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# A Simple and Effective Tool To Extrude Tropical Residual Soil Sample

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**Abstract.** Soil Investigation is a vital part of a feasibility study of modern construction project and it helps to determine the types and characteristics for better construction planning. In order to determine the types and characteristics of the soil lab tests must be conducted thus sampling of soil must be done. Sampling of tropical residual soil is vital and need a special care to extrude soil from sample casing. Traditional soil extruder and trimmer take some time to be done thus this project is done to propose a new soil extruder and trimmer that can get the job done easier, faster and also ensure the quality of the soil sample at the same time. This proposed equipment is a specially design to reduce and overcome disturbing of soil sample during extruding and trimming soil sample from thin wall tube including piston sampler. A part from that, the procedures to handle the tools will becomes easier and faster, especially on tropical residual soil that notoriously known as non-homogenous. Related to time consuming to prepared sample and effort to extrude it is conclude that the new proposed soil extruder is better than existing soil extruder.

## 1. Introduction

As soil tests are very important to investigate for the index and engineering properties of soil for many purposes, the same goes to soil preparation. A good quality samples must be prepared in order to get accurate results. Due to lack of improvement in soil preparation equipment such as soil extruder and soil trimmer or known as soil lathe, this research is to proposed and introduce better soil preparation equipment in extruding soil sample.

In order to conduct laboratory tests for determining the properties of soil, sampling technique and preparation of soil samples are needed [5]. Even though methods or apparatus used to tests the soil sample already improved and evolved into better and more efficient for the past decades but methods used to prepare soil samples such as soil extrude samples are still the same [4]. In conjunction with this problem, this research aim to provide a better proposed of soil extruder to prepare soil samples in faster and easier way without sacrificing the quality of soil samples especially on undisturbed samples.

Soil preparation techniques are vital for soil test to be executed but soil preparation equipment such as soil extruder had been the same for the past years [6],[7]. Some soil extruder is still requiring



manpower to manually spin the valve in order to extrude the soil sample. Even though there are some types that start to use motor and hydraulic piston but it is still not as efficient as expected. Due to all these, the proposed equipment is produce to faster and easier soil extruder that only required single operator to extruding soil sample.

The scopes of this study focusing on one of the soil preparation method for extruding undisturbed sample in thin wall tube. The approach of this research will be quantitative in determining a better efficient soil extruder. In addition, information about soil sampling and preparation, procedures for soil extruding will be gathered and analyses as well. The evaluation and comparison will be done on existing and proposed soil extruder on time to extrude single soil sample.

This study will beneficial to the users of the equipment for extrude soil samples in easiest and fastest way from thin wall tube to piston sampler. Besides, this equipment is equipped with a powerful and reliable hydraulic piston which can help the users of the equipment to extrude the soil samples with less effort. This equipment is a simple and effective to extrude and molding soil samples compared to several branded equipments in the market [10]. By understanding the needs of the constructions and benefits of soil samples extruder, a lot of literature will be reviewed. Moreover, this research will state the ability of the equipment to extrude the soil samples.

Furthermore, this study will be helpful to the constructions industry and site investigators to preparing the soil samples after the rigorous method of soil investigations had been carried out. It will also serve as a future reference for researchers on the subject of soil mechanics to the investigation on site practices.

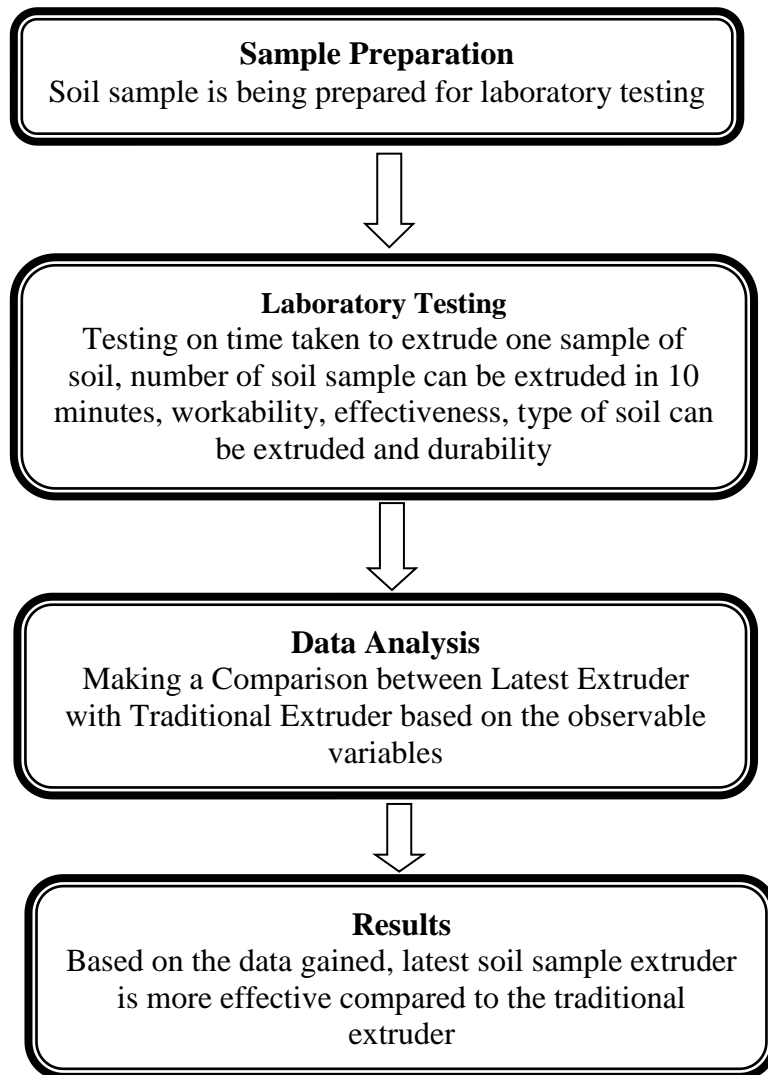
## **2. Literature Review**

Based on the past research made, there are several aspects that were being reviewed which is related to the research being conducted. The aspects being reviewed includes residual soil, factors responsible for formation of residual soil, general features of residual soil, sampling of tropical residual soil and soil and sampling. All of the aspects mentioned were discussed in details below.

For undisturbed samples, loose and disturbed soil should be trimmed from the ends, and a note made of the sample length (as laboratory tests scheduled may require a full sample). Low-shrink wax preferable microcrystalline has proved to be an effective means of sealing samples provided it is used correctly [4]. It should be melted, and then painted over the exposed end of the soil sample after it has cooled and is near solidification. If the wax is too hot, a plug is formed which contracts from the sides of the sample tube. A thickness of about 10 mm of wax should be established before pouring on way to a total thickness of about 25 mm. The orientation should be clearly indicated. Storage should be in a cool moist atmosphere and a specially constructed store may be necessary for anything other than short-term storage [7].

## **3. Methodology**

Once the proposed equipment is produced, testing was conducted to examine the capability of the newly proposed equipment. This equipment were also recorded and compared to analysis of results. After that the results from testing of equipment, were used to compare with the existing equipments and the differences and efficiency of the proposed equipment were analyses and recorded. With the analysis on both results has been done, conclusion was made to finding contribution of this research. Lastly, all of the details of this study were organized and documented in figure 1.



**Figure 1.** Flow chart of research stages



**Figure 2:** Latest Soil Extruder (Extruder View)



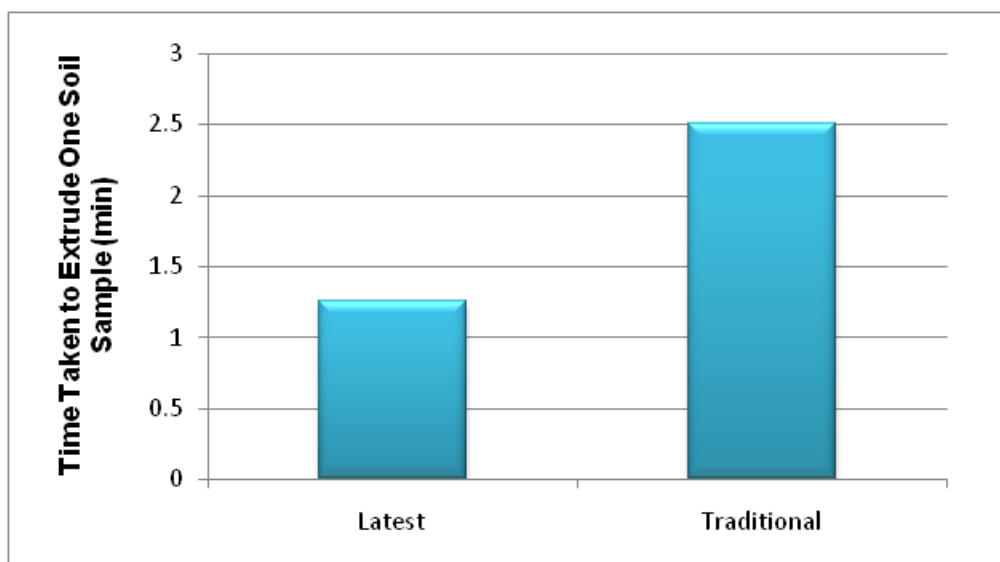
**Figure 3:** Latest Soil Extruder (Side View)

#### 4. Analysis

The aspects that were being taken into consideration are the method of extruding soil sample and the comparison between the latest extruder with the traditional extruder

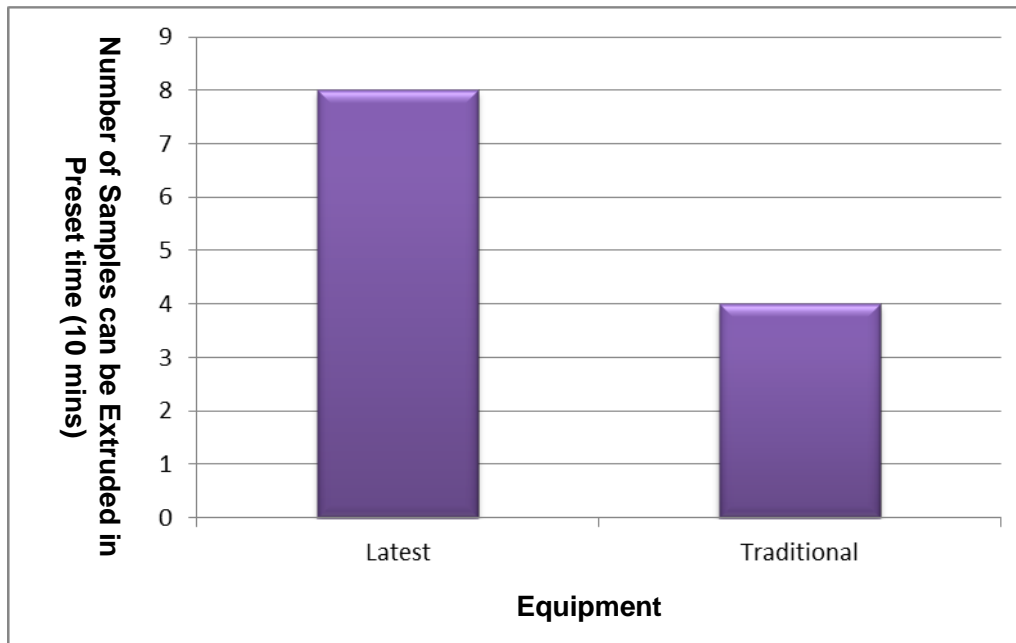
##### *4.1 Comparison between Latest Extruder Equipment With The Traditional Extruder Equipment*

Based on the research being conducted, there are a few aspects were being taken into consideration in order to make a comparison between latest extruder equipment with the traditional extruder equipment. The aspects that was being used for the analysis includes time taken to extrude one sample of soil, number of soil sample can be extruded in a setting time which was being set for 10 minutes, workability, effectiveness, type of soil that can be extruded and durability. Further discussion was being discussed below.



**Figure 4:** Graph of Time Taken to Extrude One Soil Sample (min) versus Equipment

It can be presented that the time taken to extrude one soil sample (min) by using the latest equipment is faster compared to the traditional equipment. The time taken to extrude one soil sample by using the latest extruder is 1.25 minutes or 75 seconds while the time taken to extrude one soil sample by using the traditional extruder is 2.5 minutes which is one min shorter compared to the latest extruder. In retrospect, latest equipment can extrude faster compared to traditional soil extruder as comparison between these two equipments in Figure 4.



**Figure 5:** Graph of Number of Sample can be Extrude in a Setting Time versus Equipment

The number of soil sample can be extrude in a setting time which set for 10 minutes for the latest extruder is higher then the traditional extruder. The number of soil sample that can be extruded in a setting time which is for 10 minutes for the latest extruder is 8 while the number of soil sample that can be extruded in a setting time (10 minutes) for the traditional extruder is 4. In short, latest equipment can extrude faster compared to traditional soil extruder.

The proposed soil extruder has a high workability as the soil extruding can be done easily and takes less time to extrude. Besides that, it can also be done with only one person without require any help from others unlike some existing equipment still require two person. The only drawback for proposed soil extruder is it is not portable so soil sampling tube must be taken to lab for it to be extruded. Overall, the proposed soil extruder is still considered to have a highly workability.

## 5. Effectiveness

Proposed soil extruder is considered more effective, which latest proposed soil extruder is able to extrude a soil sample in 3 minutes while the traditional soil extruder extrude a sample in 4 minutes. In 10 minutes mark, the latest proposed extruder is able to extrude 3 number samples while existing or traditional manage only 2 numbers.

The durability of proposed equipment is expected to be pretty good as it is made up of steel frame. Strong material and it is widely used in the construction of factories and houses as a proof. In fact, the component that used to extrude soil sample from soil sampling tube is hydraulic piston. Hydraulic

piston is now commonly used throughout industries and it is durable as long as routine maintenance is done [10].

## 6. Conclusion

Design of proposed soil extruder is included in this research and some tests were done to compare the differences between existing soil extruder and proposed soil extruder. The differences between existing and proposed soil extruder are that existing soil extruder uses screw to tighten the tube before it can be extruded actually take a longer time compare to proposed method which is simply slot in and extrude. Besides that energy needed to extrude soil sample has also reduce as proposed soil extruder uses electrical hydraulic piston while some of the traditional method uses manual handling where people need to actually spin the valve in order to extrude soil sample. The criteria that we compared are energy needed and time needed to extrude soil sample. After tests were done and results were compared, we can safely conclude that this new proposed soil extruder is better than existing soil extruder.

## References

- [1] Singh, H., Huat, B.B.K. (2004). "Origin, formation and occurrence of tropical residual soils", Tropical Residual Soils Engineering, 10<sup>th</sup> edition, Taylor & Francis Group, London.
- [2] Huat B.B.K., Alias, A., Jamaludin, S. (2004). "Sampling and testing of tropical residual soils", Tropical Residual Soils Engineering, 10<sup>th</sup> edition, Taylor & Francis Group, London.
- [3] Blight G.E. (2012). "Origin and formation of residual soils", Taylor & Francis Group, London.
- [4] Weltman, A., Head, J. (1983). Methods of Exploration. In Site Investigation Manual. London: Ciria
- [5] Sampling and Ground. (1981). In Code of Practice for Site Investigations. British Standard Institutions.
- [6] Hvorslev, M.J (1948). *Subsurface exploration and sampling of soils for civil engineering purposes*. Waterways Experiment Station, Vicksburg, Miss.
- [7] Idel, K.H., Muhs, H. and von Soos, P.(1969). *Proposals for quality classes in soil sampling and the importance of boring methods and sampling equipment. Specialty Session No. 1. Proc. 7<sup>th</sup> Int. Conf. Soil Mech. and Found. Eng., Mexico*.
- [8] Rowe, P.W. (1972). The relevance of soil fabric to site investigation practice. *Geotechnique*, 27, 195-300 (12<sup>th</sup> Rankine Lecture)
- [9] Serota, S. and Jennings, R.A. (1948). Undisturbed sampling techniques for sands and very soft clays. *Proc. 4<sup>th</sup> Int. Conf. Soil Mech, and Found. Eng. London*, 1, 245-248.
- [10] Matest. (2004). Soil. In Material Testing Solutions (6th ed., pp. 226-285). Bergamo: MATEST.