PAS 128:2014

Specification for underground utility detection, verification and location

ice
Institution of Civil Engineers

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Foreword

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- Heathrow Airport Holdings Limited
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- Institution of Civil Engineers
- National Joint Utilities Group
- National Underground Assets Group
- Ordnance Survey
- The Geological Society
- The Survey Association
- Transport for London
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- Utility Mapping Association
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- SUMO Services Ltd
- The Geological Society
- The Survey Association
- Transport for London

Hazard warnings

WARNING 1. This PAS calls for the use of procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

WARNING 2. For all excavations, assume that underground utilities are present and act accordingly.

Attention is drawn to laws, rules and regulations applicable to vacuum excavating or hand digging near or atop dangerous utilities such as electric, gas, fuel or petroleum.

WARNING 3. This PAS refers to physical entry into confined spaces, which is not to be attempted without suitably trained operatives and safety equipment.

Attention is drawn to HSE's publication, *Confined space – A brief guide to working safely* (INDG258) [1].

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in italic type, and does not constitute a normative element. The word "should" is used to express recommendations, the word "may" is used to express permissibility and the word "can" is used to express possibility, e.g. a consequence of an action or an event.

Spelling conforms to The Shorter Oxford English Dictionary. If a word has more than one spelling, the first spelling in the dictionary is used.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

0 Introduction

0.1 Background

As the demand on the nation's infrastructure continues to grow due to new developments, and the need to replace and/or maintain our existing utilities increases, it is essential we have accurate information on the existence and location of our underground utilities.

The accurate detection, identification, verification and location of utility assets have always been difficult tasks, subject to interpretation and inaccuracies. Not having sufficient or reliable information leads to:

- risk to the safety of workers and to the public;
- abortive and unnecessary work;
- damage to third party assets;
- inefficient design solutions.

Accurate utility data could also afford the opportunity for as yet unrealized benefits, such as the use of remote robotic techniques to maintain asset networks in busy highways in future to reduce the need for intrusive maintenance practices (road excavations). Similarly, accurate mapping of utility networks could improve asset modelling capabilities with more determined outcomes.

In the UK, there are no agreed or published standards either for the detection, verification and location of underground utilities or for the collection and recording of these data.

***NOTE** Given the wide use and varying connotations associated with the word "survey", the word "location" has been used throughout this PAS to define the act of geospatially referencing utility assets or topographical features.*

The purpose of this PAS is to set out clear and unambiguous provisions to those engaged in the detection, verification and location of active, abandoned, redundant or unknown utilities.

This PAS 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;
- standardization of the format of deliverables; and
- accountability for the work undertaken.

It is expected that with time, education and experience in the application of this PAS, this will lead to more effective planning and safer execution of street works, civil works, ground works and utility-related activities.

In creating this PAS, the development of other similar work, such as guidelines and standards undertaken in the USA, Canada and Australia, have been taken into consideration.

Different survey types and methods provide different accuracy and certainty around results. For example, verification provides more accurate results than desktop utility records search. It is recognized that an increase in accuracy and certainty inevitably means an increase in effort, cost and time to deliver those results.

0.2 The survey type

This PAS takes a hierarchical approach to the survey types used in recognition that different clients at different stages of an asset life cycle will require different levels of detail and confidence in the data provided. This PAS defines four types of survey:

- desktop utility records search (survey type D) – where underground utilities are identified through the collation and analysis of existing paper/online utility records;
- site reconnaissance (survey type C) – where existing records are supported and validated by the visual inspection of physical evidence observed during a site visit;
- detection (survey type B) – where underground utilities are detected and located by geophysical techniques;
- verification (survey type A) – where underground utilities are observed and located at a manhole or inspection chamber, or are excavated and exposed.

These represent the different levels of effort required in obtaining information on the location of utilities, whereby the desktop utility records search requires the least effort and verification the most.

A survey type D is a prerequisite for survey types C, B and A. Survey types A to C are independent of each other. For example, a detection survey can conform to this PAS without the need to conduct a survey type C or A.

0.3 Detection methods

This PAS defines a hierarchy of detection methods to be used to detect underground utilities in terms of the minimum equipment types to be used, the minimum techniques to be applied and the survey search resolution and relates this to the maximum quality levels achievable that can be attained using a particular detection method (see Table 2). The detection methods are usually selected taking into account density of services of the survey area and whether post-processing is undertaken or not. Several detection methods may be applied to one survey area.

By ensuring the practitioner indicates in their method statement the methodologies they intend to use and thus the level of work their price is based on, this enables the client to assess and compare tenders on an equal basis. More importantly it defines for the practitioner the minimum standard expected for detection associated with each typical application.

These detection methods follow the philosophy of The Survey Association's (TSA's) levels of quality for levels 4 to 6 as given in *The essential guide to utility surveys – Detailed guidance notes for specifying a utility survey* [NR1].

TSA level 3 – EML only survey is deliberately not accounted for and not included as a detection method because this PAS is looking to raise the standard of detection so that in all cases a minimum of two detection techniques – ground penetrating radar (GPR) and electromagnetic location (EML) – are used.

0.4 Quality levels

The quality level is a classification applied to each segment of utility surveyed based on survey type undertaken, location accuracy achieved, whether post-processing was undertaken and level of supporting data obtained in determining the quality level (see Table 1). It reflects the confidence the practitioner has that they have achieved this quality level. For the survey type B, detection, where there are four quality levels, the aim of the practitioner is to attain a QL-B1 not aim for a QL-B4. A "P" suffix is added to QL-B1 to QL-B4 to distinguish where post-processing has been undertaken (see Note 1 to Clause **8**).

0.5 Absolute geospatial location of underground utilities

To improve accuracies and how data are exchanged and integrated, this PAS encourages the absolute geospatial location of utilities be referenced to three dimensions using a national coordinate grid system and datum. In Great Britain this is the Ordnance Survey's National Grid (OSGB36) and Ordnance Datum Newlyn (ODN) coordinates. In Northern Ireland this is the Irish Grid (IG) as used by Ordnance Survey Northern Ireland.

NOTE The Ordnance Survey of Ireland and Ordnance Survey Northern Ireland have implemented a new coordinate system for Ireland called Irish Transverse Mercator, or ITM, which will initially run in parallel with the existing Irish grid system.

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1 Scope

This PAS specifies requirements for the detection, verification and location of existing and new underground utilities.

It applies to the detection, verification and location of active, abandoned, redundant or unknown underground utilities and the location of their associated surface features (e.g. manhole covers and utility markers). It applies regardless of where these utilities are located (e.g. in urban or rural areas, in the street, or on private sites such as hospitals or airfields). It applies to utilities buried no deeper than three metres.

This PAS sets out the accuracy to which the data are captured, the quality expected of these data and a means by which to assess and indicate the confidence that can be placed in such data.

More specifically it covers:

a) project planning and scoping process;
b) classification system for quality levels based on survey type, location accuracy, inclusion of post-processing and level of supporting data;
c) desktop utility records search;
d) detection;
e) verification;
f) location;
g) deliverables.

It does not cover:

1) emergency utility works as defined by legislation or where there is imminent risk to life, limb or environment;
2) underground basements, underground tunnels (including railways, road tunnels, and underground pedestrian walkways), plant rooms and non-utility based features;
3) above surface utility infrastructure (such as overhead power or telecommunication lines).

This PAS is for use by practitioners (usually a surveyor, geophysicist or subsurface utility engineer). It also might be of interest to clients (such as engineers, constructors, project managers and utility owners), who are responsible for recording information about underground utilities.

Where ground investigation, borehole, trial pit works or other construction works are proposed, a current utility mapping survey conforming to this PAS can be used as an indicator of the presence or absence of underground utilities before conducting further ground investigation prior to breaking ground.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards

PAS 1192-2:2013, *Specification for information management for the capital/delivery phase of construction projects using building information modelling*

Other publications

[NR1] THE SURVEY ASSOCIATION. *The essential guide to utility surveys – Detailed guidance notes for specifying a utility survey*. TSA: Newark-on-Trent, 2011.

[NR2] RICS. *Guidelines for the use of GNSS in land surveying and mapping*. RICS Business Services Limited: London, 2010.