

Detection and Identification of Underground Utilities

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Background & Current Practice

Background...

- Installation of water supply and sewerage piping typically involves deep shaft excavation, open cut, micro-tunneling and pipe jacking works.
- Before commencing installation works, we need to verify the locations of existing underground services (power, telecommunications etc) to prevent damage and to divert these utilities if required.

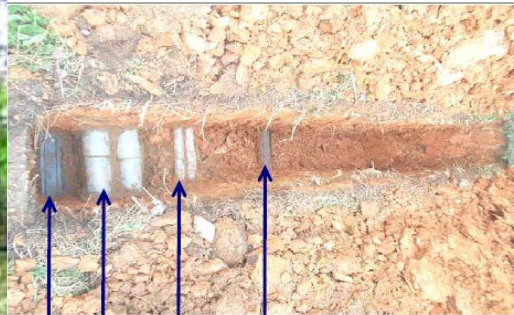
Currently...

- **Trial trenching**, where trenches are dug to reveal the underground contents, is used to verify and confirm the type and locations of the underground utilities indicated in drawings (as provided by the various utility suppliers)
- Such verification works are performed during both planning and construction stages

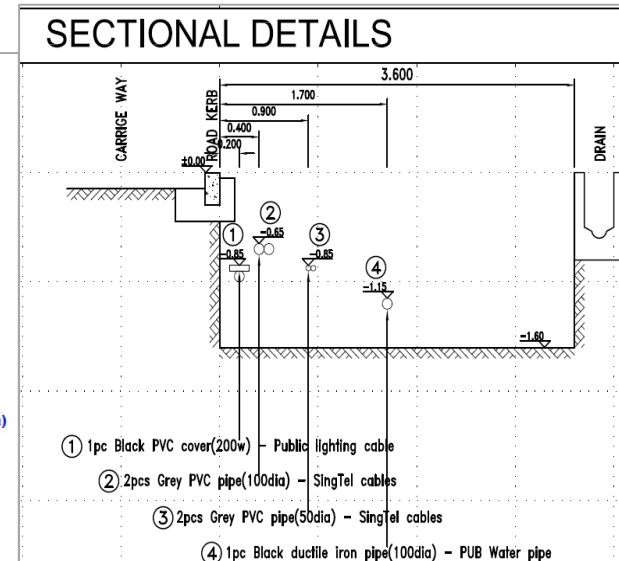


Background & Current Practice (Cont'd)

- However, trial trenching can be inefficient and increase the amount of time, effort and costs required to seek approval in the following scenarios:
 - a) the utilities are under major roads with heavy traffic
 - b) the alignment of the utilities is inaccurate and multiple trenches are required to locate the utilities
 - c) the utilities are buried too deep (*requires design and submission of Earth Retaining and Stabilising Structures for trenching works*)

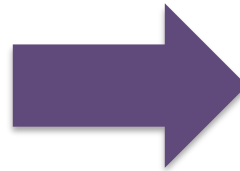


- Service No 4:
1pc Black ductile iron pipe(100dia)
- PUB Water pipe
- Service No 3:
2pcs Grey PVC pipe(50dia)
- SingTel cables
- Service No 2:
2pcs Grey PVC pipe(100dia)
- SingTel cables
- Service No 1:
1pc Black PVC cover(200w)
- Public lighting cable



Areas of Opportunity & Key Considerations

Solutions that can detect and identify underground utilities without need for trial trench



Areas of Opportunity & Key Considerations

✓ Ideally, the technology shall provide the following information:

	Information Range
Pipe Location and Depth	<ul style="list-style-type: none"> • Depth detection should be up to 3m • Technologies that can detect up to 5m or more are preferred
Type of Utilities	<ul style="list-style-type: none"> • Power (Low & High Voltage) • Clean Water & Sewerage • Telecommunications • Gas
Pipe material	<ul style="list-style-type: none"> • Iron (Ductile & Cast) • Steel • Concrete (Reinforced & polymer) • Vitrified clay • HDPE • PVC <p>Technology to indicate if material is metallic/non-metallic if it is not able to differentiate between the different types of material</p>
Pipe dimensions	<ul style="list-style-type: none"> • Pipe diameters of 100 mm to 1200 mm

Areas of Opportunity & Key Considerations

- ✓ Reading shall have an accuracy of +/- 0.1m
- ✓ Technology shall perform well under all soil types, road compositions and environmental factors (eg in presence of groundwater)
- ✓ System shall have a display to provide real-time data for on-site investigation.
- ✓ Data shall be automatically post-processed and generated into a report
(min info include: cross-sectional drawing of affected area, spatial info of detected utilities etc)

Key Challenges

Can the solution

- Determine pipe materials, and if not, differentiate between conductive and non-conductive materials
- Detect utilities under the effect of external interference, such as rebar, groundwater, soil conditions, and the presence of other utilities
- Maintain detection accuracy at greater depths
- Differentiate power cables that are closely laid or stacked
- Post process the data to support the interpretation and visualisation by officers



Expected Outcomes

1. Site-tested prototype to detect and identify the various underground utilities of $\geq 3\text{m}$ in depth using non-excavation approach

- PUB work sites as test sites

2. Implementation

- If the pilot is successful, the solution would be recommended to PUB's service contractors.

Thank You

