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# Norcross Roundabout lessons learned

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## Pot ended cables



# The Problem (Our Findings)

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Pot ended cables are virtually invisible:

- They are not recorded on utility prints
- As no electrical current is flowing through them they cannot be located using a Cat and Genny.
- The initial GPR survey could not locate them.
- The owners cannot locate them and cannot tell you where they are.

# The Problem (Our Findings)

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Pot ended cables are virtually invisible:

- HSG47 paragraph 85 – *Hum detectors detect the magnetic field associated with electricity flowing through a cable. As such they do not respond to pot ended cables.*
- Raising the Bar 9 page 8 - Be aware cable avoidance tools are not fool proof and are less likely to detect pot ends.
- Met Consultancy Group: Identifying specific utilities and live electric cables with PAS128 – *Electric cables that are pot ended are difficult to find as they do not carry current even though they are live.*

# The Problem (Our Findings)

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Pot ended cables in many instances are:

- Buried very shallow.
- Buried directly below the tarmac which prevents VacEx equipment being used until the hard surface is removed (In our experience they were buried between two layers of tarmac and or left within the concrete bases for old street furniture).

# The Problem (Our Findings)

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If a pot ended cable is damaged the owners simply install another pot end on the cable and it is then buried and it's position is **not** recorded on the utility prints by the cable owner.

As such the hazard is not eliminated, and effectively we leave a problem in the ground for others to try and find or damage in the future!





We were not happy that there appeared to be an acceptance that pot ended cables were virtually invisible and that there was no immediate solution; but if we hit one:

- It could result in a fatality or an employee sustaining serious injuries.
- It would be recorded as a service strike.

We therefore set about looking for a solution.

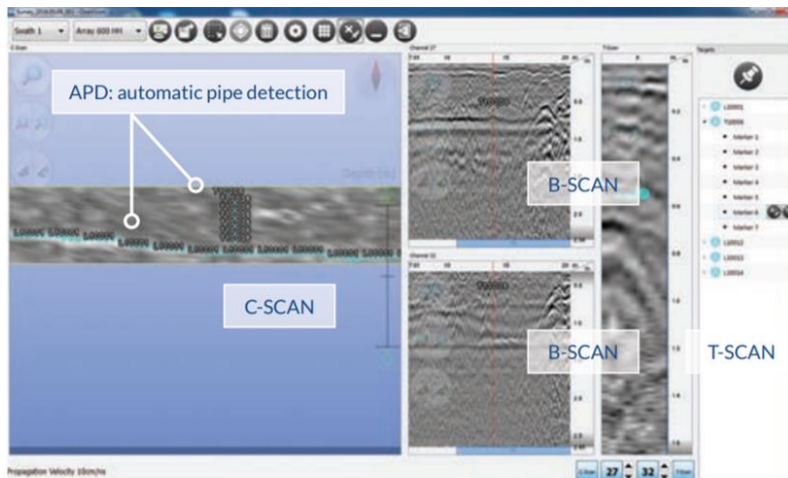
Having spoken to numerous industry experts we were put in touch with MacLeod Simmonds who had been engaged by Transport for London to conduct pre-site surveys across the city which had resulted in a demonstrable reduction in service strikes.

MacLeod Simmonds achieved this goal by using **High Density Array Ground Probing Radar** (The High Density Array Ground Probing Radar (HDAGPR) incorporates 24/36/38 aligned data channels of Impulse Radar which provides the higher detection rates, effectively because of the dramatic increase in samples recorded over the search area. For instance, the PAS128 calls for GPR measurements to be performed in a bi-directional grid at 50cm intervals. Using our Impulse Arrays, we achieve grids of 4cm with the hand pushed and 6cm with the towed solution).

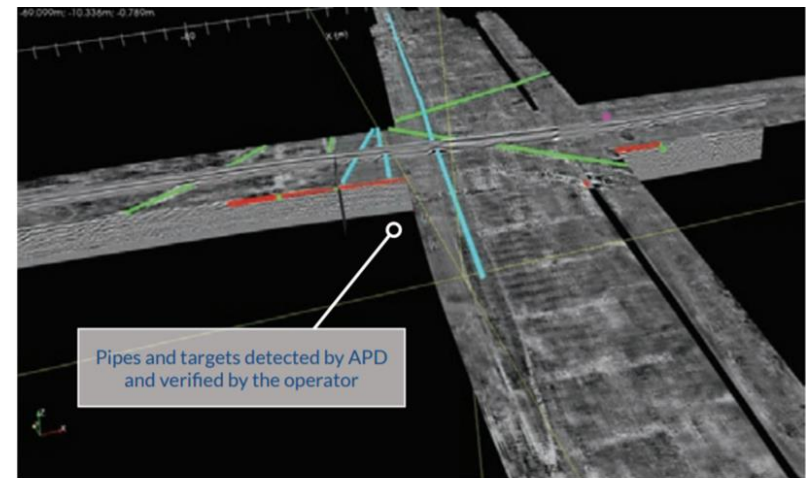


# The Solution

The images from the HDA GPR equipment are recorded as images that can be interpreted by a trained operator to highlight the position and depth of services (including pot ended cables) and can be incorporated into 3D images.

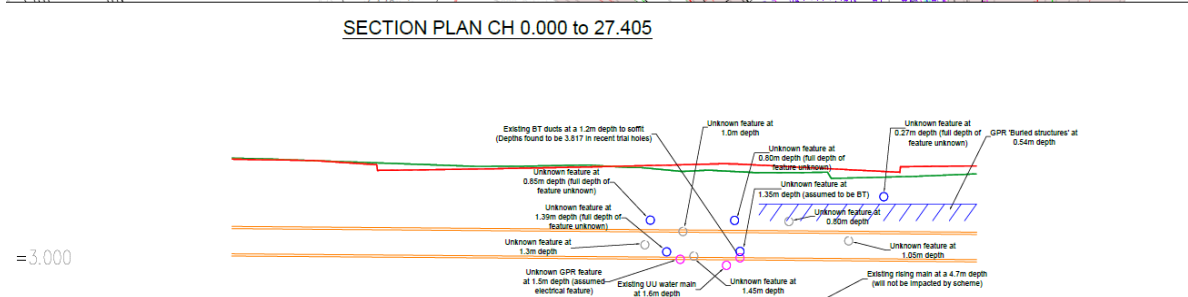


OneVision: real-time acquisition software with APD (Automatic Pipe Detection)



GREED HD 3D CAD: post processing software with pipe results

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HDA GPR equipment enabled us to:

- Accurately locate the position of pot ended cables that could not be located by Cat and Genny's or the original GPR surveys.
- Locate and safely expose 25 pot ended cable / uncharted cables.

HDA GPR provides:

- Accurate data in relation to the number and position of services in the ground including services that cannot be traced by a Cat and Genny.
- Contractors with the ability to conduct intelligent trial holes.
- Data in relation to the subsurface environment.
- Accurate data in relation to the position of redundant / abandoned services that cannot be traced by a Cat and Genny.

# The Added Benefit



HDA GPR enabled the site team to pinpoint the location of multiple electrical services on site that had not been diverted and could not be isolated; and ultimately enabled them to safely expose the services.

# The Benefit of HDA GPR

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The true benefits of using HDA GPR will be gained by using it throughout the design and ECI stage of a project as the surveys provide an opportunity to:

- Manage risks (safety, time, costs, service interruption) and increase programme and cost certainty.
- Identify / locate uncharted services.
- Reduce service strikes in line with the challenge set within Home Safe and Well (50% reduction by 2025).



# Sharing Best Practice

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As part of our desire to improve safety throughout the Supply Chain we have shared our findings and incorporated the benefits of HDA GPR into the Service Avoidance Common Intent document that was developed for the SCSLG. This information has subsequently been incorporated into the October 2020 version of RtB9 Service Avoidance.

# Sharing Best Practice

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MacLeod Simmonds have invested in the latest Ultra Wide Band Continuous Wave GPR equipment (Known as 'Step Frequency Radar) which provides significantly better data than HDA GPR (It is a magnitude above the impulse systems as it continuously emits a signal, gradually stepping up and down all frequencies between 100Mhz and 3000Ghz. The rule of thumb is that the lower the frequency, the deeper the penetration and the lower the resolution (i.e. less likely to find smaller targets). The higher the frequency, the less penetration but with a higher resolution (able to find smaller targets like direct buried cables or cracks in the carriageway for instance).

Whilst conducting a full pavement condition survey this equipment also provides details of buried structures, utilities, voids and changes in construction at the same time.

Pot ended cables are a foreseeable risk; that can't be traced using conventional methods.

HDA GPR:

- Provides an enhanced view of the sub surface environment.
- Surveys during design/ECI will:
  - Improve Safety.
  - Improve time & cost predictability.
  - Reduce services strikes.

We would welcome your feedback and would be grateful if you could complete a short questionnaire [HERE](#)