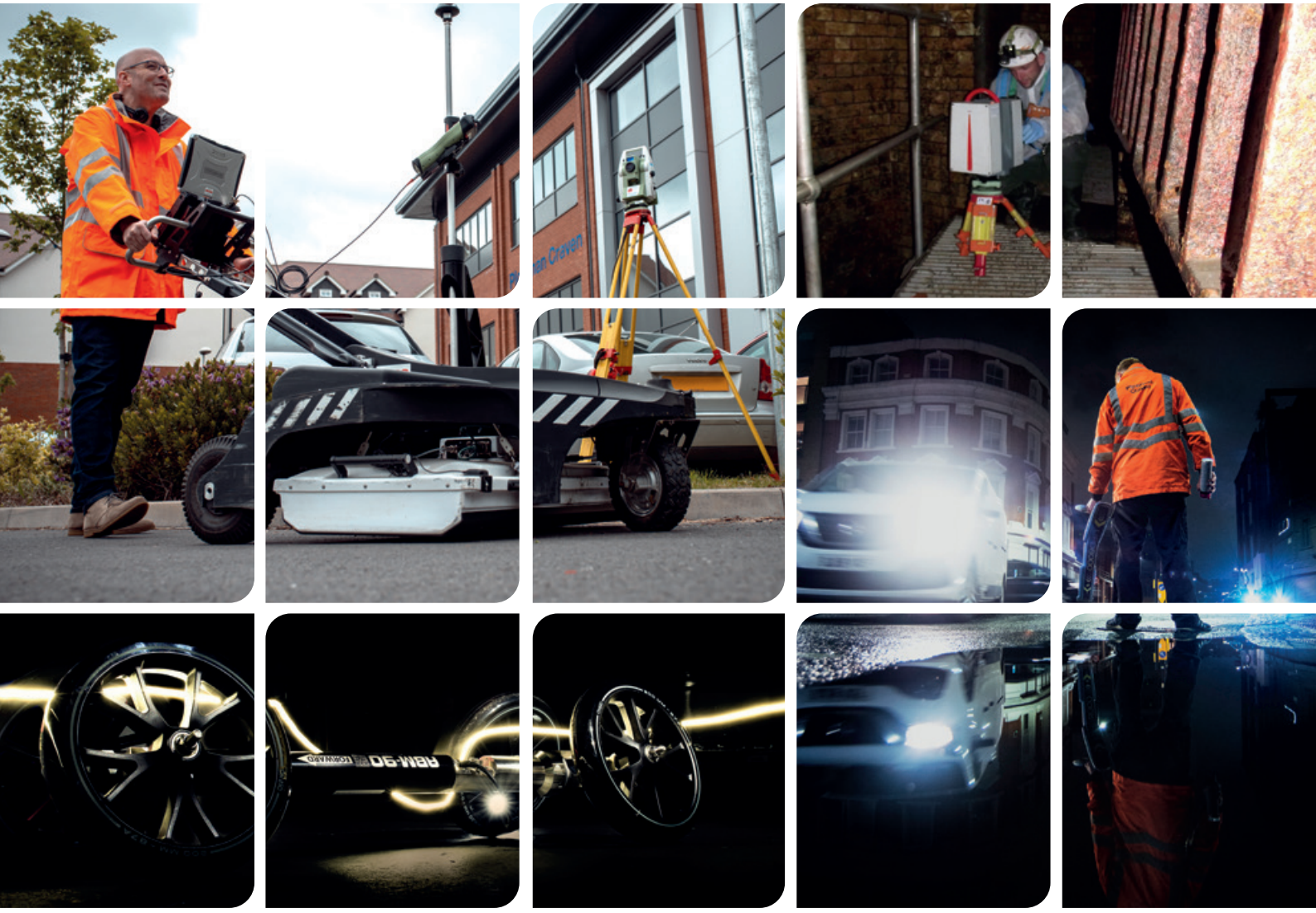
Plowman Craven

UTILITY MAPPING
SERVICES



Plowman Craven's specialist in-house utilities division uses the latest technology to trace, identify and map all underground utilities and service routes including gas, water, telecoms, electricity and drainage.

www.plowmancraven.co.uk

Consult. Trust. Innovate.

Welcome to **Plowman Craven**

Plowman Craven provides integrated measurement and consultancy services to the property and infrastructure markets, pioneering the use of technical innovation to deliver proven expertise and trusted results throughout the project lifecycle.

WHY CHOOSE **PLOWMAN CRAVEN**?

- **Honesty, Integrity and Trust** – This is integral to every practice and decision in the business. Our reputation depends on it.
- **Client Orientation** – Developing great relationships with our clients is key to our success. We work closely with our clients so we can fully understand and respond to their individual needs.
- **Innovation** – Our innovation is what sets us apart, whether we are offering a unique product or challenging our methodology to become more effective.
- **Quality** – We are committed to quality at every level of the business. We understand there is no compromise on this and we continually invest in technology, staff development and health and safety to ensure we achieve the highest standard of service.
- **Professional Approach** – We operate worldwide and our access to skilled and specialist resource allows us to respond effectively no matter the size of the project or how challenging.

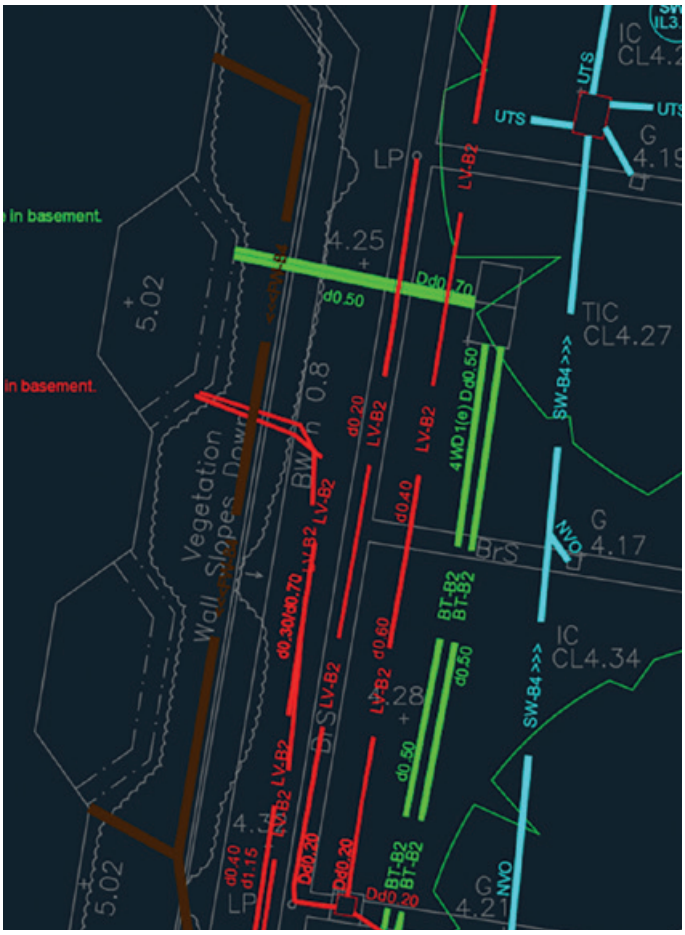
UTILITIES MAPPING SERVICES

- PAS128 Utility Mapping
- Plant Avoidance Surveys
- Geophysical Surveys
- Statutory Record Searches
- CCTV Condition Survey
- Line and Level Surveys
- Gyroscopic Mapping Surveys

UTILITIES MAPPING

Plowman Craven's specialist in-house utilities division offers a range of utilities mapping solutions. Using state-of-the-art technology, we are able to locate, identify and map underground utilities and service routes including gas, water, telecommunications, electricity and drainage.

PAS128 Utility Mapping



Our utility mapping division offers services which meet any requirement - from early planning stage through to post-construction as-built surveys, assuring confidence in results by aligning all works to PAS128.

WHAT IS UTILITIES MAPPING?

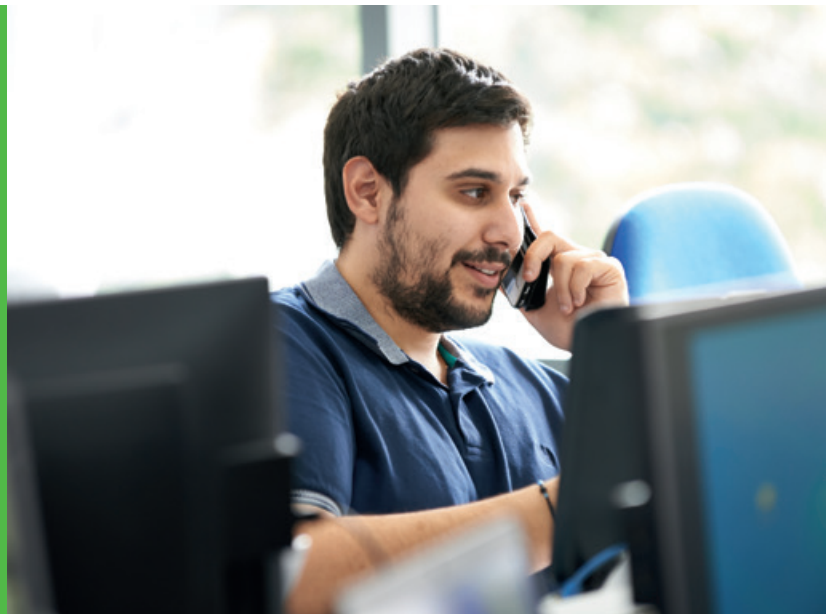
The diversification of the utilities sector in recent years has led to increasing difficulties in unifying utilities asset information. This lack of understanding, coupled with incomplete and inaccurate statutory records, leads to many unknowns and risks. Pinpointing the exact location of utilities is vital when planning and undertaking both design and construction work.

A PAS128 survey by Plowman Craven provides a comprehensive understanding of infrastructure below ground.

Utilities Mapping enables the client to:

- **Have an accurate record of existing and as-built services**
- **Minimise site disruption and potential delays**
- **Improve compliance**
- **Identify potential problems and avoid the risk of costly asset failures and emergency repairs**
- **Reduce health and safety risks**
- **Comply with HSE guidelines**
- **Mitigate the risk of utility strikes**

A dedicated Project Manager is assigned to each individual project and is responsible for ensuring all project requirements are met. All output is checked as part of our stand works procedures in accordance with the company's British Standard EN ISO 9001:2008 certification. Plowman Craven is Utilities Vendor Database Supplier Management Service (UVDB) verified, a demonstration of our compliance to health, safety, environment and quality.



TECHNOLOGY

Ground Penetrating Radar (GPR) Surveys

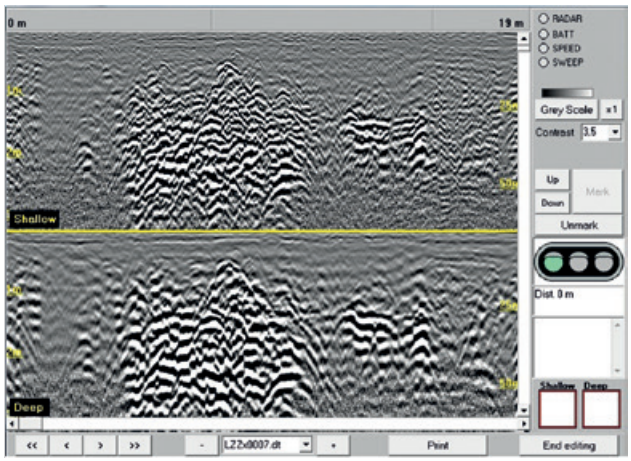
We use the latest innovative technology when undertaking a utilities mapping survey. A variety of tracing methods are available and each requirement warrants its own unique methodology.

The very latest ground penetrating radar systems are used to locate buried services which cannot be traced by other methods such as EML. GPR is also used to detect other buried features such as chambers and voids.

GPR systems are used to locate non-metallic objects and re-confirm the position of services traced by EML methods.

By carrying out a targeted grid of scans, linear below-ground features can be located and identified as services by relating the captured data to record information and surface features.

By processing our radar survey through the latest dedicated software, the captured data is filtered and enhanced to enable better data analysis and improved detection. The processing software also improves detection of sub-surface voids and non-service features. These features can be processed straight from the software into AutoCAD as a 3D model compatible with Revit models and BIM.



Example of GPR scan in good ground conditions

Ground Penetrating Radar (GPR)

Road Mapping

In conjunction with the more traditional GPR units and to keep traffic management requirements and congestion to a minimum, Plowman Craven adopts an innovative approach of using a Mass Array GPR mounted to a vehicle. Using this specialist vehicle means fieldwork is carried out quicker, with a reduction in traffic management costs with approval processes from the Local Authority reduced or removed. We can see significant program gains by using this method as we are capable of collecting significant amounts of data at high speed.

Mass Array GPR

GROUND PENETRATING RADAR AND RADIO FREQENCY LOCATION - COMMON MISCONCEPTIONS AND LIMITATIONS

There is a perception that all buried pipes, cables and ducts can be detected and mapped irrespective of their size, duty, depth, location, material type, geology and proximity to other utilities.

A well designed and executed survey should detect up to around 95% of utilities, but it may not be possible to achieve 100% detection rate. Often, the situation is not ideal for GPR due to the soil or ground conditions being unsuitable. In addition, some services are too small and buried too deep for the GPR to identify them.

Achilles UVDB SILVER PLUS

UKSTT MEMBER

TECHNOLOGY

Electromagnetic locators (EML)

EML technology works by connecting directly onto an asset at a valve pit and tracing the signal along the route of the pipe.

Low voltage electricity routes are traced by connecting to a surface feature such as a lamp-post, or by clamping the cable within an inspection chamber and tracing the signal along the route of the cable.

Once all known services have been located, the site is then scanned to check for any conductive anomalies. These unrecorded anomalies are then identified and added in order to complete the survey.

As the EML signal can be drawn to other services, this technology works at its best when the concentration of services are less dense. Although the exact location of a service cannot always be pinpointed, the presence of a service is noted and should be taken into consideration for any future planned works.

- **Accurately map routes of underground metallic, water and gas pipes, cable ducts and other metallic services**
- **Identify cable services such as telecoms, cable television and CCTV**
- **Where services cannot be directly connected, the transmitter can be placed on the ground directly above and a signal induced into the cable**

Adoption Surveys

After construction of a new site, utility owners often require a non-biased investigation of the location and condition of all utility components before accepting ownership. Plowman Craven provides independent survey advice and specialises in providing the following types of Adoption Surveys.

DRAINAGE ADOPTION SURVEY

A Drainage Adoption survey will confirm the manhole positions, pipe levels and condition prior to the utility provider taking over ownership of newly constructed sewers:

- **Position Inspection covers onto Ordnance Survey (OS) mapping data using GPS**
- **Provide levels to covers related to OS datum**
- **Full cover/chamber details (size/type/chamber material/ invert depth/pipe material and sizes/flow direction)**
- **Manhole data cards for each manhole to include location sketch and chamber sketch**

AS-BUILT SURVEY PAS256

An As-Built survey provides detailed information on utilities to determine exact routes of all services as-built rather than as-designed.

Benefits:

- **Accurate record of actual construction**
- **Independent confirmation of construction specification**
- **Protection for ground workers from utility strikes**
- **Risk mitigation should a clash occur with other planned or future works**
- **In line with PAS256**

Example of TruView™ model and 'unwrapped' panoramic image

Using the latest surveying equipment, we can accurately survey the line and level of man-entry sewers and pipes.

Line and Level Surveys

Plowman Craven has many years of experience in carrying out line and level surveys in sewers, river culverts, cable tunnels and on Rail and Underground infrastructure. Results of survey measurement can be processed to create 2D drawings with level information, a 3D wireframe model showing pipes in correct x,y,z position, or as a full 3D CAD surface model.

A photographic record can also be compiled to show the internal condition of the pipe and relevant features.

All line and level surveys are carried out in accordance with confined space regulations using industry leading safety and rescue equipment.

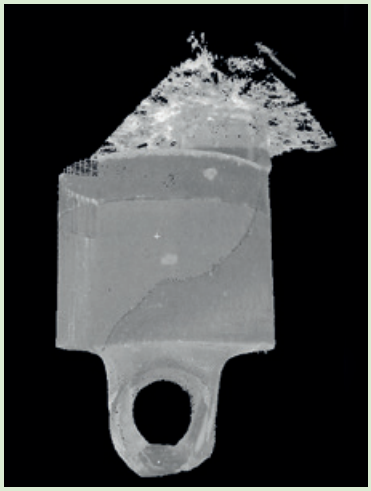
Profiles of pipes can be measured at specified intervals and at locations where the pipe size or shape changes.

Large diameter pipes and tunnels can also be scanned and photographed to create a fully measurable model and panoramic images.

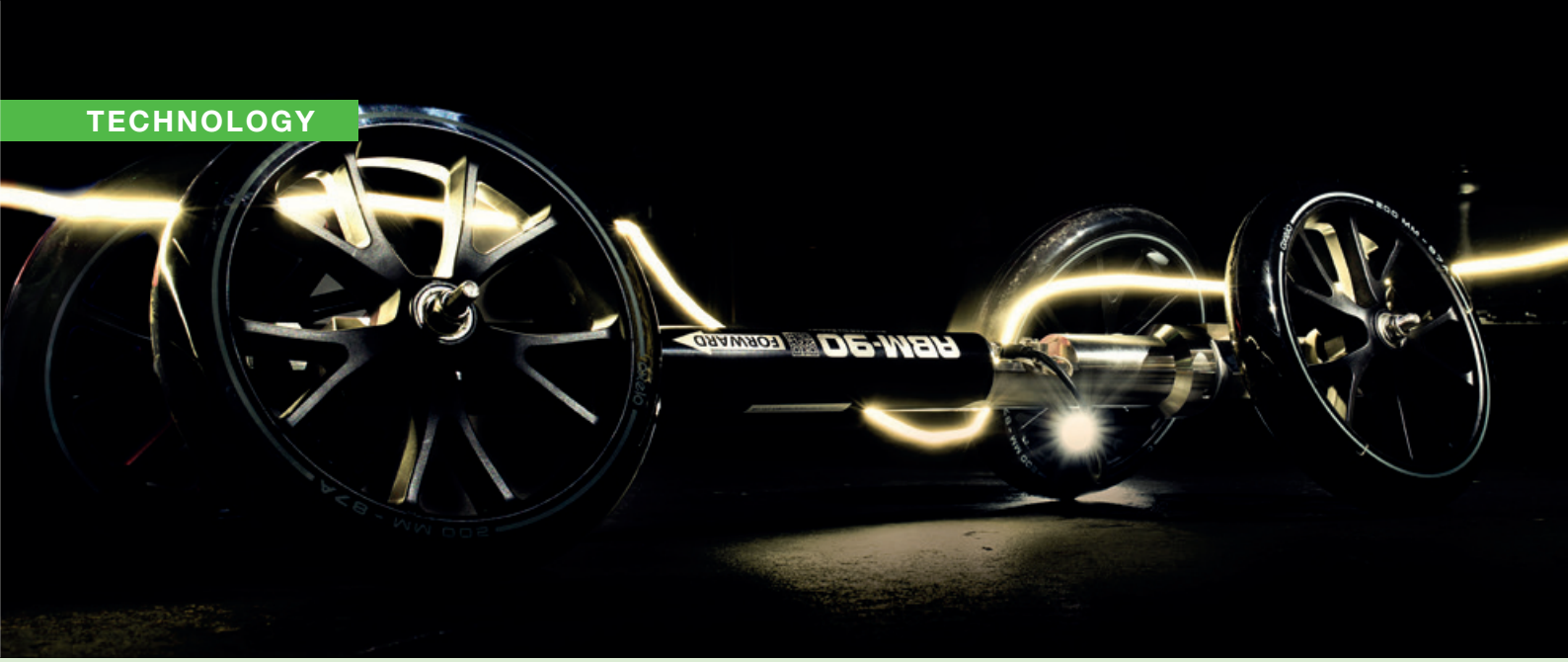
- **Accurate position of deep level pipes which cannot be located using surface techniques**
- **Photographic record of condition**
- **3D model enables detailed design for new connections**

Inverted Scanning

In addition to line and level surveys, inverted scanning techniques can be incorporated into the workflow. 3D data captured enables accurate plotting of each manhole chamber and associated pipes without having to access the chamber. These scans can also help determine the direction of the pipes entering and leaving the chamber. This methodology can be incorporated as part of the line and level survey or as an independent survey reducing the need of confined space entry and increasing the speed of data collection.



TECHNOLOGY



Gyroscopic Mapping Services

With the urban underground environment continuously growing into a more complex spider web of utility infrastructure, **Plowman Craven** continues to invest in the latest technology.

It is clear that the need for accurate mapping of networks is critical for operational, maintenance and insurance purposes, or prior to new building developments and construction activity. Plowman Craven utilises a gyroscope-based system that has been developed for off-line positional recording of the location of sewers, ducts, pipelines and tunnels.

Our investment in Gyroscopic mapping systems improves accuracy across a wider range of assets as well removes the need for person entry into the line of sewers. This dramatically increases the safety and risk associated with such activity and improves the completion rate of any construction works.

Our Gyroscope services can accurately map ducting or pipe work in excess of 15m below the surface, in both metallic and non-metallic assets.

CCTV

Using the latest high specification equipment and industry standard software, **Plowman Craven** can deliver detailed pipe condition surveys.

We present a colour written report highlighting faults, if any, in the system and provide recommendations for rehabilitation and repair. We also arrange the cleaning of the sewer system prior to survey to ensure best quality video capture. Reports are fully coordinated with a utility mapping survey to provide accurate information on all routes including 'blind' connections.

Still image showing pipe in good condition

FURTHER INFORMATION

Health and Safety Executive

The Health and Safety Executive has published a booklet which outlines unseen dangers arising from working near underground services. It provides guidance on risk reduction, especially concerning ground penetration or below surface operations. A copy can be downloaded from the Health and Safety Executive website: Booklet HSG47 - '*Avoiding danger from underground services*'

PAS128

The purpose of PAS128 is to set out clear and unambiguous provisions to those engaged in the detection, verification and location of active, abandoned, redundant or unknown utilities. It aims to provide:

- clarity in the service provided and methods employed
- consistency in the approach to data capture
- classification of the results and the confidence that can be associated with them
- standardisation of the format of deliverables
- accountability for the work undertaken

The Survey Association

The UK's Survey Association has published a useful guide to utility surveys which specifies differing levels of survey.

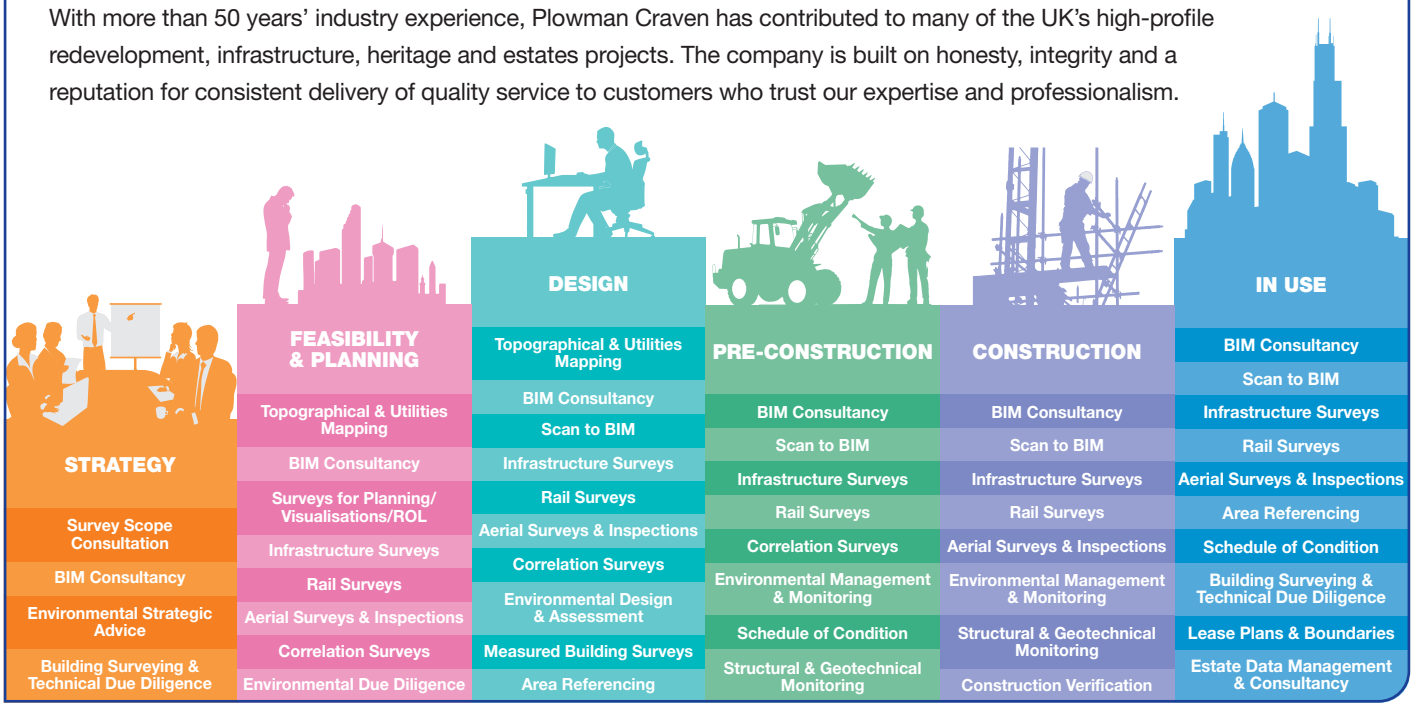
Typically, a utilities survey would be to level 4, where all covers are lifted, contents detailed and service routes traced using RFL and GPR techniques. The GPR is used in "mark out" mode with results viewed on-site.

Survey levels 5 and 6 are enhanced versions of level 4. Here, the GPR data is recorded on-site and post-processed for further analysis. The difference between levels 5 and 6 is the density of the scan grids that are undertaken. The more dense the grids, the more comprehensive the survey is likely to be.

About Plowman Craven

Plowman Craven provides integrated measurement and consultancy services to the property and infrastructure markets, pioneering the use of technical innovation to deliver proven expertise and trusted results throughout the project lifecycle.

With more than 50 years' industry experience, Plowman Craven has contributed to many of the UK's high-profile redevelopment, infrastructure, heritage and estates projects. The company is built on honesty, integrity and a reputation for consistent delivery of quality service to customers who trust our expertise and professionalism.



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