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Designing Tile Installation Tool for Floor Finishing Works

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Abstract. This study is a research on product development of tile installation tool and focused on criteria that could help in finishing works for a floor that involved in small scale construction projects such as renovation of room, hall and others. The objective of this study is to design and develop tile installation tool in order to assist the finishing work for flooring installation. Besides, this study also examined the functionality of the tile installation tool in assisting the finishing work for the floor. Product evaluation was done through the approval of expertise from three experts in Akademi Binaan Malaysia (ABM) and also 2 professional contractors with the background of civil engineering. The material used in this study is by using Perspex (acrylic) equipped with a suction cup method. The test result shows that the tile can be lifted by using this tool could reach about 2.40 kg for the tile sized 2" x 2". The advantages of this product are the developed tool could save time and even more practical for the tile installation process compared to the complicated conventional method. In addition, by using this product, the quality of tile installation process could be controlled from the beginning till the end of process. Recommendations for product improvement in the future is by diversifying the types of tile used/installed, such as the tiles with rough or uneven texture.

1. Introduction

In Malaysia, one of the necessary packaging in a new building is the installation of tiles such as the installation of floor tile in the building. There are various types of floor tiles including ceramic tiles, porcelain tiles, granite tiles and these are based on user applications and requirements. Among the favorite tiles are ceramic tiles because of its easy maintenance, high load and reliable (Baharudin, 2007).

Tiles are generally used to protect floors, walls or other objects such as table surfaces and decorative chairs. Accordingly, Pieter (2006) states that some packaging products are required to protect concrete surfaces. In addition, tiles can also refer to the same unit using lightweight materials such as perlite, wood and mineral wool (fibers). In addition, the quality of the tile used should meet the specifications of the JKR and any details of the contract or the details of the tender (Specification of JKR, 1989). Not only that, tiles are also used to form walls and floor coverings. Its use is in interior areas such as kitchen, bathroom and garage space which are often made from materials such as glass, metal and stone. Installing tiles are important considering the size of the tile used, the shape of the area after completion, the general specification requirements for the area to be installed and position planning.



The purpose of the Tile Installation Tool is to facilitate the installation of tile. This tool is also used for finishing work in the building. Besides that, educator can use Tile Installation Tool to teach finishing work because it's easy to show real practice to student. Typically, using this product, tile installation is done quickly without taking into precision using spirit level in every view. For the safety aspect, it can be harmful to the occupants in every building that is built. Additionally, the use of mortar between insufficient tile pieces makes the distance between these tile pieces to be too close. This is because tile craftsmen usually take easy steps for fast work and want to save the costs. Refer to specification of British Standard Institution (1987), which the use of mortar distance acceptable tiles is between 2 mm - 6 mm. Installing tiles require a high degree of precision and they can illustrate the position of the tile. CIDB Accredited Training (2006) records that the frequent damage to tiles is like cracking or fracture at the corners of the tile because the cement is not plastered equally and is not in the right position. In fact, the conventional way to install tiles is more tiring than using tile installation tools.

2. Problem Statement

Every year, the conventional tile installation employed by skilled workers in the construction industry is seen to be some other problems in which produce neat, clean and accurate installation is difficult. Lack of product development to facilitate tile installation work has caused construction workers to use conventional methods. Using this conventional method, it becomes a burden to new construction workers or unskilled workers in the use of equipment as the construction process is quite complicated and requires a long period of time to complete the tile installation process. Jahiman (2011) says that, finishing work is a rather complicated stage and requires high skill and competence to make sure installation tiles between 2 mm – 6 mm.

Additionally, the use of this manual installation method may also result in unsatisfactory installation quality. This illustrates that the installation of conventional tiles can result in losses if less skilled workers do so. Uneven and tedious installations can result in defects and cracks in the floor (CIDB Accredited Training, 2006). With this tile installation tool can also help to install more organized and neat. Even the risk of fracture and imprudence can be reduced and avoided.

3. Research Question

The study was conducted to answer the questions:

- (a) How does a tile installation tool be designed and developed in the floor finish work?
- (b) Is this tile installation function working properly on the floor finishing?

4. Research Methodology

The design of this study is to develop a tile installation tool to be used as a product to help floor finishing work. This study uses the Hanaffin & Peck Design Model (1988) as the basis for the development of product design in this study. Based on figure 1, Hannafin and Peck (1988) design models involve three phases, namely the need phase, the design phase and the implementation phase. Each phase is evaluated, tested and reviewed using an interview form instrument and expert legal form to see the effectiveness continuously.

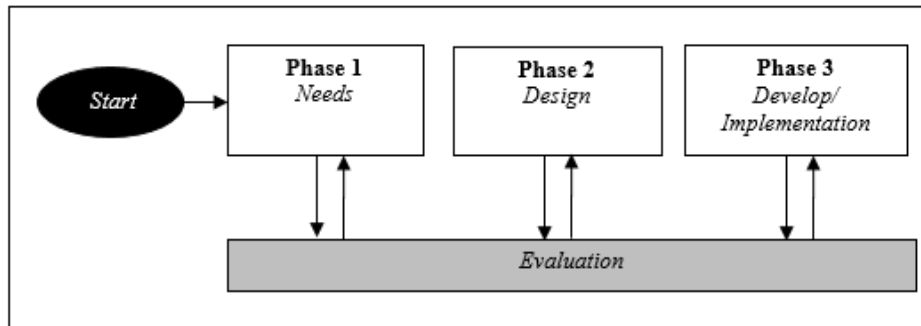


Figure 1: Hannafin and Peck (1988) Model

In the phase of their needs and phase designs, the sketcher draws initial sketches (Figure 2) to design tile installation tool products in assisting floor finishing work.

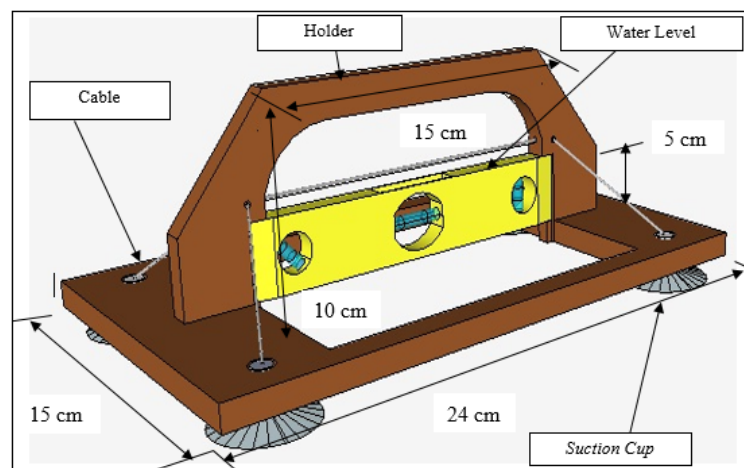


Figure 2: Design Tiles Installation Tool

Through the initial sketch, researchers also interviewed several experts to determine the size of the model and the appropriate material for developing the product. In the product development phase, researcher select the right material such as perspective, suction cup, spirit level, bolt and nut after a full sketch is made. Cutting work starts with making cuts of 11 cm x 24 cm to be used as a tool holder. The next work is a 25 cm x 14 cm cut-off work to serve as a base for tile-mounting tools. Cutting work is done using a drill machine to puncture holes in 1-inch.

For connecting work, the first connection is the installation of spirit water level on the tool holder. Then, the holder and the base are attached to the chlorophyll and the screw so that the installation will be stronger. Next is the installation of a suction cup using bolts and nut on each side of the tool set so that each piece will be joined to each other. After that, the spring will be connected to each suction cup that has been installed to be easily pulled. Finally, connecting the cables to four parts of the spring is connected which works as a pull trigger.





Figure 3: Tiles Installation Tool

5. Finding and Discussions

Analysis of loads involves several activities including the process of collecting information on how much tile load weight can be raised by this product. Weight measurement is done by using digital weighing. Tile load that is capable of lifting this product is as shown in table 1 below.

Table 1: Capable of lifting tiles

Weight	Function
Tiles 1"x1" (1.38kg)	
Tiles 2"x2" (2.40 kg)	

Referring to table 1, it can be concluded that the product has been tested in terms of the amount of load weights capable of lifting. Through this test it can be seen that the weight of the tile that can be lifted with the resulting product is up to 2.40 kg for 2 "x 2" size. This test can indirectly prove the suction cup resistance used for this product. The next analysis relates to the comparison of the time taken for the conventional tile installation and the installation of tiles by using the new product. The time taken is as shown in table 2 below.

Table 2: Comparison of the time taken

Size Tiles	Method	Times taken for installation tile 1m ² (minute)
Tile 1''x 1''	Conventional	15 minutes 52 seconds
	Tile Installation Tool	15 minutes 32 seconds
Tile 2''x 2''	Conventional	5 minutes 15 seconds
	Tile Installation Tool	5 minutes 3 seconds

Based on table 2, comparison of time taken for conventional tile installation and installation of tiles by using newly produced products. This analysis is aimed to prove that using this new product can save time and more practical for tile installation work compared to more complicated conventional methods. From the analysis, a short time was taken to bind 1m² of tiles using new product methods rather than using conventional methods. Saving time using new products may not be as significant compared to conventional tile installation, but it is able to assist in the tile installation work.

6. Conclusion

Tile Installation Tool is a product that can help construction workers or educators to install tile more easily, save time and energy. This tool can also help to improve the quality of the tile installation and meet the JKR specifications. The main material used in this tool is suction cup which is a new method in the construction of products in the building industry. The use of suction cup is to grip and lift the tile and put it without damage. Users will find it easy to use, easy to buy if broken and increase productivity.

The tile installation tool is intended to assist the construction worker in floor finishing work to be effective as the functionality of the tool has been achieved. Jahiman (2011) says finishing work is a bit complicated and requires high skill and efficiency. This is because using conventional methods, it becomes a burden to new construction workers or unskilled workers in the use of equipment as the construction process is quite complicated. Conventional process requires a long period of time to complete.

The product development process has been carefully planned by researchers to avoid significant wastage and loss. Researchers are also able to develop this product at a minimal cost compared to existing equipment in the market. However, such products are still in the market and the development of this tool is seen to be potentially marketable and suitable for use in the industry.

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