

REMOVAL OF RISK IN TRIAL TRENCHING IN KUALA LUMPUR.

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ABSTRACT

With the rapid urbanisation in the big cities, numerous services networks had not been properly recorded by the various service Authorities. These uncharted services had caused numerous problems when they are damaged in the process of new developments. In addition to cost implication, personal injuries, and loss of lives can be avoided.

With the use of water jet / compressed air and a vacuum truck, the damage to services can be eliminated. This system can be used to work in remote locations where mechanical excavation may not be possible. This system can also expose services installed in layers either in parallel or criss-crossing. It is also environment friendly.

The system is readily available but the usage is not eminent.

Are we willing to turn a blind eye to advancement at the expense of safety, friendly environment and quality if the system is more expensive as compared to the present mechanical excavation?

This paper will look into the advantage of the vacuum excavation system and the overall cost comparison between the present manual/mechanical methods against the vacuum excavation.

INTRODUCTION.

In the quest to achieve a status of a developed nation by 2020, one of the need is for the country needs to improved the infra structure of the country. This will require upgrading of the existing services and add in new services.

With the rapid urbanization of the big cities, the recording of the old and new services were not captured in the as-built drawings. These uncharted services had caused numerous problems when they are damaged in the process of new developments.

Before any new developments are constructed, the existing services needs to be identified and marked. The contractors or developer must first enquire and obtain from the various

service departments on the existing locations of these services. It is also mandatory for the contractors or developers to conduct trial trenching to establish their locations. Many a time, it is during these trial trenches that services which they are locating end up being damaged.

METHOD ADOPTED IN TRIAL TRENCHES IN KUALA LUMPUR.

In the early days, HAND DIGGING was adopted. Hand digging is physically using manual workers with “changkok” (a tool similar to a pick but had a wide blade similar to a spade at the end), and a crowbar. In Kuala Lumpur, there are cases where services are in very close proximity and/or crisscrossing each others. This method is very slow and at times could be dangerous if leakage occurs in electric cables. Time required to carry out a straight forward trial trench for a one metre square with one and half metres depths will take three workers two full days with eight hours shift.

At present, COMBINE MANUAL AND MECHANICAL EXCAVATOR is used. In the combine method, a backhoe excavator is used in additional to the three or four manual workers. Before any excavation can start, the area where the trial trenches are to be carried out, electromagnetic detection device needs to be used. The electromagnetic transmitter will directly induce a signal across the utilities. The signal is then detected with the receiver indicating the existence of the pipes, and cables. The location of the detected services will be marked and recorded. With the preliminary identification of the existing services and the depth noted. The supervisor will be brief the workers and machines operators of the existence of the services. If there are hard-standing or road premix, the concrete saw will be used to cut the proposed location. Mini-excavator or backhoe will than proceed with the excavation with a senior supervisor/site engineer supervising the excavation. Because of the destructive and cumbersome nature of the excavator, it is a risky endeavour. Even skilled backhoe operators run the risk of hitting and damaging the very utility they were trying to locate and protect. If the services are laid in parallel layers and or crisscrossing, it will be a tremendous task to safely execute the trial trench.

In cases where the services are non-metallic, the electromagnetic sensor will not be able to pick up any signal. This will create a big problem when mechanical method of trial trenches is adopted. In this case, physical manual excavation to expose the services had to be carried. One of the ways to prevent this will be to install TRACE WIRE. Trace wire shall be copper wire with a minimum gauge of 12AWG with polyethylene jacket/coating of minimum thickness of 30mm.

An alternative method for the manual/mechanical trial trenches will be to use vacuum with water or air for the excavation to expose the services.

VACUUM EXCAVATION

Vacuum excavation consists of a vacuum vessel which may be mounted on a lorry with an air compressor or a high pressure water pump. The soil is broken up by the air or water and the vacuum device sucks up the spoil. The usage of air or high pressure water jets depends on the environmental characteristics and the ground condition.

The Advantage in Vacuum Excavation System.

- A) The Vacuum Excavation is faster than the conventional excavation.
- B) It can expose services which are in many layers crisscrossing each other.
- C) In confined space where vehicles and bulky equipments are not accessible.
- D) In Hazardous environment such as gas pipes and high voltage cables.
- E) Save in manpower. (In most case it is a two men operation)
- F) Minimum environmental impact
- G) Minimum traffic disruption.

There are pros and cons for both vacuum excavation systems.

Water Vacuum System.

Water Vacuum is used when the ground is mainly heavy clay, cemented sand, fracture sandstone, etc. The high pressured water jet will be used to cut through the heavy ground material. This will reduce the size of the material and loosen the soil. These wet loosen soil and slurry will be removed via the vacuum hoses. All these material will be suck up and stored in the tank. These materials can be disposed on site or off site.

The Disadvantages in Water Jetting.

- a) With the high pressure water jet, the high pressure water jet may cut and damage the services which we are trying to locate. Thus careful and experience worker need to be engaged to carry out the water jetting.
- b) Slurry will be created and direct backfill using the wet excavated material will not be possible. Disposal of slurry will be an added cost.
- c) Additional space for water tanks will be required.
- d) If the existing electrical services are damage prior to the trial investigation, water may cause short circuit to the electrical system. It is also hazardous for workers working in the vicinity of the damage cables.

Air Vacuum System.

Air Vacuum will utilise the kinetic energy in the high velocity of the compressed air jet to penetrate and break up the soil. The loosened particles of the soil will be removed by the suction from the vacuum device through the vacuum hose into the vacuum tank. The soil removed will be stored in the vacuum tank for future use as backfilled material. The hole required can vary from a simple 300mm by 300mm hole to trenches of 2 metres wide. It can go up to 6 metres depth.

The Disadvantage in Air Jetting

- a) In hard ground condition, it will not be able to expose the services. Manual labour will be needed to dislodge the soil from the services.
- b) Under loose ground condition, dust will be created.

Using Vacuum Excavation in Trenchless Technology.

In trenchless technology, TRIAL HOLES along the route to locate services and ground conditions can be a substantial amount. With POTHOLE using vacuum system, the cost can be reduced. Pothole excavation using vacuum system can also save time as a hole of 200mm diameter 2 metres deep can be completed within 10 minutes. With this keyhole excavation, reinstatement and environmental impact is kept to a minimum time and cost. A depth of 6 metres can be done by vacuum pothole excavation with ease. Information collected from the pothole investigation can assist to determine the type of trenchless method to be used thus saving time and cost.

Target for the Future

It would be a good idea if all the information on the existing services gathered by all parties be combined and recorded with the topographic base map to create a composite drawing. This composite drawing shall be updated and be used to determine the best design based on avoiding and minimising conflicts with existing facilities. The drawing shall be drawn to scale, with dimensions indicating the horizontal and the vertical positions of the services.



**The Photograph Shows the Compact System Using Water Jetting With Vacuum Suction.
Note the small tank in the background.**



The Photograph Shows the Exposed Service Duct. Notice the Neat and Clean Surrounding.

CONCLUSION

Vacuum excavation is part of a combine approach to safely identifying and exposing underground services. The initial cost is high. But if you compare to the cost for the repair and the consequential loss that will incur and the inconvenient that the public will suffer, it will become an excepted small investment.

Are we willing to turn a blind eye to advancement at the expense of safety, friendly environment and quality if the system is more expensive as compared to the present mechanical excavation?