A simple mechanism which is useful to detect tilt with the slightest angle of 3º and the equipment stop lifting to avoid tumble. This can be used for pile driver not only minimized accuracy issues but also injuries and casualties in construction site. Tilts in piling work are due to lateral force such as wind, imbalance of the ground, weak soil and more. Can be used for piling work to make use so the pile is truly vertical to avoid pile from damage and become costly.

5.0 CONCLUSION

In closing, there are some innovations done to piling work to enhance the process. Still, there are more needed to be innovated. This is because, pile have contributed so much to enable construction of high-rise building especially in the urban area. There will be more innovation in the near future toward a better piling work and safer construction. Will be expecting the tilt sensor can be use in piling work and reduce the accuracy issues, injuries, and casualties. There potential yet to be discover by using tilt sensor. Hoping that in the future, the tilt sensor become a common thing in piling work.

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